Consumer Characteristics in the Market for Organic Food

Theodore Ellis

Roanoke College

Abstract

This paper analyzes consumer characteristics in the market for organic food and their effects on individual consumption patterns, drawing on existing analyses for the inspiration for the theoretical model. In addition to traditional demographic characteristics such as race, income, and gender, we examine aversion to pesticides and environmental consciousness in the individual using survey data gathered by the University of Michigan from participants in the Detroit Area Survey, a face-to-face survey on environmental topics. The data are analyzed with a binomial probit model and demonstrate above all else a significant relationship between an individual aversion to pesticides and the frequent consumption of organic food. The paper concludes with a discussion of the implications of the findings for future studies and for policy-makers.

Introduction

Organic agriculture has been, of late, one of the fastest-growing consumption trends in the United States (Dimitri & Greene, 2002). This pattern is by no means confined to the supply side of the economy or to the past decade. In 2009, Greene, Dimitri, Lin, McBride, Oberholtzer, and Smith found that production of organically produced foodstuffs had more than doubled since the late 1990's, but that per-capita levels of consumption have risen still faster.

There are health and environmental outcomes associated with the production and consumption of organic food which will interest the policy-maker and for the sake of which consumption and production of organic foodstuffs should be fomented. Organically produced food has greater nutritional properties that would likely result in higher levels of public health, were organic agriculture to be consumed in the same quantities in which conventionally-grown agriculture is now consumed. Scialabba has found that organic agriculture has 10-60% more

healthy fatty acids than its conventionally-produced counterparts, as well as 5-90% more vitamin C, and that organic foods have higher mineral content overall (2014). Additionally, there is steadily increasing evidence that organic diets result in a decreased proliferation of cancer cells (Scialabba, 2014).

Furthermore, it has also been found that conventional agriculture requires high inputs of energy: around 2 kilocalories of fossil fuels are required as an input for every kilocalorie of food energy produced. Organic practices can conserve as much as a third of that energy, as well as 20-60% of the water required for irrigation due to higher biological efficiency (Scialabba, 2014). Additionally, organic practices are not destructive like conventional agro-industrial processes, which destroy over 10 million hectares of arable land worldwide every year (an area just slightly larger than the state of Indiana) by means of unsustainable practices (Scialabba, 2014). Furthermore, Pimentel, Hepperly, Seidel, Hanson, and Douds (2005) estimate that the costs to both the environment and the health care system that are attributable to the use of pesticides at sanctioned levels average out to roughly $12 billion yearly, a phenomenon which is virtually entirely attributable to conventional methods of food production.

Although organic foods is the sector of the American food market which is currently demonstrating the fastest rate of growth, sales yet comprise only around 4% of the American food market (Greene et al., 2009; USDA Economic Research Service, 2014). Nonetheless, the Hartman Group has found that "most consumers (69% in 2008) purchase at least some organic goods every year" (as cited in Greene et al., 2009, p. 16). It is well-known that organic foods command a higher price than their conventionally produced equivalents, with organic soybeans fetching a price over $9.00 higher than their non-organic counterparts (Greene et al., 2009). This suggests that high-income consumers likely play an important role in the consumption of organic

foods due to their nature as a luxury good, but there are surely other factors that influence consumption (Blank & Thompson, 2004). This paper aims to analyze these factors and the extent to which they factor into the private decision to direct their food spending toward the organic market. These findings will be important in directing policy-makers towards efficient methods of encouraging consumers to consumer organically produced foodstuffs in greater quantities, a topic which will be revisited in the conclusion of this paper.

Literature Review

A quick jaunt to the supermarket will easily demonstrate that organic foods are more expensive than those not grown organically. A specific (but relatable) example is corn: prices can be between 20-140% higher than their non-organic substitutes (Dobbs, 1998). Who might this consumer be that is willing to pay such high prices? There are several basic and widely studied demographic factors that might be prevalent in a consumer willing to do so: income, gender, race, and education. Intuitively, one imagines a consumer with a higher income that is more willing to pay such price premiums; Stevens-Garmon, Huang, and Lin note that the popular perception of the consumer of organic produce is white, has children, and is of a relatively high socioeconomic status (2007). Nonetheless, the same study suggests that in reality Caucasians may buy less organic products than minorities persons and that there is no meaningful correlation between income and expenditures on organic goods (Stevens-Garmon et al., 2007). In fact, it is suggested that lower-income groups may utilize organic produce as a type of preventative medicine, putting their consumption levels at least as high as other groups (Hartman Group, 2003). The difficulties of the topic begin here; for every study that supports these findings on income, there exists another which refutes them.

In their own review of the literature, Govindasamy and Italia (1999) note the comparatively large number of studies that find an inverse relationship between income and concerns about food safety, citing Buzby, Ready, and Skees (1995) (who found that higher-income consumers were less inclined to pay a premium for pesticide-reduced grapefruit) as well as three other studies with similar results. Tellingly, a 2004 survey by the Hartman Group found that half of "frequent organic food purchasers" had an annual income of $50,000 or less. Interestingly, Fourmouzi, Genius, and Midmore (2012) demonstrate that lower social class households, especially those with children, have the most elastic demand for organic products. On the other hand, there are contradictory studies that find a positive correlation between income and willingness to pay for food-risk reduction such as that of van Ravenswaay and Hoehn (1991); furthermore, the studies of Misra, Huang, and Ott (1991) and Underhill and Figueroa (1996) both indicate that consumers with higher income are more willing to pay a price premium for organic food. The most recent and persuasive study on the matter, which is based on actual consumption data rather than stated preferences shows that higher income households are more likely to buy organic produce than those with lower incomes, but that their expenditure on organic produce is likely to be a smaller proportion of their expenditure on all produce (Govindasamy & Italia, 1999). Assumedly the reader of this literature review now has a good idea about the nature of the literature: it presents highly disputed claims, with reputable sources on either side disagreeing flat out with one another. As the discussion moves on to other demographics, the sheer number of studies cited will be reduced in the more contentious areas, with the most relevant and conclusive studies cited over those that are less so.

