A KEYNESIAN MODEL APPLIED TO THE WATER AND SEWAGE PUBLIC UTILITY OPERATORS

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Abstract: *This article presents a short foray into the scientific specialized literature on public utility services in Romania, and in particular, the utility services in the field of water supply and sewerage network. It is essential to satisfy the requirements and the needs of the client in the field of public utility services, the performance in this field being the only feasible option to ensure the quality of the services safety and accessibility, the equal treatment of the users, the continuity of the activity and last, but not least, the adaptability and the flexibility regarding the requirements. Through the performed research, by using the Keynesian model applied to the financial data reported by the local water supply operator, aimed to obtain an insight into the evolution of revenue and expenditure, as well as the effect of increased investment. These elements express the relationship between resources and results, and their balance is based on a Keynesian model in a closed economy. By applying the Keynesian model, we have concluded that the evolution of revenue and expenditure is influenced by a number of factors which can lead to a decrease in expenditure, but although that, the revenues increase from year to year. The Keynesian model applied in the economy of public utility services, involves in its structure variables such as investments, and by applying the investment multiplier consumption remains the economic phenomenon that dominates the water supply economy. However, an increase in consumption has the ultimate effect of obtaining a profit for the operator, which will in the future be its own source of financing for investments in the water supply and sewerage system. Thus the orientation towards consumption becomes beneficial both in terms of satisfaction of end-users and from the point of view of the operator, in terms of revenue growth and the analysis of the. Even if capital goods do not directly meet the needs of end-users, they lead to the development of public utilities and its specific infrastructure, and to the fulfilment of the eligibility conditions imposed by the European Union's financing programmers. Expansion investments in water and sewerage services have the direct effect of increasing the number of users, as well as increasing the number of employees of the operator.*

Keywords: *performance; requirements of the public utility services; marginal propensity to consume; the investment multiplier.*

JEL Classification: *L32; L97; E12; E13; H50.*

1. Introduction

Public utility services are subject to specific public service obligations in order to ensure a high level of safety and accessibility, equal treatment, the promotion of

universal access and user rights. Regardless of the nature of the public service, it designates all activities of general interest provided by service operators in the interest of a community, using public goods for a limited period of time, with the aim of transforming material, human and financial resources into services of the highest quality and maximum utility. Based on the claim that the Keynesian approach at the level of a local economy" is identical to the simplest version of the Keynesian model in an open economy, the only difference being that all variables refer to the local economy instead of the national one" (Constantin,2004, p85), this paper checks the Keynesian model in the field of public utility services of water and channeling at the level of a regional operator

2. The current state of the public utilities service in Romania - the field of water supply; sewage and sewage treatment, collection, drainage and drainage of rainwater.

2.1. Current status of the public utilities service in Romania

After 1990, the public utilities services experienced various regulations that in fact represented the will of post-revolutionary Romania to join the European and Euro-Atlantic structures, which was first materialized in 2001 by Law no. 326 of communal management services and the legislation specific to each field. Against the background of EU accession, Law no. 51/2006 on community services of public utilities was adopted, which was later updated by Law no. 225/2016. The general legal framework established was completed by special laws for each type of activity, which for the field of water supply and sewerage was made by the Law on water supply and sewerage service no. 241 of 2006 republished.

Public utility services are defined by national legislation as the totality of activities that ensure the satisfaction of the essential needs of utility and general public interest of a social nature of local authorities, regarding: water supply; sewage and wastewater treatment: collection, sewerage and drainage of rainwater; thermal energy supply in centralized system; sanitation of localities; public lighting; natural gas supply; local public passenger transport (Law no. 225/2016).

The legal provisions in the field are aimed at satisfying the users' requirements as fully as possible, protecting their interests, strengthening the economic-social cohesion at the level of local authorities, as well as the sustainable development of the administrative-territorial units. (Law 51/2006 republished)

The legislature, through Law no 225/2016 highlights that the organization and operation of the public utility services must ensure the fulfilment of the public service duties established according to the following fundamental demands: universality; continuity in terms of quality and quantity; adaptability to the users' requirements; equal and non-discriminatory access to the public service and transparency of the decision making and the protection of the users.

