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

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(draft)

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 21 studies (corresponding to 142 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 results, we found that on average, label's effect is an important quality signal for consumers. Indeed, on average, Geographical Indications (*GI*) and bio label (*BIO*), have a high WTP compared to other label. Then, we highlighted that Europeans consumers (*Europe*) have on average a high WTP for dairy product compared to consumers in other regions and this result is quite pronounced for French consumers. On the other hand, consumers seem to have a higher WTP for products derived from cow's milk and goat's milk compared to *sheep milk*. Finally, among dairy products, *Cheese* product has on average a low WTP compared to other dairy products. These results remain robust, that we use a sample consumer's (conjoint analysis, auction, choice experiment, etc.) or a sample prices (hedonic price method), even after withdrawal of outliers. We concluded that the case of the cheese deserves more attention due to the particularity of consumer's WTP for this type of dairy product.

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

JEL classification: D12, C19, Q18, Q1

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I- Introduction

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. 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)[2], the bio label, the no-GMO (Genetically modified organism) aliments, the HACCP (Hazard Analysis Critical Control Point) certification and others private labels.

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 are positive or 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 21 studies (142 observations) 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.

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

II- 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 label 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 label 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[3] 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.

[3] 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, 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[4] 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 side, consumers who

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

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.

III- 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".

Database

Based on search online software such as: "Google", "Google Scholar", "Science Direct", "Web of Science" and "Scopus", we list 22 studies that can form the basis of our meta-analysis. Among these studies, we have 6 "conference papers", 14 "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: $WTP=-(\beta_{attribute}/\beta_{price})$[5]. 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)[6] because willingness to pay calculated are unusable. Therefore, we stay with 21 studies for our final estimates, so 142 WTP. **Table 1** presents a list of articles used in our meta-analysis.

Data description

We select different variables[7] 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(%)*:

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

Therefore,

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

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

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 relied on the prices of these products that were available on the website of the FAO[8] 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[9].

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 meta-analysis constituting our database, we convert all prices in US[10] dollar own currencies to different countries studied.

Table 2 shows the descriptive statistics of the different variables. We observed that the minimum WTP is that of *Gjirokastra cheese*[11] (-567%), from the study of (Imami, Shkreli et al. 2014) and the maximum is *Canestrato di Moliterno cheese*[12] (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[13] (Adanacioglu and Albayram 2012), which represents the price of the *Tulum cheese*, of Turkey. The maximum base price being 16,914 $US[14] (Bernabeu, Olmeda et al. 2008), which represents the price of cheese from *Castilla-La Mancha*, in Spain.

