Consumers' willingness to pay for dairy products: what the studies say? A Meta-Analysis.

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Abstract

Willingness to pay (WTP) and consumer's preferences for dairy products (milk, yogurt, butter and cheese) have attracted attention of researchers. Therefore, several studies have focused on the question of the measure of WTP for these different products. However, these studies found a value of WTP, which is positive or negative between different dairy products, or through the same types of products. We conduct a meta-analysis with the aim to observe the different factors, which can explain the variations of the results of the studies. Therefore, we selected 24 studies (corresponding to 165 observations) which estimates the WTP of consumers for dairy products. A Geographical Indication (GI), a Bio label or other signs of quality, differentiates these products. As main results, we found that on average, label's effect is an important quality signal for consumers of dairy products. Indeed, on average, Geographical Indications (*GI*) and bio label (*BIO*), have a high WTP compared to other signals. On the other hand, consumers seem to have a higher WTP for dairy products derived from cow's milk and goat's milk compared to *sheep milk*. Among dairy products, *Cheese* has on average a WTP downward compared to other dairy products. Finally, we highlighted that the French consumers have on average a high WTP for dairy products compared to consumers in other countries. These results are robust, with survey based on a sample of consumers and a scanner data based on a sample of prices. These results remain robust, with cluster and boostrap options.

Keywords: consumer, willingness to pay, meta-analysis, dairy products

JEL classification: D12, C19, Q18, Q1

I- Introduction

Various health crises (e.g. the mad cow crisis) of these last years have contributed to increase the mistrust of consumers to the food they eat. Thus, consumers' demand for quality foods was the subject of several researches in the economic literature. Researches argue that, consumers conscious of their physical and nutritional health, have based their consumption choices on quality signals such as geographical indications (GI)[1], the bio label, the no-GMO (Genetically modified organism) aliments, the HACCP (Hazard Analysis Critical Control Point) method and others private labels or signals.

Caswell (1992), and Tse (1999) stated that consumers are willing to pay a premium to improve the safety and quality of the foods they eat. Dairy products did not escape this rule. Many studies are interested to preferences and willingness to pay (WTP) of consumers for these products, which are generally considered as products of first necessity. We can quote for cheese cases ((Bonnet and Simioni 2001), (Hassan and Monier-Dilhan 2006), (Van Ittersum, Meulenberg et al. 2007), (Vecchio and Annunziata 2011), (Adanacioglu and Albayram 2012)), for milk cases ((Wang and Sun 2003), (Wang, Mao et al. 2008), (Bai, Zhang et al. 2013), (Walley, Custance et al. 2014)), for butter cases (Saulais and Ruffieux 2012), finally for yogurt cases ((Carlucci, Monteleone et al. 2009), (Barreiro-Hurle, Gracia et al. 2010)). Generally, these studies have a positive or a negative WTP between same categories of products or different categories of products.

We carry out a meta-analysis (Stanley 2001), in order to observe the different factors which can explain the variations in the results of the studies. To do this, we retain 24 studies (165 WTP) carried out in different countries, focuses on preferences and WTP of consumers for one or more dairy products. These products are differentiated by the GI, the bio label, no-GMO foods and other privates' quality signals. Note that, a quality label helps consumers imperfectly informed in the process of taking their decision, in structuring their information environment (Van Trijp, Steenkamp et al. 1997).

The article is organized as follow. A section 2 presents a debate in the literature on the dairy products. In section 3, we present the methodology used. Section 4 presents the model and estimation method. Section 5 presents results and interpretations. Finally, we conclude in section 6.

[1] PDO (Protected Designation of Origin),PGI (Protected Geographical Indication) and TSG (traditional specialties guaranteed)

I- Background

The literature on preferences and WTP of dairy products is very rich. Kuperis, Veeman et al. (1999) studied the impact of the use of recombinant bovine somatotropin (rBST) in milk production, on a sample of 279 Canadian consumers. They found that a milk containing rBst has a negative WTP than milk free rBst, because this hormone is injected in cows to increase their milk production. Therefore, consumers fear the impact on their health. Wang, Mao et al. (2008), meanwhile studied the consumers' demand for dairy products, on a sample of 559 Chinese consumers. They found that dairy products under HACCP method are sold with a premium of 5% in Beijing supermarkets compared to the products without this label, because Chinese consumers are concerned about the quality and safety of the food they eat. Therefore, the HACCP method appears as ensuring the safety and quality. Still working on the Chinese case, Bai, Zhang et al. (2013) studied the preferences and WTP of consumers for milk. Using a sample of 799 consumers, they found that consumers in urbans areas have a strong preference for the traceability of the milk and WTP of these consumers is very high for milk certified by the government, then by an industrial association and finally by a third party. In this case, government certification appears to guarantee a better quality. Walley, Custance et al. (2014) studied influences of COOL[2] on demand and consumption of Chinese consumers' choices. Based upon a survey of 430 individuals, they found that in the minds of consumers, milk from other countries is perceived as being a better quality compared to the one produced in China. Nevertheless, these consumers are always forced to consume Chinese milk, due to numerous markets barriers imposed on foreign companies. Finally, in Turkey, Adanacioglu and Albayram (2012) studied the preferences of consumers for traditional cheeses. From a sample of 185 consumers (divided into two groups), they found that consumers of both groups are willing to pay a premium for regional cheeses, compared to non-regional cheeses. Therefore, the regional attribute is important for these consumers.