The public utility services are subject to certain obligation particular for the public sector, with the purpose of ensuring a high level of quality, safety and accessibility, equal treatment, promoting the universal access and the rights of the users. The legal provisions aim at satisfying as fully as possible the users' requirements, protecting their interests, strengthening the economic and social cohesion among

local collectivities, as well as the sustainable development of the territorial and administrative divisions (Law no 51/2006 republicate).
These services are provided by means of specific technical-public infrastructures, called public utility systems, which are goods of public interest and use and belong, by their nature or according to the law, to the public or private domain of the administrative-territorial units, being subject to the regime. legal status of their public or private property, as the case may be, as defined and delimited by Law No. 213/1998 on public property goods, as subsequently amended and supplemented.
The public utility services are the responsibility of the local public administration authorities or, as the case may be, of the inter-community development associations with object of activity, the public utility services, mandated by decisions of the deliberative authorities of the member administrative-territorial units. The public utility services are established, organized and managed in compliance with the legal provisions, according to the decisions adopted by the deliberative authorities of the administrative-territorial units, depending on the degree of urbanization, the economic and social importance of the localities, the size and the degree of their development and in relation to the existing technical-municipal infrastructure. In the organization, operation and development of public utility services the general interest of local communities is a priority. The legal provisions aim at satisfying the users' requirements as completely as possible, protecting their interests, strengthening the economic and social cohesion at the level of local communities, as well as the sustainable development of administrative-territorial units (Law 51/2006 republished).
The public utility services are subject to the legal regime of the public services of general interest, the legislator establishing the legal regime of the operators, the relations between the same users, the ways of managing the services, their financing.
Romania's accession to the European Union had as an effect the transposition in the national legislation of the European Community directives, a significant impact on the public utility services having the provisions regarding the regionalization. Creation of development regions and institutional structures for regional development, initially according to the Regional Development Law no. 155/1998 and subsequently to the Framework Law on Decentralization no. 195/2006, is an integral part of these series of reforms. As Demeter J., Klarik L. and Kolumban G. remarked, the regionalization of Romania is not the result of a spontaneous social, economic or administrative evolution, but of the political “pressure” of the European Union and was carried out in order to absorb the pre-accession / structural funds of European Union. (2003)
In fact, the economic and social situation as well as the specific legislation have evolved, being created regional operators, as well as inter-community development associations, which represent the association and cooperation between two or more territorial administrative units, within the competences of their deliberative and executive authorities. The inter-community development associations established, have legal personality, are of private law and public utility, in order to jointly carry out development projects of zonal or regional interest or to jointly provide public services. (Law no. 286 / 2006 for the amendment and completion of the Law on local public

administration No. 215/2001). The establishment of inter-community development associations was followed by the emergence of shareholder operators of member local c.

2.2. The public utilities service in the field of water supply; sewage and sewage treatment, collection, drainage and drainage of rainwater from Romania.

In the context of the presented ones, in the following we make a brief diagnosis of the public water supply and sewerage service in Romania, a benefit included in the sphere of public utilities services, respectively in the framework regulations in the field. The public water supply and sewerage service is established, organized and managed under the leadership, coordination, control and responsibility of the local public administration authorities and aims at water supply, sewage and wastewater treatment for all users in the localities. The deliberative authorities of the administrative-territorial units have exclusive competence, which can also be exercised through the associations of inter-community development with object of activity the water supply and sewerage service, in the name and on behalf of the associated administrative-territorial units, based on the granted mandate. to them, regarding: approval of local strategies for setting up, organizing, managing and operating the water supply and sewerage service; approving the investment programs regarding the establishment, development, modernization and rehabilitation of the technical-commercial infrastructure related to the service; approving the regulations and specifications of the service; adopting the management modality and approving the documentation for organizing and carrying out the procedures for delegating the management; approval of service performance indicators councils and generated regionalization in the field of public utility services.
The authorities of the local public administration are responsible for the implementation of the water supply, sewerage and wastewater treatment systems in the city and for ensuring the conditions for the public water supply and sewerage service to comply with the legal provisions transposing the European Union directives.
The operators have the responsibility regarding the compliance with the quality provisions of the supplied drinking water, respectively of the waste water discharged in the natural receivers, monitoring, informing the consumers, the public health authority and the authorities of the local public administration.
Also, the services of public utilities, organized on economic and efficiency principles, are provided / provided on the basis of the principle "the beneficiary pays" and the recovery of the operating or investment costs is done through prices and regulated tariffs or special taxes. In this sense, the public utility services, set up, organized and coordinated by the authorities of the local public administration, can be provided / provided by the license operators who are organized and operate either under public law or private law regulations.
The public utilities services imply the existence of an adequate technical-urban infrastructure and benefit from the coverage area with local dimensions: communal, city, municipal or county. Considering the history, the origin of the public utilities systems in the field of water channelization, these are goods of public interest and public interest and, by their nature or according to the law, belong to the public or

