Essays on the market for sustainability

by

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CHAPTER I

INTRODUCTION

Although the notion of sustainability sounds relatively new, the idea comes from the old concept of "*sustainable development*" that dates at least from the 17th century with the concern of some authors like Matthew Hale and William Petty about population growth and its effects on resources. From the first essays on the necessity of sustainable development, we can refer to "*Essay on the Principle of Population as it Affects the Future Improvement of Society*" by Thomas Robert Malthus in 1798, where the author calls out the constant tendency for population to grow faster than resource replacement.

But formally, the idea of "*sustainability*" appeared in 1713 when Hans Carl Von Carlowitz – a German mining administrator- edited the first book on forestry, "*Sylvicultura Oeconomica"*, suggesting a sustainable use of forest resources (Keiner, 2005; Du Pisani, 2006).

Later in the 20th century, the concern shifted to oil when it was the primary energy source, and many publications discussed the finite supply of oil and warning wasteful consumption. We can mention economists like Arthur Cecile Pigou and his work on the concept of externalities (1929) and Henry Fairfield Osborn in his "*Our Plundered Planet"* (1948) about the consequences of the intensive use of natural resources and the need for responsible consumption (Du Pisani, 2006).

From the 1900s to 1970s, population growth, the industrial revolution, war, etc., had drastic effects on resource consumption and exploitation, making the 20th century the period where the concept of sustainable development evolved the most but preserving the central idea as it was presented by Carlowitz three centuries earlier.

By the 1980s, the world realizes that even though the effort to raise living standards through industrialization at the cost of ecological health and social equity, many countries were still dealing with extreme poverty (McGill University). This new concern urged the idea of finding how to combine the environment's preservation with human development. Thus, in 1984, the Brundtland Commission of the World Commission on Environment and Development released "Our Common Future", a report that brought a formal definition for sustainable development: "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED).

Though this definition is still a subject for readaptation, the majority of economists agreed on the central idea that sustainable development is the intergenerational transfer of wealth or natural resources (Pezzey, 1997) and that it is achieved by sustaining the (i) environment (ii) society and (iii) economy (United Nations, 2012).

More precisely, a sustainable environment is an environment where the ecological integrity of all environmental systems is preserved by balancing the consumption of natural resources with the time needed for their replenishment. At the same time, a sustainable economy defines a resilient economy that provides a good quality of life for everybody in terms of access to resources (e.g., financial, education, health, etc.) within the respect of the planet (WWF). Finally, society is sustainable if the universal human rights that keep communities healthy and secure are respected (Mc Gill University).

If these three pillars are determinants of the sustainability of humanity's development, they are also subject to the prosperity of a common field: agriculture. In fact, since it provides humanity with food, feed, and fiber, agriculture has the power to interact with the environment simultaneously, economy, and society. This strength makes agriculture one of the main fields to be considered to achieve sustainable development (Meyer-Höfer, 2014, Sanchez-Bravo, 2021).

The continuous demographic growth creates numerous issues connected to the need for an increase in agricultural productivity levels implying the intensive use of agricultural inputs. Consequently, agriculture often places significant pressure on natural resources; for example, it uses 30% and over 70% of worldwide energy and freshwater. (Jeswani et al., 2015). Moreover, by 2050, water withdrawals are expected to increase to 15% to accommodate the expected 50% increase in agricultural production that the world needs to feed 9 billion persons (Worldbank, 2017; FAO). This intense exploitation of natural resources affects nature severely because, among other issues, it causes biodiversity loss, depletes aquifers, contributes to climate change, and dramatically interferes with the nitrogen and phosphate (N & P) cycle (Willett et al., 2019, Sanchez-Bravo et al., 2021).

Thus, it is crucial to adopt sustainable agricultural practices that would protect the environment, expand the Earth's natural resource base, and maintains soil fertility (NIFA-USDA). The concept of sustainable agriculture as for sustainable development is an umbrella term for all agricultural practices that respond to the general idea of maintaining a balance between the use of natural resources and their regeneration time. From the multitude of reinterpretations of sustainable agriculture in the literature, I chose the USDA's official definition to be the formal reference retained for this research.

Sustainable agriculture as defined by the USDA, originates from the 1990 Farm Bill, where it is presented as "*an integrated system of plant and animal production practices having a site-specific application that will, over the long term (1) satisfy human food and fiber needs; (2) enhance environmental quality and the natural resource base upon which the agricultural economy depends; (3) make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; (4) sustain the economic viability of farm operations; and (5) enhance the quality of life for farmers and society as a whole*." (NIFA-USDA).

Besides discussing the concept of sustainable development in general and its relationship to agriculture, it is mandatory to depict the weight of human well-being within this process.

Therefore, and as mentioned previously in this introduction, society is another key agent for sustainable development, with human health and well-being being the core of social sustainability (Sanchez-Bravo et al., 2021). Littig and Grieβler (2005) explain that "*social sustainability is a quality of societies. It signifies the nature-society relationships, mediated by work, as well as relationships within the society. Social sustainability is given if work within a society and the related institutional arrangements (1) satisfy an extended set of human needs, and (2) are shaped in a way that nature and its reproductive capabilities are preserved over a long period of time and the normative claims of social justice, human dignity and participation are fulfilled*."

Again, as the difficulties encountered to sustain the environment, many issues make the implementation of sustainability in societies a difficult mission. The United Nations lists six main challenges to social sustainability: (1) securing dignity and equality for all human being, (2) realization of decent work for all, (3) empowering women in the workplace, marketplace, and community (4) securing children's rights, (5) preserving the livelihoods of indigenous peoples, and (6) improving learning worldwide to benefit business and society. For this research, I will limit the discussion to points (1) and (2) of this list.

If revolutionary scientific and technological developments[1] mark the 20th and 21st centuries, socially, humanity is still fighting several issues: racial and gender discrimination, illiteracy, and modern slavery[2]. Despite the numerous and continuous efforts[3] that mandate the respect of human rights, these issues prosper within most societies. For example, forced labor touches fields from agriculture to manufacture and concerns 21 million victims worldwide (ILO, 2017).

Consequently, the existence and persistence of environmental, economic, social issues and the trend towards globalization contribute to the expansion of an atypical category of consumers that require social and environmental responsibility from corporations and producers. Furthermore, their decision-making, purchases, and other consumption experiences are influenced by their ethical concerns (Cooper-Martin and Holbrook, 1993). This consumption niche is often interchangeably labelled "Consumer ethics", "consumer citizenship", "anti-consumption", "responsible", "conscious", "ethical", "political", "pro-social", "radical", "green" and "sustainable", dependently on the popularity and definitional clarity across and within disciplines (Carrington et al., 2019). Needless to precise that these

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[1] e.g., the discovery of DNA-1950; detection of gravitational waves-2015; creation of human organ-2019; quantum theory-1900; first laser-1960…etc.

[2] Modern slavery, modern slavery covers a set of specific legal concepts including forced labour, debt bondage, forced marriage, slavery and slavery-like practices, and human trafficking. Although modern slavery is not defined in law, it is used as an umbrella term that focuses attention on commonalities across these legal concepts. Essentially, it refers to situations of exploitation that a person cannot refuse or leave because of threats, violence, coercion, deception, and/or abuse of power. an estimated 40.3 million people were victims of modern slavery in 2016 (ILO, 2017)

[3] Such as the international convention on the elimination of all forms of discrimination that was adopted January 4th, 1969 (OHCHR).

sustainable consumers played – and still- an important role to impose their concerns about numerous ethical issues (e.g. forced labor, animal welfare, air pollution, etc.) to directly impact entities in the immediate supply chain, such as farmers through consumption of fairly traded commodities; or, indirectly creating positive outcomes for entities outside of the immediate commodity chain, such as, the beneficiaries of cause-related marketing[4] (Hawkins 2011; Olson et al. 2016, Carrington et al., 2019).

In sum, the implementation of sustainability is a highly challenging mission that requires the involvement of all economic agents. Thus, through this dissertation, I tried to analyze from the economics perspective, facets of sustainability from the consumer and producer sides. Though there is extensive literature on sustainability and its different forms (e.g., sustainable food, sustainable transports, sustainable energy, etc.), there are still unanswered questions regarding producers' and consumers' behavior regarding sustainability. Through this dissertation, I am trying to provide an empirical understanding on (1) the methodological determinants in the farmers' willingness to adopt sustainability research, and (2) US ethical consumerism for cotton apparel.

[4] Cause-Related Marketing is when companies use their corporate social responsibility in their communication activity.

CHAPTER II
FARMERS' WILLINGNESS TO ADOPT SUSTAINABLE AGRICULTURAL PRACTICES: A META-ANALYSIS

ABSTRACT

The increasing growth of consumption needs puts pressure on the natural systems, harming the climate, biodiversity, and water. This has induced a growing recognition that action should be taken to mitigate irreversible damage to the environment and climate (OECD, 2008, 2012a). Consequently, the sustainability of the environment can be impacted through a change in consumer's and producer's behavior (OECD, 2012a), which can be primarily done through the transformation of our agricultural system using alternative farming approaches that are based on ecological principles (Riar et al., 2017).

By exploring past studies, this research assesses the literature on sustainable agriculture adoption. The major findings of peer-reviewed works provide a list of significant methodological factors affecting the elicitation of producer's preferences for sustainable farming practices which are used to examine Willingness to Accept values across different studies by way of meta-analysis.

Keywords: WTA, Meta-Analysis, Farmers, Sustainability

Introduction

For decades farmers were pressed to intensify their practices that do not necessarily take into account the ecosystem aspect of the farms to increase their lands' productivity and efficiency to face the increasing demand from consumer. Technical and scientific achievements allowed unprecedented gains in productivity but have also created same heavy environmental impacts due to the exhaustive use of natural sources leading to a high carbon footprint, water resources depletion, soil degradation and acidification, nutritional imbalance, and deterioration of the micro-ecological environment (e.g., Lin et al., 2019; DeLonge et al. 2016). As a global consequence, each year, the earth loses about 18.7 million acres of forests, and 80% of the world's plants and animals living in forests lose their habitats due to deforestation in favor of agriculture (FAIRR, 2020). Giving these environmental repercussions and market pressures, sustainable production practices have emerged as focal points of research and policy (UCSUSA, 2020).

To sustainably manage farms, producers need to change their conventional practices in favor of practices that promote environmental sustainability.

As a concept, sustainability in agriculture has been defined by many entities but was knowledgeably introduced in late 1980 in the WCED report (WCED, 1987) while developing the concept of sustainable development (Creemers et al., 2019). Since then, the concept has evolved and gained attention in agricultural policy debates (Creemers et al., 2019). The U.S. Department of Agriculture defines sustainable agriculture as an integrated system of plant and animal production practices that aim to 1) satisfy human food and fiber needs, 2) enhance environmental quality and the resource base, 3) sustain the economic viability of agriculture, 4) use efficiently nonrenewable resources and integrate where appropriate biological cycles and controls, and 5) enhance the quality of life for farmers, farmworkers, and society as a whole (U.S. Code Title 7, Section 3130).

The abundant literature contains numerous qualitative and quantitative reviews summarizing past works on farmers' preferences for sustainable agricultural practices. However, most of these reviews focus on the Willingness to Accept factors for adoption (e.g., Lastra-Bravo et al., 2015), or specific elicitation methods and methodological approaches affecting the WTA estimation (e.g., Mamine et al., 2020; Barrio and Loureiro, 2010), or limited to specific sustainable practices (e.g., Lech and Wachenheim, 2014; Loomis and White, 1996; Van Houten et al., 2007). Therefore, this study aims to present a more expansive view of WTA by exploring past studies that focus on the elicitation of farmers' willingness to produce bioenergy crops, to adopt practices that reduce pollution levels as well as their willingness to adopt water and soil conservation practices. Studies with hypothetical elicitation using either conjoint analysis or contingent valuation and that provide an estimated quantitative value for the WTA are targeted. The results of this meta-analysis put existing WTA values into context of time, elicitation method, and location of the study both in the aggregate as well as for specific sustainability practices.

Theoretical Framework

The OECD defines the Willingness to Accept (WTA) as the stated price that an individual would accept in compensation for the provision of an environmental service that may adversely impact short-run profitability (OECD,2005). In other words, the WTA is the minimum amount of income a person will accept for a decline in circumstances or the minimum amount a person will accept to forgo an improvement in circumstances (Haab and McConnell, 2002).

The concept of WTA is derived from the Hicksian welfare measures of the compensating variation (CV) and the equivalent variation (EV) (Ahlheim and Buchholz, 2000). To derive WTA from CV, we assume that an individual consumes "X" goods with prices "p", and "q" is a scalar representing environmental quality, so the CV is as following:

$$\text{CV}= \text{e}(p, Q^1, U^1) - \text{e}(p, Q^1, U^0) \quad (1),$$

where the "e(p, Q^1, U^1)" is the individual expenditure function after a quality improvement so he attains a new utility level keeping his current income level. While "e(p, Q^1, U^0)" defines his expenditure function after quality improvement but with a hypothetical income level that would keep his utility level unchanged. In other words, CV expresses the maximum amount of money an individual could give up given a change in the environmental quality (Q) without being worse-off than in the initial situation where the quality level is unchanged (Ahlheim and Buchholzb, 2000).

Therefore, when the amount of CV is positive it reveals individual's willingness to pay (WTP) and when it is negative the CV becomes the smallest amount that compensates an individual to keep his initial utility level, which is his WTA.

Table 1. Increase and decrease in the environmental quality

	Increase in environmental quality ($\Delta U>0$)	Decrease in environmental quality ($\Delta U<0$)
CV	WTP (CV>0)	WTA (CV<0)

Source: Ahlheim and Buchholz (2000)

Methods and Procedures

Meta-analysis (MA) is a body of statistical methods that are useful in reviewing and evaluating empirical research results (Stanley, 2001). The MA integrates the findings of separate studies to determine the overall size of an effect, and to determine the impact of moderating variables on the effect size. The MA needs to be reliable and valid allowing for the detection of the true effect size and the true impact of moderator variables (Tammo et al., 2001). To conduct our MA, several steps were followed to search, collect, and analyze the meta-sample. For convenience, the process is divided into two phases: (1) the search of the literature that will constitute the meta-sample, and (2) the estimation of the meta-regression.

Phase 1: Literature Search

The objective of this investigation is to explore studies that focused on farmers' willingness to adopt or to convert to sustainable farming practices as defined in the introduction and detailed below; thus, it is important to set a definite list of keywords that represent the subject of interest and to set the right search strategy that will be followed to collect the meta-data.

The first step is to search for the works corresponding to the topic of interest. Following the approach adopted by Tey et al. (2018), the SPIDER search tool was used to target the studies that compose our meta-sample. This technique consists of finding keywords that best identify the topic during searches on electronic databases. Table 2 reports the keywords that have been employed to identify published works focusing on the WTA to adopt or convert to sustainable farming.