Fortunately, the research is of one voice on gender: it indicates that females typically place greater value on organic produce than conventional produce (Groff, Kreider, and

Toensmeyer's (1993) study does a fine analysis which demonstrates this very point). Additionally, in a stated choice experiment, Bryne et al. (1991) found that women without a college degree were among the most likely to purchase organic produce, although being a stated choice experiments and not a study based on empirical consumption data, these findings are not as convincing as actual purchasing data would be.

With an examination of race, the voices in the literature once again become cacophonic. In this instance, it is difficult to tell where the truth may lie: compared to African-American consumers, Caucasians were more likely to purchase organic produce, according to Dettmann (2004) and Dettmann and Dimitri (2010), but this runs perfectly opposite to findings from the findings of Zepeda, Hui-Shung, and Leviten-Reid (2006). Attempting to illuminate the issue, another 2006 study defined African-Americans and Hispanics as "core consumers" of organic goods, but this neither simplifies nor clarifies the matter (Hartman Group, 2006). In the face of so much contention, it likely remains to be seen how race affects purchases of organic goods- perhaps a gap in the literature could be filled by controlling for factors such as geographical proximity to organic producers and environmental conscientiousness, the latter of which would be difficult to measure, but which is an important factor that Michaud, Llerena, and Joly (2013) and Dettmann (2004) rightly note is missing from nearly all data on the subject.

The effect of age on consumption, like the effect of gender, seems to be more or less agreed upon, albeit not much more examined. Simply put, however, younger age groups have greater preference for organic goods. Regressing for multiple age groups, it was found that the younger the age group, the greater their consumption of organic produce was predicted to be (Govindasamy & Italia, 1999). This is consistent with a finding that consumers over the age of

50 had a lower inclination to purchase organic produce (Govindasamy, DeCongelio, Italia, Barbour, & Anderson, 2001).

According to further findings of Govindasamy et al. (2001), persons with some or more college education were more likely to be consumers of organic produce. Nonetheless, only two years earlier, Govindasamy and Italia (1999) show through regression analysis that increasingly educated people in their data set (those with a higher attained level of certification- a Master's or Doctoral degree, etc.) were increasingly unwilling to pay the price premiums for organic produce, a finding that is consistent with results found by Misra, et al., (1991) and Malone (1990). That said, Dettmann's (2008) excellent analysis demonstrates that higher levels of education *do* correspond with Govindasamy et al.'s more recent (2001) estimate and an increased likelihood of purchasing organic produce. Previously, Govindasamy and Italia (1999) gave an explanation for the counter-intuitive nature of a less educated person making the more progressive and (as is now more definitively known) healthier choice, stating that it is probable that an uneducated person would tend to overestimate the risks involved in consuming pesticide-heavy foods. However, this explanation would likely not hold weight today (in a market in which the consumer has over a decade more information to draw upon) as a more educated person would likely understand both the risks of eating conventional food and the benefits of eating organic food, and would make a rational decision to consume more of the latter and less of the former.

As of yet, there is currently very little literature devoted to the analysis of food consumption in relation to individual preference for news saturation or news media preference. However, Kean, Prividera, Boyce, and Curry (2012) have shown that general patterns suggest that individuals who consume more television are more likely to make unhealthy food choices,

while the reverse is true for those who consume more print-media sources, even when those sources include magazines. This trend is demonstrated for the African-American community, but likely speaks to a larger truth that applies to Americans in general.

As can be easily seen, a review of the literature shows surprisingly high levels of inconsistency in results. This study will attempt to bring clarity to the picture by controlling for as many factors as possible, particularly those that are rarely examined in the existing literature, such as individual levels of environmental conscientiousness and whether the consumer is risk-averse with respect to consuming the pesticides that are often present in conventionally produced food. If nothing else, this review of literature has hopefully demonstrated that the prototypical consumer of organic produce is complex, if he or she exists at all. Therefore, great care and thought must be exercised in the attempt to explain his or her nuances.

Data & Summary Statistics

Data Set

The data set that will be used in this analysis is the 2002 Detroit Area Survey (DAS), which is an environmentally-oriented paper study gathered via face-to-face interviews of adults in the Detroit tri-county area. A multi-stage probability model was used to sample participants from the following Michigan counties: Wayne, Macomb, and Oakland. For the DAS, students from the University of Michigan conducted 77 face-to-face interviews between April 6, 2002, and April 28 2002. Interviewers from the University of Michigan Institute for Social Research Survey Research Center conducted the remaining 202 face-to-face interviews between April 6, 2002, and July 31, [2002]. A copy of the data from the DAS survey was procured for this study

by the gracious library staff of the Virginia Polytechnic Institute and State University, Blacksburg campus.

Variables

The purpose of this analysis is to determine how different factors affect consumer willingness to consumer organic food; the dependent variable being a measure of self-reported frequency of household organic food purchases which will be modeled as a binomial dummy variable where 1 = "frequent consumption," which is an aggregated function of the survey responses "always" and "often." The failure response, (0 = "infrequent consumption") is an aggregate of the survey responses "sometimes," "rarely," and "never."