private domain of the administrative-territorial units, as they are regulated by Law no. 213/1998 regarding public property goods, as subsequently amended and supplemented.
The public water supply and sewerage service has a strong impact on the health of the population, its standard of living and economic development, which is why Romania, through the Accession Treaty, has assumed important commitments in the water sector. and wastewater for the transposition of Directive 98/83 / EC on drinking water quality5, respectively Directive 91/271 / EC / 19916, as amended and supplemented by Directive 98/15 / EC / 19987 on urban waste water treatment. From a legislative point of view, the provisions of the Romanian normative acts regarding the water sector have been aligned with the acquis communautaire. Following the negotiations for Chapter 22 - Environment, Romania has made a number of firm commitments to make investments in the water and wastewater sector during relatively short transition periods.
Moreover, following the accession negotiations, Romania declared its entire territory as a sensitive area, this aspect implying the obligation that all human agglomerations with more than 10,000 inhabitants be provided with treatment plants with advanced degree of treatment. In this sense, the appropriate strategic direction is represented by the promotion of major regional infrastructure investment projects, doubled by the regionalization of utilities as a key element in improving the quality of services and the efficiency of capital and operating costs. The main results pursued by the promotion of investments in the field of water and wastewater are aimed at achieving the commitments deriving from the European directives on wastewater treatment (Directive 91/271 / EEC) and the quality of water intended for human consumption (Directive 98/83 / EC). sectoral investigation launched by Order No. 82 of 15.02.2017, issued by the President of the Competition Council, on the market of public water supply and sewerage services in the county seat municipalities and the Romanian Intercommunity Development Associations).
In fact, since the pre-accession period to the European Union, the operators of the public utilities services in the field of water and sewerage have deployed significant programs with different sources of financing, such as USAID, or EBRD (state guaranteed credits), or those with non-reimbursable financing, of which we mention, ISPA or SAMTID. Due to the continuous evolution of the economic and social situation, combined with the legislative changes of the period, not least by the appearance of the regional operators and of the associations of inter-community development, the public utilities in the field of drinking water and sewage have registered a significant increase. Thus, in practice, the regional operators of the public water supply and sewerage service, have implemented and finalized investment projects with European funding, as part of the Sectoral Operational Program 2007-2013, and they have in plan for the upcoming period works for public utilities, pertaining to the funds for the Large Infrastructure Operational Programme (LIOP) 2014-2020. Most of the regional operators, in order to ensure the co-financing needed to implement the ISPA, SAMTID and POS Environment programs, have contracted external credits. Taking into consideration the need to continue the investments in the sector of public utilities in the field of water and sewerage in order to reach the objectives assumed by Romania through the Treaty of Accession, as

well as the fact that, at present, the investments will be oriented towards the rural environment, which implies a decrease of economic efficiency, a new stage is needed in the organization of these services, probably through the fusion / association / cooperation of the regional operators. This need varies from the concrete situation in each area of Romania and is due to the fact that there are regional operators operating in the county in which they have their headquarters, several counties or localities in other counties, or the situation with two or more operators in a county (as the case of Bihor County).

S.C Compania de Apă Oradea SA, having the headquarters located in Oradea str. Duiliu Zamfirescu no. 3, with a social capital of 12.000.800 lei, conducting their operation under the Law 31/1990 republished on commercial companies, Law 51/2006 on community services of public utilities, Law 241/2006 on water supply and sewerage service and GEO 13/2008 on amending and supplementing Law no. 51/2006 and of Law 241/2006.

Starting with 01.07.2009 the company is a regional operator, and other 8 villages in the Metropolitan Area being shareholders. The operator holds a 2 class operating license no. 3551 of 21.01.2016 for the public service of water supply and sewerage in the area of the Crişuri river basin (according to Order no. 22 / 21.01.2016) issued by the National Regulatory Authority for Community Services for Public Utilities. These certificates represent the guarantee for the entire activity according to the requirements of quality, environment, health and occupational safety respecting the recognized standards in the field, for the Integrated Management System.