In opposition to these findings, studies conducted in the European context had found results with very contrasting light preferences, mainly for the WTP of consumers for dairy products. Indeed, if some works show that consumers have a clear preference for labeled products or whose origin is known or reputed, for others, these differentiation signals have mixed effects, and sometimes contradictory to the choices of consumers.

[2] Country Of Origin Labelling

From a sample of 658 prices, Santos and Ribeiro (2005) studied regional reputation and WTP for the Portuguese cheeses, they found that, not only the type of milk but also the region of origin of the cheese have a significant impact on cheese's prices. Specifically, cheeses made from sheep milk have a positive WTP (+33%), while the cheeses made from cow milk and goat milk have a negative WTP (-36% and -17% respectively); cheeses with a mixture of milk have a very varying WTP. In addition, cheese made in the regions of "Minho e Trás-os-Montes" and "Ribatejo e Estremadura" can have positives WTP, while those of "Alentejo" and "Ilhas" regions have negatives WTP. For these authors, the type of milk, and the origin of the product are important attributes for consumers. In 2010, Barreiro-Hurle, Gracia et al. (2010) are studying the effects of quality labels on Spanish consumers consumption decisions. Based on a sample of 400 consumers, they found that Spanish consumers have a high WTP for products, including yogurt, with a nutritional label or health label, compared to those without label. This result supports the idea that a label on products may be an important sign of quality for consumers. Similarly, conducting a study on the preferences of consumption of 471 Italian consumers, Pilone, De Lucia et al. (2014) found that for consumers in South of Italy, the presence of quality label on cheese is seen as an important signal, allowing an increase in the consumption of cheese.

However, referring to a sample of 1002 prices (scanner data), Bonnet and Simioni (2001) studied WTP of French consumers for camembert cheese and found that on the basis of the same price, only a small proportion of consumers will prefer to buy a PDO camembert cheese compared to those who prefer to buy a brand of camembert without PDO. They concluded that private labels appear more relevant in the mind of consumers than the PDO label. Similarly, Hassan and MONIER (2002) studied WTP of French consumers for blue-veined cheeses under AOC[3] label and no AOC label. They found that the AOC label is not always associated with a positive willingness to pay. By the same token, based on a sample of 85 individuals, Saulais and Ruffieux (2012) demonstrate in their study of WTP of French consumers for butter, that differentiation of products, notably on the basis of nutritional criteria, does not increase the WTP of consumers for butter; in contrary, it decreases. Outside of the French context, Vecchio and Annunziata (2011) were based on a sample of 400 Italian consumers to study the role of PDO/PGI labels in food consumption choices. They found that in the case of cheese, PDO/PGI labels are on average an important quality signals only to consumers who have some knowledge of these labels, as they increase their WTP. In the other

[3] Controlled Designation of Origin, it's the equivalent of PDO in the European Union (EU)

side, consumers who do not know these labels make their consumption choices based upon a low price products, better appearance or Italian origin.

In the light of these different results, we conduct a meta-analysis on dairy products (milk, cheese, yogurt, and butter), as these products are of similar nature. The goal is to synthetize and integrates the results of these studies.

II- Methodology

Meta-analysis

The term meta-analysis comes from Glass (1976), which is defined as the statistical analysis of the results of individual studies, with the aim to integrate them. Pignon and Poynard (1993) defined the meta-analysis as the use of statistical techniques for the synthesis of a set of separate but similar experiments. For Stanley and Jarrell (1989), the meta-analysis is an analysis of the "empirical analysis" which attempts to explain the differences in results between studies. Meta-analysis is a simultaneous analysis of a set of studies addressing the same question, in order to obtain the information that none of these studies taken singly could provide and explain the differences in the results of these studies. The first meta-analysis has been realized in the medical field. The objective was to reduce the costs of experimental studies, which often led to different results. Very quickly, this method has spread in other areas of research such the environment, marketing and the social sciences. In the agricultural and agri-food field, several meta-analysis were conducted. We can mention: "A meta-analysis of the willingness to pay for reductions in pesticide risk exposure" (Florax, Travisi et al. 2005), which contain 15 studies and 331 observations ; "A meta-analysis of Genetically Modified Food Valuation Studies" (Lusk, Jamal et al. 2005), which contain 25 studies and 57 observations ; "A meta-analysis of willingness to pay for traceable meat attributes" (Cicia and Colantuoni 2010), which contain 23 studies and 88 observations. Closer to us, we have: "A meta-analysis of consumer willingness to pay for farm animal welfare" (Lagerkvist and Hess 2011), which contain 24 studies and 106 observations ; "A meta-analysis of Geographical Indication food valuation studies" (Deselnicu, Costanigro et al. 2013) which contain 25 studies and 134 observations. Based on 140 meta-analysis, Nelson and Kennedy (2009) carry out a meta-analysis of "meta-analysis". All these meta-analysis show that, this method is used increasingly in the economic literature.