The basic demographic independent variables that will be employed in this analysis are the following: a discrete independent variable to measure the *squared age* of the participant at the time of the study, their self-reported levels of *education* and *income*, modeled as dummy variables, as well as dummy variables to represent the participant's self-identified *race* (black, white, or other) and *gender* (male or female). Also modeled by dummies are the presence of *children* aged 0-18 in the household and the *marital status* of the participant. Further variables will include: the participant's views on whether the presence of *pesticides* in food is a serious problem, in addition to a measure of the individual's willingness to pay increased *taxes* to the government for the purpose of environmental protection. These variables will be modeled as dummy variables. Other, policy-focused variables will include whether an individual receives the majority of their news from *audiovisual* sources or *print-media* sources and the individual's frequency of *news* consumption. The penultimate and antepenultimate variables will be modeled as dummy variables, and *news* consumption will be modeled as a trinomial variable.

A positive relationship is hypothesized between the square of age and the consumption of organic foods. Despite the findings in the literature that suggest a linear relationship between age and consumption, we hypothesize a new relationship that has this relationship following a positive parabolic form, as the literature suggests that younger individuals will have the greatest desire to consume organic foods, but the very youngest may not have the purchasing power necessary to pay the price premiums on organic foods. Furthermore, the oldest individuals may also find themselves on a more limited budget, in addition to not having the same interest level in organic foods as consumers in the younger age brackets likely would. A positive relationship with the dependent variable is also hypothesized for the values of the coefficients of education and income, as these higher-income and better-educated individuals tend to have not only the higher purchasing power that is required by the price premiums placed on organic food, but also because higher levels of education seem likely to result in greater knowledge about the health and environmental benefits of organic food, as well as the harm that conventional practices often inflict on the environment. This hypothesis is again well-supported by the literature.

It is further theorized that females are greater consumers of organic foods than males (a contention consistent with the literature), simply because widely-practiced gender roles dictate that females do the majority of tasks related to homemaking, such as grocery shopping. The addition of this variable will explain the discrepancies between male and female individuals that have the similar household characteristics otherwise, the likelihood of which would not at all be improbable. While it could be predicted that the presence of children in the household could lead to greater consumption of organic foodstuffs due to parental concern about child health, it will instead be predicted that the financial strain that often accompanies children will outweigh this desire, and that their presence will result in less frequent consumption of organic foods.

Additionally, it has been noted that families belonging to a lower socioeconomic class tend to have more elastic demand curves for organic foods.

The relationship between marital status and consumption of organic food is hypothesized to be positive for those individuals that are married or living together. Research has shown that married individuals tend to have superior health outcomes than single individuals, which is attributable to several factors; among them, higher combined income to purchase health-enhancing goods (such as organic foods, in our case), or because of the ability of coupled persons to divide their labour so as to specialize in domestic and extra-domestic tasks, an important factor in the preparation of meals made from organic food, which tend to be based more heavily on whole ingredients which require more time to prepare (Ali & Ajilore 2011). It might be assumed that divorced persons continue the habits learned in marriage and therefore be hypothesized that the relationship between divorce and organic consumption would be positive as well. However, we will refer to Blank and Thompson's classification of organic foodstuffs as luxury goods and hypothesize that since divorced persons usually experience a drop in income, that the relationship will be negative, ceterus paribus. The literature is of many voices on the subject of race as an influence on consumer expenditure on organic foods. Nonetheless, this analysis will hypothesize that white individuals more frequently consume such foods, while black consumers consume less, following in the mode of Dettmann, for reasons of lower average income (2008).

Simply put, it is hypothesized that the graver an individual finds the issue of chemical pesticides in food, the more likely he or she will be to purchase organic foods, as they do not contain such pesticides. This variable will likely prove important as a point of differentiation between those who are able to afford to purchase organic foods, but do not choose to do so, for

one reason or another. Additionally, a positive relationship will be assumed between the dependent variable and a participant's willingness to shoulder an increased tax burden for the purpose of environmental protection. This variable will serve to represent environmental consciousness, a high degree of which is associated with the organic movement. Such a measure has been missing from the previous literature, as Michaud, et al. (2013) point out; it will help the analysis greatly by allowing further differentiation between types of consumers, hopefully also serving to demonstrate any correlations between environmental consciousness and other traits.

Lastly, because there are few studies that attempt to analyze consumer preferences for organic food based on news media preference and frequency of consumption, we will only cautiously predict positive or negative values for the coefficients of the policy-focused variables. Following the (perhaps naïve) presupposition that individuals who consume more news are generally better informed about the world around them, it is hypothesized that such individuals will be more likely to understand the broad benefits of consuming organic foods, which will be positively reflected in their consumption habits. Based on Kean. et al.'s findings, it will be predicted that individuals that receive more news from audiovisual sources will consume lower quantities of healthier organic foods, while those who receive more news from print media will consume more.

Because the author of this study was fortunate enough to find proxy measures for environmental consciousness in the existing data, there are no independent variables that are lacking from this study that are strongly recommended from the literature or the theory. Ideally, the dependent variable would be of a nature that was continuous and discrete, rather than a dummy, but the survey from which the data was gathered was not specifically designed for such

a purpose; it was designed to measure participant perspective and opinion on environmental and merely happens to contain data that fit the intentions of this study.

Variable Definitions. For the reader's ease of reference, we include here a table with the definitions of each variable and their predicted values:

Table 1. Variable Definitions.