S.C Compania de Apa Oradea SA, with 120 years of experience in the field of water supply, currently exploits the following capacities: capture - treatment - drinking water pumping stations: 8 stations, of which in Oradea 5 stations with a total capacity of 2,100 l / s capture-treatment-pumping drinking water, transport networks and distribution of water 1,355 km, drinking water pumping stations 142 stations, water connections 51,490 pcs, sewerage networks 762 km, pluvial sewerage networks Sewerage connections 37,024 pcs, pumping stations in the system sewage 131 stations, sewage treatment plants 6 stations. These capabilities make it possible to serve a total number of consumers throughout the operating area as follows:

- water supply 254,983 inhabitants (97.2% of the resident population),
- sewage 214,041 inhabitants (81.6% of the resident population).

For Oradea City, the situation of the users is presented as follows:

- water supply 184,440 inhabitants (99.9% of the resident population),
- sewage 174,792 inhabitants (94.8% of the resident population).

The water company from Oradea is the operator that has implemented projects with external financing sources since the 90s, such as USAID (modernization of Oradea treatment plant), MUDP II (Automation of water plants, modernization of 77 hydropower stations, expansion of water networks drinking water), ISPA (automation of the Oradea treatment plant, rehabilitation of the sewage system on 64 km). After accession, the operator accesses Priority Axis 1 of the Environmental Sector Operational Program 2007-2013, regarding the development of specific investments in the field of drinking water and waste water in Bihor county, by signing the financing contract no. 121230 / 18.04.2011. The project represents a significant step in the general rehabilitation and expansion of the water supply and sewerage infrastructure

in Bihor County, continuing the investment process carried out through the MUDP and ISPA programs to create regional systems in the water sector.
Phase I, related to the period 2011-2014, had a total value of 83,274.55 thousand euros, of which for the works from Oradea were allocated 35,310.13 thousand euros. Of the total value 76.3% represents Cohesion Funds, 13, 47% State and local budget and 10.23% co-financing provided by the operator through an external credit.
The project includes investments in the treatment and distribution of drinking water as well as the collection and treatment of waste water in the municipalities of Oradea and Beiuș and the towns of Tinca, Sântandrei, Palota, Girișu de Criș, Tărian, Paleu, Săldăbagiu de Munte, Nojorid, Osorhei, Alparea, Alparea.
From the savings realized in the implementation of the project, the Compania de Apă Oradea has started a new phase, with the completion in 2020, by co-financing Cohesion Funds, realizing the extension of the connection rate to the water supply and sewerage services in Oradea and the villages: Nojorid, Osorhei, Sântandrei, Sânmartin, Tinca, Ineu and Copăcel.
Considering the information presented above, regarding the investment effort of the operator and the state and local budget, in the following we present a case study on the Keynesian grounding in the development of public utility services.

3. The Keynesian model of local development

In General Theory, Keynes claims that the total income of an economy was for the short term, determined mainly by the wish to spend for households, companies and the government. The bigger the desire to spend, the larger the volume of sold goods and services, and the higher the sales volumes, thus the increased production, which leads to more people being employed. The economic perspective on which the current economic interventionism is based starts from what we call Keynes "multipliers". The formulas below were presented by the author Boloș M. (2007) in the paper Note de Curs.

$Y = C + I + G$ where Y=aggregate income
C=aggregate consumption
I= investments
G= Government expenses

This formula is also called the Keynesian cross equation (the closed economy pattern).
From this Keynesian formula it was established that a variable depends directly on the income, thus become an endogenous variable: consumption. The other options (I, G) are independent of the income, thus being considered exogenous variables.

$C = C_O + c * Y$ where 0<c<1 C_O – autonomous consumption (bread, water etc.)
c - the marginal disposition for consumption

$$Y = C_O + C * Y + I + G$$

$$Y = \left(\frac{1}{1-c}\right)(C_O + I + G)$$

The term $\frac{1}{1-c}$ is called Keynesian multiplier.
It is noticed that between the cumulated income Y and the investment I there is the following situation:

$$\Delta Y = \left(\frac{1}{1-c}\right) * \Delta I$$

To sum up, it can be said that multiplication of investments ΔI will include o change in structure (dynamic) for the cumulated incomes, directly to the same extent as the Keynesian multiplier $\frac{1}{1-c}$.

