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## Drinking water demand determinants: Evidences from Vlora city

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### Abstract

In Albania there are plenty of natural water resources, a fraction of these reserves cover the need of population for fresh, clean drinking water. But this sector presents several critical problems related with water suppliers. It seems they have not completed the decentralization process; they depend on state subsidies to cover losses from uncollectible bills. Literature shows traditional forms of financing of water supplier in different economies (developed or not). One of the classic financial forms is to increase the rate paid bills. The water should be seen as product that has its own market and an equilibrium price. But do the citizens of Vlora city perceive in adequate way this concept? Should be an economical problem for them if the water tariffs increase or are they using alternative resources of drinking water?

The article aims to give a descriptive overview of water industry and suppliers in Albania and especially empirically conclusions about of the situation in Vlora city, focusing on the perceptions of citizens. Are the accumulated financial losses of water supplier correlated with the citizens' perception about water as a public good? It's been used data through a structured questionnaire (Zeneli F., WP-Questionnaire, 2015) about 160 families, were part of the survey; also data from General Directorate of Water in Albania; elaborated using statistical software IBM SPSS 21, to identify link between determinants of drinking water demand in the sector.

The main conclusion is that citizens see the water provider service a public good, while from water suppliers water distributed is their product that provides their market position and their economic sustainability.

Let this paper be one of the first in the topic to determine drinking water demand determinants in Vlora city.

*Keywords:* water supply, alternative resources, financial sustainability, public perception;

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## 1. Introduction

Drinking water and sanitation services are part of a large industry today: the water industry. In Albania there are 57 companies that operate actually<sup>b</sup>. According to Rapport of Albanian Regulatory Authority of the Water Supply and Waste Water Disposal and Treatment Sector, during 2015, over 25 companies have applied for license or license renovation and only 10 of them got the license. The company of Vlora Water Supply and Sewerage Services hasn't respected procedure's deadline for the license renovation; administrative penalty is in process.

During 2014 costs are increased with 5% compared to 2013 and revenues with 2%, resulting in financial lose for the operators of the sector. For the Vlora Water Supply and Sewerage Services Company during the same period the revenues are decreased with 10% per connection and the costs are decreased with 3% per connection<sup>c</sup>.

At the moment the rate coverage of population with drinking water from the companies is 81% of population of jurisdiction areas of operation, with sewerage services only 51% of population and for the waste water treatment services only 10% of population.

The New Administrative National Reform that legitimates 61 municipalities will play a crucial role especially in the water sector; the water suppliers will be under the management and monitoring of local government institutions. This reform has reduced the number of local entities shareholders of water companies, facilitating the management process.

Tariffs for the drinking water and sanitation services are approved fulfilling four main principles:

- Tariffs are increased gradually until incomes exceed costs (including amortization and interest payments);
- Tariffs are consequence of an efficient technical and financial performance;
- Tariffs should be affordable ( not more than 5% of family incomes);
- Tariffs should preserve water resources and ensure stable consuming level.

Water and sanitation services tariffs are the main source of incomes for the companies in water sector. Tariffs for water and sanitation services are 2.6 times higher in 2014 compared with those in 2006<sup>d</sup> for the Vlora Water Supply and Sewerage Services Company. But how the change's tariffs affect welfare of citizens of Vlora? How is the perception of citizens about the quality of service of water sector and are they behaviors correlated with the financial loses of Vlora Water Supply and Sewerage Services?

The article aims to give an empirical answer to the questions above. In the section two is summarized the literature consulted for the empirical part, in the section three is formulated the methodology and empirical findings followed by the final conclusions of the article.

## 2. Literature review

Identifying the determinants of water consumption requires taking in consideration classical factors such as: population's incomes and other characteristic, household features and other factors, such as weather conditions, geographical position. Starting from 1980s, there are many empirical works on this topic.