Variable	Predicted Value	Definition
organic		Consumption of organic food. A binomial dummy dependent variable where 1 = frequent consumption and 0 = infrequent consumption.
age2	+	Squared age of the participant as of 2002. A continuous discrete independent variable.
white	+	The self-identified race of the participant. A dummy independent variable where white = 1 and non-white = 0
black	+	The self-identified race of the participant. A dummy independent variable where black = 1 and non-black = 0
sex	-	The self-identified gender of the participant. A dummy independent variable where male = 1 and female = 0
lesshs	-	The self-reported level of education of the participant. A dummy independent variable where completed years of schooling which sum to less than high school= 1 and a level of high school or greater = 0
morehs	+	The self-reported level of education of the participant. A dummy independent variable where a level of education beyond high school= 1 and a level of high school or below = 0

highincome	+	The self-reported income of the participant. A dummy independent variable where an annual household income of greater than $75,000 = 1 and all other incomes = 0
coupled	+	The marital status of the participant. A dummy independent variable in which a status of married or cohabitating = 1 and all other statuses = 0
div_sep	-	The marital status of the participant. A dummy independent variable in which a status of divorced or separated = 1 and all other statuses = 0
children	-	The presence of a child in the home. A dummy independent variable in which the habitation of a child age 0-18 in the household = 1 and the absence of such a child = 0
pesticides	+	The participant's self-reported aversion to pesticides in food. A dummy independent variable in which a strong aversion = 1 and all other levels of aversion = 0
taxes	+	The participant's self-reported willingness to pay increased taxes to support environmental protection. A dummy independent variable in which willing = 1 and unwilling = 0
news	+	The participant's self-reported frequency of news consumption. A trinomial variable in which three or fewer days of news consumption per week = 1, more than three days but no more than 6 per week = 2, and the consumption of news daily = 3
audiovis	-	The participant's self-reported source for the majority of his or her environmental news; here a dummy proxy variable for sources of general news consumption in which audiovisual sources being the principle source of news = 1 and all other sources = 0
printmed	+	The participant's self-reported source for the majority of his or her environmental news; here a dummy proxy variable for sources of general news consumption in which print-media

		sources being the principle source of news = 1 and all other sources = 0

Summary Statistics

Table 2. Selected Summary Statistics.

Variable	Observations	Mean	Standard Deviation	Min	Max
organic	336	0.205	0.405	0	1
age2	330	2623.930	1757.653	324	7744
white	339	0.540	0.499	0	1
black	339	0.389	0.488	0	1
sex	334	0.401	0.491	0	1
lesshs	335	0.134	0.341	0	1
morehs	335	0.618	0.487	0	1
highincome	302	0.295	0.457	0	1
coupled	339	0.513274	0.501	0	1
div_sep	330	0.176	0.381	0	1
children	334	0.449	0.498	0	1
news	339	2.696	0.657	0	3
audiovis	335	0.143	0.351	0	1
printmed	335	0.104	0.306	0	1

*Additional summary statistics can be found in the Appendix, such as those seen in Table 6, which shows the frequency of each possible response for each variable.

Table 2, seen above, lists relevant summary statistics for each independent variable. Nearly every variable included in this model is a dummy variable, as both the nature of demographic analysis and the nature of this data set lend themselves to such an analysis. This makes the summary statistics fairly easy to look at, so we will not discuss them at length, simply calling the reader's attention to the fact that the value of the pseudo-R^2 is extremely low. This is an occurrence common to models with dummy dependent variables, as the binary nature of the dependent variable limits its validity, even for models which may do an exceptional job of modeling the data. Therefore, the reader should not put much stock in the value of R^2 seen above as a measure of the model's goodness-of-fit with respect to the data.

Aside from variables that have are related by definition (for example, because they have a mutually exclusive relationship between them), such as *black* and *white*, or having a level of education greater or lesser than high school, the reader will note that the correlation coefficients seen in Table 3 (see Appendix) tend to have values that are clustered fairly tightly around zero. This bodes well, suggesting that there will be few, if any, problems of multicollinearity in the regression model once it is run.

Lastly, the reader should note that practically none of the variables are missing a noticeable number of observations- only *highincome* is missing more than ten observations, and it still has nearly 90% of the maximum number of observations, 339. Data of this level of completeness will help the regression that will ultimately be run to be accurate, as relatively few responses will have to be dropped from the regression.

Econometric Model

In this paper, the consumption of organic foods will be modeled as follows:

organic = f(square of age, race, sex, education, income, marital status, presence of children in the home, aversion to pesticides, tax willingness)

The most appropriate regression model in regards to both the data and the analyst is a binomial probit model, which serves the useful function of avoiding the problem of unboundedness which the linear probability model presents. The binomial probit model follows the mathematical form:

(1) $P_i = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Z_i} e^{-s^2/2}\, ds$

where: P_i = the probability that the dummy variable D_i = 1

$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \ldots + \beta_k X_k$

s = a standardized normal variable

The binomial probit model can be rearranged to take on a linear form:

(2) $Z_i = \Phi^{-1}(P_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots \beta_k X_{ki}$

where Φ^{-1} is the inverse of the normal cumulative distribution function and the *X*'s represent the coefficients of the independent variables: *age, white, black, lesshs, morehs, highincome, coupled, div_sep, children, pesticides, taxes, news, audiovis, printmed.* (See Table 1 for definitions.) This transformation (Equation 2) will be used as the functional form of the model throughout the remainder of the paper as the coefficients of the variables are referenced.