The Investment multiplier

The concept of "multiplier" occupies an important place in Keynesian theory of income and employment. It is an important tool in terms of revenue growth and business cycle analysis. Keynes believed that an initial increase in investment leads to a final increase in investments and thus to a final increase in aggregate income, which Keynes called "Investment Multiplier".

The idea of a multiplier has its origins in an explanation of the favorable effects of investment on labor acquisitions and has become an integral part of Keynesian theory of income and employment. For income analysis Keynes adopted the notion of multiplier, an idea borrowed from R.F. Kahn. The latter sought, through a multiplier, the effect of increased investment on employment.

Keynes turned this into an income multiplier designed to show that a small increase in investment can lead to a much higher income increase.

It is closely related to the concept of marginal propensity to consume and is considered one of Keynes's contributions. In fact, the Keynes investment multiplier is a modification of Kahn's "job multiplier".

Keynes's multiplier is the ratio between the total change in income and the initial change in investment. In other words, the report expresses the quantitative relationship between the increase in national income and the increase in investment that induces income growth.

According to the investment multiplier, an exogenous increase in investment demand also leads to an increase in demand and spending.

Arithmetically, this relation is expressed as follows:

$$Y = k\Delta I$$

where Δ (delta) represents increases or changes, Y for income, k for multiplier and I for investment. Therefore, we obtain k-ΔY / ΔI, meaning k (the multiplier) is equal to the ratio between the increase of the income and the increase of the investment that is responsible for the increase of the income.

4. Use of the Keynesian model at the S.C. Compania de Apa S.A.

Knowing the structure of the units providing water supply services, we proceeded to gather the data needed to implement the Keynesian model. The data were taken from the annual financial statements of the economic agent submitted to the General Administration of Public Finance fom Bihor county. During the analyzed period, the economic agent providing public utility services from Oradea municipality recorded the following economic situation:

Table 1: Indicators Compania de Apa Oradea expressed in thousands lei

Period	Revenues	Expenditures	Investments
2015	66.552	64.696	127.590
2016	76.281	54.933	87.383
2017	76.028	67.987	47.576
2018	78.693	72.330	31.576

Source: Own processing

The main local indicators taken into consideration, in the present study, refer to the revenues realized from the provision of public utility services, the expenses registered for this purpose and the investments realized in the sphere of public utility services at the level of the Compania de Apa.
In order to apply the equations for the water supply services, as well as to be able to determine the coefficients of the equations, it was necessary for all the data used be homogeneously expressed, respectively in the same measure unit (thousand lei).
The computer function programs were used, in determining the correlation equations, resulting, for the equation of the correlation between consumption and revenue for the period 2015 - 2018, the following data: to establish the marginal propensity to consume (c) the ratio between the variation of expenses (C-Co) and the variation of income (Y-Yo) was calculated, where (C) and (Y) belong to the reference year, and (Co) and (Yo) the previous year, as follows:

$$c = \frac{C - C_0}{Y - Y_0}$$

where : $$C = C_0 + cY$$

Given the expenditure and revenue data in Table 1 taking into account the calculation ratios presented above, we obtain the values for "c" and "C_0" in Table 2.

Table 2: Values calculated for "c" and "Co"

Period	c	Co
2016	-1,003525361	-131.482,21
2017	-51,59496407	-3.990.630,04
2018	1,628934482	55.856,72

Source: Own processing

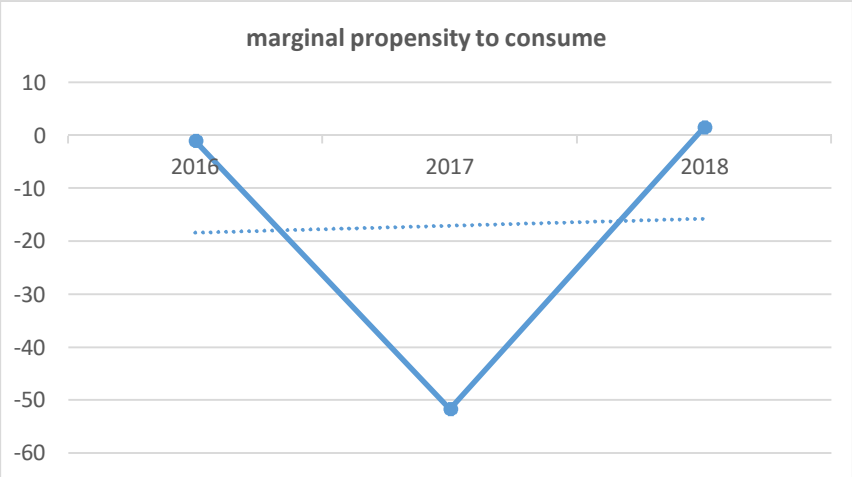
From the table it can be seen that "c" representing the marginal propensity to consume does not register positive values when the expenses of the reference year decrease compared to the previous year. Thus, we note that in order to establish the marginal propensity to consume (c) it is necessary for revenues and expenditures to increase proportionately from one period to another. In the present example, only for the period 2017-2018 we can establish a marginal inclination towards consumption, which is equal to 1.6289, a positive value, but which does not fall under the condition 0 <c <1. Therefore, for the analyzed period 2017-2018, the marginal propensity to consume does not meet a favorable situation.