Arbués and Villanua (2006) and Worthington and Hoffmann (2008) identified water price and average per-capita water consumption as the main determinants of water demand. Water price is one of the most used instruments for monitoring water demand. According to the literature a price increase in water causes a decrease in per-capita water consumption (the influence of water quantity demand's price elasticity). Worthington and Hoffmann (2008) calculated that that price elasticity has a range between  $-0.25$  and  $-0.75$  (water has no a substitute good for basic uses). Average consumption (per-capita) was much higher in Australia and the US than in Europe, due to a higher

<sup>b</sup> Rapport of Albanian Regulatory Authority of the Water Supply and Waste Water Disposal and Treatment Sector, 2015

<sup>c</sup> Calculations of the author, data of AGDWS, Vlora Water Supply and Sewerage Services Indicators for years 2006-2014

<sup>d</sup> Albanian General Directorate of Water and Sanitation (AGDWS), Vlora Water Supply and Sewerage Services Indicators for years 2006-2014

level of outdoor consumption. It's to be noticed that only 24% of the studies reviewed by Worthington and Hoffmann were situated in Europe.

Marinoski et al. 's work (2014) is focused in Brazil and Araral and Wang (2013) studied important cities and provinces in Southeast Asia.

Most studies that cover a wide range of countries focusing on water demand prove empirically that consumers with higher incomes use more water than poorer ones. Dalhuisen et al. (2003) findings were interesting: water consumption was inelastic to income changes (for lower income countries).

Climate conditions are believed that affect indirectly the quantity and/or frequency of tasks or activities that requires water-consumption such as: personal hygiene practices, garden maintenance and car cleaning. Domene and Sauri (2006) proved that consumer behavior was an important determinant factor in household water demand, among other known variables (e.g., socio-demographic and economic variables).

Lee et al. (2011), Michelsen et al. (1999), March et al. [2013] found a noticeable effect of the installation of water meter on water demand. Households with individual water metering consume less than those with a collective water metering.

Italy has been studied only through regional focus: Mazzanti and Montini (2006) studied the Emilia Romagna Region, Musolesi and Nosvelli (2007) studied the Cremona Province, and Statzu and Strazzera (2009) studied the situation in island of Sardinia.

Among determinants of water consumption that are taken into consideration are: tariffs and income, population characteristics, population density, the presence of immigrants or tourists, household features or house characteristics.

Unfortunately there are not study of this topic done in Albania; just materials and reports that scan the water sector performance and efficiency during years. This study aimed to contribute to this lack of literature, determining factors of water demand by focusing on Vlora city, Albania, where data are available only at local levels.

The table below summarizes papers and works used as a reference point for the article.

Table 1. Critical summarized literature

Author/Authors	Topic	Findings
Statzu and Strazzera (2009)	Geographical features effects on the water consumption of population	"...altitude had a significant negative effect on water consumption in Italy"
Gaudin (2006)	Effect of price information on residential water demand	"...price elasticity increased by 30% or more when pricing was provided on the bill."
Martínez-Espiñeira (2002)	Residential water demand	"...water use was highest in summer."
Martínez-Espiñeira and Nauges, (2004)	Price control and water demand	"...per-capita water use was highly insensitive to price changes; pricing policies barely affect demand"
Mazzanti and Montini (2006)	The determinants of residential water demand in Italian municipalities	"...negative correlation of water consumption with temperature"

Source: The author

### 3. Methodology

#### 3.1. Purpose of the study

The paper aims to give answer to the main research question: "*Which are the main determinants of water demand for the citizens of Vlora?*"

3.2. Data collection

It's used official data from rapports of Albanian Regulatory Authority of the Water Supply and Waste Water Disposal and Treatment Sector and Albanian General Directorate of Water and Sanitation. Also, a structured questionnaire with multiple Likert questions is spread in Vlora city in 2015, as a tool to identify certain behaviors and determinants that affect drinking water demand of citizens. The used scale (from 1 to 5) ensures internal consistency ("reliability"). It's used OLS method to formulate a multiple linear regression about the main determinants of water demand in Vlora, Pearson correlation test, etc.

3.3. Theoretical model(s)

According to the literature and similar paper on the topic, the variables used are as below:

Table 2: Variables

Variables	Description
Household Water Quantity Sold	The total drinking water sold to the clients of company (in m <sup>3</sup> )
Average price	The tariffs in Albanian Lek per m <sup>3</sup> (approved by General Directorate of Water)( in ALL/m <sup>3</sup> )
Proportion of metered connections	Percentage of company's clients that have individual water meter (there are different from they that pay a flat water tariff)
Continuity of Service	Hours per day of drinking water services ( isn't not the European rate of 24 hours per day) (in hours)
Water Coverage	Kilometers of company's coverage with drinking water (in km)