Empirical Testing

Three different regressions will be run for the data. First, a regression (Model 1) will be run that includes all variables except for those that are policy-focused. Next, that variable set will be parsed to test for the equations' robustness (Model 2). Finally, on satisfying the condition of robustness, the policy-focused variables will be integrated into Model 1 and regressed (Model 3). Stata's regression software, analyzing the data by means of our binomial probit model (Equation 2), yields the following models:

Table 4. Regression results for the consumption of organic food.[1][2]

Model 1				***Model 2***				***Model 3***			
Organic	**∂F/∂x**	**Std. Err.**	**P>|z|**	***Organic***	**∂F/∂x**	**Std. Err.**	**P>|z|**	***Organic***	**∂F/∂x**	**Std. Err.**	**P>|z|**
age2	0.000	0.000	0.718	*age2*	0.000	0.000	0.662	*age2*	0.000	0.000	0.607
white	-0.078	0.102	0.441	*white*	-0.051	0.049	0.294	*white*	-0.098	0.106	0.344
black	-0.03	0.095	0.756	*sex*	-0.049	0.046	0.290	*black*	-0.037	0.095	0.702
sex	-0.053	0.047	0.263	*lesshs*	0.001	0.065	0.983	*sex*	-0.068	0.047	0.161
lesshs	-0.001	0.073	0.990	*highincome*	-0.070	0.053	0.216	*lesshs*	0.007	0.075	0.929
morehs	0.004	0.055	0.941	*coupled*	0.004	0.050	0.930	*morehs*	0.004	0.055	0.945
highincome	-0.067	0.055	0.252	*children*	-0.026	0.051	0.613	*highincome*	-0.080	0.054	0.173
coupled	-0.011	0.057	0.849	***pesticides***	0.169	0.045	0.000	*coupled*	-0.001	0.057	0.988
div_sep	-0.021	0.06	0.740	*taxes*	0.058	0.047	0.251	*div_sep*	-0.023	0.060	0.709
children	-0.024	0.052	0.648					*children*	-0.031	0.052	0.55
pesticides	0.173	0.046	0.000					***pesticides***	0.174	0.047	0
taxes	0.06	0.048	0.240					*taxes*	0.049	0.050	0.355
								news	0.028	0.036	0.432
								audiovis	-0.003	0.065	0.967
								printmed	0.147	0.098	0.087
Pseudo-R^2	0.101			*Pseudo-R^2*	0.0988			*Pseudo-R^2*	0.1140		

[1] ∂F/∂x is for the discrete change of the dummy variable from 0 to 1. P>|z| corresponds to the test of the underlying coefficient being 0.

[2] Statistically significant variables are designated by ***bold, dark blue text***.

Robustness

In order to test the robustness of the model, the Model 1 will be re-estimated with the elimination of independent variables that are highly correlated. The only two variables modeled which have a questionably high multicollinearity are *white* and *black*, so they will be omitted. Additionally, the variable pairs *morehs*. *lesshs* and *coupled*, *div_sep* each have correlation coefficients that are quite high, -0.496 and -0.494, respectively (*white*, *black* has a correlation coefficient of -0.892). The results of this new regression can be seen in as Model 2 in Table 4.

As can be seen in Model 2, the addition of larger numbers of independent variables did affect the statistical significances of the variables to a degree, but not to an extent great enough to alter their status as significant or insignificant to the opposite. Thus we conclude that our model is robust and is not skewed by the presence of too many independent variables.

Testing for Modeling Problems

Heteroskedasticity. Fitting the data in Model 3 to a maximum-likelihood heteroskedastic probit model in order to test for the presence of heteroskedasticity in the error term yields a p-value of 0.0054, using a chi-square test. This makes it possible to safely reject the null hypothesis of heteroskedasticity in favor of the alternate hypothesis of no heteroskedasticity.

Multicollinearity. To test for multicollinearity, variance inflation factors (VIF's) were calculated for each variable in Model 3 (see Table 5 in the Appendix for the values of the VIF's and tolerances of each coefficient) by setting each variable equal to a function of all other explanatory variables in the equation:

(3) $X_i = \alpha_i + \alpha_{i_1} X_{i_1} + \alpha_{i_2} X_{i_2} \ldots + \alpha_{i_k} X_{i_k} + v$

and calculating:

(4) $VIF(\hat{\beta}_i) = \frac{1}{(1-R_i^2)}$

As can be seen in Table 5, the only two variables that show relatively high indications of the presence of imperfect multicollinearity are *white* and *black*, having respective VIF's of 5.21 and 5.07. By the general rule suggested by Studenmund, such a VIF indicates multicollinearity that could be considered severe[3] (2011). However, we feel that the best remedy for this problem is to do nothing, given the risk of causing specification bias by dropping a theoretically relevant variable and the impossibility of increasing the size of the sample.

Interpretation

Model 3 holds against testing for specification and other types of modeling error, a pleasing result. Interestingly, only two variables that hold up as being statistically significant, *pesticides*, being significant at all levels, and *printmed*, being significant at the 10% level. Interpreting the coefficient of *pesticides*, we see that the marginal effect of an aversion to pesticides for the consumption of organic food is 0.171. This should be interpreted to mean that individuals with such an aversion are roughly 17% more likely to frequently consume organic food than non-averse individuals would be, holding all other factors constant. Similarly, the coefficient of *printmed* is 0.147, indicating that those who receive the majority of their news from print media are roughly 15% more likely to be frequent consumers of organic food. Further discussion of the implications of the data and the generated coefficients will continue in the conclusion.

[3] Studenmund's rule is that for a VIF > 5, there is severe multicollinearity. However, given Studenmund's acknowledgement that the value of 5 as a maximum VIF for a variable that does not suffer from severe multicollinearity should be increased slightly for a large number of independent variables, it is questionable as to whether any multicollinearity seen here is severe enough to warrant concern. However, as to err on the side of caution, we will treat it as severe.