Database

Based on search online software such as: "Google", "Google Scholar", "Science Direct", "Web of Science" and "Scopus", we list 25 studies that can form the basis of our meta-analysis. Among these studies, we have 7 "conference papers", 16 "journal papers" and 2 "working papers". Keywords used to select our studies were "willingness to pay AND cheese", "willingness to pay AND butter", "willingness to pay AND milk", "willingness to pay AND yogurt", "willingness to pay AND dairy products". These studies are generally about preferences and WTP of consumers for one or more dairy products (milk, yogurt, butter and cheese). In some cases WTP are directly given in articles and other cases, they are calculated using the formula: $WTP=-(\beta_{attribute}/\beta_{price})$[4]. Following Cicia and Colantuoni (2010), we separate the valuation methods of WTP in two families : the hypothetical methods (choice experiment, conjoint analysis, hedonic price, contingent valuation and simple survey) and non-hypothetical method (experimental auctions). In the latter, consumers are confronted with real choices situations and they have real possibilities to buy. We choose to exclude article of Di Pasquale, Adinolfi et al. (2011)[5] because willingness to pay calculated are unusable. Therefore, we stay with 24 studies for our final estimates, so 165 WTP. Then, in our database, we consider the negative WTP as 0. Because the WTP is a premium that consumers are willing to pay, therefore a negative WTP means that consumers are not willing to pay a premium relative to the price (So we consider this as a null willingness to pay) and a positive WTP means that consumers are willing to pay a premium relative to the price. **Table 1** presents a list of articles used in our meta-analysis.

Data description

We select different variables[6] that could influence WTP of consumers in the studies. Our study period extends from 1998-2014. the oldest paper of our study is from 1998 (Gath and Alvensleben 1998) and the most recent papers are from 2014 ((Pilone, De Lucia et al. 2014), (Garavaglia and Marcoz 2014), (Walley, Custance et al. 2014), (Imami, Shkreli et al. 2014)). Following (Deselnicu, Costanigro et al. 2013) and (Cai and Aguilar 2013), we pose the formula of *WTP(%)*:

[4] Case studies using a "logit" model for estimates.
[5] The authors introduce the formulas for the calculation of the WTP, but these formulas are not exploitable.
[6] See Table 2

$$\%WTP = \left(\frac{(Base\ price + premium) - (Base\ price)}{base\ price}\right) \times 100 \qquad (a)$$

Therefore,

$$\%WTP = \left(\frac{premium}{base\ price}\right) \times 100 \qquad (b)$$

In equations (a) and (b), "*premium"* represents the surplus of the base price of the product that a consumer is ready to buy.

During construction of our database, we faced some challenges. For example, the study of (Kaye-Blake, Saunders et al. 2004) does not provide the *base price* of milk and butter from 2004 in New Zealand. Thus, we take the prices of these products on the website of the FAO[7] for the survey period. We had the same problem on the study of (Walley, Custance et al. 2014) concerning the price of milk in China in 2012. We referred once more to the price of milk from the website of the FAO[8].

Study of (Van Ittersum, Meulenberg et al. 2007) does not also provide base prices for cheese, but we were able to note directly two WTP. Another feature of this study is related to the fact that it is realized considering consumers of three European countries (Greece, Italy and The Netherlands). We decided not to impute a *base price* at the two WTP proposed. Finally, before exploiting WTP and prices of each study constituting our database, we convert all prices in US[9] dollar.

Table 2 shows the descriptive statistics of the different variables. We observed that the minimum WTP is 0%. For example, This value can be observed for the *Gjirokastra cheese*[10], from the study of (Imami, Shkreli et al. 2014) and the maximum is *Canestrato di Moliterno cheese*[11] (383,33%), from the study of (Pilone, De Lucia et al. 2014). In the same table, there is a minimum base price of 0,00001 $US[12] (Adanacioglu and Albayram 2012), which represents the price of the *Tulum cheese*, of Turkey. The maximum base price being 16,914 $US[13] (Bernabeu, Olmeda et al. 2008), which represents the price of cheese from *Castilla-La Mancha*, in Spain.