Table 2. SPIDER search technique

SPIDER Tool	Search terms
S- Subject	"Farming methods"; "Farming practices"; "Agricultural practices"
PI- Phenomenon of Interest	"Sustainable", "Environmentally friendly"; "Ecological"; "Green"; "Crop rotation"; "Organic"; "Organic seeds", "Compost", "Animal manures", "Green manures", "Cover crop", "Conservation", "Bioenergy", "PAMS strategy", "Climate-smart", "BMP", "Biodiversity", "Chemical-free."
D-Design	"Questionnaire"; "Survey"; "Interview", "Experiment"
E-Evaluation	"WTA"; "Premium"; "Reward"
R-Research Type	"Quantitative"

As reported in Table 2, this research includes only quantitative studies, which means that the sample choice is limited to research works that report quantitative values of the WTA excluding all other studies that present a qualitative analysis of producers' WTA, as well as studies that express WTA premium per other metrics than a hectare (e.g., some studies expressed WTA per household) or other than an economic value (e.g., some studies are presenting WTA in percentages). Also, the keywords reported in the section "Phenomenon of Interest" include all the practices that are considered sustainable farming practices based on the USDA's definition of sustainable farming (USDA, 2018). The search was conducted in the electronic databases reported in Table 3 and targets published studies in English and French without a time-frame limit.

Table 3: List of databases

Databases in English	Databases in French
EconLit, Business Source Premier, Agricola, AgEcon Search, Web of Science, Wiley Online Library, American Economic Association, Google Scholar, EBSCO Host Electronic Journal Service, ProQuest, PubMed, Science Direct, Scopus, Web of Knowledge, JSTOR, CiteSeerX, Springer	Erudit, CAIRN, Isidore, Europeana, AgroForst, Tel-Archives, Bibliotheque de la Diete, AGRIS, Systeme Universitaire de Documentation, Gallica.

The choice of papers is based on their relevance by examining their abstracts, their results, and methods and procedures sections. Once collected, how WTA values are expressed were examined in each study and uniformized into a common metric and/or U.S. dollars when it was necessary. Values expressed in a foreign currency were converted to US Dollar as well as values that were expressed in other metric measures than a hectare. This step generated the collection of the meta-data that compiled 62 studies and 287 WTA estimates.

Phase 2: The Meta-Regression Analysis (MRA)

Meta-regression analysis is a form of MA especially designed to investigate empirical economics research (Stanley and Jarrell, 1989; Jarrell and Stanley, 1990). In a meta-regression analysis, the dependent variable could be a summary statistic, or a regression parameter, drawn from each study, while the independent variables may include characteristics of the method, design, and data used in these studies (Stanley, 2001). This analysis method allows explaining the wide study-to-study variation found among research findings (Stanley, 2001). It is also a powerful tool that provides information about relationships of interest by combining results from various previous studies (Stanley and Jarrell, 1989), and using the differences across these studies as explanatory variables in a regression model (Alston et al., 2000). This regression seeks to provide a scientific approach to research synthesis (Doucouliagos, 2016), and to go beyond estimates that are obtained from individual studies (Nelson and Kennedy, 2009) to find the best proxy possible of the true effect of interest (Prinlezis et al., 2019).

The MRA Model

The meta-analysis function has a panel structure. Because some original studies report multiple WTA estimates, an unbalanced structure exists as the number of reported estimates differs between studies. Thus, the meta-regression is based on the following model presented by Stanley (2001), and Lagerkvist and Hess (2011):

$$WTA_{mn} = \alpha + \sum_{k=1}^{k} \beta_k X_{k,mn} + \varepsilon_m + \mu_n \quad (2),$$

where WTA_{mn} stands for the dependent variable, the subscript "*m*" denotes the sampled study from which the WTA estimate comes, and "*n*" denotes the WTA estimate reported in that study. If each study "m" provides a single estimate "n", then $N_m = 1$, and the error terms ε_m collapse into μ_n . Alternatively, if study "m" provides more than one estimate, it is necessary to account for the common error across estimates (μ_n), and the group-specific panel error in a study (ε_m), so that the total number of estimates is $N = \sum_{m=1}^{M} N_m$.

The variations in WTA_{mn} are explained by a vector of explanatory variables, i.e. *k=1,…, K*, denoted $x_{k,mn}$ (Lagerkvist and Hess, 2011).

The parameter α represents the intercept term of our regression and β_k is a vector of slope parameters to be estimated.

The meta-sample contains different regressions that would share the same objective - estimating the WTA but differs partly or completely from the chosen explanatory variables. Thus, the estimates might not be independent in a given sample study, so that the decomposed error variance at the study level, ε_m, and error at the estimation level, μ_n is assumed to be normally distributed with zero mean and constant variances, σ_ε^2 and σ_μ^2, respectively (Bijmolt and Pieters, 2001).

The intuition behind the meta-regression analysis is that the variation in reported WTA estimates can be explained by the study design characteristics summarized in table 4. Equation (3) represents a simple MRA version that does not take into account two possible problems. First, due to heterogeneous variances used in WTA estimation, potential heteroskedasticity in the error terms can occur and cause biased standard errors of equation (3). As solution, the variable square root of the sample size is a good indicator of this heteroskedasticity because it is positively related to the estimation precision (Stanley, 2005). Second, because we have 288 WTA estimates from 62 cluster studies, intra-cluster error correlations may affect WTA observations which would result in biased standard error estimates in regression (3) (Nelson and Kennedy, 2009; Hirsh, 2017; Printezis et al., 2019).

Therefore, to solve these potential issues and generate efficient estimates of (3) with corrected standard errors, two regressions where the square root of sample size is used as weight were used: a weighted least squares (WLS) regression with robust standard errors (Hedges and Olkin ,1985; Stanley , 2005; Oczkowski and Doucouliagos ,2014) that serves as the base specification, and the weighted least squares with clustered robust standard errors that is considered to be the main model to which we are referring while interpreting the findings. Following previous meta-analyses literature in Agricultural Economics (e.g., Printezis et al., 2019; Johan and Hess, 2010; and Lusk et al., 2005), this model choice is justified because it takes into account the 62 cluster studies and is more powerful to capture heteroskedasticity (Stanley and Doucouliagos, 2010).

Publication selection bias and precision effect

Besides the two potential problems mentioned in the previous section, a meta-analysis also presents the risk of publication selection bias. Publication selection bias refers to a tendency of having a greater preference for estimation and publishing statistically significant results compared to results that do not reveal statistical significance (Hirsh, 2017). Stanley (2005, 2008) shows that the relationship between analyzed estimates and their precision (e.g. standard errors or sample size) can serve as an indicator for publication selection bias. Therefore, the square root of the sample size is used here (labelled "sqrt(n)"). This indicator can also serve as an adequate precision measure because it is proportional to the inverse of the standard error (Stanley, 2005; Zigraiova and Irsova, 2016; Bakucs et al.,2014), moreover, it has been shown that in MRA, the square root of the sample size is a superior measure of precision (Sterne et al., 2000; Macaskill et al., 2001).

In combining information from independent but similar research, MA has the capacity to improve parameter estimates that are obtained from a single study (Erez et al., 1996; Printezis et al., 2109), and this allows to the estimation of a proxy for the "true" effect of the variable of interest. Thus, equation (3), which is a simplified version of equation (2), is used to obtain a proxy of the true WTA proxy:

$$WTA_i = \beta_0 + \beta_1 sqrt(n_i) + \varepsilon_i \quad (3),$$

where WTA_i is the explained variable which is the WTA estimates collected from the 62 studies, and $sqrt(n_i)$ is the squared root of the sample size variable, the precision measure variable. Using the same models as for equation 3, the "true" WTA is obtained by the estimated constant, such as $True\ WTA_i\ effect = WTA_i = \beta_0$.

To confirm the presence of a significant WTA for sustainable farming, we perform the precision effect test (PET) that is a t-test for the constant. Rejecting H_0: β_0=0 means that a significant WTA exists (Stanley, 2005).

If the publication selection bias is not verified, then the observed WTA effects should vary randomly around this "true" effect, independently of their precision (sqrt (n)) (Stanley, 2005; Bakucs et al., 2014; Printezis et al., 2019). Therefore, to test for the presence of publication selection bias, the funnel asymmetry test (FAT) is used, which is also a t-test performed for the slope β_1. Rejecting H_0: β_1=0, would indicate the presence of publication bias (Stanley, 2005). Note that it is mandatory to have at least 10 studies in a meta-data, and sampled studies should not have similar standard errors to perform this test, conditions that are fulfilled for this case. Also, to affirm the findings, it is recommended to provide a visual representation of the results by a plot of the dependent variable (WTA), and the precision measure variable (sqrt(n)) (Printezis et al., 2019).

Following the recommendation of Nelson and Kennedy (2009), we perform a robustness check by estimating regression (4) using the sample size "n" as the precision measure as well as presenting two regression models (WLS with robust errors and WLS with cluster robust errors) for all the meta-regressions (MR).

The variables

The dependent variable: We use our meta-regression models, the WTA estimates reported by the 62 articles as the dependent variable. As explained above, WTA values were converted to USD/Ha/year to keep a common metric across studies. It is important to mention that the final total number of WTA estimates (n=288) is larger than the number of studies included in the meta-regression (n=62) because some studies report multiple WTA estimates due to multiple programs/schemes, or products, or samples per each study.

The independent variables

Year of study: identifies the year when each study was published. The year of the study was identified because many of the sampled studies do not provide the year in which the data was collected. We used a trend variable for each study since one study can have more than one WTA estimate.. This variable allows testing if there is a trend over time in WTA for sustainable practices' estimates (Printezis et al., 2019). For our MRA, a trend variable is created to assess the evolution of WTA elicitation through time.

The continent of study: As the sample has studies that have been conducted in numerous countries, the continent to which each WTA belongs is identified as a dummy variable for the regression. Four dummy variables for Europe, Africa, America, and one for both Australia and Asia (Australasia) that is used as a base in the MR. This variable permits the identification of differences in the reported WTA estimates among the continents.

Sample size: The sample size used in each study is included to have an insight into how much sample size magnitude can influence the WTA estimates. In all studies, the sampled individuals are farmers.

The square root of the sample size: It is important to include this precision estimate as an independent variable to explain the variance in reported WTA estimates because although it is highly correlated with $1/_{SE}$, the square root of the sample size is free of estimation error (Stanley, 2005).

Sampling method: The sampling method used in each study is also included as an explanatory variable to test if the manner of choosing the sample affects the WTA estimation. Random and non-random sampling methods were identified across the meta-data: random sampling, stratified sampling, quotas sampling, cluster sampling, and convenience sampling. Thus, a dummy variable was created that takes the value one if the study uses a random sampling method and takes the value zero if a non-random sampling is used instead.

Elicitation method: Several methods have been employed across the literature to analyze preferences and most of the studies used choice experiments. As all the sampled research are hypothetical studies, two elicitation methods were identified across the metadata: the conjoint analysis and the contingent valuation method. Based on that, a dummy variable was created taking the value of 1 if the study uses a “contingent valuation method” and the value of zero if using “conjoint analysis”.

Energy: This variable refers to the use of biomass crops in energy production. In our data, we observe studies focusing on farmers’ willingness to plant biomass woody (e.g., pine hoak), grassy (e.g., switchgrass), and cereal (e.g., corn) crops for use in bioenergy production. This variable takes the value of one when the article discusses the willingness to grow one of these biomass crops and takes the value of zero otherwise.

Soil: This variable refers to all agricultural practices that aim to enhance/preserve soil health. Based on our data, practices include: agroforestry, cover crops, conservation tillage, rotational grazing, and organic farming. Thus, the variable takes the value of one if one of these practices is identified in the sample WTA and takes the value of zero otherwise.

Water: this dummy variable includes practices that aim to conserve water resources like the conservation of wetlands, watersheds, water reservoirs, and riparian lands. It takes the value of one when the study sample focuses on one of these, and the value of zero otherwise.

Pollution: this dummy variable includes practices that aim to reduce pollution levels and those that preserve ecosystem biodiversity. The specific practices found in the data are reduction of chemical use, climate-smart agricultural practices, and biodiversity conservation. The variable takes one if one of these practices is verified and takes zero otherwise.

Even though the metadata gathers important information from the variety of practices supported, this same variety brings a high degree of heterogeneity completing from observing the magnitude of the effect of the specific practices that exists within each category (referring here to the dummies created for each practice category: soil, water, pollution, and energy). A regression including only binary variables may result in loss of information and specificity of results. Thus, to reduce the variation across studies and use the additional information brought by the diverse practices within each category, the metadata were subdivided into four subsets based on the sustainable practice category. The categorization of these subsets is based on the last four dummies previously described (soil, water, energy, and pollution). To recover the information supported by each specific sub-category of practices, an additional set of dummy variables were created: for soil data, two dummy variables were created and labelled forest and Best Managerial Practices (BMPs). For water data two dummies: watershed and riparian; For pollution and energy data, three dummy variables for each: chemical, biodiversity and other, for pollution, then, grass, woody, and crop for energy data, respectively. Each subset has 30 or more observations.

For the Soil dataset

There were 137 WTA estimates in the soil subset derived from 19 studies. Two categories of sustainable practices: one related to agroforestry practices (forest), and a second category referring to agricultural practices that are qualified as Best Management Practices (BMP) such as organic farming, crop rotation, grazing rotation, soil tillage, cover crops, grassland conservation, and conservation tillage were identified. A dummy variable for each of the two categories was created: agroforestry and BMPs, it takes the value of one if the practice in the study sample is related to agroforestry and takes zero if the discussed practice belongs to the BMP category.

For the Energy dataset

This subset contains 50 WTA estimates from 15 studies. Three dummy variables corresponding to the biomass crop type were created. In the data, three biomass crops were identified: grassy crops (switchgrass & hay), cereal crops (corn & wheat), and woody crops (pine & hoak) that are the base. Thus, the variables take the value of one when the respective biomass crop is identified in the sampled study and takes the value of zero otherwise.

For the Water dataset

For this subset, there were 32 WTA estimates from 8 studies that focus on either farmers' WTA to adopt watersheds/wetlands conservation or riparian lands conservation. Two dummies were created for each category of conservation: watershed and riparian (the base), taking the value of one when one is verified and zero otherwise.

For the Pollution dataset

This dataset included 73 WTA estimates from 19 studies and gathers studies investigating farmers' WTA for practices that aim to reduce pollution levels and preserve natural biodiversity. Three dummies were created: one for practices that aim to reduce chemical use (chemical), one for practices that aim to preserve nature biodiversity (biodiversity), and the last one for climate-smart agriculture practices (other) that is the base. These variables take the value of one when the specific practice is observed and take the value of zero otherwise.

Results

Summary statistics

Table 4. Summary statistics of the overall data and the subsets

	Overall Data		Soil Data		Water Data		Energy Data		Pollution Data	
VARIABLE	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
WTA	403.16	818.41	151.14	323.79	297.79	487.62	1347.89	1383.99	279.9	592.11
Elicitation Method	0.188	0.391	0.015	0.12	0.613	0.495	0.122	0.331	0.11	0.32
Random Sampling	0.62	0.487	0.478	0.50	0.581	0.501	0.776	0.422	0.2	0.401
Europe	0.582	0.494	0.073	0.262	0.032	0.180	0.755	0.434	0.394	0.492
Africa	0.226	0.419	0.721	0.45	0.774	0.425	0	0	0.437	0.500
America	0.181	0.386	0.206	0.406	0	0	0.204	0.407	0.141	0.35
Asia	0.063	0.243	0.015	0.121	0.194	0.402	0.041	0.200	0.099	0.300
Soil	0.474	0.500	-	-	-	-	-	-	-	-
Water	0.108	0.311	-	-	-	-	-	-	-	-
Energy	0.171	0.377	-	-	-	-	-	-	-	-
Pollution	0.247	0.432	-	-	-	-	-	-	-	-
Trend	8.08	2.57	8.26	2.87	7.52	2.51	7.84	1.98	8.13	2.33
Sample Size (n)	740	886.05	479	672.15	210	58.19	328	246.55	344	26.458
Grassy crops	-	-	-	-	-	-	0.184	0.391	-	-
Woody crops	-	-	-	-	-	-	0.571	0.5	-	-
Cereal crops	-	-	-	-	-	-	0.245	0.434	-	-
Agroforestry	-	-	0.213	0.411	-	-	-	-	-	-
BMPs	-	-	0.787	0.411	-	-	-	-	-	-
Watershed	-	-	-	-	0.742	0.445	-	-	-	-
Riparian	-	-	-	-	0.258	0.445	-	-	-	-
Chemical	-	-	-	-	-	-	-	-	0.437	0.500
Biodiversity	-	-	-	-	-	-	-	-	0.268	0.460
Other	-	-	-	-	-	-	-	-	0.268	0.446

The summary statistics table reveals that the average reported WTA to adopt sustainable practices in farming across the included studies is estimated to \$403/Ha/year. The mean number of farmers participating in each study is 740 individuals. This number allows us to evaluate the precision with which the WTA estimate was measured as described below.