Conclusions

The results of this paper will add a new perspective to the current literature, but the contrary nature of these results compared to the rest of the voices will be, unfortunately, the status quo. It seems that for every researcher and data set that exists in this fringe field (of both economics and agriculture) there is a different view that can be reasonably taken.

Weakness

The great weakness of this study is that it depends on a dummy dependent variable to model consumption habits, which are typically (and with good reason) modeled by continuous variables. Besides this, another strength of the Nielsen Homescan dataset and others like it is that it has exact data for consumption and does not rely on a participant's memory and perceptions of what "frequent" or "infrequent" consumption might mean. Nonetheless, we feel that the professional nature of the survey and the rigor with which it was instituted compensate for uncertainties that might be generated by participant error. Another weakness attributable to our study, and one that is more piercing, is that the sample size used is small and unrepresentative of the nation as a whole. As a result, some caution should be taken when generalizing the results of this study. Nonetheless, there are certain aspects that may be attributable to the population in general; these will be the subject of our forthcoming policy recommendations.

Discussion

Interestingly, this study did not find a significant link between consumer income and the consumption of organic foods. This weakens the idea that organic foods are a luxury good and suggests that consumers in the market have much more varied financial characteristics that previously hypothesized. Although organic foods have in the past been considered to be niche

goods for high-income consumers, this study concludes that researchers would do well to avoid attempts that would use income as a proxy or predictor for a given consumer's consumption of organic food.

An innovative aspect of this study was the inclusion of the variables *pesticides* and *taxes*, non-demographic variables that attempt to identify and quantify the effects of consumer characteristics beyond the normal demographic variables: aversion to pesticides in food and environmental conscientiousness. Although the marginal effect of *taxes* was not significant, the marginal effect of a risk-averse attitude to pesticides certainly was, and by comparison all other variables paled in significance. In fact, our analysis indicates that an aversion to pesticides may be the only important characteristic in terms of reliably predicting which consumers will choose to purchase organic foods. Such a finding may have important policy ramifications, the likes of which will be examined in the final section of this paper.

Regional Discrepancies

Foodstuffs are goods that tend to have a prominent characteristics that are region-specific and are often defined regionally, both in the way that consumers perceive them and construct consumption habits specific to them, as well as in many of food's economic qualities such as cost, quality, and quantity. It is possible, then, that different groups might emerge when the United States is viewed in a regional light rather than as an erroneously unified whole. To date, the predominant data set to be used in analyses of this sort has been the Nielsen Homescan dataset, a nationally distributed survey. It is possible, therefore, that the coefficients generated from the Detroit data are in conflict with the true values of the coefficients as suggested by larger studies for good reason. It may be that the true trends are regional rather than national and are unable to be seen clearly from such a broad examination.

Future Studies

This study has begun the work of incorporating analyses of non-demographic characteristics into the ongoing discussion of the "organic consumer." Future analyses of consumers in the market for organic foods can continue this trend by attempting to gather and analyze data that are specifically engineered for such a purpose, and in greater quantities. Other consumer characteristics for which it might be illuminating to control might include consumer attitudes toward both public and private health, among others. As mentioned above, geographical differences may create distinctions among consumer groups, and future studies must begin to take these into account, perhaps controlling for what region of the country in which the surveyed individual resides and whether the environment is rural or urban. Additionally, when broadening studies to encompass various regions of the United States, it would be astute to control for a given consumer's geographical proximity to organic food markets. Furthermore, as the local-food movement and the organic-food movement often go hand in hand both ideologically and in practice, it would be appropriate to control for a consumer's nearness to small-scale producers of agriculture (USDA Economic Research Service, 2014).

Insights for Policy and Practice

We shall now turn our attention to the creation and exposition of a set of general guidelines that policymakers as well as private corporations and enterprises will be able to follow in order to make the best use of the information that this study has to offer. As the policymaker will recall, notable results of our study included the revelations that an individual aversion to pesticides is the only psychological determinant of the consumption of organic foods, the fact

that consumers who receive the majority of their news from print media are more likely to consume organic foods, and that organic foods are not a luxury good. The recommendations here espoused will center policy logic around these three findings, with the aim that legislators, activists, lobbyists, farmers, cooperatives, grocers, and other members of the public/private sphere might have a new set of policy tools with which to encourage greater private consumption of organic foods.

Organic Food as a Non-luxury Good

A key finding of this study was that income was an insignificant predictor of a given consumer's predilection to consume organic foods. This is important, because it is commonly assumed in the industry that consumption of organic foods is heavily dependent on a high income; that it is a luxury good.[4] However, if we take that premise to be lacking in credibility, we emerge with both a very different picture of who the consumer of organic foods might be, as well as a very different policy tactic to follow. Previous authors, likely believing in organic food's status as a luxury good, would no doubt have recommended price-differentiation or subsidy-based strategies as a methodology for encouraging wider segments of the population to consume more organic foods. However, we do not.