[7] Perspectives agricoles de l'OCDE et de la FAO 2003
[8] Perspectives agricoles de l'OCDE et de la FAO 2006-2015
[9] platform OANDA, allows us to convert prices at the exchange rate of the survey year
[10] Cheese produced in southwestern Albania.
[11] Cheese produced in Basilicata, in southern Italy. (premium/base price) ×100= (4,60/1,20) ×100= 383,33%
[12] The initial value is 10 TL/kg. This price is converted using the exchange rate $US/TL of 2011
[13] The initial value is 12/kg. This price is converted using the exchange rate $US/€ of 2008

Table 1: Summary of studies on dairy products

N°	Authors	Products	Year of survey	Methods	number of WTP	region	country	Sample
1	Gath and Alvensleben (1998)	cheese	1998	hypothetical	2	Europe	Germany	200
2	Kuperis, Veeman et al. (1999)	milk	1996	hypothetical	8	America	Canada	279
3	Bonnet and Simioni (2001)	cheese	2000	hypothetical	1	Europe	France	1002
4	Alvensleben and Schrader (1998)	butter	1998	hypothetical	3	Europe	Germany	265
5	Hassan and MONIER (2002)	cheese	1999	hypothetical	2	Europe	France	5000
6	HASSAN and MONIER-DILHAN (2002)	cheese	1998	hypothetical	6	Europe	France	5000
7	Wang and Sun (2003)	milk	2002	hypothetical	7	America	Usa	519
8	Kaye-Blake, Saunders et al. (2004)	butter & milk	2003	hypothetical	13	Oceania	New Zealand	701
9	Santos and Ribeiro (2005)	cheese	2004	hypothetical	6	Europe	Portugal	658
10	Hassan and Monier-Dilhan (2006)	yogurt, milk & cheese	2000	hypothetical	6	Europe	France	8000
11	Van Ittersum, Meulenberg et al. (2007)	cheese	2007	hypothetical	2	Europe	Greece, Italy, Netherlands	1232
12	Wang, Mao et al. (2008)	milk	2005	hypothetical	1	Asia	China	559
13	Bernabeu, Olmeda et al. (2008)	cheese	2006	hypothetical	12	Europe	Spain	420
14	Carlucci, Monteleone et al. (2009)	yogurt	2008	auction	4	Europe	Italy	104
15	Barreiro-Hurle, Gracia et al. (2010)	yogurt	2007	hypothetical	4	Europe	Spain	400
16	Di Pasquale, Adinolfi et al. (2011)	yogurt, milk & cheese	2009	hypothetical	3	Europe	Italy	163
17	Vecchio and Annunziata (2011)	cheese	2007	hypothetical	6	Europe	Italy	400
18	Adanacioglu and Albayram (2012)	cheese	2011	hypothetical	6	Europe	Turkey	185
19	Saulais and Ruffieux (2012)	butter	2008	auction	22	Europe	France	86
20	Bai, Zhang et al. (2013)	milk	2011	hypothetical	9	Asia	China	799
21	Tempesta and Vecchiato (2013)	milk	2010	hypothetical	12	Europe	Italy	400
22	Pilone, De Lucia et al. (2014)	cheese	2013	hypothetical	9	Europe	Italy	471
23	Garavaglia and Marcoz (2014)	cheese	2010	hypothetical	12	Europe	Italy	200
24	Walley, Custance et al. (2014)	milk	2012	hypothetical	1	Asia	China	800
25	Imami, Shkreli et al. (2014)	cheese	2011	hypothetical	11	Asia	Albania	210

III- Model and estimation methods

Following Lusk, Jamal et al. (2005), Cai and Aguilar (2013) and Cicia and Colantuoni (2010), we modeled a consumers' WTP as a function of the base price of the product, the method of the survey, the attributes of the products and the characteristics of the sample. We also choose to introduce 2 study periods: periods before global economic crisis (1996-2007) and periods during global economic crisis (2008-2014), the objective being to observe the influence of economic situation on the preferences of the choices of consumers. We estimate two Ordinary Least Square models (OLS), using the software Stata 13.

In model 1, whose results are presented in table 3, we introduce the dummy "*sample consumers*" among the explanatory variables. This variable captures the effect of the use of a survey of consumers for measuring the WTP. Furthermore, given that there may be a within-study autocorrelation leading to the dependence of regressions within one article, we ran OLS with cluster-robust inference. Because, it is very possible that the WTP within each studies may not be independent, and this could lead to residuals that are not independent within studies. Therefore, we use the cluster option to indicate that the observations are clustered into studies and that the observations may be correlated within studies, but would be independent between studies. Standard errors are clustered by each study. Such an approach has been used, for instance, by Barrio and Loureiro (2010) and Choumert, Motel et al. (2013). Finally, we perform a bootstrap to deal with non-normality of residuals and to get reliable standard errors.