Substituting the values of "c" and "Co" in Table 2 in the relation

$$C = C_0 + cY$$

we obtain the consumption functions for each period, as follows:
C2016 = -1.003525361Y -131,482.21
C2017 = -51,59496407Y -3,990,630.04
C2018 = 1.628934482Y +55.856.72
Schematically, the variation of "c" in the analyzed period can be followed in Figure 1.

Figure 1: Evolution of the marginal propensity to consume



Source: Own processing

In the economic sense, investments are the whole of the expenditure oriented towards the acquisition of capital goods. Unlike consumer goods, capital goods do not directly meet the needs of end-users but lead to the development of public utilities and its specific infrastructure, implicitly in fulfilling the eligibility conditions imposed by EU funding programs.
In the case of Compania de Apa, the investments for the period 2017-2018 are presented as follows:

Table 3: Statement of investments of the Compania de Apa

Period	Own sources	Local Budget	State Budget	Cohesion Fund	EBRD financing	TOTAL
2015	11.788	4.681	33.455	77.666		127.590
2016	20.024	2.154	11.178	28.268	25.759	87.383
2017	14.188	981	7.986	20.109	4.312	47.576
2018	19.897	557	2.901	7.249	972	31.576

Source: Own processing

In order to highlight the effect of the capital increase at the Compania de Apa, we consider it necessary to study the relationship between the increase of the income level and the increase of investments ΔI.
In this context, when increasing investments in by ΔI, income Y will increase with kΔI, so

$$Y = k\Delta I$$

and knowing that, k = 1 / s, and by replacing it in the relation, we obtain

$$\Delta Y = \frac{1}{s} * \Delta I$$

The determination of the local investment multiplier depends on the marginal quota for saving, depending on the marginal inclination towards consumption, a variable whose evolution can be traced in Table 4.

Table 4: Evolution of the local investment multiplier

Period	c	s=1-c	k=1/s	ΔY=ΔI/s
2016	-1,003525361	2,003525361	0,49912021	43614,62
2017	-51,59496407	52,59496407	0,019013227	904,57
2018	1,628934482	-0,628934	-1,5899907	-50205,55

Source: Own processing

Analyzing the evolution of the local multiplier of investments at the level of the Compania de Apa from Table 4 we observe that the stimulation of the economic activity, therefore the effect of the local development, appears in 2016 and 2017, otherwise the consumption remains the economic phenomenon that dominates the economy of the water services operators.
The study presented in Table 4 confirms the theory according to which the value of the multiplier is much higher as the marginal propensity to consume is lower or the marginal propensity to save is higher.

5. In conclusion

The operators' responsibility regarding the compliance with the provisions of the extension of services and implicitly of the specific infrastructure, not least the improvement of the quality of the drinking water leads to the necessity of continuous investments, but after analyzing the evolution of the investment multiplier it was found that the activity of the local supplier of public services, is oriented towards consumption and not saving. Given the fact that an increase in consumption in the end has the effect of obtaining profit for the operator, which returns as its own source of financing investments in the water and sewerage system, we can conclude that the consumption orientation is beneficial both from the point of view of the satisfaction of the end users as well as from the point of view of the operator, regarding the increase of the revenues and the analysis of the business cycle. Therefore, the Keynesian hypothesis is verified, according to which an initial increase of investments leads to a final growth of them and implicitly to a final growth

of the investment multiplier. Extension investments in the field of water and sewerage services have a direct effect on increasing the number of users, but also on increasing the number of operator's employees.
In order to verify the conclusions of the present research, in the future, we intend to conduct a comparative study with other regional operators and extend the study period for several years.

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