Recommendation. While it is true that a decrease in price yields an increase in quantity demanded, we do not recommend that policymakers pursue price-differentiation tactics or attempt to subsidize the consumption of organic foods, as such strategies would likely yield disproportionately weak effects. Furthermore, as Dekhili and Achabou point out, consumers have access to an enormous amount of information in the digital age- it is almost laughably easy

[4] Following such a line of thought, organic food would seem to fit well within the framework that Ghosh and Varshney (2013) create, where they delineate a type of luxury good, the "little luxury," which is a sort of mass-luxury.

to compare prices online and find price differences (2013). McMahon-Beattie notes, similarly, that price discrimination may undermine trust in an organization where the consumers perceive that prices are assigned differently or unfairly to different buyers (2011). For many reasons, including those simply ideological and ethical ones, we feel that it is important that the vendors and producers of organic food remain on good terms with their consumers. Those notwithstanding, it is important from an economic perspective as well- such a loss of trust can undermine consumption; furthermore, as a fledgling industry compared with conventional foods in the United States, the organic food movement needs the opportunity to establish the greatest possible rapport with consumers.

News Consumption

This study found a significant relationship between those who are frequent consumers of organic foods and those who receive most of their news from print media. We found that a consumer who received the majority of his or her news from such sources was about 15% more likely to be a frequent consumer of organic food. This fact, while not incredibly illuminating, does, nonetheless, make an important initial foray into the confusing thicket that is the market for organic foods. Unfortunately, virtually no data, if any at all, exists that analyzes consumer characteristics or psychological disposition in relation to media preference. Therefore, we cannot postulate a necessary relationship going in either direction between the two factors. That being the case, the policymaker or market agent will be left to his or her best discretion in terms of how this finding might best be utilized as a starting point for better understanding of who the most frequent and infrequent consumers of organic foods are.

Recommendation. We recommend, nonetheless, that the policymaker, advertiser, or other agent use this finding to frame their media presence in a somewhat more confident manner.

If the desire is to appeal to those who are already more frequent consumers of organic foods, then the agent might do well to appeal to print media outlets; he might do better, conversely, to appeal to non-print outlets in order to reach those individuals who are not yet frequent consumers of organic foods.

Pesticide Aversion

We shall conclude by examining how policymakers might make use of the predilection for individuals that are averse to the consumption of pesticides in food to consume more organic food in order to foment the general consumption and demand of organic foods. In the instance of pesticide aversion, the consumer is faced with a very basic problem which is essentially insurmountable on the individual level. This problem, is of course, that he or she can do very little to ascertain whether or not a particular food item has been exposed to pesticides. Foods that have been grown organically do not generally have any distinguishing physical features, and any investigative costs become almost instantly prohibitive beyond the scope of local markets. McCluskey (2000), using a game theoretic approach to the problems that are encountered in the marketing of organic foods, defines such goods as "credence goods," that is, good in which qualities, in addition to those obstacles already mentioned, are "observed too slowly or too late to matter… by consumers even after consumption." Other examples of such goods might include so-called "free-range eggs," or kosher foods. Due to information asymmetry, the consumer is at a disadvantage in such an instance. As McCluskey (2000) points out, the consumer receives a utility payoff if he or she believes that the producer used organic methods, regardless of whether such a belief might be verifiably accurate or true in any way, due to the nature of the problem of the credence good. A profit-maximizing producer would be logically inclined, therefore, to signal consumers that his or her foods are organic, while continuing to produce them in a way

that adheres to conventional production practices. As Akerlof (1970) demonstrates, such a market, in which sellers are unable to demonstrate the quality of their goods, will ultimately result in a market of "lemons." This obstacle is surmounted, of course, when information asymmetries are reduced or eliminated. Fortunately, there are already systems such as labeling schemes which work to close that gap between producer and consumer knowledge.

The current labeling system to delineate organic foods from their conventionally-produced look-alikes is administered by the USDA, under the authority of the Organic Foods Production Act of 1990, which went into full effect as of October 2002 (Kremen, Greene, & Hanson, 2004). These national standards create a framework under which producers may identify their foods as "100% organic[5]," "organic" (that is, having 95% or more organic ingredients), or "made with organic ingredients" (a predominance of 70% or more); quantities of organic ingredients below 70% may not use the term "organic" anywhere on the main part of the label (Kremen, et al., 2004). Finally, producers who meet the requirements for "100% organic" or "organic" designations may use the certified organic seal of the USDA to advertise this aspect of their product (Kremen, et al., 2004).

Such systems are useful and necessary to create markets in which consumers can confidently purchase organic foods. Additionally, as Baourakis (2004) notes, this should be a prime opportunity to employ labels for the good of consumers, after all, whereas "we are thinking about organic or origin-labelled food products… consumers are mainly eating them. Consumers give an effective response towards food, not a cognitive one." Regrettably, there is still a lack of deep research in this still somewhat nascent field of inquiry, but a French study has demonstrated that the organic label has been effective in a number of ways: "it boosts overall

[5] Water and salt are not included in calculations of the percentage of organic ingredients within any categorization.

perceived quality and generates different product beliefs, including the descriptive belief that the product is environmentally friendly and the inferential belief that it offers good taste. *However, in the studied case it did not affect health risk beliefs*" (my emphasis; Larceneux, Benoit-Moreau, & Renaudin, 2012). This suggests that there is an aspect to the organic label that fails to capture some of the essential qualities of organic foods that make their production and consumption so desirable from a public policy standpoint. Additionally, such a finding is particularly relevant to this study given the finding that pesticide-averse (a quality related to health consciousness) individuals tend to consume more organic foods.

Larceneux, et al.'s recommendation, with which we wholeheartedly agree, is to clarify labels. As the authors emphasize, despite the legal clarity in which such demarcation may take place or the standard of rigor under which organic products might be labeled, unclear labeling may yet induce inferential beliefs, which renders the intended meaning vague and unhelpful (Larceneux, et al., 2012). Indeed, another French study found that 80% of French consumers desired more information on the advantages and disadvantages of consuming organic products than was currently afforded to them by standard labeling practices (Ifop, 2011). Considering the similarities between the French and American labeling systems, this is not likely a solely French phenomenon. A more recent study by Daunfeldt and Rudholm (2014) suggests that this is a reasonable conjecture. Daunfeldt and Rudholm also found that point-of-purchase labeling increased sales of organic coffee by 48% and organic olive oil by 43%, although sales of organic flour fell by 29% when the product was subjected to the same labeling practices. They do not postulate as to why flour might have been adversely affected by such labeling.