The specification of the model 1 is as follows.

Model (1): $$\%WTP_{ij} = \beta_0 + \beta_1(Base_{Price})i + \beta_2(hypothetical)i + \beta_3(cow_{milk})i + \beta_4(goat_{milk})i + \beta_5(cheese)i + \beta_6(Europe)i + \beta_7(America)i + \beta_8 IG(PDO/PGI)i + \beta_9(BIO)i + \beta_{10}(sample_{consumers})i + \beta_{11} year\_of\_survey(2008-2014)i + \varepsilon_{ij}$$

In model 2, whose results are presented in table 4, we remove the dummy "*sample consumers*" and introduce the dummy "*sample price*" that captures the effect of the use of a scanner data of prices for measuring the WTP. The specification of the model 2 is as follow.

Model (2): $$\%WTP_{ij} = \beta_0 + \beta_1(Base_{Price})i + \beta_2(hypothetical)i + \beta_3(cow_{milk})i + \beta_4(goat_{milk})i + \beta_5(cheese)i + \beta_6(Europe)i + \beta_7(America)i + \beta_8 IG(PDO/PGI)i + \beta_9(BIO)i + \beta_{10}(sample_{price})i + \beta_{11} year\_of\_survey(2008-2014)i + \varepsilon_{ij}$$

In the two models, $\%WTP_{ij}$ represents i^{th} WTP estimated, corresponding to the j^{th} study. The "robust" option, allows us to solve the potential heteroscedasticity problems with White correction. Following Chatterjee and Hadi (2006), to ensure that the model does not suffer of multicolinearity problem among explanatory variables, we calculate the VIF[14] (variance inflation factor). The results give a VIF inferior to 10, allowing us to conclude that our variables are not multicolinear.

[14] The results are presented in Appendix

Table 2: Description of variables

Variables	Description	Mean	Min	Max	SD
WTP%	premium price in %	43.109	0	383.33	60.128
base_Price	baseline price per each study and each product in US dollar	3.543	0.001	16.914	3.956
hypothetical	binary variable coded 1 if the method is: conjoint analysis, choice experiment, hedonic pricing and simple survey, 0 otherwise	0.654	0	1	0.476
auction	binary variable coded 1 if the method is experimental auction and 0 otherwise	0.157	0	1	0.365
Cow_milk	binary variable coded 1 if the product made from cow's milk and 0 otherwise	0.521	0	1	0.501
goat_milk	binary variable coded 1 if the product made from goat's milk and 0 otherwise	0.121	0	1	0.327
sheep_milk	binary variable coded 1 if the product made from sheep's milk and 0 otherwise	0.175	0	1	0.381
other_attribute	binary variable coded 1 for other attributes (example: nutrition information and production process, cholestorol etc., 0 otherwise)	0.303	0	1	0.460
cheese	binary variable coded 1 if the product is cheese and 0 otherwise	0.466	0	1	0.500
milk	binary variable coded 1 if the product is milk and 0 otherwise	0.333	0	1	0.472
other_product	binary variable coded 1 if the product is yogurt and butter, 0 otherwise	0.236	0	1	0.426
Usa	binary variable coded 1 if US consumers, 0 otherwise	0.042	0	1	0.202
France	binary variable coded 1 if french consumers, 0 otherwise	0.224	0	1	0.418
Italy	binary variable coded 1 if italian consumers, 0 otherwise	0.260	0	1	0.440
IG(PDO/PGI)	binary variable coded 1 if product is PDO/PGI, 0 otherwise	0.424	0	1	0.279
BIO	binary variable coded 1 if product is BIO, 0 otherwise	0.115	0	1	0.320
other_Signal	binary variable coded 1 if product is HACCP, COOL, private certification, 0 otherwise	0.375	0	1	0.485
sample	sample size of each study	791.193	7	8000	1751.002
sample_price	binary variable coded 1 if it's a scanner data of price, 0 otherwise	0.127	0	1	0.334
sample_consumers	binary variable coded 1 if it's a survey consumers, 0 otherwise	0.751	0	1	0.433
year_of_survey[1996-2007]	binary variable coded 1 if the study is the period 1998-2007, 0 otherwise	0.478	0	1	0.501
year_of_survey[2008-2014]	binary variable coded 1 if the study is the period 2008-2014, 0 otherwise	0.521	0	1	0.501

Finally, in our major regressions, we have R-square superior to 0.2, following Greene and Hensher (2003), we conclude that our exogenous variables significantly explain our dependent variable.

IV- Results interpretation

Interpretations

In **table 3**, which represents results of the model (1), regression [1] shows that:

On average, the *Hypothetical* methods increase the WTP of consumers for dairy products of 18,109% compared with non-hypothetical methods. This result is significant at 5%. Thus, when we use a hypothetical method to collect the data, this can increase on average the premium paid by consumers of 18,109%.