[8] Perspectives agricoles de l'OCDE et de la FAO 2003
[9] Perspectives agricoles de l'OCDE et de la FAO 2006-2015
[10] platform OANDA, allows us to convert prices at the exchange rate of the survey year
[11] Cheese produced in southwestern Albania. – ($\beta_{attributes}/\beta_{price}$) ×100= -(0,54490/ 3,09328) ×100= -567%
[12] Cheese produced in Basilicata, in southern Italy. (premium/base price) ×100= (4,60/1,20) ×100= 383,33%
[13] The initial value is 10 TL/kg. This price is converted using the exchange rate $US/TL of 2011
[14] 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	Hassan and MONIER (2002)	cheese	1999	hypothetical	2	Europe	France	5000
5	Wang and Sun (2003)	milk	2002	hypothetical	7	America	Usa	519
6	Kaye-Blake, Saunders et al. (2004)	butter & milk	2003	hypothetical	13	Oceania	New Zealand	701
7	Santos and Ribeiro (2005)	cheese	2004	hypothetical	6	Europe	Portugal	658
8	Hassan and Monier-Dilhan (2006)	yogurt, milk & cheese	2000	hypothetical	6	Europe	France	8000
9	Van Ittersum, Meulenberg et al. (2007)	cheese	2007	hypothetical	2	Europe	Greece, Italy, Netherlands	1232
10	Wang, Mao et al. (2008)	milk	2005	hypothetical	1	Asia	China	559
11	Bernabeu, Olmeda et al. (2008)	cheese	2006	hypothetical	12	Europe	Spain	420
12	Carlucci, Monteleone et al. (2009)	yogurt	2008	auction	4	Europe	Italy	104
13	Barreiro-Hurle, Gracia et al. (2010)	yogurt	2007	hypothetical	4	Europe	Spain	400
14	Di Pasquale, Adinolfi et al. (2011)	yogurt, milk & cheese	2009	hypothetical	3	Europe	Italy	163
15	Vecchio and Annunziata (2011)	cheese	2007	hypothetical	6	Europe	Italy	400
16	Adanacioglu and Albayram (2012)	cheese	2011	hypothetical	6	Europe	Turkey	185
17	Saulais and Ruffieux (2012)	butter	2008	auction	22	Europe	France	86
18	Bai, Zhang et al. (2013)	milk	2011	hypothetical	9	Asia	China	799
19	Pilone, De Lucia et al. (2014)	cheese	2013	hypothetical	9	Europe	Italy	471
20	Garavaglia and Marcoz (2014)	cheese	2010	hypothetical	12	Europe	Italy	200
21	Walley, Custance et al. (2014)	milk	2012	hypothetical	1	Asia	China	800
22	Imami, Shkreli et al. (2014)	cheese	2011	hypothetical	11	Asia	Albania	210

IV- 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 sample of consumers for measuring the WTP. Next, we do some tests of robustness. The specification of the model 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 sample of prices for measuring the WTP. The specification of the model is as follow

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

Where $\%WTP_{ij}$ 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[15] (variance inflation factor). The results give a VIF inferior to 10, allowing us to conclude that our variables are not multicolinear. Furthermore, the Fischer test shows that there is at least a significantly coefficient different to 0, this test is significant at 1% in our regressions.

[15] The results are presented in Appendix

Table 2: Description of variables

Variables	Description	Mean	Min	Max
WTP%	premium price in %	21.98291	-567	383.33
base_Price	baseline price per each study and each product in US dollar	3.68164	.00001	16.914
hypothetical	binary variable coded 1 if the method is: conjoint analysis, choice experiment, hedonic pricing and simple survey, 0 otherwise	.6041667	0	1
auction	binary variable coded 1 if the method is experimental auction and 0 otherwise	.1805556	0	1
Cow_milk	binary variable coded 1 if the product made from cow's milk and 0 otherwise	.4722222	0	1
goat_milk	binary variable coded 1 if the product made from goat's milk and 0 otherwise	.0972222	0	1
sheep_milk	binary variable coded 1 if the product made from sheep's milk and 0 otherwise	.1597222	0	1
other_attribute	binary variable coded 1 for other attributes (example: nutrition information and production process, cholestorol etc., 0 otherwise)	.3472222	0	1
cheese	binary variable coded 1 if the product is cheese and 0 otherwise	.4930556	0	1
milk	binary variable coded 1 if the product is milk and 0 otherwise	.2361111	0	1
other_product	binary variable coded 1 if the product is yogurt and butter, 0 otherwise	.2708333	0	1
europe	binary variable coded 1 if european consumers, 0 otherwise	.6527778	0	1
america	binary variable coded 1 if american consumers, 0 otherwise	.1041667	0	1
other_region	binary variable coded 1 if consumers other regions	.1805556	0	1
Usa	binary variable coded 1 if US consumers, 0 otherwise	.0486111	0	1
France	binary variable coded 1 if french consumers, 0 otherwise	.2152778	0	1
Italy	binary variable coded 1 if italian consumers, 0 otherwise	.2152778	0	1
IG(PDO/PGI)	binary variable coded 1 if product is PDO/PGI, 0 otherwise	.3611111	0	1
BIO	binary variable coded 1 if product is BIO, 0 otherwise	.1319444	0	1
other_label	binary variable coded 1 if product is GMO, 0 otherwise	.0972222	0	1
other_Signal	binary variable coded 1 if product is HACCP, COOL, private certification, 0 otherwise	.4097222	0	1
sample	sample size of each study	659.3889	7	8000
sample_price	binary variable coded 1 if a sample price, 0 otherwise	.1041667	0	1
sample_consumers	binary variable coded 1 if a sample consumers, 0 otherwise	.7569444	0	1
year_of_survey[1996-2007]	binary variable coded 1 if the study is the period 1998-2007, 0 otherwise	.4861111	0	1
year_of_survey[2008-2014]	binary variable coded 1 if the study is the period 2008-2014, 0 otherwise	.5138889	0	1