Regarding the subsets, the highest average WTA is reported in the data related to farmers' WTA to grow/supply biomass crops that is estimated to 1348USD/ ha/ year. While the data for soil health practices, reports the lowest average WTA estimated to 151 USD/ha/year. For the subsets for water conservation practices and pollution reduction practices report both the same WTA averages of 280 USD/ha/year each.

For the variables related to the study design, the data shows that 19% of the included studies used a contingent valuation method to elicit farmers' WTA for sustainable practices in their farming, which implies that over 70% of the meta-data used studies conducting discrete choice experiments. Summaries show also that 59% of the meta-data studies were carried out in Europe, 18% were conducted in America, 23% in Africa, and only 6% in Asia and Australia. On average, 62% of the studies used a random sampling method to draw their samples.

Regarding the sustainable practices investigated in the sampled studies, 47% of the overall studies focused on farmers' WTA for practices that would enhance/conserve soil health, and 25% valued farmers' willingness to preserve biodiversity and reduce pollution levels, while water conservation practices and biomass crops planting represent only 11% and 17% respectively.

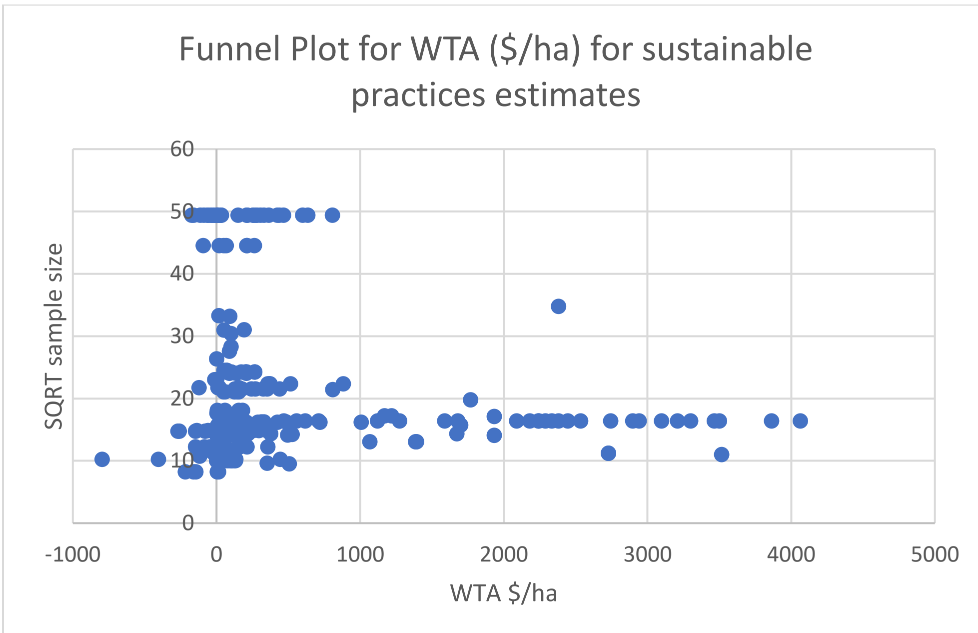
At the subsets level, descriptive statistics show that practices related to BMPs and conservation of watersheds and wetlands are the most investigated practices (respectively 79% and 74%) within their categories: "Soil" and "Water" data, respectively. Also, 57% of energy data combines articles analyzing willingness to produce biomass woody crops, and 44% of pollution data is relative to studies valuing farmers' preferences to adopt practices that aim to reduce chemicals' use.

As an initial diagnosis, the correlation matrix reported in Appendix 1 does not show high correlations among our independent variables for the overall data.

FAT and PET analyses

Following Printezis et al. (2019), two approaches are employed to correct the intra-study error correlations and publication bias using the square root of the sample size "sqrt(n)" and the sample size "n" as precision measures: the funnel asymmetry test (FAT) and the precision effect test (PET). Table 5 presents WLS regressions results for the simple model without additional study design covariates (equation 3). The interpretation is based on results obtained from the WLS cluster robust standard errors as it is the main model of our study.

Figure 1. Funnel plot for WTA ($/ha) for sustainable practices estimates



The Funnel plot is used as an initial check for the presence of publication bias. It is a scatter diagram that plots the precision measure against the variable of interest, which are in our case: the square root of the sample size (sqrt(n)), and the WTA for sustainable farming practices (WTA $/ha). Figure (1) displays no emptiness on the lower-left corner of the plot which means that there is no indication of publication bias. This finding is supported by the t-test obtained from the simplified MRA (equation 3), the coefficient of the precision variable "sqrt(n)" in (2), as well as the coefficient of "n" in (3), are not significant. Thus, we fail to reject the null hypothesis and we conclude that there is no presence of publication bias in the metadata.

Table 5. PET and FAT analyses (using WTA in $/ha/year)

	WLS robust				WLS cluster Robust SE			
	(1)		(2)		(3)		(4)	
	Coef.	CI	Coef.	CI	Coef.	CI	Coef.	CI
Constant	680.72*** (*91.067*)	(501.47; 859.96)	546.06*** (*68.47*)	(411.29; 680.84)	709.45* (*362.46*)	(-15.31 1434.24)	566.68* (*271.88*)	(23.02;1110.34)
sqrt(n)	-11.73*** (*1.99*)	(-15.67; -7.80)	-	-	-12.24 (*7.49*)	(-27.22; 2.73)	-	-
N	-	-	-0.18*** (*0.031*)	(-0.24; -0.12)	-	-	-0.19 (*0.12*)	(-0.43; 0.04)
Obs	287		287		287		287	
F	34.44		35.40		2.67		2.80	
Pr > F	0.000		0.000		0.1072		0.0996	
R^2	0.1064		0.1111		0.0790		0.0824	

*Standard errors are in parentheses; *** and * indicate significance at the 1%, and 10% levels*

The estimated constant which serves as a proxy for the “true” WTA for sustainable agricultural practices, presented in Table 5 indicates the presence of a significant WTA for sustainable agriculture practices. That is, the constant estimate is significant in the two models, implying that the weighted average of WTA for adopting sustainability in farming across the included studies ranges between $567/ha/year and $709/ha/year in all regions.

Meta-regressions Analyses

Overall data MRA

Table 6 presents the results of the full MRA models that take into account methodological differences across the studies included in this analysis. Model diagnosis shows that the two models are overall significant based on the F-test.

Table 6. Meta-regression of the overall data (using WTA in $/ha/year)

	WLS Robust SE		WLS Cluster Robust SE	
	(1)		(2)	
	Coef.	P>|t|	Coef.	P>|t|
Constant	762.969 (195.228)	0.000***	793.536 (351.638)	0.028*
Elicitation Method	305.626 (115.927)	0.009**	290.004 (144.799)	0.050*
Random Sampling	309.697 (113.583)	0.007**	318.848 (146.455)	0.033*
Europe	174.300 (145.216)	0.231	211.096 (238.833)	0.380
Africa	-343.285 (126.774)	0.007**	-325.541 (181.836)	0.078*
America	-72.474 (177.608)	0.684	-88.553 (214.314)	0.681
Soil health related ag. practices	-903.044 (174.820)	0.000***	-908.287 (424.569)	0.036*
Water related ag. practices	-750.992 (234.312)	0.002**	-769.416 (460.411)	0.100
Pollution related ag. practices	-704.007 (200.281)	0.001**	-711.006 (447.512)	0.117
Trend	53.373 (14.939)	0.000***	53.829 (25.826)	0.041*
Sqrt(n)	-15.602 (2.973)	0.017*	-16.982 (6.448)	0.011*
Obs	287		287	
F	7.81		2.53	
Pr>F	0.000		0.0127	
R^2	0.3855		0.4030	
Adj. R^2				

****, **, * indicate significance at the 1%, 5%, and 10% levels, sqrt(n) is used as weight*

As was demonstrated previously through the PET analysis, the result confirms the presence of a proxy of the true “WTA” since it shows a positive and significant constant. The result shows also four significant covariates at the 10% level: trend, Africa, soil elicitation method, and random sampling.

The trend variable estimate is significant and positive, meaning that observed WTA values, on average, are increasing over time by $54/ha/year. This increase of researchers’ interest in sustainable farming is justifiable by the current and the main challenge for worldwide agriculture to reconcile the growing demand for food with sustainable agriculture (Crosson, 1992; UNDESA, 2017).

Also, the estimate of the variable Africa is negative and significant, showing that studies conducted in Africa show lower WTA values for adopting sustainable farming compared to studies conducted in Australasia (the base region). However, this result is controversial, the literature show a low responsiveness of African farmers to sustainability in agriculture

(Agula et al., 2018, Kassie et al., 2009; Wollni et al., 2010). This resistance has been analyzed by many researchers who point out several constraints encountered by farmers that discourage them to adopt. For example, Norman et al. (1997) relate non-adoption of sustainability in agriculture to the fact that sustainable agriculture practices are demanding in terms of management and learning, while others (e.g. Pannell, 1998; Barlas et al., 2001; Nowak, 1991; Bell et al., 2001; Rodriguez-Baide, 2005) explain it by economic factors such as cost of adoption, uncertainty of profitability, loss of productivity, labor demand, and economic policy. These factors are likely compounded by small farm size in of African agriculture: findings estimate that 80% of farms across nine sub-Saharan countries are smaller than two hectares. This implies that to reach the poverty line, these farms need to generate at least $1,250 per hectare but available data from Mozambique, Zimbabwe, and Malawi for example, displays mean revenues ranging between $78 and $424 per hectare per year which appears to be far from the minimum that allows transgressing poverty (Lowder et al., 2016).

Regarding the effect of the sustainable practice type, the regression shows that the coefficient for the variable for studies on farmers' preferences for practices aiming to enhance soil health is significant and negative, which means that these studies show lower WTA premiums compared to studies eliciting farmers' preferences for biomass crops planting/supplying. The preference of a production system over another is equivalent to prefer an investment over another, so referencing to the time preference theory, this behavior becomes more understandable. Time preference theory in behavioral finance literature explains that individuals tend to place larger premiums for near in time utility over more remote utility (Rothbard, 1990). In this context, time preference would mean that producers would prefer to invest in biomass crops production that is less costly and profitable within a short time cycle (Marrison and Larson, 1995) rather than to invest in practices to conserve their soil health involving costs, management changes (ARS/USDA, 2006), and not generating immediate or/and additional profit.

For methodology design covariates, the regression shows that the random sampling and elicitation methods coefficients are significant and positive, indicating that studies that adopted a random sampling and contingent valuation had higher WTA premiums on average, compared to studies having used non-random sampling. This is an important methodological finding as that the use of non-random samples and conjoint analysis likely generate a lower WTA values, thus reducing anticipated participation

Given the high heterogeneity that is in the overall data, the following section presents MRAs estimated from the four subsets.

Soil data

As defined previously, the subset "Soil" includes studies focusing on eliciting farmers' preferences for Best Management Practices (BMPs) and agroforestry practices. The data includes 137 estimates from 19 studies.

Table 7. Meta-regression results of the soil-health related ag. practices data

	WLS Robust SE		WLS Cluster Robust SE	
	(1)		(2)	
	Coef.	P>|t|	Coef.	P>|t|
Constant	4.333 (87.448)	0.961	15.815 (143.84)	0.914
Elicitation Method	470.122 (60.293)	0.000***	506.582 (97.851)	0.000***
Random Sampling	116.423 (142.017)	0.414	107.790 (148.688)	0.478
America	542.742 (265.457)	0.043*	711.401 (335.697)	0.048*
Africa	166.563 (109.595)	0.131	219.442 (174.888)	0.226
Agroforestry	113.231 (150.437)	0.453	193.909 (217.388)	0.384
Trend	-36.536 (27.269)	0.183	-59.419 (35.997)	0.116
Sqrt(n)	4.291 (2.940)	0.147	7.602 (7.106)	0.299
Obs	136		136	
F	24.47		12.64	
Pr>F	0.000		0.000	
R^2	0.1587		0.2148	
Adj. R^2	0.2328		0.3029	

****, **, * indicate significance at the 1%, 5%, and 10% levels, sqrt(n) is used as weight*

The regression displays no evidence that agroforestry-related practices are more valued by farmers than BMPs, the base category of the estimation, which is reinforced by the non-significant estimate for the constant. However, regarding research methodology for soil-health practices, it seems that contingent valuation leads to higher WTA premiums compared to studies using conjoint valuation method. Also, the regression shows that, in contrast to findings from studies carried in Europe, Asia, and Australia, American farmers have a higher WTA value, which is in line with recent findings showing a wide range of adoption of sustainable agricultural practices among American farmers (Field to Market, 2019).

Water Data

The subset "Water" is limited to research works related to water conservation practices' adoption, more specifically: riparian lands, wetlands, and watershed conservation practices. This data includes 32 WTA estimates obtained from 8 studies.

Table 8. Meta-regression results of the water conservation-related ag. practices data

	WLS Robust SE		WLS Cluster Robust SE	
	(1)		(2)	
	Coef.	P>|t|	Coef.	P>|t|
Constant	-1653.578 (392.398)	0.000***	-1607.772 (569.424)	0.022**
Elicitation Method	-806.897 (157.069)	0.000***	-826.823 (231.683)	0.007**
Random Sampling	624.226 (133.143)	0.000***	639.080 (204.685)	0.014**
Europe	1110.148 (125.100)	0.000***	1098.95 (184.180)	0.000***
Africa	-763.009 (108.981)	0.000***	-781.822 (163.539)	0.001
Watershed	318.120 (88.522)	0.002**	319.431 (121.266)	0.030**
Trend	39.223 (16.002)	0.022**	39.008 (21.268)	0.104
Sqrt(n)	146.838 (19.956)	0.000***	145.001 (26.961)	0.001
Obs	31		31	
F	.		.	
Pr>F	.		.	
R^2	0.9356		0.9424	
Adj. R^2	0.7005		0.9637	

****, **, * indicate significance at the 1%, 5%, and 10% levels, sqrt(n) is used as weight*

The estimates resulting from the two regressions (WLS with Robust SE, and WLS with Clusters Robust SE) are significant despite the variable trend in the clustered regression. For the type of water conservation practice, watersheds and wetlands conservation-related practices have a higher WTA more valued than riparian lands conservation practices. Regarding the geographic area, we observe that in contrast to Australasia, incentives are highly required in Europe while in Africa, farmers require lower incentives. This later result does not support previous findings that demonstrate a low adoption of water conservation technologies by African farmers (e.g., Perret and Stenvens, 2006; Mango et al., 2017; Jha et al., 2019), which is a complex hurdle if we recall the issue of water scarcity in Africa. Perret and Stenvens (2006) relate this reluctance to a range of factors in place that ignore African farmers' circumstances and needs. In their paper, they argue that (1) resource-conserving technologies are mainly developed ignoring the farmers' agenda of short-term production for survival, (2) that most research is done in areas with favorable soil and climatic conditions, which is not typical of farmers' conditions, and (3) that the adoption doesn't depend upon only the farmers' willingness but also upon the role of property rights to resources and collective action at the community level.