Source: The author

And the theoretical regression model:

$$\text{Water Sold} = \beta_0 + \beta_1 \text{Average Price} + \beta_2 \text{Metered connections} + \beta_3 \text{Continuity of Service} + \beta_4 \text{Water Coverage} + \varepsilon_i$$

3.4. Hypothesis and empirical findings

The article is based on the main hypothesis:

**H1: Price per m<sup>3</sup>, formal connections rate, water coverage and continuity of service (hours per day) in Vlora city are determinants of drinking water demand.**

Table 3: Regression parameters

Model	Dependent Variable	Independent Variables	Coefficients	R <sup>2</sup>	F Value	Model Sig.
I	Household Water Quantity Sold (m <sup>3</sup> )	Constant	217*	0.931	13.532	0.014
		Average Price	-1.516*			
		Proportion of metered connections	+0.357*			
		Continuity of Service	-0.298			
		Water Coverage	-0.550*			

\*Note: Significant at 0.02

Source: The author's calculations

According to the theoretical findings in literature:

- There is a negative correlation between average price per m<sup>3</sup> of produced water and sold quantity of water (according to the demand law, the water is considered a priced good);
- There is a positive correlation between metered connections (as %) and sold quantity of water (illegal connections on water network are formalized, so it's added a proportion of population among company's clients, the overall demanded water quantity increases);
- There is a negative correlation between continuity of service and sold quantity of water (due to the low quality of water as drinking water; it's used for other activities);
- There is a negative correlation between water coverage service and sold quantity of water (many families have private water deposits or use bottled water). *The Hypothesis is verified.*

Table 4: Correlations between formalized water sector and rate of payment

		Existence of water contract services	Payment of water bills
Existence of water contract services	Pearson Correlation	1	.247**
	Sig. (2-tailed)		.003
	N	168	145
Payment of water bills	Pearson Correlation	.247**	1
	Sig. (2-tailed)	.003	
	N	145	146

\*Note: Correlation is significant at 0.01 level (2-tailed)

Source: The author's calculations

There is a significant positive correlation between the formalization of water sector (identifying company's clients through legal contracts) and the willingness of paying the drinking water bills. The civic awareness is increased and the drinking water is seen as a priced good.

Table 5: Correlations between consume of bottled water and residence of citizens (rural or urban)

		Bottled water consumed	Residence
Bottled water consumed	Pearson Correlation	1	.235**
	Sig. (2-tailed)		.003
	N	169	158
Residence	Pearson Correlation	.235**	1
	Sig. (2-tailed)	.003	
	N	158	159

\*Note: Correlation is significant at 0.01 level (2-tailed)

Source: The author's calculations

There is a significant correlation between the residence of the family (rural or urban) and the tendency of bottled water usage. It's known that citizens in Vlora have private deposits, or family in rural areas have private wells to ensure the daily needed water quantity.

### 3.5. Limitations

The period taken in consideration is short (from 2006-2014). Also, to be able to formulate findings for whole Albanian water sector, it's necessary to include in study also the 56 other companies that operate in the sector.

It's aimed in further articles to compare Albanian water industry characteristics with those of other country of Western Balkan.

## 4. Conclusions

Water sector is supported from plenty natural water resources in Albania, around 316 resources.<sup>°</sup> The sector has his problems related with the low rate of bills payment from the citizens and lack of empirical information about determinants of water demand. The paper is one of the few papers on the topic with case study Vlora city.

The first empirical results is as stated in literature; the water is considered from citizens as a priced good, the higher the water tariffs per m<sup>3</sup> of demanded water, the lower the demanded water quantity. But, the elasticity from the tariffs is low, due to the trend of bottled water or private deposits usage.

Other factors such as coverage rate and continuity rate with drinking water service are part of determinants of water demand for citizens of Vlora correlated negatively with it, due to the low quality of service or the existence of substitute goods such as bottled water, private deposits in urban areas and private wells in rural ones.

The lasts empirical findings are related with the perceptions of Vlora citizens. Empirically it's proved that there is a positive correlation between the formalization of water sector (identifying company's clients through legal contracts) and the civic awareness for payment of water bills. This increases the metered water demanded quantity by citizens. The mentality about not paying the water services because my neighbors not pay at all is diminished during years.

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