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.

V- Results interpretation

Interpretations

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

The high *base price* decreases WTP for dairy products, this result is significant at 10%. On average, an increase in the base price of 1 U.S. dollar decreases WTP of 4.64%. This result is in line with Cicia and Colantuoni (2010), because the increase in the price of a product does not encourage consumers to pay more.

Furthermore, products made from *cow milk* and *goat milk* increases WTP for dairy products of 51.17% and 115% respectively compared to products made with *sheep's milk* and these results are significant at 10% and 5% 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.

Among dairy products, the WTP of cheese decreases (-58.87%) relative to other products (yogurt and butter). 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, 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 same natures products and we find that, in this case, *cheese* has negative WTP. So, consumers would tend to pay less for the cheese among dairy products.

The variable *Europe* is positive and significant at 5%. Therefore, European consumers of dairy products have on average a higher WTP (70.24%) for these products, compared to consumers in other regions. We can conclude that they have a strong preference for these products, because they are willing to pay a high premium. We also found that the label effect is very important, because *IG(PDO/PGI)*, and *BIO* have a high WTP at 35.14% and 68.86%

respectively compared to other label. Therefore, they are important and reassuring signals for consumers.

In regression [2], we seek to observe countries whose consumers have strong preferences for dairy products. Therefore, we are withdrawing the variables *Europe* and *America*, then we are introducing variables *France*, *Italy* and *Usa.* These variables represent, respectively French, Italian and US consumers. We found that *France* and *Italy* have a high WTP at 68.98% and 71.18% respectively compared to consumers of other countries. We are concluding that among European consumers, the French consumers have strong preferences for dairy products and are therefore willing to pay a premium. This finding is also not negligible among Italians.

In regression [3], under the assumption that our basic results can be drawn by outliers, we decided in the following Lusk, Jamal et al. (2005) and Dannenberg (2009) removed the extreme outliers. As outliers, we removed : (-567% ; -321.4% ; 246.27%) from article of Imami, Shkreli et al. (2014) and (383.33%) from article of Pilone, De Lucia et al. (2014). After withdrawal of these extreme outliers, our main results remained, despite a decrease in the magnitude of the coefficients. We always found that *cow milk* and *goat milk* increases WTP for dairy products of 19.69% and 49.71% respectively compared to products made with *sheep's milk* and these results are significant at 10%. We also found that, among dairy products, the WTP of *cheese* decreases (-46.72%) relative to other products. European consumers *(Europe)* always have a high WTP (34.87%) compared to consumers of others countries. Finally, the *IG(PDO/PGI)* variable always has a high WTP (31.52%) compared to other label.

In regression [4], we tested again, whose countries consumers have a strong preferences for dairy products after removing the extreme outliers. We found that French consumers (France) have a high WTP (47.53%) than the ones other countries consumers are willing to pay.

In **table 4**, which presents the results of the model (2), regression [1] present results that converge towards those of **table 3** (regression [1]): The *base price* decreases WTP for dairy products, this result is significant at 10%. On average, an increase in the base price of 1 U.S. dollar decreases WTP of 5.784%.

Table 3 : Results of OLS regressions-with dummy "sample_consumers"

	OLS-Robust	OLS-Robust	OLS-Robust	OLS-Robust
Outlier	yes	yes	no	no
VARIABLES	WTP	WTP	WTP	WTP
	[1]	[2]	[3]	[4]
Base_Price	**-4.639***	-2.244	-1.110	-0.616
	(2.754)	(2.729)	(1.409)	(1.406)
hypothetical	14.44	31.53**	9.638	21.36*
	(14.67)	(15.80)	(12.52)	(12.32)
Cow_milk	**51.17***	36.41	**19.69***	10.25
	(30.70)	(28.08)	**(10.87)**	(11.52)
goat_milk	**115.0****	100.6**	**49.71***	42.14
	(50.12)	(46.99)	**(25.92)**	(25.90)
cheese	**-58.87*****	-20.51	**-46.72*****	-26.11
	(21.80)	(21.64)	**(14.97)**	(16.11)
europe	**70.24****		**34.87****	
	(31.57)		**(14.96)**	
america	-32.21		-21.21	
	(31.06)		(26.89)	
IG(PDO/PGI)	**35.14****	-18.25	**31.52*****	12.37
	(17.61)	(46.31)	**(11.43)**	(17.78)
BIO	**68.86***	57.37	33.44	35.59
	(35.04)	(43.44)	(21.73)	(23.24)
sample_consumers	0.0556	-6.240	7.693	6.335
	(17.61)	(18.30)	(14.32)	(15.57)
year_of_survey[2008-2014]	-19.04	-15.83	11.92	12.23
	(29.27)	(31.84)	(12.99)	(18.71)
France		**66.98*****		**47.53*****
		(20.85)		**(11.44)**
Italy		**71.18***		**28.72**
		(41.26)		**(18.37)**
Usa		**-65.95**		**-43.10**
		(42.14)		**(27.03)**
Constant	-30.52**	-21.37*	-16.60**	-17.05***
	(15.17)	(12.04)	(8.142)	(6.404)
Observations	142	142	138	138
F-test	9.09***	25.28***	11.38***	94.84***
R-squared	0.228	0.215	0.240	0.266

Robust standard errors in parentheses

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

Products made from *cow milk* and *goat milk* increases WTP for dairy products of 51.17% and 115% respectively compared to products made with *sheep's milk* and these results are significant at 10% and 5% respectively. Among dairy products, the WTP of cheese decreases (-45.56%) relative to other products (yogurt and butter). European consumers of dairy products have on average a higher WTP (63.74%) for these products, compared to consumers in other regions. The label effect is very important, because *IG(PDO/PGI)*, and *BIO* have a high WTP at 29.60% and 88.75% respectively compared to other label.

In regression [2], we tested the effect of variables *France*, *Italy* and *Usa*. We found that consumers of *France* (50.98%) and *Italy* (68.79%) have a high WTP compared to consumers of other countries. These results are in line with those found in the **table 3** (regression [2]). It should also be noted that, when we use the variable *sample price*[16], the US consumers *(Usa)* have a low WTP (-68.74%) compared to consumers of other countries. We can conclude that, on average, American consumers are not willing to pay more for dairy products compared to others consumers, when the study is based on a sample of price.

In regression [3], as in **table 3** (regression [3]), we withdrew the outliers WTP (-567%; -321.4%; 246.27% and 383.33%). After withdrawal of these extreme outliers, we always found that *cow milk* and *goat milk* increase WTP for dairy products, respectively of 21.47%% and 51.98%, compared to *sheep's milk*. We also found that, among dairy products, *cheese* always has a low WTP (-34.56%) compared to other products. European consumers *(Europe)* always have a high WTP (32.25%) compared to consumers of other countries. The variables *IG(PDO/PGI)* and *BIO* always have a high WTP, respectively of 25.40% and 44.81% compared to other labels. We can note that the removal of outliers WTP makes the variable *year survey [2008-2014]* positive (21.92%) and significant at 10%. In this case, we can say that on average, studies that have been conducted on this period are a high WTP compared to *year survey [1996-2007]*. This can be explained by the fact that dairy products are considered as products of first necessity, so consumption of these products is not influenced by macroeconomic shocks.

In regression [4], we tested, whose countries consumers have a strong preferences for dairy products after removing the extreme outliers. We found that French (France) and Italians (Italy) consumers have a high WTP (48.68%) and (29.46%) respectively, than the ones other countries consumers are willing to pay. However, US consumers have a low WTP (-48.88%).

[16] Hedonic price method

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

	OLS-Robust	OLS-Robust	OLS-Robust	OLS-Robust
Outlier	yes	yes	no	no
VARIABLES	WTP	WTP	WTP	WTP
	[1]	[2]	[3]	[4]
Base_Price	**-5.784***	-3.699	-1.797	-0.628
	(3.078)	(3.029)	(1.488)	(1.426)
hypothetical	2.810	15.67	1.303	22.25*
	(13.53)	(16.87)	(12.03)	(12.85)
Cow_milk	**53.64***	40.32	**21.47***	10.22
	(31.41)	(30.64)	**(11.16)**	(12.93)
goat_milk	**118.6****	104.3**	**51.98***	41.60
	(50.95)	(48.88)	**(26.30)**	(26.20)
cheese	**-45.56****	-15.35	**-34.56****	-25.44*
	(21.47)	(20.93)	**(14.70)**	(15.07)
europe	**63.74****		**32.25****	
	(29.34)		**(13.89)**	
America	-33.64		-19.67	
	(32.67)		(28.56)	
IG(PDO/PGI)	**29.60***	-18.92	**25.40***	12.28
	(17.26)	(45.38)	**(13.43)**	(17.91)
BIO	**88.75****	84.91*	**44.81***	37.14
	(41.85)	(50.54)	**(24.28)**	(22.72)
sample_price	32.44	43.95	18.10	-4.944
	(21.90)	(41.77)	(14.64)	(17.30)
year_survey[2008-2014]	-9.069	-3.728	**21.92***	13.89
	(28.43)	(23.72)	**(11.34)**	(12.86)
France		**50.98*****		**48.68*****
		(18.73)		**(13.13)**
Italy		**68.79***		**29.46***
		(39.08)		**(17.77)**
Usa		**-68.74***		**-48.88****
		(38.61)		**(23.81)**
Constant	-32.12*	-25.99	-15.13*	-13.67
	(17.20)	(15.79)	(8.757)	(8.644)
Observations	142	142	138	138
F-stat	8.66***	18.26***	10.76***	93.80***
R-squared	0.232	0.220	0.242	0.266

Robust standard errors in parentheses

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

Mains Results

On samples of consumers and prices, we found that overall the *cow milk* and the *goat milk* have on average a high WTP compared to *sheep milk* in the studies. Thus, these milks or products made with these types of milk have a high premium. *Cheese* product has on average a low WTP compared to other dairy products like *yogurt* and *butter*. This can be explained by organoleptic characteristics of cheese like taste for example, unlike yogurt and butter. The Europeans consumers (*Europe*) have on average a high WTP for dairy product compared to consumers in other regions like Asia and Oceania. Therefore, we can say that Europeans want to pay a premium for these products because their nutritional qualities. Then, French consumers (France) have on average a high WTP for dairy products compared to consumers in other countries. We also found that label effect is an important signal in the studies. On average, Geographical Indications (*GI*) and bio label (*BIO*), have a high WTP compared to other label like HACCP and GMO. Finally, we found that on average, the valuation methods of WTP for dairy products like hypothetical method (conjoint analysis, choice experiment, hedonic pricing and simple survey) have no effect compared to non-hypothetical method (auction).