Furthermore, on average, products made from *cow milk* and *goat milk* increases WTP of consumers for dairy products of 19,706 % and 64,399% respectively compared to products made with *sheep's milk* and these results are significant at 10% and 1% respectively. These results are very important, because they demonstrate that dairy products, which are derived from cow milk and goat milk, encourage consumers to pay a high premium.

Then, on average, among dairy products, the WTP of *chees*e decreases (-36,783%) relative to other dairy products. This result is significant at 1%. Therefore, for the case of cheese, consumers want to pay on average 36,783% less compared with other dairy products. This result is contrary the result of Deselnicu, Costanigro et al. (2013). Which found that, among geographical indications (GI), the WTP of *cheese* on average increases (43,48%). This difference in the results is explained by the fact that in their sample, they mix different types of products (wine, cheese, meat, olive oil and grain). Therefore, in this case, consumers for example may prefer the cheese than the wine due to the difference in the nature of products. In the case of our study, we choose the products of the same nature and we find that, in this case, *cheese* has a WTP downward. So, consumers would tend to pay on average 36,783% less for the cheese among dairy products.

We also found that the label effect is very important, because *IG(PDO/PGI)*, and *BIO* have on average a high WTP at 35,14% and 68,86% respectively compared to other signals. These results are significant at 5%. The presence of these labels on dairy products encourages consumers to pay more. Therefore, they are important and reassuring signals for consumers.

Then, we found that the French consumers *(France)* have on average a high WTP for dairy products of 25,699% compared to consumers of other countries. This result is significant at 5%. The US consumers *(Usa)* have on average a WTP downward for dairy products of -55,887% compared to consumers of other countries. This result is significant at 1%. We are concluding that among European consumers, the French consumers have strong preferences for dairy products. Therefore, they are a high premium for these products. However, US consumers want to pay 55,887% less for dairy products.

In regression [2], which represents a cluster regressions, Standard errors are clustered by each study. Such an approach has been used, for instance, by Barrio and Loureiro (2010) and Choumert, Motel et al. (2013). We note that, our main results remain significant. The *Hypothetical* methods increase on average the WTP of consumers for dairy products compared with non-hypothetical methods. *Cow milk* and *goat milk* increases on average a WTP of consumers for dairy products compared to products made with *sheep's milk*. On average, among dairy products, the WTP of *chees*e decreases relative to other dairy products. *IG(PDO/PGI)*, and *BIO* have on average a high WTP compared to other signals. The French consumers *(France)* have on average a high WTP for dairy products compared to consumers of other countries. Finally, The US consumers *(Usa)* have on average a WTP downward for dairy products compared to consumers of other countries.

In regression [3], we perform a bootstrap to deal with non-normality of residuals and to get reliable standard errors. We note that, our main results are still significant.

Table 3 : Results of regression with dummy sample consumers

VARIABLES	OLS-Robust WTP	OLS Cluster-Robust WTP	Boostrap OLS-Robust WTP
	[1]	[2]	[3]
Base_Price	-2.296	-2.296	-2.296
	(1.615)	(1.474)	(1.677)
hypothetical	**18.109****	**18.109****	**18.109****
	(8.636)	**(7.212)**	**(9.109)**
Cow_milk	**19.706***	**19.706***	**19.706***
	(10.280)	**(9.700)**	**(10.609)**
goat_milk	**64.399*****	**64.399*****	**64.399*****
	(23.789)	**(19.730)**	**(24.772)**
cheese	**-36.783*****	**-36.783*****	**-36.783*****
	(11.868)	**(10.537)**	**(12.862)**
IG(PDO/PGI)	**39.401****	**39.401*****	**39.401***
	(18.916)	**(11.500)**	**(20.459)**
BIO	**46.813****	**46.813****	**46.813****
	(21.755)	**(19.900)**	**(22.668)**
sample_consumers	15.607	15.607	15.607
	(9.704)	(10.678)	(10.062)
year_of_survey[2008-2014]	5.063	5.063	5.063
	(12.691)	(10.326)	(12.907)
France	**25.699****	**25.699****	**25.699****
	(10.377)	**(5.448)**	**(10.414)**
Italy	3.838	3.838	3.838
	(18.455)	(12.026)	(19.670)
Usa	**-55.887*****	**-55.887*****	**-55.887*****
	(20.371)	**(17.669)**	**(21.083)**
Constant	-2.295	-2.295	-2.295
	(5.996)	(7.035)	(6.437)
Observations	163	163	163
R-squared /Pseudo R-Squared	0.332	0.332	0.279
Replications			1000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In **table 4**, which presents the results of the model (2), regression [1] present results that converge towards those of **table 3**.