Recommendation. We recommend, then, that labeling practices be expanded to include the domain of pesticides; we will suggest two ways in which this might be done. The first way

in which such labeling might be achieved is this: non-organic foods could be required to list all pesticides that were used in the production of a certain good, whereas organic foods could assert their pesticide-free status. It might even a requirement to list the pesticides in a format that is similar or identical to that of the current way in which a food's ingredients are listed, to drive home to the consumer that these pesticides could well be ingested in the same way in which the macro-ingredients are. Furthermore, the micro-ingredients (pesticides) could be color-coded to indicate their level of toxicity or type of effect on humans. The alternative method would be to indicate on the packaging for organic foods the absence of a range of chemical pesticides, and warn that products that do not bear the organic label may carry such chemicals. Either tactic could prove successful, but we will provide a few considerations for the probable effectiveness of each.

First, bearing in mind the size and political weight of the agro-industrial complex, it might prove more difficult than one might hope to compel large, conventional producers to label their products as potentially adverse to consumer health. For this reason, we recommend, as do Larceneux, et al., (2012), that policymakers turn to organic producers for the institution of new labeling practices, as these tend to be small or medium-sized companies (and often regional), which seem to benefit more, anyway, from organic labeling than a larger competitor might. However, since organic goods, despite their rapidly rising popularity, are still somewhat of a niche market, information disseminated on organic labels might travel slowly to consumers who have not yet acquired the habit of regular purchase and consumption of organic foodstuffs. In that respect, then, the policymaker might do better to throw his or her political weight against the agro-industrial complex.

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Appendix

Table 3. Correlation Coefficients.

Variable	age2	white	black	sex	lesshs	morehs	highincome	coupled	div_sep	children	pesticides	taxes	news	audiovis	printmed
age2	1														
white	0.0591	1													
black	-0.0401	-0.897	1												
sex	0.0882	0.0995	-0.128	1											
lesshs	0.2264	-0.1278	0.0879	0.0073	1										
morehs	-0.2868	0.1417	-0.1126	0.04	-0.4907	1									
highincome	-0.1646	0.2466	-0.2291	0.0441	-0.2298	0.3243	1								
coupled	0.0434	0.3386	-0.3216	0.1241	-0.109	0.1484	0.3704	1							
div_sep	-0.0104	-0.1272	0.1268	-0.041	-0.0059	0.0203	-0.1535	-0.4914	1						
children	-0.4288	-0.1091	0.0778	-0.1485	-0.1039	0.1834	0.1539	0.1644	-0.0929	1					
pesticides	-0.0124	-0.2311	0.238	-0.156	0.0677	-0.0351	-0.2534	-0.0932	0.1176	0.0667	1				
taxes	-0.0637	-0.0393	0.0043	-0.0961	-0.0528	0.0599	0.1787	0.0871	-0.0556	0.0752	0.1047	1			
news	0.2073	0.0762	-0.0426	0.0617	0.0076	-0.0665	0.1144	0.0893	0.0125	-0.0014	-0.0408	-0.0128	1		
audiovis	-0.0585	-0.107	0.0283	-0.0304	-0.0105	0.0339	0.0069	-0.0259	0.0102	0.043	0.0848	0.0735	-0.0343	1	
printmed	0.0182	0.1686	-0.1579	0.108	-0.0341	0.064	0.1066	0.041	0.0086	-0.0326	-0.0546	0.1133	0.0239	-0.1391	1

Table 5. Variance Inflation Factors.

Variable	VIF	Tolerance	R^2
age2	1.44	0.695	0.305
white	5.52	0.181	0.819
black	5.28	0.189	0.811
sex	1.11	0.905	0.096
lesshs	1.37	0.729	0.271
morehs	1.51	0.661	0.339
highincome	1.47	0.682	0.318
coupled	1.73	0.578	0.422
div_sep	1.36	0.734	0.266
children	1.38	0.725	0.276
pesticides	1.19	0.841	0.159
taxes	1.11	0.905	0.095
news	1.09	0.914	0.087
audiovis	1.08	0.924	0.076
printmed	1.08	0.922	0.078

Table 6. Binomial Independent Variables: Frequency

Variable / *Value* / *Total*	Value Frequency (Integer)	Value Frequency (Percent)
white		
0	156	46.02
1	183	53.98
total	339	100
black		
0	207	61.06
1	132	38.94
total	339	100
sex		
0	200	59.88
1	134	40.12
total	334	100
lesshs		
0	290	86.57
1	45	13.43
total	335	100
morehs		
0	128	38.21
1	207	61.79
total	335	100
highincome		
0	213	70.53
1	89	29.47
total	302	100
coupled		
0	165	48.67
1	174	51.33
total	339	100
children		
0	184	55.09
1	150	44.91
total	334	100

pesticides		
0	145	43.28
1	190	56.72
total	335	100
taxes		
0	94	28.14
1	240	71.86
total	334	100
news		
1	3	8.33
2	28	11.31
3	38	80.36
total	270	100
audiovis		
0	287	85.67
1	48	14.33
total	335	100
printmed		
0	300	89.55
1	35	10.45
total	335	100