For the methodological covariates, the result shows that on average, studies carrying a random sampling method provide higher WTA, which is in line with the result of the MR from the overall data. In contrast, for the elicitation method, this data shows that using a contingent valuation method provides lower WTA than studies using the conjoint valuation, contrary to the result of the overall data MR.

Also, the negative sign and significance of the constant's estimate mean that if setting all other covariates equal to zero, there would be, on average, no evidence for farmers' WTA for water conservation practices.

Note that the variable America was removed from the data since none of the sample studies was carried in this geographic area.

Pollution Data

This third subset combines 73 estimates from19 studies investigating farmers' willingness to reduce chemicals' use, conserve biodiversity, and adopt climate-smart agriculture practices.

Table 9. Meta-regression results of the pollution reduction-related ag. practices data

	WLS Robust SE		WLS cluster Robust SE	
	(1)		(2)	
	Coef.	P>|t|	Coef.	P>|t|
Constant	982.804 (378.582)	0.388	1016.144 (547.237)	0.079*
Elicitation Method	1192.987 (232.071)	0.000	1223.05 (253.121)	0.000***
Random Sampling	-221.256 (97.218)	0.048	-209.549 (103.643)	0.058*
America	331.120 (286.462)	0.280	334.242 (323.105)	0.314
Africa	-100.881 (114.063)	0.554	-87.573 (186.109)	0.643
Chemicals	-292.850 (224.036)	0.087	-300.259 (273.446)	0.286
Pollute	377.342 (159.453)	0.316	358.055 (220.199)	0.120
Trend	-25.925 (22.532)	0.382	-30.176 (34.864)	0.398
Sqrt(n)	-31.901 (13.620)	0.382	31.570 (16.860)	0.077*
Obs	71		71	
F	47.88		26.60	
Pr>F	0.000		0.000	
R^2	0.5639		0.6569	
Adj. R^2	0.5814		0.6063	

****, **, * indicate significance at the 1%, 5%, and 10% levels, sqrt(n) is used as weight*

The WLS Cluster Robust SE model result displays only three significant coefficients. The variable elicitation method is positive and highly significant, indicating that, on average, studies using contingent valuation reported a significantly higher WTA than those using conjoint analysis. In contrast with the previous results, the MR result for pollution-reduction practices data show that studies that used random sampling found lower WTA than those having used a non-random sampling method.

Also, as this data provides a positive and significant estimate for the constant it means that there might be a true proxy for the WTA for practices that aim to reduce pollution. To test for that, a PET is run using the simplified regression (equation 3).

Table 10. PET analysis of the Pollution data (using WTA in $/ha/year)

	Model 1		Model 2	
	Coef.	P-Value	Coef.	P-Value
Constant	560.684 (*365.084*)	0.141	462.102* (242.569)	0.072
sqrt(n)	-15.173 (*15.240*)	0.332	-	-
N	-	-	-0.474 (0.413)	0.265
Obs	71			
F(1;19)	0.99		1.32	
Pr > F	0.3320		0.2649	
R^2	0.0302		0.0386	

*Standard errors are in parentheses; *** and * indicate significance at the 1%, and 10% levels*

Table 10 shows different results. Using the squared root of the sample size as a precision measure provides not significant estimates, while using the sample size instead displays a significant estimate for the constant but not for the variable sample size. We can conclude that we reject the hypothesis of the existence of a true proxy for the WTA for this category of practices.

Energy Data

This last subset includes studies on farmers' willingness to grow/produce: grassy, woody, and cereal biomass crops. From the 15 studies, 50 estimates were collected.

Table 11. Meta-regression results of the biomass crops production-related ag. practices data

	WLS Robust SE (1)		WLS cluster Robust SE (2)	
	Coef.	P>|t|	Coef.	P>|t|
Constant	2305.446 (218.094)	0.000***	2294.758 (45.923)	0.000***
Elicitation Method	48.535 (25.108)	0.060*	42.677 (21.689)	0.071*
Random Sampling	-15.089 (10.878)	0.173	-15.109 (10.741)	0.183
America	1179.561 (213.822)	0.000***	1187.994 (32.040)	0.000***
Crop	-2290.097 (210.934)	0.000***	-2287.439 (12.454)	0.000***
Grass	-3452.359 (28.902)	0.000***	-3455.401 (31.995)	0.000***
Trend	-2.010 (5.684)	0.725	-1.025 (3.640)	0.783
Sqrt(n)	1.061 (1.312)	0.423	1.173 (1.487)	0.444
Obs	49		49	
F	.		.	
Pr>F	.		.	
R^2	0.7296		0.7134	
Adj. R^2	0.6752		0.6546	

****, **, * indicate significance at the 1%, 5%, and 10% levels, sqrt(n) is used as weight*

In contrast with the previous sub-dataset, any of the covariates related to study design are significant. For the variables "Crop" and "Grass" (corresponding to cereal and grassy biomass crops respectively), the estimates are highly significant and negative, which means that in contrast to woody biomass crops, studies focusing on grassy and cereal biomass crops reported smaller WTAs. We also found that studies carried in America display higher WTA premiums compared to studies conducted in the other continents.

Also, and in contrast with the other subsets results, the output here shows the presence of a proxy for a true value of WTA for biomass crops planting based on the positive and significant constant. Giving this finding, we performed a robustness check using the simplified MRA's equation (3) (PET analysis) to test for the presence for a proxy.

Table 12. PET analysis of the biomass crops production-related ag. practices data (using WTA in $/ha/year)

	Model 1		Model 2	
	Coef.	P-Value	Coef.	P-Value
Constant	2765.586* (*1375.792*)	0.066	2054.385* (828.343)	0.028
sqrt(n)	-78.644 (*48.989*)	0.132	-	-
N	-	-	-1.936* (0.933)	0.058
Obs	49			
F(1;13)	2.58		4.30	
Pr > F	0.1324		0.0585	
R^2	0.1476		0.1826	

*Standard errors are in parentheses; *** and * indicate significance at the 1%, and 10% levels*

Thus, based on the results, the proxy of the true WTA for biomass crops planting ranges between 2054.4 USD/ha to 2765 USD/ha.

Conclusion and discussion

The literature on sustainable agriculture is extensive, with many studies investigating questions around producers' willingness to adopt sustainable agricultural practices, but not as much tried to estimate an economic value of farmers' valuation of sustainability. Thus, our interest in this review was limited to studies providing a quantitative WTA. Our metadata shows results from different research works offering a range of estimates that appears to vary significantly based on the region, the sustainable practice of interest, the elicitation method, and the sampling method.

Through this research, we looked forward to estimating a proxy for the "true" WTA for sustainable agriculture adoption and providing a comprehensive and quantitative analysis of previous works on the topic. To do so, five meta-regression analyses were estimated to analyze the effect of practice-category variables and study-specific characteristics on published empirical results, in addition to four simplified MRAs that were used to depict the proxy for the WTA.

The contribution of our work in the broad literature is that from the 62 collected studies and the 287 WTA estimates, that form our overall meta-data, we find that there is a significant mean estimate for sustainable farming practices. By using the precision measures square root of the sample size (sqrt (n)) and the sample size (n), we found that a proxy for the true WTA exists ranging, on average between $567/ha/year and $709/ha/year. A proxy for WTA for biomass crops growing was also found following the same method, ranging between 2054 USD and 2766 USD per hectare and per year. Estimating a proxy for farmers' WTA demonstrates the presence of a willingness to adopt sustainability and growing biomass crops by farmers worldwide which should be translated as a positive general response to the multitude of environmental policies and programs encouraging sustainability. However, the ranging values should be taken very carefully because even if the metadata WTA values were carefully converted to a common metric and currency (WTA in USD per 1 ha per year), the conversion did not take into account inflation nor has been calculated in the same day for all observations, which means that if reevaluated to today's currency exchange rate, for example, the ranging values would variate following currency rates' fluctuation.

Using our analysis, we also provide interesting results on the effect that practice-category and methodological variables have on the WTA estimates. Starting with the methodological variables, it seems that the effect of using a random sampling method depends on a practice to another. On average, a researcher who examines farmers' willingness to adopt water conservation programs, or sustainability without specifying the practice type, would get a higher WTA than if he uses a non-random sampling method. While, if the research is oriented towards sustainable practices that is for biodiversity preservation, chemicals reduction, climate-smart agriculture, the WTA values would likely be lower than if non-random methods were used. For soil-health practices and biomass crops growing, our data didn't provide an evidence of an effect of the sampling method.

Therefore, the result here shows different conclusions, and by analyzing literature, it was found that using either method random or non-random sampling gives the same result as long as the attribute being sampled is randomly distributed among the population (Sweetland, 1972). However, if the relevance of this statement is true for conventional analyses, it is not verified yet for meta-analyses and it is an interesting research opportunity.

Regarding the elicitation method, four out of the five MRs show a highly significant and positive estimate for the variable elicitation method showing that the methodology of elicitation has a direct effect on the magnitude of the WTA value. The MRAs result of the three subsets "Energy", "Soil" and "Pollution" shows that using a contingent valuation method when eliciting farmers' preferences for pollution reduction, biomass crops growing, and soil conservation practices lead on average to higher WTAs than if using conjoint analysis. While for water conservation practices it seems that on average, using contingent valuation leads to lower WTA values. This result is interesting because it highlights a difference in outcomes that could reflect a difference in the suitability of an elicitation method over another based on the nature of the practice being valued.

Though the two approaches are different in their settings: the contingent valuation (CVM) is designed to examine changes in a single attribute while the conjoint analysis is designed to examine multi-attribute goods (Harper, 2000), the two methods are widely used in the agricultural and environmental economics. Only few studies tried to compare between the two approaches and determine if there are differences in their results (Halvorsen, 2000; Mackenzie 1993; Stevens et al., 2000), and findings were different. For example, in her study that compares the two methods for WTA elicitation to value environmental amenities, Harper (2000) found no statistical difference can be determined between contingent and conjoint analyses in environmental studies, while other studies estimating WTP found that using the conjoint valuation method provides higher WTP than the contingent valuation (e.g. Halvorsen et al., 1998; Printezis et al., 2019; Carlsson and Martinsson, 2001; Lusk and Schroeder, 2004; List et al., 2006). Given the limited literature supporting (or not) these differences, and our findings, we cannot draw a firm conclusion on the difference in effects of contingent valuation versus conjoint valuation on WTA values. Therefore, it is clear that there is still a need to jointly investigating the reliability and suitability of these two methods based on the type of the agricultural practice of interest.

By relaxing findings obtained from the four subsets' MRAs, we notice that WTA measurements commonly show sensitivity regarding the practice category-type and/or the continent of the study, except for the subset "Pollution". In the "Energy" subset, even though previous studies indicate that hesitation and skepticism among farmers are important barriers to the development of renewable energy industries in the United States (Rossi and Hinrichs, 2011; Qualls et al., 2012), the result of our meta-analysis shows a high willingness of American farmers to supply biomass crops in contrast to Australasian and European farmers. At the same time, the coefficients of the variables regarding cereal and grassy biomass crops, are negative and significant which translate that on average, farmers, in all regions are requiring lower incentives to grow/supply biomass cereal and grassy crops than to grow/supply woody biomass crops that are the base crop. This result is controversial because the literature reveals a reluctance to produce biomass crops (e.g.: Signorini et al., 2021; Nepal et al., 2020; Jensen et al., 2007; Khanna et al., 2017; Jiang et al., 2019). At the same time, the literature depicts the same low adoption interest for woody bioenergy crops. If grassy crops like switchgrass are seen as low-intensity cropping systems, woody and cereal crops are perceived as high-intensity cropping production systems (Signorini et al., 2021). Woody energy crops require different crop establishment, cultivation harvesting, and transportation processes (Rodias et al., 2019) which involve additional costs to the farmer. In addition to that, grassy crops are found to have a greater probability of making profit than woody crops (Clancy et al., 2012) which might explain the low WTA for grassy crops in comparison to woody crops.

Besides that, cereal biomass crops are also found to present interesting economic advantages, which can explain the low WTA values for growing/supplying biomass cereal crops compared to the base; woody crops. For example, for cereal straws - that are also widely used for bioenergy; have the advantage to use on farm technology for its production system (Glithero et al., 2013) and, their storage and transportation are also economically feasible, and are a potential source of additional income for farmers (Wagner et al., 2000) as they can be transformed into fiber and used for isolation, in the textile industry, and more.

In sum, these findings show that on average and in all regions, farmers require lower premiums for bioenergy crops growing than for supplying woody biomass crops. However, this result does not reflect all the literature as numerous studies discuss a low WTA to grow biomass crops. Studies explain this low interest by factors linked to farmer and farm characteristics like risk aversion, age, education, farm size, logistics…etc. (Jensen et al., 2017; Fewell et al., 2011; Hand et al., 2019), as well as factors linked to a lack of knowledge regarding biomass systems (Hand et al., 2019), and free technical assistance availability (Hand et al., 2019; Skeleton et al., 2015; Strong and Jacobson, 2006). Therefore, it is notable to say that having these low WTA values do not inform us on the average propensity of adoption to judge if our result is in line with the findings or not but based on our metadata and the review of literature that followed to build this discussion, there are some suggestions that would benefit farmers and researchers in the future. Based on the factors determining the low interest in supplying biomass crops, it is noteworthy to suggest that larger effort need to be made in extension activities to elevate and ameliorate knowledge about biomass crops production among farmers. Also this finding show a gap that need to be filled on the research on the feasibility and consequences of biomass crops planting, because there are still unanswered questions regarding biomass crops characteristics, storage, and transportation issues that affect farmers' growing decision, in addition to their risk aversion that should be also a research focus since it was mentioned more than once in the literature as one of farmers' determinant factors of resistance (e.g., Fewell et al., 2011, Hand et al., 2019).

Another interesting finding of our research is the negative and significant coefficients for the variable Africa for both MRAs of the overall data and the subset data regarding water conservation practices. Compared to farmers from Australasia, African farmers are requiring on average lower incentives for sustainability. This controversial result shows that the efforts of the international and national programs and policies[5] to implement sustainable practices in the African agriculture seem to be productive. Similarly to bioenergy crops planting case, this result is not in line with the current literature that affirm a low response to sustainability adoption, which is confirmed by many studies (e.g., Perret and Stenvens, 2006; Mango et al., 2017; Jha et al., 2019). Therefore, one possible explanation for this difference could be due to the difference of currency exchange rate between the American dollar and African countries' currencies; but this hypothesis is very hard to verify because of the instability of the exchange rates and it is not realistic to generalize a statement about some countries to a whole continent- the studies in the meta-data do not represent all countries in Africa -.