In regression [1], the *Hypothetical* methods on average increases the WTP of consumers for dairy products of 17,949% compared to non-hypothetical methods. This result is significant at 10%.

Products made from *cow milk* and *goat milk* on average increases WTP for dairy products of 19,399% and 62,448% respectively compared to products made with *sheep's milk* and these results are significant at 10% and 1% respectively.

Among dairy products, the WTP of *cheese* on average decreases (-34,752%) relative to other dairy products. This result is significant at 1%.

The label effect is very important, because *IG(PDO/PGI)*, and *BIO* have on average a high WTP at 38,678% and 55,373% respectively compared to other labels. These results are significant at 5%.

The French consumers *(France)* have on average a high WTP of 25,132% compared to consumers of other countries. This result is significant at 5%. The US consumers *(Usa)* have on average a WTP downward for dairy products of -72,377% compared to consumers of other countries. This result is significant at 1%.

In regression [2], which represents a cluster regressions, Standard errors are clustered by each study. We note that, our main results remain significant.

In regression [3], we perform a bootstrap to deal with non-normality of residuals and to get reliable standard errors. We note that, our main results are still significant.

Table 4: Results of regressions-with dummy "sample_price"

VARIABLES	OLS-Robust WTP	OLS Cluster-Robust WTP	Boostrap OLS-Robust WTP
	[1]	[2]	[3]
Base_Price	-2.595	-2.595	-2.595
	(1.668)	(1.725)	(1.849)
hypothetical	**17.949***	17.949	**17.949***
	(9.526)	(11.356)	**(10.559**)
Cow_milk	**19.399***	**19.399***	**19.399***
	(10.521)	**(10.309**)	**(10.886)**
goat_milk	**62.448*****	**62.448*****	**62.448****
	(23.711)	**(19.484)**	**(24.257)**
cheese	**-34.752*****	**-34.752*****	**-34.752*****
	(11.745)	**(10.657)**	**(11.588)**
IG(PDO/PGI)	**38.678****	**38.678*****	**38.678***
	(18.809)	**(11.815)**	**(20.316)**
BIO	**55.373****	**55.373****	**55.373****
	(23.342)	**(24.664)**	**(26.068)**
sample_price	-4.670	-4.670	-4.670
	(17.139)	(20.663)	(19.141)
year_survey[2008-2014]	12.015	12.015	12.015
	(12.036)	(11.812)	(12.978)
France	**25.132****	**25.132***	**25.132***
	(12.346)	**(12.129)**	**(12.909)**
Italy	5.429	5.429	5.429
	(18.221)	(11.962)	(19.055)
Usa	**-72.377*****	**-72.377*****	**-72.377*****
	(18.496)	**(17.755)**	**(20.18)**
Constant	6.673	6.673	6.673
	(7.183)	(9.913)	(7.482)
Observations	163	163	163
R-squared /Pseudo R-Squared	0.328	0.328	0.274
Replications			1000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Mains Results and discussions

On samples based of consumer's survey and scanner data of prices, we found that overall in the studies:

The label effect is an important signal in the studies. On average, Geographical Indications (GI) such as *PDO/PGI* and bio label (*BIO*), have a high WTP compared to other signals like HACCP method and GMO. The presence of these labels on dairy products encourages consumers to pay more. Therefore, they are important and reassuring signals for consumers.

The *cow milk* and the *goat milk* have on average a high WTP compared to *sheep milk*. These results are very important, because they show that dairy products, which are derived from cow milk and goat milk, encourage on average consumers to pay a high premium.

Cheese has on average a WTP downward compared with other dairy products. This result is contrary the result of Deselnicu, Costanigro et al. (2013). Which found that, among geographical indications (GI), the WTP of *cheese* increases (43,48%). This difference in results is explained by the fact that in their sample, they mix different types of products (wine, cheese, meat, olive oil and grain). Therefore, in this case, consumers for example may prefer the cheese than the wine due to the difference in the nature of products. In the case of our study, we choose products of the same nature and we found that, in this case, *cheese* has a WTP downward. So, consumers would tend to pay less for the cheese among dairy products.

The *Hypothetical* methods increase on average the WTP of consumers for dairy products compared with non-hypothetical methods. Thus, when we use a hypothetical method to collect the data, this can increase the premium paid by consumers.

Then, the French consumers (France) have on average a high WTP for dairy products compared to consumers in other countries. So, the French consumers are very concerned by their health and therefore place a special emphasis on the quality of the products they consume.

