# THE INFLUENCE OF PHYSICAL PHENOMENA AND PROCESSES ON THE DIFFERENT ECONOMIC SITUATIONS FACED BY THE ECONOMIC AGENTS

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#### Abstract

Analysing the multitude and complexity of physical phenomena, we were able to distinguish a number of such processes that may resonate to some extent with economic phenomena. Thus, I will discuss in the following about some physical processes that can be modeled and can offer interesting solutions to the economic phenomena, which I consider to be of real utility to the economic agents that operate in the real market.

I find it interesting to watch how the information is disseminated in the market and how it is perceived by the consumer, whether it starts from the economic agent who wants to promote his products and services, or it spreads from one individual to another. If we refer to the promotion of products and services, this can be highlighted by an analysis made on the financial results that the company records after the moment of launching the information compared to the previous one. Regarding the propagation of information from one individual to another, the phenomenon can be traced by the feet-back received from the consumers who come to the physical store to buy products following the recommendations received from other customers who have already bought from the respective store. Given the similarity of the economic phenomenon with the physical process of propagating information from molecule to molecule, I will quantify the influence of physical phenomena on economic ones.

At the same time, I will analyse to what extent the physical phenomenon known as "viscosity", which represents the characteristic of matter, whether it is gas, liquid, solid or other intermediate states (emulsion), which influence the movement of a body in these mediums, will help to understand and solve an economic situation generated by the possibility of entering and consolidating the market position of a new economic agent.

It is interesting to see to what extent these knowledge we have about the development of phenomena and processes in physics will help to solve the various economic situations faced by the economic agents in the daily activity.

**Keywords:** diffusion, viscosity, price, sales, quantities, coefficients, variables, regression, statistical tests

JEL classification: C01, L11, L61

## Introduction

We know from physics that when an isolated system evolves over time, it is done in a direction that is well defined, from a less chaotic to a chaotic state. For example, the molecules of a gas collide with each other changing energy, and the equilibrium state is ultimately reached and will correspond to the most chaotic distribution of total energy for all gas molecules.

In society we find similar processes when we refer to the dissemination of information or the generalization of certain behaviors. For example, we have noticed over time, the role that advertising plays in promoting and selling some products and services. In this area that includes the promotion and sale of products and services, I will address the situation of positioning an economic agent in the online environment and disseminating consumer information through this electronic channel. I will follow the effects that the dissemination of information will have on the market from an economic point of view, how closely this phenomenon is related to the physical one of molecular diffusion and how we can use the knowledge from physics in order to analyse the economic phenomena as accurately as possible.

According to the same species, I will address economic situations that, due to their characteristic complexity, generate different environments, which may be less or more "viscous". Here I can refer to situations such as the information that is transmitted to the market and circulates. Therefore, the information underlying the economic development is experiencing a higher or lower degree of resistance in the market (it will move in a less or more "viscous" environment). Similarly, a new company can enter and develop in the business environment, depending on the factors related to the respective environment: sales, prices of promotion and sale of products and services, the geographical area in which the activities are carried out, etc.

The physical phenomenon similar to the economic situations presented above is generally encountered in the case of fluids that at a low temperature know that they have a high viscosity, and as the temperature increases its viscosity decreases. Following this aspect I will strictly analyse the property of the fluid to be able to penetrate easier or harder, analogous to the economic situations created by the possibility of penetrating the profile market by a new economic agent and its development in the respective business environment.

#### Literature review

Anghelache, C., Angel, M.G. (2018), approaches the econometric models for the analysis of economic phenomena. Anghel C. și Stanescu C. (2016). The authors outline the physical phenomenon and present the way of diffusion of the molecules through a surface respecting the characteristic physical

laws. Brenneke R., Schuster G. (1973) describe and exemplify the various physical phenomena. Bulinski, M. (2007) approaches the field of economics. Giorgio Fabbri (2007) which addresses optimal control problems and viscosity solutions. