

# Prospects for a certified mint supply chain in Morocco based on an assessment of consumers' willingness to pay

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## 1. Introduction

In developing countries, many food certification schemes have been created for exports. For instance, an increasing number of date processing units in Tunisia have adopted standards to export, especially to Europe (Allani *et al.*, 2016). However, the fruit and vegetable domestic sector in many developing countries is still by and large informal, with limited control over the quality of the food products (De Bon *et al.*, 2014; Kussaga *et al.*, 2014). In response to increasing consumer awareness of health risks related to food products, several food certification schemes have recently been launched in the domestic markets of developing countries (Reardon *et al.*, 2007). These schemes may be based on public standards (Posri *et al.*, 2006; Schreinemachers *et al.*, 2012; Yu *et al.*, 2014). Due to the failure of public institutions to enforce standards for food products in many developing countries, some private standards have been set up in recent years, especially in Asia (Moustier *et al.*, 2010).

Morocco is representative of such trends and food quality management issues. The 28-07 Law on the Safety of Food Products was enacted in 2010 and provides general principles to define and control food safety. The law gives authority to the National Office for Health Safety of Food

## Abstract

*In Morocco, there is a weak control of the quality of fruits and vegetables on the domestic market. The present study assesses the prospects for a certified mint value chain (either complying with legal criteria of maximum residue level or using organic production), based on interviews with 368 consumers and with actors of the current mint value chain. Among the consumers interviewed, 43% had reduced their consumption of mint between 2005 and 2015 due to concerns over the quality of mint, and 68% stated that they were willing to double the price they paid for mint in urban markets to get mint that complies with legal norms. A majority of interviewed coffee shops managers and urban resellers of mint also expressed their interest in selling certified mint. Mint appears as a relevant product to test a certified food chain in Morocco.*

**Key words:** certification, mint, Morocco, organic agriculture, urban markets.

## Résumé

Le contrôle de la qualité des fruits et légumes sur le marché intérieur marocain est limité. L'étude analyse les opportunités d'une filière de menthe certifiée au Maroc (soit répondant aux normes légales concernant les résidus soit biologique) à partir d'enquêtes auprès de 368 consommateurs urbains et des acteurs de la filière de menthe actuelle. Parmi les consommateurs enquêtés, 43% ont diminué leur consommation de menthe entre 2005 et 2015 du fait d'inquiétudes sur la qualité de la menthe, et 68% ont déclaré être prêts à payer le double du prix qu'ils paient actuellement dans les marchés urbains pour une menthe répondant aux normes légales. Une majorité des gérants de cafés et des revendeurs de menthe dans les marchés urbains ont exprimé leur intérêt pour participer à une filière de menthe certifiée. La menthe apparaît comme un produit prometteur pour tester une filière de produit agricole certifié au Maroc.

**Mots-clés:** agriculture biologique, certification, Maroc, marché urbain, menthe.

Products (ONSSA in French), created in 2009, to undertake quality control of food products. The Autonomous Office for the Control and Coordination of Exports (EACCE in French) is more specifically in charge of controlling the compliance of food products to the requirements of export markets (Ait Hou *et al.*, 2015). The EACCE undertakes many quality controls before food products are exported. Moreover, many exporters have also adopted private standards, which entail specific quality controls (Ait Hou *et al.*, 2015). All these controls help Moroccan exporters meet the requirements in terms of quality set by international markets (Codron *et al.*,

2014). However, on the domestic market, the ONSSA has limited human and financial resources. Therefore, it gives priority to animal products over fruit and vegetables. In practice, there is almost no quality control of fruit and vegetables destined for the domestic market (Lejars and Courilleau, 2015). High levels of pesticide residues and bacterial pathogens (in the case of irrigation with wastewater) have been detected in food products sold on the Moroccan domestic market (Benkerroum, 2013; Ibenyassine *et al.*, 2007; Mahjoub, 2015). Moroccan consumers pay attention to the quality of food products (Graf, 2015) but cannot buy fruits and vegetables of guaranteed quality on the main rural and urban markets.

Public regulations require time to be implemented at a large scale and to become effective. Consequently, in Morocco and more generally in Africa, there is a need for certified food product chains that can be implemented in the

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short term and that do not rely only on public regulations. In order to support the design of certified food value chains, many studies have analyzed consumers' willingness to pay (WTP) for certified food products in developing countries, for instance in the fruit and vegetable sector (Ifft *et al.*, 2012; Lagerkvist *et al.*, 2013) or street food (Akinbode *et al.*, 2011). However, to our knowledge no study was specifically made in this regard in Morocco.

The present study assesses possible characteristics of a certified mint value chain in Morocco that may be set up in the future. Currently, on the Moroccan main urban and rural markets, there is no control of mint quality. In 2015, the only places in Morocco where consumers could purchase mint produced under quality standards were some organic shops in large cities (Casablanca, Marrakech). However, these shops sold very small amounts of mint (e.g., in Casablanca, less than 10 bunches per day).

Mint is of interest to study the possible characteristics of a future supply chain of guaranteed quality for food products in Morocco for three reasons. First, mint tea is often referred to as the "national drink" in Morocco and is frequently drunk at home or in coffee shops (Laraqui *et al.*, 2008). Second, the purchase of mint represents a very small share of the budget of Moroccan households, meaning that consumers who feel concerned by health risks might agree to pay more for mint of guaranteed quality. Third, in the Settat region close to Casablanca (the economic capital of Morocco), many farmers grow mint for export to Europe, and know how to produce mint that would pass European tests on the type and quantity of pesticide residues. Many laboratories in the Settat region routinely analyze pesticide residues in locally grown mint before it is exported to Europe.

We analyze two types of certified mint supply chains that could be set up in the future. The first chain produces and distributes mint that is not irrigated with waste water and whose level of pesticide residues is lower than the maximum legal residue levels. As announced in a decree published by the Moroccan Ministry of Agriculture and Marine Fisheries in 2015, since there is no definition of such levels for mint in Morocco, legal maximum levels of pesticide residues are those indicated in the FAO Codex Alimentarius. In this paper, mint of this quality is referred to as "guaranteed mint". The second type of supply chain produces and distributes organic mint, as legally defined by Moroccan law 39-12, which was enacted in 2013. Hereafter, the term "certified mint supply chain" refers to both types of supply chain.

## 2. Mint supply chains in Morocco

In Morocco, mint is almost exclusively consumed as mint tea at home and in coffee shops. Urban consumers buy mint for household consumption from resellers in district markets. The total production of mint in Morocco is estimated at 70,000 tons per year (Ait El Mekki, 2014). Settat region is the largest mint growing area and produces most of the

5,000 tons of mint that are exported every year. Investor-owned companies and farmers' cooperatives perform quality control tests before the mint is exported to Europe. Traceability systems have also been developed to identify the farm on which each bunch of mint being checked was produced. Most Moroccan mint is exported to Europe in spring because there is less demand for mint in Europe in winter and because in summer Spanish mint is sold at competitive prices due to lower transportation costs.

In Morocco, middle men purchase mint directly from farmers and sell it either to other middle men in the wholesale market of each major city, or directly to resellers in urban markets and to managers of coffee shops. Mint is handled unpacked throughout the whole supply chain. In coffee shops, mint is mixed with tea in the teapot before being served to the consumer. A few studies analyzed farming practices used to produce mint in Morocco and the levels of pesticide residues in mint sold on the Moroccan domestic market. El Housni (2008) found that only 15% of farmers respected the pre-harvest no-treatment intervals. Eddaya *et al.* (2015) and El Housni (2008) reported that levels of pesticide residues were higher than official norms.

## 3. Method

### 3.1. Studied certified mint supply chain

The certified mint supply chain analyzed in this paper involves two key actors: the core actor of the chain hereafter referred to as the Operator, and the certification body in charge of quality control. In practice, the Operator could be a reseller or a group of mint marketing cooperatives (in 2015, the creation of such a group was in progress in the Settat region).

The organization of the certified mint supply chain analyzed here is based on two principles. First, as shown by the limited amount of mint sold in the few organic shops in Casablanca, it is highly unlikely that consumers would go to a special shop just to buy certified mint. Certified mint should thus be delivered to places where consumers usually go to buy or consume mint. Second, for consumers to trust quality controls, the latter should include analyses of pesticide residues conducted at the place where consumers purchase mint, i.e., at the end of the supply chain.

Based on these two principles, the supply chain could be organized as follows. First, farmers grow the mint using "guaranteed mint" practices (no use of waste water for irrigation and pesticide residues must be below the defined thresholds) or cultivate organic mint. The Operator buys mint from farmers and packs it in bags either in small quantities (30 g) for individual consumption in coffee shops or in bunches (between 150 and 200 g) to be sold in urban markets. The labels on the bags show that the mint is certified (or organic) together with the name of the certification body. The Operator also organizes the traceability of the bunches of mint. The Operator distributes the mint to coffee shops and to middle men in wholesale markets. In

the coffee shops, mint is brought to consumers separately from the tea. The consumers open the bag of mint themselves and add the mint to the teapot. The certification body is paid by the Operator and conducts random checks of the mint bags distributed in coffee shops and sold by resellers in urban markets to ensure pesticide residues are below the defined thresholds (in the case of guaranteed mint) or that there is no residue at all (in the case of organic mint). In the case of organic mint, the certification body also performs the usual checks at the farms concerned.

### 3.2. Data collection

The survey was conducted in two cities (Casablanca and Meknes) between March and June 2015. Casablanca was chosen because it is the largest city in Morocco and because it is situated close to Settat region. Meknes was selected because, as preliminary interviews revealed, some consumers were aware that several farms in the vicinity of the city cultivated mint using waste water. The survey was undertaken more specifically in three districts of Casablanca (Maarif, Sidi Belyout and Maarif) and two in Meknes (Hamria and Bassatine). These districts were chosen as representing a range of consumer incomes, based on an initial hypothesis concerning the average income of the inhabitants of each district (Table 1).

First, a total of 26 resellers in urban markets were interviewed (Table 1). They were asked how much mint they sold every day (in winter and in summer). After a presentation of the proposed supply chain, resellers were asked the maximum amount they would be willing to pay to obtain guaranteed mint and for how much they thought they would sell it. The same questions were asked for organic mint. A survey was conducted of the location and of the price of tea in all the coffee shops in the two districts of Meknes. In the districts of Casablanca (which are much larger than those of Meknes), a similar survey was conducted, but only in the area of each district where most coffee shops were concentrated. Based on this assessment, 16 coffee shops were selected in each city (see Table 1). The sample was representative of the price of tea in the coffee shops of each district, which ranged from 6 to 20 MAD (data not shown). The

managers of the 32 coffee shops were asked about their daily use of mint and the quantity of teas they served everyday (with mint, with other herbs or with no addition of herb leaves). They were also asked their maximum WTP for guaranteed mint and the price they thought they would sell tea with guaranteed mint. The questions were then repeated for organic mint.

Second, the amount of mint distributed every day in each city was quantified using different methods, each differentiating summer and winter periods. We interviewed resellers operating in the wholesale markets of Casablanca and Meknes. We weighed 28 bunches sold in 10 reseller shops or urban markets. With this information and the data on the number of inhabitants per district, we estimated the average consumption of mint per household in each district. Interviews with coffee shop managers provided estimates of the average quantity of mint sold in each coffee shop.

Third, 368 consumers were interviewed (Table 1). Two hundred interviewees were randomly chosen in urban market places. The other 168 interviewees were interviewed in the coffee shops whose managers had been interviewed. Interviewees in coffee shops were tea consumers (independently of whether or not they took mint in their tea). Men made up 45% of interviewees. The people interviewed in the markets were asked about their daily home consumption of mint and if their consumption had changed over the period 2005-2015. If yes, they were asked the reasons for the change. Next they were asked if they thought there were problems with mint quality, and if yes, they were asked to identify the problems. The people interviewed in coffee shops were asked the same questions plus about their consumption in coffee shops.

The hypothetical certified mint supply chain described above was then presented to interviewees. The people interviewed in urban markets were asked about their maximum WTP for a bunch of mint of guaranteed quality. The people interviewed in coffee shops were asked their maximum WTP for an individual bag of guaranteed mint (i.e., on top of the price they were paying for the tea in the coffee shop where the interview took place) as well as their WTP for a bunch of guaranteed mint in an urban market. After the

interviewer had explained the main differences between guaranteed and organic mint, the same question was asked about organic mint. The stated WTP was assessed using a payment card (Ogbeide *et al.*, 2014; Yu *et al.*, 2014). Consumers were presented cards with the following values: 0 MAD<sup>1</sup>, 0.5 MAD, 1 MAD, 2 MAD, 3 MAD, 4 MAD and more. If the consumer said more than 4 MAD, then (s)he was asked the maximum amount he or she was willing to pay. The values were

City	Casablanca			Meknes		Total
	District	Maarif	Sidi Belyout	Sidi Bernoussi	Hamria	
Hypothetical average income per household	High	Average	Low	High	Low/Average	
Number of inhabitants	192,000	186,000	223,000	40,000	36,500	
Number of people interviewed						
Resellers of mints in urban markets	3	3	5	12	4	27
Managers of coffee shops	6	4	6	9	7	32
Consumers in urban markets	40	40	40	40	40	200
Consumers in coffee shops	34	35	25	36	38	168
Total						427

Source of population data: High Commission for Planning in Casablanca and Meknes (data obtained in April 2015).

<sup>1</sup> In March 2015, 1 MAD = 0.093 Euro.

calculated based on 10 interviews in a pretest. To give an example of the hypothetical certified food product, we showed the interviewees a photomontage of an individual bag of mint for consumption in a coffee shop and a wrapped bunch for home consumption.

Finally, the interviewees were asked the number of people in their household and to position their average monthly household income on a scale with five intervals. We used the distribution of Moroccan household income in five quintiles as assessed by the High Commission for Planning (2009): less than 2,000 MAD per month, between 2,000 and 3,000, between 3,000 and 4,200, between 4,200 and 6,000, and more than 6,000 MAD per month.

### 3.3. Data analysis

We assessed to what extent consumers' stated WTP for certified mint bought in urban markets was related to their characteristics and their mint consuming practices. We modeled the maximum stated WTP  $w$  for guaranteed and organic mint bunches as a percentage of increase over the current price of mint. The variable  $w$  is continuous and censored to zero. In this case, a corner solution model, or standard censored Tobit, is appropriate (McDonald and Moffit, 1980; Wooldridge, 2002 pp. 517-520). The model defines a latent (unobserved) regression:  $w^* = \beta' \cdot x + \varepsilon$ , where  $x$  is a vector of explanatory variables,  $\beta'$  is a vector of the impact of the explanatory variables, and  $\varepsilon$  is a disturbance assumed to be a normally distributed mean-zero random variable with variance  $\sigma^2$ . The observed dependent variable  $w$  is defined by the equation  $w = w^*$  if  $(w^* \geq 0)$ , and  $w = 0$  otherwise. The variable  $w^*$  should have a homoscedastic normal distribution. Since we detected a high level of heteroscedasticity, we used the logarithmic transformation of  $w^*$ .

The explanatory variables were the price currently paid by consumers (CURRENT\_PRICE); a dummy for gender (WOMAN); declared monthly income expressed as a set of dummy variables to indicate ranges of incomes (INC0 for income below 2,000 MAD per month, INC1 for income between 2,000 and 3,000 MAD per month, INC2 for between 3,000 and 4,200 MAD per month, and INC3 for above 4,200-6,000 MAD per month, the base level being incomes higher than 6,000 MAD per month); the average weekly consumption of mint at home (MINT\_CONS); a dummy indicating whether the respondent had reduced his or her consumption of mint over the period 2005-2015 (REDUCE\_CONS); and a dummy indicating whether respondents considered there were problems with the quality of mint (QUALITY\_PROBL). We expected gender would influence stated WTP but had no prior hypothesis about the sign of the influence (the literature on WTP for organic products reported contradicting results in this connection, Rödiger and Hamm, 2015). We also hypothesized an in-

crease in income would also increase the stated WTP. Finally, we hypothesized that respondents who had identified problems of mint quality were likely to have a higher stated WTP for certified products.

A workshop was organized in Settat in June 2015 to present and discuss preliminary results. Participants were staff from the National Office for Health Safety of Food Products, staff from the provincial office of the Ministry of Agriculture and Marine Fisheries and leaders of mint marketing cooperatives.

## 4. Results

### 4.1. Characteristics of the current mint supply chain

The managers of the wholesale market of Casablanca estimated that roughly 50 tons of mint are distributed in Casablanca every day in summer and 26 tons per day in winter (the amount of mint distributed in Casablanca that does not transit through the wholesale market is small). The estimated population of Casablanca is 3.35 million (High Commission of Planning, 2015), which corresponds to 15 g/day of mint per inhabitant in summer (and 8 g/day in winter). According to the measurements made in urban markets, in Casablanca the average weight of a bunch is 145 g and is sold at a uniform price of 1 MAD. In Meknes, the average weight of a bunch is 206 g and is sold at an average price of 1.3 MAD (i.e., at 0.92 MAD per 145 g, mint is cheaper in Meknes than in Casablanca). Based on the survey of 368 consumers, families consume an average of 1.99 bunches of mint per week in Meknes and 1.84 in Casablanca in summer. According to the survey, the average number of persons per household is 4.17 in our study areas in Casablanca<sup>2</sup>. This amounts to a mint consumption of 10 g/inhabitant/day in summer in Casablanca, less than the 15 g/day found above. Mint costs households approximately 9 MAD per month, which is a small expense compared to the cost of other food items. For instance, tomatoes, which are a key vegetable in the Moroccan diet, cost between 6 and 10 MAD/kg in urban markets. In winter, the average household consumption is 0.9 bunches of mint per week in Meknes and 1.3 in Casablanca.

Consumption of 10 g of mint/inhabitant/day amounts to 1,939 kg/day of mint purchased in urban markets in Maarif district during summer. We identified 62 coffee shops in this district. Based on calculated average mint consumption per coffee shop, these 62 coffee shops use 210 kg/day in summer. The mint sold in coffee shops in this district represents only 9.7% of the total amount of mint consumed in this district and the bulk of the mint is sold in urban markets. A similar ratio between mint for household consumption and mint distributed in coffee shops was found in the other study districts. Consumers drink different types of tea in coffee shops. In summer, on average, 59% of teas served are mint teas, 19% are teas mixed with the leaves of other herbs (such as verbena), and 21% are teas with no addition of herb leaves (referred to as "dry tea" in Moroccan Arabic).

<sup>2</sup> According to the High Commission for Planning (2013), average household has 4.1 members in Maarif and Sidi Belyout, and 4.9 in Sidi Bernoussi.

## 4.2. Consumers' income, consumers' assessment of problems related to mint and willingness to pay for certified mint

Table 2 shows the distribution of interviewees as a function of monthly household income. Our initial hypothesis concerning the relative position of study districts in terms of the distribution of inhabitants' income was validated. Among the interviewees, 43% said they had reduced their consumption of mint during the period 2005-2015, 57% had not changed their consumption, and none had increased their consumption. The reasons given by interviewees who decreased their consumption were: problems of gas during digestion (45%), stomach pains (30%), the fact that they had heard about health risks related to mint consumption (30%) and the mint did not taste good (3%). Table 3 shows the problems related to mint quality according to interviewees: 86% of them mentioned at least one problem related to mint quality. There were no major differences in consumers' answers between Meknes and Casablanca. Consumers in coffee shops who decreased their consumption of mint shifted to coffee, asked for other herbs in their tea or started drinking tea without herbs.

Table 2 - Distribution of household monthly income as a function of the district (N = 368).

Household income (MAD/month)	Maarif	Sidi Belyout	Sidi Bernoussi	Hamria	Bassatine	Average
Less than 2,000	0%	0%	0%	0%	0%	0%
2,000-3,000	1%	12%	14%	14%	26%	14%
3,000-4,200	7%	28%	37%	24%	35%	26%
4,200-6,000	32%	29%	28%	23%	23%	27%
More than 6,000	59%	31%	22%	39%	17%	33%

Table 3 - Problems related to the quality of mint according to the consumers interviewed (N = 368).

Problems	Casablanca	Meknes	Average
No problem or not aware of any	13%	16%	14%
Excessive use of pesticides	67%	56%	62%
Waste water used for irrigation	65%	56%	61%
Mint dirty	26%	32%	29%

Table 4 - Distribution of consumers according to their maximum stated WTP (in Moroccan Dirham) for guaranteed and organic mint in coffee shops.

Increase in price (MAD)	0	0.5	1	1.5	2	2.5	3	4	5	Total
Guaranteed (N = 165)(%)	20.6	9.7	60.0	1.2	6.1	0.0	1.2	0.6	0.6	100
Organic (N= 152)(%)	19.7	6.6	52.6	3.9	15.1	0.0	0.7	1.3	0.0	100

Table 5 - Distribution of consumers according to their maximum stated WTP (as a percent of current price) for guaranteed and organic mint in urban markets.

Increase in price ( percent of current price)	0	15-38	50	77	100	115-155	200-250	300-330	350-400	Total
Guaranteed (N= 362)(%)	5.0	4.2	3.9	18.8	21.0	16.9	20.4	7.2	2.8	100
Organic (N=353)(%)	2.0	2.5	1.7	13.8	10.7	19.2	32.7	11.8	5.6	100

Tables 4 and 5 show the maximum stated WTP declared by interviewees for guaranteed and organic mint, respectively in coffee shops and in urban markets. Some consumers in coffee shops said that they did not know enough about the issue to state their willingness to pay for certified mint in coffee shops (three in the case of guaranteed mint, and 16 in the case of organic mint). For the same reason, four of the 368 interviewees did not say how much they would pay for a bunch of guaranteed mint in urban markets and 15 did not say how much they would pay for a bunch of organic mint.

The price premium of 1 MAD appeared to be a threshold in the distribution of consumers' stated WTP for guaranteed mint in coffee shops (Table 4). A total of 69.7% of interviewees in coffee shops stated that they would pay 1 MAD over and above the price of the tea (this percentage includes those willing to pay 1 MAD, plus those willing to pay more than 1 MAD). This amount corresponds to the increase in price that some coffee shops ask for a better quality espresso than for a normal one. Since there was a difference in the average weight of a bunch of mint in Casablanca and Meknes, consumers' declared WTP for a bunch of certified mint was expressed as a percentage of the increase in the current

price per kilogram (Table 5). The average stated WTP for a bunch of guaranteed mint was 139% more than the current price and 182% more for organic mint. With regards to the distribution of consumers' stated WTP for a bunch of guaranteed mint, first, 68.3% of interviewees stated that they were willing to pay 100% more than the current price for a bunch of guaranteed mint. Second, 30.4% of interviewees stated that they were willing to pay 200% more for guaranteed mint.

Table 6 shows the results of the Tobit regression model with regards to the link between consumers' stated maximal WTP for a bunch of certified mint bought in urban markets, consumers' characteristics and mint consumption practices (some interviews with incomplete data were not included in the analysis). For both guaranteed and organic mint supply chains, the chi square of the likelihood ratio test shows that the full model provides significant improvements over the model with only a constant term. The McFadden pseudo  $R^2$  also shows that the Tobit analyses account for a significant amount of observed variance among respondents. Average partial effects, computed using the delta method, or as the difference in expected WTP when the dummy variable is fixed to 0 and then to 1, are presented in Table 7.

Table 6 - Tobit estimates of the maximum stated WTP for a bunch of certified mint bought in urban markets, expressed as a percentage of current mint price (log scale).

	Guaranteed			Organic		
	Coefficient	Sig	St. Error	Coefficient	Sig	St. Error
Constant	-5.22	***	1.36	-3.90	***	0.98
CURRENT_PRICE	0.78	***	0.20	0.65	***	0.15
WOMAN	0.26	***	0.09	0.19	***	0.07
INC1‡	-0.81	***	0.16	-0.76	***	0.11
INC2‡	-0.34	***	0.11	-0.41	***	0.08
INC3‡	-0.26	***	0.10	-0.29	***	0.07
MINT_CONS	0.06		0.05	0.05		0.04
REDUCE_CONS	0.08		0.09	0.12	*	0.07
QUALITY_PROBL	0.04		0.13	0.09		0.10
Sigma‡‡	0.66	***	0.04	0.52	***	0.03
Log likelihood function -284.42			Log likelihood function -276.71			
N=356			N = 351			
Mc Fadden Pseudo R <sup>2</sup> : 0.116			Mc Fadden Pseudo R <sup>2</sup> : 0.172			
LR Test = 74.49 (df=8) p = 0.000			LR Test = 115.13 (df=8) p = 0.000			
‡Base level for income= INC4: >6000; INC1: 2000-3000; INC2: 3000-4200; INC3 : 4200-6000;						
‡‡ Sigma (σ): Disturbance standard deviation						
***, ** and * denote statistical significance at 1%, 5% and 10% respectively						

Table 7 - Partial effects of the variables (using the delta method).

	Guaranteed			Organic		
	Partial Effect		St. Error	Partial Effect		St. Error
CURRENT_PRICE	0.410	***	0.100	0.499	***	0.106
WOMAN†	0.133	***	0.047	0.139	***	0.051
INC1†	-0.281	***	0.035	-0.429	***	0.043
INC2†	-0.156	***	0.044	-0.271	***	0.049
INC3†	-0.118	***	0.045	-0.194	***	0.050
MINT_CONS	0.026		0.026	0.024		0.029
REDUCE_CONS	0.048		0.046	0.089	*	0.049
QUALITY_PROBL†	0.030		0.069	0.094		0.075
†: For dummy variables, the delta method does not apply, instead we used the difference $E(w   x_i = 1) - E(w   x_i = 0)$ (where $x_i$ indicates the dummy variable)						
***, ** and * denote statistical significance at 1%, 5% and 10% respectively.						

The stated WTP was positively correlated with the current price of mint, for both guaranteed and organic mint. As the price of mint was correlated with the city where the interviews were conducted, this variable may capture differences between consumers in Meknes and Casablanca (consumers in Casablanca have a higher willingness to pay than in Meknes). Women had significantly higher stated WTP than men. As expected, there was a significant positive correlation between household income and stated WTP: consumers with lower incomes expressed lower WTP. The partial effects of income were larger for organic than for guaranteed products, reflecting a greater response of higher incomes to organic products than to guaranteed products.

Current consumption of mint and the perception of problems of quality were not significantly correlated with stated WTP in either type of mint certification. Respondents who had reduced their consumption in recent years did not have a higher stated WTP for guaranteed mint but had a significantly higher stated WTP for organic mint. One possible

explanation is that respondents who reduced their mint consumption consider it more important to obtain quality mint than other consumers, but consider that only organic mint provides sufficient guarantees in terms of health risks.

### 4.3. Assessment by actors of the mint supply chain

Twenty-two of the 32 coffee shop managers interviewed said they could not increase the price of tea in their shops, even if the tea was served with a bag of certified mint. They considered that the price of tea had to remain aligned with the price of other hot beverages. Six coffee shop managers said they could increase the price of tea by 1 or 2 MAD, and four managers said they did not know yet how much. Many managers who said they could not increase the sales price commented that they were nevertheless interested in purchasing guaranteed mint at a higher price than the current one. Indeed, in Casablanca, coffee shops currently pay 1 MAD for a 145 g bunch of mint. They buy an average of eight bunches per day, at an overall cost of 8 MAD per day. The increased cost related to buying guaranteed mint would anyway remain a small amount compared to the opportunities to attract new consumers

thanks to the guaranteed quality of mint. Among the 32 coffee shop managers interviewed, six said they did not yet know how much they would be willing to pay to purchase guaranteed mint, and 26 mentioned a strictly positive WTP, with an average WTP of 230% of current price above current price. Only two coffee shop managers thought their consumers would be willing to pay more for organic mint than for guaranteed mint.

Urban resellers buy mint at an average price of 3 MAD/kg and sell it at 6 MAD/kg. Among the 27 resellers interviewed in urban markets, seven said that they would wait and see the product before proposing a purchase price. The other 20 said they were willing to buy guaranteed mint with an average increase in price of 5.3 MAD/kg, i.e. 170% of the current price they buy mint. With regards to organic mint, nine resellers said they did not know how much they would pay to purchase it; the others said they would be willing to buy mint involving an increase of 9.1 MAD/kg on average. None of the resellers gave us a price at which

they would sell a bunch of guaranteed or organic mint. They said they needed to see the product first.

## 5. Discussion

The consumers' stated WTP for guaranteed mint (on average 139% more than current price of a bunch of mint) can be considered as high for a non-organic product, especially compared with the ranges of values obtained in other studies on organic products, for which the bulk of average stated WTP was between 5% and 30% (Hemmerling *et al.*, 2015; Xia and Zeng, 2008). Such high stated willingness to pay results from the relatively low cost of mint and from consumers' widely-shared concern over health risks, as revealed by the 43% of interviewees who had reduced their mint consumption during the 2005-2015 period. Similar changes in consumer behavior in response to concerns about health risks have been reported in developed countries and in Asia (e.g., Hanser and Li, 2015), but much more rarely in Africa.

Based on the analysis of consumers' WTP, a scenario of how a guaranteed mint supply chain could function was designed (see Rais *et al.*, 2016 for more details). The scenario considered the distribution of mint produced in the Settât region to Casablanca. In such scenario, the Operator purchases mint from farmers for 3 MAD/kg. This is the usual price paid for mint for export and at this price, production of mint is profitable (Ait El Mekki, 2014). The prices for consumers in urban markets and coffee shops were set based on the assessment of their willingness to pay (taking into account the usual bias between stated and actual willingness to pay). The scenario also estimated volumes of mint sold and costs for the Operator and the certification body. In the studied scenario, the certified value chain appeared profitable for all actors involved in the value chain. The scenario was presented in the workshop in Settât and participants considered the costs estimated in the scenario to be realistic. They agreed that the proposed supply chain offered interesting prospects for profit.

Participants in the workshop held in Settât also discussed the type of regulation needed to provide a legal basis for a guaranteed mint chain. The 25-06 law (enacted in 2008) provides a framework for certified food supply chains. This law defines three types of label, which all include specifications to be met with regards to food product characteristics. By the middle of 2015, 37 food products had already been labeled in the framework of this law. The specifications for all these labels concern production practices and possibly the production area. None includes quality control in market places or where products are consumed.

The originality of the proposed supply chain would thus be the type of quality control. Imposing a quality check at the end of the supply chain is possible under the terms of the 25-06 law, but should take into account what is scheduled in the 28-07 law on Food Safety. This law covers all food products and designates the National Office for Health Safety of Food Products as the organization in charge of

checking that food products comply with legal food safety requirements, such as maximum residue levels. With regards to the mint supply chain proposed here, the National Office for Health Safety of Food Products could provide an accreditation to the private certification body enabling the latter to undertake frequent quality checks. The Office could also undertake annual checks of pesticide residues to assess the quality of the checks by the certification body. The proposed value chain can thus be considered as a joint public-private standard.

## 6. Conclusion

Several results of this study may be of key importance for setting up a certified mint value chain in Morocco. First, the quantity of mint sold in urban markets is approximately nine times larger than the amount bought by coffee shops, so urban markets should be given a priority. Even though the amount of certified mint distributed in coffee shops may be much lower than in urban markets, the distribution of mint to coffee shops may be of interest because of the high willingness expressed by interviewed coffee shop managers to participate in this value chain. Second, most interviewed consumers in Casablanca and Meknes are aware of problems of mint quality and 68% of them stated that they were willing to double the price they currently pay mint in urban markets in order to get guaranteed mint (i.e., no use of waste water for irrigation and level of pesticide residues that is lower than the maximum legal residue levels). Third, interviewees' stated WTP for organic mint was higher than their stated WTP for guaranteed mint. However, the costs of production of organic mint on the farm are higher than the costs of producing guaranteed mint (16% higher according to Ait El Mekki, 2014, including certification costs). Moreover, certification processes for organic products are much more complex than for guaranteed mint, as they involve on-farm checks. Thus, it may be relevant to focus on the development of a guaranteed mint rather than an organic one in the short term.

Major changes have recently taken place in the consumption of mint in Morocco, due to consumers' increased awareness of the health risks involved. If this trend continues unabated, in a few years, the label "national drink" of Morocco may no longer be justified. But mint is also a cheap food product and a value chain of certified mint is already in place for export. As such, it is an appropriate product to test a certified food product chain in Morocco. Lessons learned from such an experiment would be of great interest when considering certification of more expensive food products in Morocco, such as tomatoes and potatoes.

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