Besides that, the literature provides strong evidence on African farmers' low willingness to adopt sustainability as mentioned above, if we add to that: poverty, hunger, mal-nutrition, that are all issues that still treating Africa (FAO, IFAD et al., 2019) - with regions that are more affected than others of course-, a question arises: why not adopting? As mentioned in the result section, many studies present a range of factors that explain this reluctance from sustainability adoption related to knowledge, labor, profit, and more (see Pannell, 1998; Barlas et al., 2001; Nowak, 1991; Bell et al., 2001; Rodriguez-Baide, 2005; Norman et al., 1997; Holden and Shiferaw, 2004). In addition to that, other issues need to be mentioned such as the lack of infrastructure (Mastroianni et al., 2021), corruption (Transparency International, 2019), gender bias in agriculture (Glazebrook et al., 2020), unstable governments (Marc et al., 2015) that should make the implementation of sustainable agriculture a difficult mission. Also, though there is an extensive work on the Agricultural Economics focusing on Africa, based on my review, most studies investigating African farmers' behavior and drivers for adoption or non-adoption of sustainability, follow the same research approach as studies conducted elsewhere. Consequently, since Africa overlaps many different issues that make its case complicated (Holden and Shiferaw, 2002), researchers need to use more complex models and techniques (e.g. spatial models, dynamic models, general equilibrium models…etc.), and

[5] e.g., Le Plan Maroc Vert (ADA, 2008), the Comprehensive Africa Agriculture Development Program -CAADP- (OCDE), and ECOWAS Agricultural Policy-ECOWAP-, (Zimmermann et al., 2009)

give more importance to those political and social issues while analyzing farmers' behavior in general, and willingness to adopt sustainable agricultural practices specifically.

Despite these findings, this research is not without limits. First, since our meta-sample was randomly built, the subset regarding water conservation practices turned out to have no observation from the American continent and the same case for Africa regarding the subset for bioenergy crops production, but this does not mean that no study corresponding to our research criteria was found was conducted in these continents. If the search of data was done by specifying the continent or country for the study, the random sampling would be biased which would affect the final result.

Also, it was preferable if the conversion of all WTA estimates was done at the same time using the same daily currency exchange rate. Another limit is concerning compiling values that were obtained from different econometric estimation tools, it would be preferable if we included at least one dummy variable to indicate what econometric model is used.

Needless to say, that the "sustainability" of some practices are seriously questionable if we refer to all the energy and resources it consumes through the technology or/and the production systems used. Accordingly, this should be another concern to take care of in future research as it would be interesting to investigate within each practice category what would be the perfect sustainable practice? In other words, does a "fully" agricultural sustainable practice even exist?

Though these limits, and the fact that not all our findings correspond to the findings of a single study, we tried to avoid methodological mistakes of past meta-analyses in the environmental and natural resource economics, following the "best practices" guidelines for meta-analyses in the field, as recommended by Nelson and Kennedy (2009), to present a work that we are encouraged by its ability to reflect the extant literature.

In sum, this analysis leads us to state that there are still gaps in the literature regarding the analysis of farmers' behavior in general, and farmers' adoption drivers regarding sustainable agriculture which appeal to more research, even if there is presently an increasing number of studies focusing on farmers' preferences for sustainability (see figure 2 in appendix). To conclude, this study provides valuable information about farmers' valuations for sustainable agriculture, which should be taken into consideration by future research focusing on farmers' WTA for sustainability. Also, knowing a more precise proxy for the value that producers are ready to forgo to adopt green farming, can help policymakers, and industrials for better decision-making regarding how to promote sustainability, price setting, and more.

CHAPTER III

CONSUMER WILLINGNESS TO PAY FOR ETHICALLY PRODUCED COTTON APPAREL

ABSTRACT

The United States is the largest importer of cotton apparel in the world and the largest supplier is China. The U.S. State Department among others has charged China with the exploitation of the Uighur Muslim minority in forced labor in cotton farms and textile mills in Xingjian China. We examine the impact that information about this potential exploitation has on consumer WTP for denim jeans by country of origin (China, US, and ROW) using data collected from an online nationwide survey and a discrete-choice experiment. Random utility theory is the basis for the survey's responses analysis to obtain the WTP space (Scarpa et al., 2008) that is estimated by using simulated maximum likelihood procedures (Train, 2003). Results show that consumers express an increased relative WTP for US C.O.O than ROW C.O.O, and a negative premium to C.O.O China after exposure to the information regarding potential labor exploitation.

Keywords: WTP, Sustainability, Consumer preferences, Choice Experiments, Mixed logit model

Introduction

Cotton represents 35% of all fibers produced for textile and apparel products (AGMRC, 2017). Behind China and India, the United States is the third-largest cotton producer in the world, and represents 38% of global cotton fiber exports (ERS, 2019). In 2017, U.S. cotton production was more than 20 million bales representing over 7 billion dollars in total value (ERS, 2019). Moreover, the U.S. cotton industry accounts for more than $21 billion in products and services annually, generating more than 125,000 jobs in the industry sectors from farms to textile mills (ERS, 2020).

Cotton production (from farming to manufacturing) has a consequential environmental impact (Garcia et al., 2019). Cotton not only consumes 16% of the world's pesticides and causes 45% of the global greenhouse gas emissions (Cotton, Inc, 2021) but it is also responsible for as much as 3% of the global water use (Cotton, Inc, 2021). In addition to these negative environmental impacts, cotton production has also negative social impacts relative to illegal or unsustainable labor practices (ERGON, 2008).

While the environmental sustainability of the textile industries is a growing concern, labor rights abuses continue to dominate reports and news articles about these industries (European Parliament, 2014). Growing costs of production and demand in the fashion industry has obliged companies to delocalize their production to low-cost countries with limited capacity to implement labour laws and regulations.~~,~~ Investigations recensed many factors that contribute to forced labor and bonded labor, such as :

" *Social exclusion, Asymmetric information; whereby illiterate workers are not aware of their rights and can be taken advantage of, Labour migration – particularly the situation of (irregular) migrant workers, who are commonly unaware but also unable to assert their legal labor rights, as non-registered workers,…, Coercion on the part of state authorities – such as the situation relating to cotton harvesting practices in Uzbekistan and Tajikistan where forced labor in the cotton industry has affected mainly women, children, and young students. During the planting and harvesting seasons, they are transported to the cotton fields and made to work for little or no remuneration. Coercion can be exercised through such penalties as threats of dismissing students from the university. Women are sent by families according to an established quota, whereas children take part in this compulsory work as part of their school curricula*." (ERGON, 2008).

These predispositions were sufficient to create an increasing proportion of vulnerable workers leading to child labor, and labour-exploitation of migrants, refugees, unskilled individuals…etc. (ILO, 2019). The harsh conditions in which those workers perform their roles have been qualified as "slave labor", and many scandals have emerged involving many famous textile and fashion brands. The most unfortunate one is the deadly industrial accident at the Rana Plaza Disaster (Dhaka, Bangladesh) in 2013, where the entire eight-story building containing five clothing factories, a bank, and shops collapsed completely, killing 1138 workers and injuring over 2500. We can enumerate more ethical issues involving cotton production: immigrants, minorities, and children labor at all stages in the fashion industry: from the production of cotton seeds in Benin, harvesting in Uzbekistan, yarn spinning in India, to the different phases of putting garments together in factories across Bangladesh, and more recently, the forced-labour in cotton production in the Xinjiang region, China, of 1.8 million Uighurs and other Turkic and Muslim minorities. Reports qualify this forced labor system as the largest internment of an ethnic and religious minority since the second war (The Guardian, 2020).

Thus, environmental footprint and ethical issues related to cotton production provoked and continue to provoke many debates (ILO, 2019), and centralize discussions at many conventions and protocols encouraging sustainable development (Pierce and Barbier, 2002). As a consequence of all these debates and facts, many companies are orienting their production towards ethical practices (Jegethesan et al., 2012) as an answer to not only a growing demand for responsible goods but also to a self-initiative to contribute to the preservation of the environment and human well-being.

Besides the emergence of responsible producers, these multiple ethical concerns generated a new wave of ethical consumers who actively select products that are seen as less harmful to the environment and society (Harper and Makatouni, 2002). This new consumerism participated in stimulating retailers to become more aware of the need to be eco-friendly, socially conscious (Brown, 2010), and involved in ethical fashion (Shen et al., 2012). Accordingly, recent statistics estimated the global market for ethical fashion to nearly value $6.35 billion in 2019, with an expected growth **to** $8.25 billion in 2023. In the United States, the market for sustainable products is expected to reach $150 billion by 2021 (Nielsen, 2018) where the segment of sustainable fashion is expected to be the fastest-growing region in the 2020-2030 forecast period (Research and Market, 2020).

Many studies focused on this category of consumers and tried to elicit their purchase behavior given a specific ethical good or service, and researchers found that one out of five people is willing to pay more for products that are socially and environmentally responsible (Chi et al, 2019; Wessels, 2001). The existence of this growing niche and their willingness to pay for such products represents an interesting new source of infinite competitive advantages that would benefit businesses (Chi et al., 2019), and encourage ethical production practices. Thus, confronting the social challenges in a win-win strategy where the consumer satisfies their utility in consuming socially and ethically responsible goods, and the producers minimize the harm on the environment and the society while maximizing profit in new markets (Ellis et al., 2012; Zheng and Chi, 2015).

There has been little research on people's ethical concerns and preferences when considering products produced under labor exploitation. However, industry research has not examined the positive and negative impacts of perceptions of labor exploitation on consumers' responses to cotton apparel. Further, little is known about the extent to which these ethical attributes influence people's cotton apparel purchase decisions. Therefore, and given that the U.S. State Department among others has charged China with the exploitation of the Uighur Muslim minority in forced labor in cotton farms and textile mills in Xingjian China, we examine the impact that information about this potential exploitation has on consumer's WTP for denim jeans by country of origin (China, US, and ROW). There are several reasons behind this choice of denim jeans as a prompt product for this study. First, denim jeans are a cultural icon (Kuik, 2004) that is commonly worn around the world (Jegethesan et al., 2012; Miller and Woodward, 2007, Herbst and Burger, 2010). Second, denim is made from 100% cotton (Cotton Mill, 2014). If many studies have focused on consumers' willingness to pay for ethical products, the majority have oriented their interest towards food products instead of apparels' ethical attributes. This might be explained by the fact that apparel consumption decisions are more complex and involve trade-offs between a variety of garment and ethical attributes (Jegethesan et al., 2012). Also, even if some manufacturers have already launched environmentally responsible denim jeans and that a flourishing market exists, little is known about the extent to which these functional, hedonistic, and ethical attributes influence purchase decisions (Jegethesan et al., 2012).

However, investigating preferences for ethically produced denim jeans opens the possibility for a better understanding of the economic value of ethical practices that is of interest to society, manufacturers, and the retailers who distribute those products (Tully and Winer, 2014 Tully and Winer, 2014). As every purchase is a proof of support or lack of support for how companies conduct business (Brosdhal, 2007; Shen et al., 2012), three hypotheses will be tested in this research:

(1) H_1: US consumers are willing to pay premiums for organic cotton made denim jeans
(2) H_2: US consumers prefer US made denim jeans over ROW made denim jeans
(3) H_3: US consumers are willing to pay for ethically produced denim jeans

Literature Review

Ethical consumerism refers to moral consumption (Khan, 2016), where values are the main motivation for the consumption decision. The individual's purchase choice is made based on their beliefs and perceptions towards ethical values (Tallontire et al., 2001), and their purchasing behavior expresses their concern with ethical issues (Shaw & Clarke, 1999; Harper & Makatouni, 2002) such as environmental sustainability, health and safety risks, fair trade, labour conditions, and human rights (Barnett et al., 2005). These consumers' preferences pushed several fashion companies like H&M and Timberland to include ethical clothing lines (Siegle, 2012; Ficner, 2010) and publicize their corporate social responsibilities through their websites and media to ease the access to information to consumers (Nassivera et al., 2017).

Numerous studies have analyzed ethical consumerism, but each has approached it from a different perspective (e.g.: Goworek, 2011; Hwang et al., 2015; Kim et al, 1999; Shen et al., 2012; Suki, 2013; Zheng and Chi, 2015; Nassivera et al., 2017). Studies showed that consumers are willing to pay substantially more for ethically produced goods (Auger et al., 2008; Dickson, 2001; Mohr & Webb, 2005). An example was given in 2000 by the National Bureau of Economic Research that conducted a poll where they found that 80% of surveyed individuals were willing to pay more for a product that is made under good working conditions (Elliott & Freeman, 2003), similar findings were shown by Aguilar and

Vlosky (2007), De Pelsmacker, Driesen and Rayp (2005), Saphores et al., (2007) and, Tully and Wine (2014).

Ethical consumerism of apparel products is one of the fastest-growing personal ethical product sectors (The Cooperative Bank, 2010). The concept of ethical consumerism had evolved from an almost exclusive focus on matters of conscience (e.g. animal welfare and labor rights) to a concept that incorporates environmental issues (Jegethesan et al., 2012; Auger et al., 2007).

Before going through the literature of ethical consumerism of apparel products, it is important to mention that, consumers' apparel purchase-decisions is constructed based on an ensemble of trade-offs between garment attributes (Sondhi and Singhvi, 2006) and, that garment purchase-decisions itself is mainly constructed based on price, style, quality (O'Cass, 2000; Sondhi and Singhvi, 2006; North et al., 2010), brand (Carrigan and Attalla, 2001), country of origin (COO), suitability, fiber content, and comfort (Eckman et al., 1990; Davis, 1987; McLean et al., 1986). Even though studies gave some explanations of apparel purchase-decision, little is known about the relative value that consumers place on ethical attributes during their purchase process (Jegethesan et al., 2012), which makes understanding apparel ethical consumerism complex.

The first studies that focused on apparel ethical-consumerism appeared during the 1970s as a response to the aggravation of environmental issues like climate change, natural resource depletion, pollution, and the over-use of pesticides that represent real threats to human life (Creyer & Ross, 1997; Shaw & Clarke, 1999; Carrigan & Attalla, 2001; Magnuson, 2017). Even if it plays an important role in international trade through the income and employment it generates (MacCarthy and Jayarathne, 2011), the clothing industry highly contributes to the degradation of the environment by engendering pollution and depleting intensively natural resources (Magnuson, 2017). Thus, many studies had not only examined the relationship of these environmental issues with apparel lifecycle (Butler and Francis, 1997; Kim et al.1997; Kim and Damhorst, 1998; Shim, 1995) but also analyzed stated preferences of consumers for ethically produced apparel. Based on numerous studies, the typical consumer of ethical apparel is a young female, well educated, and urban dwelling that tends to be married with at least one child and lives at an owned home (Arbuthnot, 1977; Weigel, 1977; Banarjee and McKeage, 1994; Laroche et al. 2001).

Moreover, the ethical consumer's purchases are based on his ethical commitment, as studies showed that consumers are willing to pay a premium price of 16.8% for a product with a socially responsible attribute over products without socially responsible features (Tully and Winer, 2014).

Regarding consumers' preferences for sustainable denim jeans apparel products, a recent study shows that consumers are willing to pay up to a 10% premium and that they would prefer having more sustainability-related information labelled on these jeans (Engle et al., 2018). Researchers also found that consumers are increasingly concerned about the social consequences of their purchases, especially concerning the human rights violations in sweatshops (Dickson, 2001). In addition, sweatshop labor is consumers' most important ethical concern when making apparel purchase decisions (Tomolillo and Shaw, 2004). Moreover, McFadden (1995) found that 75% of US consumers avoid retailers who sell clothing produced by offshore sweatshops.

Theoretical framework

Before Lancaster's work in 1966, the traditional consumer theory was limited in seeing a commodity as a whole item excluding all its intrinsic properties and was providing nothing to explain and analyze the consumer's reaction to new commodities and quality variation. At this point, the Lancastrian theory came to change this simplistic approach by considering a commodity by its properties and characteristics. This perception identifies the good as a commodity that has more than one characteristic and argues that many characteristics will be shared by more than one good, and in combination, goods could possess distinct characteristics from those pertaining to the goods separately. Thus, the utility is gained through the commodity's characteristics and not through the good itself. Therefore, from these basic ideas emerged the three major assumptions of the theory:

(1) Consuming a good or a bundle of goods is an activity. This activity should be associated with a scalar and, assuming a linear objective relationship between "k"

(the level of the activity), y_k (the goods consumed in this activity), and if "x_j" is the j^{th} commodity-, we have:

$$x_j = \sum_k a_{jk} y_k,$$

Notice that the coefficients a_{jk} is determined by the intrinsic properties of the goods themselves and possibly the context of technological knowledge in the society. So the vector of total goods required for a given activity vector is $x = Ay$.

(2) Each consumption activity provides a fixed vector of characteristics so that z_i is the i^{th} characteristic:

$$z_i = \sum_k b_{ik} y_k \text{ and its vector is } z = By,$$

Where the coefficients b_{ik} are objectively determined in principle, at least for some arbitrary choice of the units of z_i.

(3) Individuals have an ordinal utility function on characteristics. An individual will choose the situation that maximizes his utility

These assumptions permit to include the good(s)'s characteristics into the consumer problem so that the utility-maximizing model is given by:

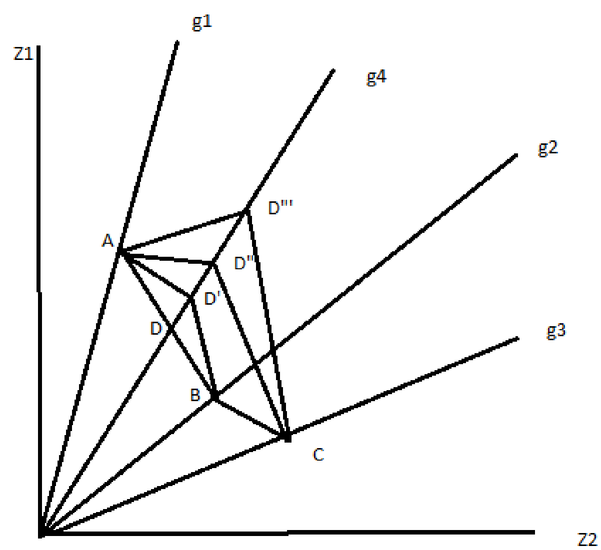
$$Maximize\ U_{(z)} subject\ to\colon px \leq k, with\ \ z = Bx,\ and\ x, z \geq 0,$$

"$U_{(z)}$" is a maximum operating on the characteristics, where "U" is defined on the characteristics-space (C-space) and "$px \leq k$ "is the budget constraint defined in the goods space (G-space). Finally, the equation "$z = Bx$" which is the spinal component in the model, represents the transformation between the two spaces. This is the simplified Lancaster model allowing a single step between goods and characteristics.

Lancaster's theory didn't stop to these generalities but also gave a premise to the market's novelties case. As the traditional theory doesn't allow explicitly the introduction of new commodities, the Lancastrian theory proposes to introduce one or more activities to the consumption technology. Given this technology and the intrinsic characteristic of the activity associated with the new good, it becomes possible to insert it in the appropriate place in the technology, so the consequences could be predicted. Hence, if a new good possesses characteristics in the same proportions as some existing good, it will simply fail to sell to anyone if its price is too high or will completely replace the old good if its price is sufficiently low.

So, it is supposed that a new good has characteristics that are somewhat different in proportions from an existing good. In this case, if its price is too high it could mean that the new good is dominated by some combination of existing goods and it won't be sold. If its price is sufficiently low, it will add a new point to the efficiency frontier (see figure 1 below).

Figure 2. Efficiency frontier



Source: Lancaster (1966)

From this figure, Lancaster shows the differentiated good as a new good within an existing intrinsic commodity group and analyzes it as a new good within this group, so that:

(1) The path ABC represents the old efficiency frontier, where some individuals will consume combinations of goods (g1, g2) in different amounts and some combination of (g2 and g3).
(2) If the new good (g4) has a price at point "D" on the old efficiency frontier, the individuals consuming combinations of (g1 and g2) will show indifference between their old combinations of either (g1, g4) or (g2, g4).

(3) Reaching the point "D' ", shows the situation where the price of the good (g4) is lower, so individuals will prefer (g1, g4) or (g2, g4), instead of (g1, g2) which means that the new good is taking away some of the sales from (g1, g2).
(4) If the price drops to "D'' then the bundle (g4, g3) will completely dominate "g2" that will be replaced.
(5) And lastly, if the price is lower, then the bundle (g4, g3) will dominate g2 and the corner solution g4 only would dominate all combinations of (g1, g4) so that g4 would replace (g1, g2).

In sum, Lancaster's theory brocks the inflexibility of the traditional consumer theory and has been from the first studies that built the basis of the theory of hedonic utility. However, this theory says nothing about pricing models that particularly interest us in this study.

In 1974, an evolution has been made to fulfil this lack by Rosen who presented the first theory of hedonic pricing. The model argues that a commodity can be evaluated by its characteristics which means that its price is the sum of prices of each homogenous attribute, and each attribute has a unique implicit price in the market equilibrium. Technically, it suggests that the price of a good can be regressed on the characteristics of this good to find the contribution of each attribute in the overall composite unit price. Consequently, Rosen contributed to the evolution of the consumer theory by providing a two-stages procedure to recover the "Marginal Willingness to Pay" (MWTP) functions of heterogeneous individuals for the characteristics of differentiated products.

This hedonic approach reflects the marginal trade-offs that both suppliers and demanders make among characteristics in the markets, so that differences in amounts of components will be estimated given the weights implicitly prevailing in the marketplace. This work has been developed since to reach the actual concept of the "Willingness-To-Pay" (WTP)- also called reservation price (Kalish and Nelson, 1991; Kristensen and Gärling, 1997; Krishna, Wagner and Yoon, 2006)-. The WTP is defined as the maximum price a buyer accepts to pay for a given quantity of goods or services (Kalish and Nelson, 1991; Kohli and Mahajan, 1991; Wertenbroch and Skiera, 2002). In other words, the WTP corresponds to the highest price at which, and under which, the consumer is completely certain to buy a product.

This attribute-based choice method is an interesting alternative to price elasticities of demand when market data is not available such as the case of pure public goods and services or innovative products under development (Le Gall-Ely, 2009). Following the Lancastrian reasoning, the WTP is based on the ranking choices that allow for the possibility to get a complete ranking across "J" alternative product-profiles leading to a preference ranking (Cicia et al, 2002), such as:

$$U\varepsilon_j^1 \geq U\varepsilon_j^2 \geq \cdots \geq U\varepsilon_j^J,$$

Where "U" is the utility, "ε" is the profile of attributes, the subscript "j" is the generic alternative, and the superscript "J" is the rank. These attributes, alternatives, and choice-sets are three factors that must be determined in a Cross-Entropy (CE): an attribute describes one aspect of an alternative, an alternative is a bundle of attributes, two or more alternatives constitute a choice-set, and several choice sets compose a CE (Le Gall-Ely, 2009).

The WTP method is widely approached by the random utility theory (Luce, 1959; Mc Fadden, 1974), and is defined by Block and Marschak (1960) as:

"Let "α" be a finite set of alternatives, "T" be a finite population of decision-makers and let $\in^c$ *means "is chosen from". Then choice is consistent with a random utility model if there exist real valued random variables* U_{at}, *all* $a \in \alpha$, $t \in T$ *such that* $Pr_t(a \in^c C) = Pr\,(U_{at} \geq U_{a't}, all\ a' \in C)$ *for all alternatives* $a \in C$, *all non-null choice sets* $C \subset \alpha$ *and all decision makers* $t \in T$.*"*

More explicitly, the random utility theory explains that a consumer's alternatives choice depends on the utility that this choice will provide him subject to income, and time. This random utility is composed of a deterministic component and a random component, (Berges M., 2015), such as:

$$U_{ni} = V_{ni} + \varepsilon_{ni} \text{ (1)},$$

with: U_{ni} is the n^{th} individual's utility of consuming alternative i, V_{ni} is the systematic part of the utility function determined by the attributes of alternative *'i'* as well as the characteristics of individual 'i', and ε_{ni} is a stochastic part following a certain distribution. The systematic part is given by:

$$V_{ni} = V(Z_{ni}; S_{ni}; B_n; \delta_n)\ (2),$$

And depends on: consumers' perceptions about 'i' attributes of the good Z_{ni}, consumer 'n' characteristics, (S_n), and B_n *and* δ_n that are the parameters of Z_{ni} *and* S_n respectively.

The role of the random component in the utility function is to include the unobserved attributes and measurement errors, and to permit the insertion of probabilistic assumptions on the consumer's behaviour.

Supposing that a consumer tries to choose the alternative that provides the highest utility, then individual 'n' will choose alternative 'i' among *C* alternatives at the unique condition where his utility U_n is the highest utility among the utilities of the other alternatives, which yields to a probability of occurrence of :

$$Pn(i|C) = \Pr\left[U_{in} > U_{nj}\right] = \Pr\left[(V_{ni} + \varepsilon_{ni}) > \left(V_{nj} + \varepsilon_{nj}\right)\right], \forall\ j \in C\ (4),$$

$$Pn(i|C) = \Pr\left[(\varepsilon_{nj} - \varepsilon_{ni}) < (V_{ni} - V_{nj})\right], \forall\ j \in C\ (5),$$

$$Pn(i|C) = \Pr\left[(\varepsilon) < (V_{ni} - V_{nj})\right], \forall\ j \in C\ (6),$$

knowing the attributes of alternatives 'i' and 'j'- Z_{ni} *and* Z_{nj}- , the consumer's characteristics, the chosen alternative, and the parameters alpha, beta, and delta can be estimated which lead to the WTP for the presence (or increased level) of an attribute.

Methods and Procedures

Revealed and stated preferences are two approaches that are used to study consumers' preferences for a given good. The first method, the revealed preferences, considers consumers' responses to model their preferences for market and non-market goods using techniques such as hedonic analysis and travel cost methods. Stated preferences is a method that consists of collecting data from participants' preferences in a hypothetical setting using the contingent valuation, contingent behaviour, and choice experiments. In cases where market data are not available, stated preferences are the primary method of analysis.

Therefore, given that information on some of the ethical considerations is relatively new stated preference data were collected to elicit consumers' preferences for ethically produced denim jeans.

Experiment and survey design

The experiment design

In practice, some procedures are the most used to estimate the economic value of consumers' preferences for a given product such as personal interviews, written surveys, and experimental auctions (Umberger et al., 2000). Recently, experimental auctions gained a lot in popularity given their effectiveness in providing more credible measurements for consumers' willingness to pay than hypothetical surveys and in ensuring high response rates (Lusk et al., 1999). However, the method presents some inconveniencies: it is a costly technique, time-consuming, bids can also be influenced by other substitutes, and zero (or protest) biddings might be observed (Lusk and Hudson, 2004), and also it limits the sample size which reduces its power in representation of the total population. Therefore, to obtain consumers' WTP values for ethically produced denim jeans, this research uses a survey composed of dichotomous choice and choice-based questions,as it is the most commonly used hypothetical method to elicit WTP (Lusk and Hudson, 2004).

In contingent valuation, individuals are asked to directly report their WTP to possess a specific good rather than inferring them from observed behavior in regular marketplaces (FAO). While in conjoint valuation, participants are asked to state their WTP for a non-market good that is traded in a hypothetical market (Mitchell and Carson, 1989). Various methods exist to conduct a conjoint analysis such as choice-based conjoint analysis, ratings-based conjoint analysis (Elrod et al., 1992), full-profile conjoint analysis, trade-off matrices, and paired-comparisons (Reibstein et al., 1988). The present research opts for the choice-based conjoint analysis (CBCA).

CBCA is a prominent approach that is used in both academic research and marketing practice (Sichtmann et al., 2011, Struhl, 1994). In a typical Choice-Based Conjoint

Experiment, a respondent is asked to choose an alternative from a competitive set of alternatives or choice sets, each of which is a profile of a different combination of levels or values of a set of multiple attributes and repeats this task for a limited number of choice sets (Desarbo et al., 1995). In their paper that compares Rating-Based Conjoint Analysis to CBCA, Elrod et al. (1992) cite numerous advantages of the CBCA explaining that the method is better in predicting choice behaviour and allows for a direct prediction of choice shares without using conjoint simulators. Also, CBCA allows for varying product attributes in choice experiments enabling the effects of each attribute to be identified (Louviere et al. (2000)). Moreover, using Choice-Based Experiments can predict participants' choices by determining the relative importance of various attributes in their choice process (Hanemann and Kanninen 1998). The responses from choice experiments can be analyzed based on the random utility theory (Thurstone, 1927), and Lancaster's theory of utility maximization (Lancaster, 1966).

Technically, in a Choice-Based Conjoint Experiment sampled individuals are asked to choose their most preferred alternative from choice sets comprising of several alternatives with pre-specified attributes and individuals can be allowed to choose none of the alternatives in a given choice set. Each choice set has two alternatives (Denim jeans products A and B), and each product alternative is specified with three attributes (price, production system, and country of origin) which levels differ from two to five. The attributes are discussed in detail in the following paragraphs and described in table 1.

Table 13. Attributes and levels

Attributes		Levels
Price	-	$ 62 (30% Above the average market price)
	-	$ 54 (20% Above the average market price)
	-	$ 43 (Average market price for a regular denim jeans)
	-	$ 34 (20% Below the average market price)
	-	$ 22 (30% Below the average market price)
Production systems	-	Conventional farming
	-	Organic farming
Country of Origin (COO)	-	USA
	-	China
	-	Other

The survey was online administered by QUALTRICS nationwide to 727 respondents.

The survey design includes two survey blocks. Each survey has one sequential choice experiment reflecting the current situation where consumers know the price, country of origin, and production system attributes, to select denim jeans products. Each respondent needs to choose between two alternatives or neither option. The two blocks have the same survey questions and differ only in the information provided in the conjoint choice script. Block 1 is assigned to the two first surveys that have no cheap talk on labor exploitation but differ in the organic farming definition. One survey presents organic agriculture as defined by USDA, and the second one provides a generic definition of it. Block 2 is assigned to the two other surveys having the same different definitions of organic agriculture, and a conjoint-choice script containing a cheap talk on labor exploitation. As presented above, our conjoint analysis contains three attributes that differ in levels, and below are their definitions.

Attribute 1: Price

The attribute “Price” has four levels that are below or above the average market price for a regular denim jeans 10%, 20%, and 30%. The value of the average market price represents a weighted mean price for denim jeans around the U.S, and was obtained by Cotton Incorporated using their “Retail Monitor” database. However, this average price may be a little higher than the true average price as it is a bit oversampled to higher-end retailers. For the levels we choose five levels differing from 20% to 30% above and below the average market price based on the price range provided by the first 10 retailers of denim jeans in the US. These levels were set based on the literature and a search on different retailers’ market prices for regular denim jeans.