VI- 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, HACCP certification and other private labels...). We selected 21 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 samples of consumers and prices, overall the *cow milk* and the *goat milk* have on average a high WTP compared to *sheep milk* in the studies. Thus, these milks or products made with these types of milk have a high premium. *Cheese* product has on average a low WTP compared to other dairy products like *yogurt* and *butter*. This can be explained by organoleptic characteristics of cheese like taste for example, unlike yogurt and butter. 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. 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 was not more preferable, compared to other products of the same nature. The Europeans consumers (*Europe*) have on average a high WTP for dairy product compared to consumers in other regions like Asia and Oceania. Therefore, we can say that Europeans want to pay a premium for these products because their nutritional qualities. Then, French consumers (France) have on average a high WTP for dairy products compared to consumers in other countries. We also found that label effect is an important signal in the studies. On average, Geographical Indications (*GI*) and bio label (*BIO*), have a high WTP compared to other label like HACCP and GMO. Finally, we found that on average, the valuation methods of WTP for dairy products like hypothetical method (conjoint analysis, choice experiment, hedonic pricing and simple survey) have no effect compared to non-hypothetical method (auction). These results remains strong even after withdrawal of the outliers. 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), regressions of Table 3

variables	VIF [1]	variables	VIF [3]
Base_Price	2.59	Base_Price	2.65
hypothetical	2.02	hypothetical	1.99
Cow_milk	2.28	Cow_milk	2.35
goat_milk	1.71	goat_milk	1.77
cheese	5.78	cheese	5.64
europe	1.61	europe	1.74
america	2.17	america	2.18
IG(PDO/PGI)	4.44	IG(PDO/PGI)	4.25
BIO	3.35	BIO	3.39
sample_consumers	2.29	sample_consumers	2.28
year_of_servey[2008-2014]	3.44	year_of_servey[2008-2014]	3.46
Mean VIF	2.88	*Mean VIF*	2.88

variables	VIF [2]	variables	VIF [4]
Base_Price	3.70	Base_Price	3.77
hypothetical	2.30	hypothetical	2.27
Cow_milk	2.03	Cow_milk	2.06
goat_milk	1.66	goat_milk	1.69
cheese	5.71	cheese	5.54
France	1.53	France	1.57
Italy	2.16	Italy	2.36
Usa	4.31	Usa	4.34
IG(PDO/PGI)	6.42	IG(PDO/PGI)	6.52
BIO	7.56	BIO	7.67
sample_consumers	2.79	sample_consumers	2.77
year_of_servey[2008-2014]	3.22	year_of_servey[2008-2014]	3.26
Mean VIF	3.62	*Mean VIF*	3.65

Variance Inflation Factors (VIFs), regressions of Table 4

variables	VIF [1]
Base_Price	3.25
hypothetical	2.78
Cow_milk	2.33
goat_milk	1.74
cheese	5.85
europe	1.86
america	2.06
IG(PDO/PGI)	4.19
BIO	4.69
sample_price	2.90
year_of_servey[2008-2014]	3.04
Mean VIF	3.15

variables	VIF [3]
Base_Price	3.32
hypothetical	2.73
Cow_milk	2.40
goat_milk	1.80
cheese	5.74
europe	1.97
america	2.08
IG(PDO/PGI)	4.00
BIO	4.76
sample_price	2.90
year_of_servey[2008-2014]	3.09
Mean VIF	3.16

variables	VIF [2]
Base_Price	4.64
hypothetical	3.92
Cow_milk	2.13
goat_milk	1.69
cheese	5.80
France	2.70
Italy	2.15
Usa	3.60
IG(PDO/PGI)	6.42
BIO	9.52
sample_price	4.62
year_of_servey[2008-2014]	3.66
Mean VIF	4.24

variables	VIF [4]
Base_Price	4.73
hypothetical	3.85
Cow_milk	2.18
goat_milk	1.73
cheese	5.63
France	2.71
Italy	2.34
Usa	3.63
IG(PDO/PGI)	6.53
BIO	9.66
sample_price	4.67
year_of_servey[2008-2014]	3.64
Mean VIF	4.28

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