Finally, we found that the US consumers have on average a low WTP for dairy products, compared to consumers in other countries. We conclude that US consumers want to pay less for dairy products

V- Conclusion and future research

Various health crises (e.g. the mad cow crisis) of these years have contributed to increase the mistrust of consumers to the food they eat. (Schröder and McEachern 2004), (Miles and Frewer 2001) and (Bernués, Olaizola et al. 2003) showed that the quality of life, food ethics, the environment and health have become the important attributes for consumers

Dairy products are not exception to this tendency. Many studies, which have focused the preferences and willingness to pay of consumers for these products, have led to very different results. Therefore, we have implemented in this paper, a meta-analysis on preferences and WTP of consumers for dairy products (milk, cheese, butter, and yogurt). These products are differentiated compared to all of the products available in the market by specific information indicating their geographical origin (IG) or their mode of production 'healthy' (bio label, no-GMO, and other private signals). We selected 24 studies on dairy products. These studies addressed more specifically the effect of these distinguishing characteristics on WTP of consumers for these products.

As results, we found that on a sample based on consumer's survey, we found that label effect is an important signal in the studies. On average, Geographical Indications (GI) such as *PDO/PGI* (39,401%) and *BIO* (46,813%), have a high WTP compared to other signals like. These results are significant at 5%. The *cow milk* (19,706%) and the *goat milk* (64,399%) have on average a high WTP compared to *sheep milk*. These results are significant at 10% and 1% respectively. Thus, these milks or products made with these types of milk have a high premium. *Cheese* (-36,783%) has on average a WTP downward compared to other dairy products like *yogurt* and *butter*. This result is significant at 1%. This result is very different from the result of (Deselnicu, Costanigro et al. 2013), which found that among the products under GI label, *cheese* has on average a high WTP (43,48%). We explained this different result by the fact that, among the products under GI label, a consumer will prefer for example the *cheese* compared the *wine*, because GI products are of different natures. However, when we introduced the *cheese* in the dairy family, it is not more preferable, compared to other products of the same nature. The *Hypothetical* methods (18,109%) increases on average the WTP of consumers for dairy products compared with non-hypothetical methods. This result is significant at 5%. Thus, when we use a hypothetical method to collect the data on consumers, this can increase the premium paid by consumers. Then, the French consumers (25,699%) have on average a high WTP for dairy products compared to consumers in other countries. This result is significant at 5%. Therefore, the French consumers are very concerned by their health and therefore place a special emphasis on the quality of the products they consume.

Finally, we found that the US (-55,887%) consumers have on average a WTP downward for dairy products, compared to consumers in other countries. This result is significant at 1%.

As results on samples based on scanner data of prices, we found that label effect is an important signal in the studies. On average, Geographical Indications (GI) such as *PDO/PGI* (38,678%) and *BIO* (55,375%), have a high WTP compared to other signals. These results are significant at 5%. The *cow milk* (19,399%) and the *goat milk* (62,448%) have on average a high WTP compared to *sheep milk*. These results are significant at 10% and 1% respectively. Thus, these milks or products made with these types of milk have a high premium. *Cheese* (-34,752%) has on average a WTP downward compared to other dairy products like *yogurt* and *butter*. This result is significant at 1%. When we introduced the *cheese* in the dairy family, it is not more preferable, compared to other products of the same nature. The *Hypothetical* (17,949%) methods increase on average the WTP of consumers for dairy products compared with non-hypothetical methods. This result is significant at 10%. Thus, when we use a hypothetical method to collect the scanner data of prices, this can increase the premium paid by consumers. Then, the French consumers (25,132%) have on average a high WTP for dairy products compared to consumers in other countries. This result is significant at 5%. Therefore, the French consumers are very concerned by their health and therefore place a special emphasis on the quality of the products they consume. Finally, we found that the US (-72,377%) consumers have on average a WTP downward for dairy products, compared to consumers in other countries. This result is significant at 1%.

We conclude that the case of the *cheese* deserves more attention for future research, in the light of the different results in the Meta-analysis on this product. A meta-analysis of "meta-analysis" (Nelson and Kennedy 2009) could also be carried out on the *cheese* in order to explain the difference in the meta-analysis results.

Appendix

Variance Inflation Factors (VIFs), regression 1 of Table 3

variables	VIF[1]
Base_Price	3.58
hypothetical	1.83
Cow_milk	1.64
goat_milk	1.50
cheese	2.94
France	1.54
Italy	2.72
Usa	3.46
IG(PDO/PGI)	5.05
BIO	5.95
sample_consumers	2.83
year_of_servey[2008-2014]	2.90
Mean VIF	2.99

Variance Inflation Factors (VIFs), regression 1 of Table 4

variables	VIF [1]
Base_Price	4.32
hypothetical	3.01
Cow_milk	1.65
goat_milk	1.48
cheese	2.91
France	2.93
Italy	2.70
Usa	2.81
IG(PDO/PGI)	5.04
BIO	7.50
sample_price	5.00
year_of_servey[2008-2014]	3.42
Mean VIF	3.56

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