Attribute 2: Production systems

An agricultural system is an assemblage of components that are united by some form of interaction and interdependence and which operate within a prescribed boundary to achieve a specified agricultural objective on behalf of the beneficiaries of the system (FAO, 1989). For this attribute, we are considering two levels that refer to organic and conventional farming systems.

(1) Conventional production systems are defined as the use of seeds that have been genetically altered using a variety of traditional breeding methods, excluding biotechnology, and are not certified as organic (USDA, 2015).

(2) Organic production systems as defined by USDA refer to the ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs, and on management practices that restore, maintain, and enhance ecological harmony. Organic agriculture practices cannot ensure that products are completely free of residues; however, methods are used to minimize pollution from air, soil, and water (*USDA*).

Attribute 3: Country-of-origin (COO)

The attribute "Country-of-Origin" refers to where the cotton fiber is processed or manufactured. We chose three levels as a potential origin for the cotton fiber used in jeans: The United States, China, and the rest of the world (ROW).

The cheap talk

Recently the U.S State Department among others has charged China with the exploitation of the Uighur Muslim minority in forced labor in cotton farms and textile mills in Xingjian China. We examine the impact that information about this potential exploitation has on consumer WTP for denim jeans by country of origin (China, US, and ROW) using a concise, neutral, and short cheap-talk (75 words) on the scripts of two of our 4 surveys. In practice, a cheap-talk is a common technique that is used in stated preferences methods of nonmarket valuation to reduce hypothetical bias (Penn & Hu, 2019). Studies have demonstrated that short and neutral cheap talks were efficient in reducing the hypothetical bias (Aadland and Caplan, 2006). Given that WTP generated from hypothetical valuations are often greater in comparison to the premiums obtained from real and bidding outcomes, findings demonstrate that introducing cheap talks are on average significant in reducing estimated values by about 20% compared to the baseline treatment without implementing cheap talks (Penn & Hu, 2019).

The experimental question design

SAS software is used to create the experimental question design. The combination of all attributes and levels for our experiment resulted in a total of 30 (2×3×5) possible product profiles and 435 possible choice scenarios (C_{30}^{2}). Where C_n^r denotes the number of unordered subsets of n objects taken r at a time (Hogg et al., 2001). Hence, fractional factorial designs were applied to choose 12 choice scenarios for each block. Finally, the design was blocked into two-versions of the conjoint-choice script with the same survey questions, where each respondent was offered a twelve choices scenario.

Survey design

An online survey was administered and randomly sent to 727 subjects nationwide. The panel of consumers is purchased from a marketing research company and designed to be representative of the U.S population. The survey is organized into four parts that collect information about households: (1) socio-economic and demographic characteristics, (2) Denim jeans purchase habits, (3) knowledge, opinions, and experiences about cotton production and conservation techniques, (4) One sequential stated choice experiment to assess their preferences for denim jeans attributes.

Methods

Random utility modelling considers: 1) the choice set, 2) the observed attributes and decision rules of combining them, 3) and the model of individuals' choice and behaviour and its distribution patterns in the population. Let U_{iqt} be the utility derived from the q^{th} alternative in the t^{th} choice occasion for the i^{th} individual, according to the random utility theory, this can be written as:

$$U_{iqt} = V_{iqt} + \varepsilon_{iqt} \text{ (1),}$$

where: i=1, …,I; t=1,…,T; q=1,…,Q; V_{iqt} is the systematic component of the utility, and $\varepsilon_{iqt}$is the random component that represents the unobserved factors not included in V_{iqt} such as consumers' perceptions or their knowledge level. It is also assumed to be independent and identically distributed, and distributed extreme value and the variance of ε_{iqt}can differ among consumers such as: $Var(\varepsilon_{iqt}) = k_i^2(\frac{\pi^2}{6})$, where k_i is a scale parameter corresponding to consumer i. Intuitively, this consumer-specific scale parameter reflects the variability of utility across choice situations (Train and Weeks, 2005). We can formulate U_{iqt} as:

$$U_{iqt} = -\alpha_i p_{iqt} + \beta'_i X_{iqt} + \varepsilon_{iqt} \text{ (2)},$$

where: the β_i and α_i are individual-specific utility parameters corresponding respectively to the nonprice and price attributes. Dividing equation (2) by the scale parameter k_i results in a new error term (e_{iqt}) with constant variance ($\frac{\pi^2}{6}$) that corresponds to the traditional indirect utility model in preference space (Train and Weeks, 2005):

$$U_{iqt} = -(\alpha_i/k_i)p_{iqt} + (\beta_i/k_i)'X_{iqt} + (\varepsilon_{iqt}/k_i),$$

$$U_{iq} = -\gamma_i p_{iqt} + \tau_i{}' X_{iqt} + e_{iqt} \text{ (3)},$$

because the WTP for an attribute is the ratio of the attribute's coefficient to the price coefficient, $W_i = {}^{\tau_i}/_{\gamma_i}$, equation (3) can be re-parameterized if we multiply and divide τ_i by γ_i.

$$U_{iq} = -\gamma_i p_{iqt} + (\gamma_i W_i)' X_{iqt} + e_{iqt} \text{ (4)},$$

Which is called the model in WTP space, and $W_i$is the vector of WTP values for all the attributes (Train and Weeks, 2005). We adopted the model in WTP space instead of the model in preference space because this approach tends to fit data better and results in more plausible estimates of the WTP values for the nonprice attributes (Scarpa et al., 2008). The subject will choose the choice q over j only if : $U_{iqt} > U_{ijt}$ (4), for all j ≠ q∈B, where B is the choice set available for subjects so this implies:

$$V_{iqt} + \varepsilon_{iqt} > V_{ijt} + \varepsilon_{ijt} \text{(5)},$$

if rearranged:

$$V_{iqt} - V_{ijt} > \varepsilon_{ijt} - \varepsilon_{iqt} \text{ (6)},$$

given that ($\varepsilon_{ijt} - \varepsilon_{iqt}$) is not observable, equation (6) cannot be specified too. Therefore, it is only possible to estimate the probability of the condition where $V_{iqt} - V_{ijt} > \varepsilon_{ijt} -$

ε_{iqt} occurs as it is shown by equation (7), where:(Pr_{iqt}) is the probability that an individual *i* will prefer choice q rather than choice *j*:

$$Pr_{iqt} = \text{Pr}\ [(\varepsilon_{ijt-}\varepsilon_{iqt}) < (V_{iqt} - V_{ijt})] = \text{Pr}\ [\varepsilon_{ijt} < \varepsilon_{iqt} + V_{iqt} - V_{ijt}]\ (7),$$

the Independence-from-Irrelevant Alternatives (IIA) axiom states that introducing a third irrelevant, alternative X into a choice set {A, B} will not change the original preferred status between A and B. It implies that the ratio of the probabilities of choosing one alternative over another (given that both alternatives have a non-zero probability of choice) is unaffected by the presence or absence of any additional alternatives in the choice set (Louviere, Hensher, and Swait, p. 44, 2000). These IIA conditions allow to compute the choice model and introduce or eliminate the alternatives from choice sets without re-estimation. IIA also implies that the random elements in the utility function such as *S*, ψ, and ε to be independent across alternatives and identically distributed. Therefore, if we are assuming that the errors are distributed according to the extreme value type 1 distribution (Louviere et al., 2000) such as: (Pr $(\varepsilon_{ijt} \leq \varepsilon)$ = exp $(-exp - \varepsilon) = e^{-e^{-\varepsilon}}$, the equation (7) then can be rewritten as:

$$Pr_{iqt} = \text{Pr}\big(\varepsilon_{ij} < b + V_{iqt} - V_{ijt}\big) = \textstyle\prod_{j=1}^{J} \exp\Big(-exp - \big(b + V_{iqt} - V_{ijt}\big)\Big) =$$
$$\exp(-b)\exp\ [-\textstyle\sum_{j=1}^{J} exp - (b + V_{iqt} - V_{ijt})]\ (8),$$

∀ j ≠ q, and b is a given value for ε_{iqt} .

Thus, given the assumption that each e_{iqt} is i.i.d extreme value, the probability that consumer *i* chooses alternative q in choice occasion *t*, conditional on the coefficient vector θ_i=$[\gamma_i W_i{}']'$, (Revelt and Train, 1998) is :

$$Pr_{iqt} = \frac{\exp\ (V_{iqt}\ (\theta_i))}{\sum_q \exp(V_{iqt}\ (\theta_i))}\ (10),$$

where $V_{iqt}(\theta_i) = -\gamma_i p_{iqt} + (\gamma_i W_i)' X_{iqt}$, furthermore, conditional on θ_i, the probability of consumer i's observed sequence of T choices is then (Train, 1998):

$$S_i(\theta_i) = \textstyle\prod_t P_{iq(i,t)t}(\theta_i)\ \ (11),$$

where q(i,t) denotes the specific alternative q that consumer i selects in choice occasion t. the coefficient vector θ_i is unobserved for each consumer i and varies in the population with density $f(\theta_i|\Gamma)$ where the parameters of the distribution of θ_i are Γ.

Equation (11) represents a conditional logit model. It assumes that there is a linear relationship between utility and attribute parameters, and that error terms are identically and independently distributed. However, conditional logit models assume preference homogeneity across respondents subject to the independence of irrelevant alternatives, so they do not reflect the heterogeneity that exists across consumers' preferences. To capture this heterogeneity, a better approach is needed and, it is provided by the mixed logit models (Hu et al., 2005). McFadden and Train (2000) proved that mixed logit models could approximate any random utility model especially when it comes to repeated choice models (Brownstone and Train, 1999) as is the case in this study.

Thus, the unconditional probability of the observed choice sequence is represented by the mixed logit equation (12) such as:

$$P_i(\Gamma) = \int S_i(\theta_i) f(\theta_i|\Gamma) d\theta_i \text{ (12),}$$

the loglikelihood function for all n consumers is $LL(\Gamma) = \Sigma_i \, lnP_i(\Gamma)$. The estimation of WTP is carried out using the command "mixlogitwtp" in STATA. The procedure fits mixed logit models in WTP Space by using maximum simulated likelihood (Train and Weeks, 2005; Scarpa et al., 2008; Hole and Kolstad, 2012). Regarding the distribution of the coefficients in θ_i, the price coefficient will be specified to be lognormal, and the WTP distributions for all nonprice attributes were assumed to be normal.

Results

Summary of sociodemographic characteristics

Analysis of respondent demographics reveals that the typical shopper is a white (74%) married female (53%), aged between 25 and 44 years old, who had some college (34%) and annually earns more than $100,000 (25%).

Apparel shopping habits

The survey shows that 33% of the respondents shop for themselves and their friends or family once per month or only when needed. More than half of the respondents prefer to shop in-store (67%) rather than online (32%), and among all denim products they would buy denim jeans (79%).

Respondents were also asked how important were a set of attributes and how often they were checking some labels while shopping for apparel and results show that labels that were checked most of the time were: fiber content (42%), and country-of-origin (35%). For other label items: environmental impact, fair trade, and organic, 25% of the respondents checked them only sometimes during their shopping for apparel.

The price of the item is considered as the most important by 68% of the respondents, followed by the attribute toxin-free dye (40%), and the attribute country of origin of apparel (33%). The rest of the attributes: water use/ conservation techniques, sustainability, country-of-origin of fiber, designer/store brand, carbon/greenhouse gas emission, and certified organic are seen to be slightly important by about 30%, which is consistent with previous studies on apparel product attributes that found price and country/brand of origin were among the most important attributes for the consumer (Davis, 1987; Martin, 1971; [Dickerson, 1987; Jin et al., 2009).

Knowledge, experiences, and opinions

Knowledge and experiences

To assess their experience, respondents were asked how familiar they were with: agriculture, conservation techniques, organic production, and irrigation systems, if they have or are currently working in /owning a cotton farm, cotton mill, an apparel store, and if they have ever bought, traded, or sold raw cotton. About 27% of respondents did, while 28% affirm to have taken one or more courses in agriculture, fashion industry, cotton, and/or irrigation technology.

Opinions about environmental damage and brands' action

Results show that 40% of the respondents perceive cotton and denim production (from growing to manufacturing and dying) as not harmful or has an insignificant impact on the environment, while activities like running machines, dying, and manufacturing polyester are seen as having significant damage to the environment. However, 50% of the respondents give moderate importance to a brand's action regarding the environment while only 26% consider it as extremely important, and almost the same proportion (24%) think that is not important at all. Overall, our descriptive statistics show that respondents seem not to be aware of the environmental harm caused by cotton production, but they are showing interest in sustainability.

Mixed Logit results

To analyze the impact of the information treatments, we employ a mixed logit regression approach. We assumed that the parameters of levels were random and normally distributed (Ubilava and Foster, 2009). Table 2 presents the parameter estimation results of two mixed logit models. The difference is that model 1 includes only the parameter estimates of the main effect to analyze consumer preferences for (1) organic production systems, (2) organic production systems when they are explained using USDA definition, (3) denim jeans made in China, and finally, (4) denim jeans made in China with the information on the Uighurs labor-exploitation. Based on model 1, interaction terms between the demographics (education, gender, income, and age) and the variable (4) were created to measure the impact of basic demographics and labor exploitation information on the purchase intention.

Table 14. Mixed logit WTP space model results

	Model 1			Model 2	
Variable	Mean	P-value		Mean	P-value
Price	-2.267	0.000***		-2.245	0.000***
ASC	-68.815	0.000***		-65.952	0.000***
Production Systems	0.841	0.372		1.653	0.028*
Production Sytems × CT	1.404	0.226		-0.374	0.760
COO USA	14.726	0.000***		13.463	0.000***
COO China	-12.531	0.000***		-13.937	0.000***
COO China ×CT	-0.663	0.627		-7.164	0.720
COO China ×CT× Education	-	-	-	3.534	0.017*
COO China × CT× Income	-	-	-	-0.964	0.435
COO China ×CT×Gender	-	-	-	-6.734	0.003**
Wald Chi		5123.53			5281.14
LogLikelihood		-6031.497			-6031.099
LR			0.796		
McFadden R^2			0.000066		

*Note: CT stands for cheap talk; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.*

In model 1, the estimates for the variables ASC, COO USA, and COO China are highly significant. The negative sign of the estimate if the variables ASC, COO China are as expected, respondents would rather choose between jeans from a different origin than neither option, also, if they had to choose between a denim jeans ROW made or China made, they would ask for a discount of $13 to buy the Chinese made denim jeans.

For the variable COO USA, the estimate is significant and positive showing a willingness to pay of $15 for US-made jeans compared with jeans from the ROW. In parallel, adding information related to USDA definition for organic farming and a statement on Uighurs labor exploitation seems to not have an effect, as the two estimates are not significant, and same outcome is observed for the attribute production systems.

Based on the log-likelihood ratio test and the McFadden R^2, we conclude that model 2 fits better our data. Therefore, we use the estimation of model 2 to analyze interaction terms as well as WTP for the attributes.

The result shows that the price coefficient is statistically significant and negative, as expected, since utility declines with higher prices. The coefficient of the ASC variable is negative and statistically significant suggesting that participants would rather choose one of the two alternatives than neither option. The coefficient of the variable US as country of origin is statistically significant and positive and shows that respondents have a preference for US-made denim jeans over those manufactured elsewhere, and are willing to pay a $ 13 premium, thus, we fail to reject the hypothesis H_2.

The estimate for the production systems variable is significant and supports the hypothesis H_1, stating that respondents are showing a preference for denim jeans made of cotton organically produced to ones made of conventionally produced cotton, and are willing to pay a $1.65 premium. However, when we introduce USDA cheap talk into the variable production systems, the result is non-significant which means that consumers are indifferent to information related to the definition of organic farming. Regarding China as the country of origin of denim jeans, the coefficient is statistically significant and negative as expected, which means that respondents show a preference for denim jeans made in ROW, and are asking for a discount of $14 to purchase made in China denim jeans. Also, and as expected, the coefficient is significant and negative when we include the Uighurs labour-exploitation cheap talk to the COO China variable, showing that respondents are sensitive to the cheap-talk and require a $21 discount to buy China-made denim jeans.

The result of interacting the added labor exploitation information to the attribute COO China, with the demographics education, and gender is significant for both descriptives. This result shows that women ask for a larger discount than men ($28) when confronted with the labor exploitation information to buy made in China denim jeans. Also, more educated respondents show sensitivity to the labor-exploitation information as the result shows that they ask for a $18 discount. Therefore, we fail to reject H_3.

Conclusion and discussion

In recent years, an increasing number of firms and brands have begun to make more efforts to relieve the effects the textile and apparel industry has on natural and human resources and fulfil the growing demand for ethically produced apparel. The present research sought to examine the impact of information on labour-exploitation in cotton farms and textile mills have on US consumers' purchase decisions and our findings indicate that U.S. consumers express preferences for ethically produced denim jeans. By exploring production systems attributes, our result is in concordance with previous findings where consumers are found to be ready to pay more for apparel made of organic fiber (Hustvedt and Bernard, 2008; Hustvedt, 2006, Ellis et al., 2012). The $ 0.65 premium for organic cotton fiber found in this study is not far from the $1.86 premium found by Hustvedt and Bernard (2008). However, exposing the respondent to different versions of organic agriculture definition seems to have no effect on his intention to buy which is in contrast to previous findings. For example, a recent study found that additional information regarding a fair trade system increases the willingness to pay a premium for fair trade certification (Ruggeri et al., 2021). Also, if some studies found larger premiums for production systems attribute than the country of origin attribute (e.g. Hustvedt and Bernard, 2008), our research demonstrates the contrary since a larger premium was offered for the attribute COO U.S than for cotton organically produced.

Only a few studies focused on organic fiber consumers, and until 2017, organic fiber was still seen as a 'new phenomenon (Nassivera et al., 2017), which was captured by the descriptive statistics regarding respondents' understanding of production systems. The statistics display that a large number of respondents have low knowledge about production systems (55%), and an errored perception of the environmental impact of cotton production from farming to manufacturing (47%). These facts, on one hand, show that industrials need to put more efforts into informing consumers on the different production systems used to produce sustainable apparel, and on the other hand, offer new opportunities for researchers to investigate organic fiber consumerism.

Another interesting result from the study is concerning the COO US attribute. Respondents expressed a preference for US-made denim jeans compared to denim jeans made in ROW, which is in line with previous findings such as Ha-Brookshire and Norum (2011) who showed that US consumers were willing to pay over a $13 premium for a shirt made of US-grown cotton, compared to cotton without the COO display. Also, studies suggest that COO is often a proxy for quality (Insh and McBride, 2004), and consumers from developed countries tend to prefer their home products (Watson and Wright, 2000). This preference was explained in the literature by the COO-effect which refers to a consumer's dependency on COO when forming opinions on the quality of a product (Han and Terpstra, 1988). Ha-Brookshire and Yoon (2012) found that when consumers see a product "Made in the USA," compared to a product "Made in China," they may perceive the US product to be higher in quality and value. Moreover, as a country brand, the United States of America is considered a strong brand (Adina, 2015). Also, Drozdenko and Jensen (2009) attempted to translate the COO-effect into prices and found that US consumers were willing to pay a 37 per cent premium for US-made shoes, and a 105 per cent premium for US-made toothpaste, compared to the same products made in China.

Since studies proved that pre-conceived opinions on COO have an effect on consumers' purchase decision a country image can thus, be viewed as an asset when it has a positive connotation and as a liability when it is associated with negative elements (Lampert & Jaffe, 1998). The relationship between country-of-origin and willingness to buy a product can be moderated by affinity or animosity[6]. Findings suggest that consumers are less interested to buy a product manufactured in a country for which they have a deep feeling of animosity (Ha-Brookshire and Yoon, 2012).

So, introducing the information on the Uighurs minority labour-exploitation to our survey script, allowed consumers to express their opinion about this issue through their WTP, and thus show on average, their support to ethically produced apparel which explains the negative coefficient of the interaction attribute COO China with the variable cheap talk. This result is also consistent with Drozedenko and Jensen (2009) who found that price

[6] Animosity is defined as "the remnants of antipathy related to previous or ongoing military, political or economic events" (Klein et al., 1998, p. 90).

premiums were positively correlated with the amount of exposure to negative news about Chinese products.

Also, the discount asked for denim made in China with the added labor exploitation information, compared to the premium offered for denim produced from organic cotton, is much larger, this disparity is also in line with the literature where findings explain that people value social considerations more than environmental concerns when buying clothing (Dickson, 2001; Shaw and Tomolillo, 2004). Thus, providing the consumer with labor exploitation information has an effect on his purchase behavior, and this finding confirms another study's result that affirms that consumers' knowledge of ethical issues shapes his purchase behavior (Hill, 1981), moreover, in their meta-analysis, Tully and Winer (2013), conclude that all else equal, offering good working conditions may yield to greater price premiums and market share.

In ethical consumerism studies, demographics are often found to have a significant effect on purchase behavior (Ha-Brookshire and Norum, 2011; Ruggeri et al., 2021). Therefore, based on the significant estimates of the interaction terms including the variables COO China, the dummy for labour exploitation, with gender and age, proofs the presence of a potential market niche of young and women consumers for ethically produced cotton apparel that needs to get the attention of producers.

Our knowledge of the key factors driving the U.S. consumers' purchase intention towards ethically made denim jeans apparel is limited. Furthermore, the empirical findings of consumer purchase intention towards other environmentally friendly products cannot be simply generalized to denim jeans. Consequently, further research is needed to depict how much consumers are valuing the attribute country-of-origin of garments rather than the whole product. It will be also interesting to test the effect of cheap-talks on other labor-conditions (such as minimum wage, incarcerated- individuals' labor in the apparel industry…etc) on the purchase decision. However, our results imply that businesses need to assess where and how their materials and products are grown and manufactured, and make sure they meet the quality and sustainability standards. They need also to give more attention to the "Made in the US" and "Organic" attributes given the market opportunity they present in the denim jeans market segment and develop their communication regarding their ethical practices.

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APPENDICES

APPENDIX A

TABLES FROM PAPER I

A. Simplified meta-regression results for biomass crops production-related ag. practices data

	WLS cluster Robust SE			
	(3)		(4)	
	Coef.	P>|t|	Coef.	P>|t|
Constant	2054.39 (-828.34)	0.058*	2765.59 (-1375.79)	0.066*
sqrt(n)	-	-	-78.64 (48.99)	0.132
n	-1.94 (0.94)	0.028*	-	-
Obs	49		49	
F	4.3		2.58	
Pr > F	0.0585		0.1324	
R^2	0.1826		0.1476	

****, **, * indicate significance at the 1%, 5%, and 10% levels*

B. Energy data summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WTA	49	1347.889	1383.999	-2.24	4063
Random sampling method	49	0.77551	0.42157	0	1
Elicitation method	49	0.122449	0.331201	0	1
Europe	49	0.755102	0.434483	0	1
Australasia	49	0.040816	0.199915	0	1
America	49	0.204082	0.407206	0	1
Cereal crops	49	0.244898	0.434483	0	1
Woody crops	49	0.571429	0.5	0	1
Grassy crops	49	0.183674	0.39123	0	1
Sample size (n)	49	328.3469	246.5457	118	1107
Trend	49	7.836735	1.982706	2	11

C. Soil data summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WTA	136	151.1401	323.7897	-796.39	2380.51
Random sampling	136	0.477941	0.50136	0	1
Elicitation method	136	0.014706	0.120818	0	1
Europe	136	0.073529	0.261968	0	1
Africa	136	0.720588	0.450369	0	1
Asia	136	0.014706	0.120818	0	1
America	136	0.205882	0.40584	0	1
Agroforestry	136	0.213235	0.411107	0	1
BMPs	136	0.786765	0.411107	0	1
Sample size	136	1216.853	1085.036	90	2439
Trend	136	8.264706	2.87321	0	11

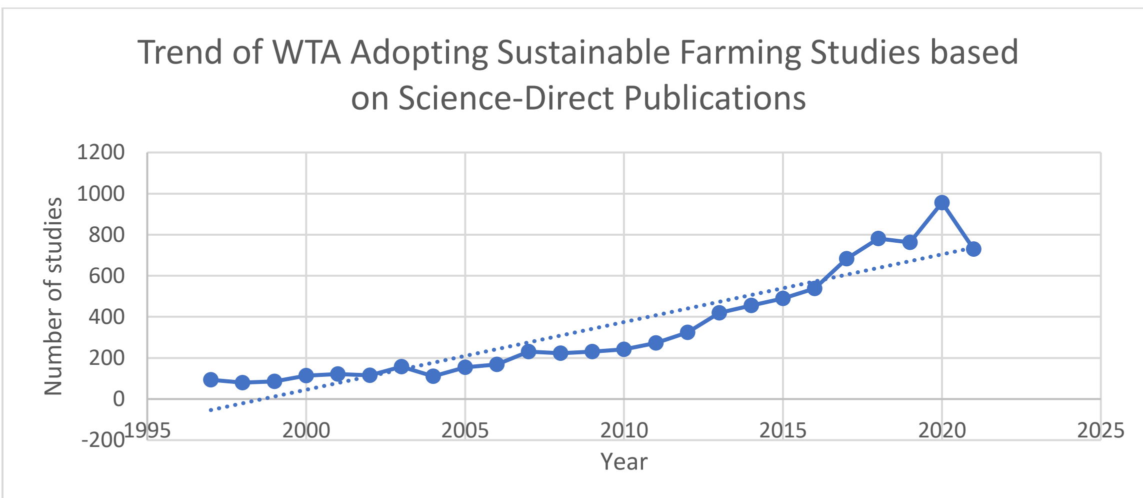
D. Pollution data summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WTA	71	279.895	592.1105	-217.31	2727.868
Random sampling	71	0.197183	0.400704	0	1
Elicitation method	71	0.112676	0.318447	0	1
Europe	71	0.394366	0.492193	0	1
Africa	71	0.43662	0.499497	0	1
Asia	71	0.098592	0.300235	0	1
America	71	0.140845	0.350338	0	1
Chemical use	71	0.43662	0.499497	0	1
Biodiversity	71	0.295775	0.459639	0	1
Pollution	71	0.267606	0.445862	0	1
Sample size	71	343.7183	222.9363	68	962
Trend	71	8.126761	2.329498	2	11

E. Water data summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WTA	31	297.7939	487.6184	-145.44	1767.462
Random sampling	31	0.580645	0.50161	0	1
Elicitation method	31	0.612903	0.495138	0	1
Europe	31	0.032258	0.179605	0	1
Africa	31	0.774194	0.425024	0	1
Australasia	31	0.193548	0.40161	0	1
Watersheds	31	0.741936	0.444803	0	1
Riparian lands	31	0.258065	0.444803	0	1
Sample size	31	209.5161	58.18068	150	391
Trend	31	7.516129	2.501612	2	10

F. Trend of wta adopting sustainable farming studies based on science-direct publications



APPENDIX B

TABLES FROM PAPER II

G. Summary statistics of respondents' demographics

Variable and Category	Percentage
Gender	
- Male	48.01
- Female	51.86
Race	
- Black	13.09
- White	74.66
- Native	2.07
- Asian	4.55
- Other	5.65
Education	
- Less than High School	2.75
- High School Graduate	27.79
- Some College	34.94
- 4 Year Degree	21.18
- Professional Degree or Graduate	13.34
Age	
- [18-34]	30.81
- [35-54]	37
- [55-74]	28.74
- 75 and older	3.44
Employment	
- Employed Full-Time	44.71
- Employed Part-Time	12.66
- Retired	19.53
- Student	4.95
- Unemployed	18.16
Annual income in $ of the household	
- Less than $ 20,000	17.74
- [$20,000-$39,999]	22.97
- [$40,000-$69,999]	19.94
- [$70,000-$99,999]	13.89
- $100,000 or more	25.45
Marital Status	
- Married	49.79
- Widowed	5.23
- Divorced or Separeted	13.2
- Never Married	31.77

H. Apparel shopping habits

How often/when do you shop for apparel products?	Only when needed or during sales or holidays	Once a month	Once or multiple times per week	Department store	Online	Specialty stores	Other
For yourself	49.04%	29.62%	21.34%	55.30%	26.82%	14.44	3.44
For your family/ friends	60.33%	15.01%	24.65%	48.01%	29.16%	15.82%	7.02%

I. Most & least checked labels during shopping

	Never	Frequently	Always
Fiber Content/Type	24.9	50.89	24.21
Environmental Impact	40.22	45.74	14.05
Organic	46.91	38.65	14.44
Fair Trade	43.92	39.78	16.3
Country of Origin (COO)	25.14	50	24.86

J. Most and least preferred attributes during shopping

	Very Important in %	Moderately Important in %	Not at all important in %
Certified Organic	26.17	40.91	32.92
Price	70.98	26.69	2.34
Water use/Conservation	31.78	45.26	22.97
Carbon/Greenhouse Gas Emissions	28.82	45.8	25.38
Designer/Store Brand	29.58	48.97	21.46
COO of fiber	31.64	46.76	21.6
COO of apparel	33.43	45.94	20.63
Toxin free dye	40.57	41.95	17.47
Conservation techniques / Sustainability	31.68	46.28	22.04

K. Most and least preferred denim apparel

	Percentage in %
Accessories	1.65
Dress/Skirt	6.87
Jeans	71.11
Jacket	13.76
Shorts	6.6

L. Respondents' experience about production systems

	Percentage
You work at a cotton farm	5.91%
You have bought or sold raw cotton	4.95%
You own an apparel store	5.5%
You work or have worked in a cotton mill or traded cotton	4.26%
You are familiar with agricultural conservation techniques	9.35%
You are familiar with irrigation systems	8.53%
You are familiar with organic production systems	6.74%
None of the above	54.76%

M. Respondents' Knowledge about agriculture, fashion industry, cotton, and irrigation systems

	Percentage
Agriculture	8.25%
Cotton	11%
Irrigation Technology	6.88%
Fashion Industry	8.39%
None of the above	65.48%

N. Respondents' perceptions on environmental damage caused by each of the following activities

	Insignificant Damage	Moderate Damage	Significant Damage
Growing cotton	46.83%	40.50%	12.67%
Manufacturing Denim products	38.10%	49.52%	87.62%
Manufacturing cotton fiber	44.55%	42.48%	23.97%
Dying Cotton fabric	36.09%	46.38%	17.63%
Dying Polyester fabric	33.06%	46.97%	19.97%
Manufacturing Polyester	30.67%	48.01%	21.32%
Running Machines	27.59%	49.79%	22.62%

O. **Respondents' perception on the importance of their favorite apparel brands' actions regarding environmental responsibility**

Extremely important	Moderately important	Not at all important
25.86%	50.48%	23.66%

P. Example of CBCA Choice

	Option 1	Option 2	None
Production Systems	Conventional	Organic	None of the Above
Price $	$22	$34	
COO	China	ROW	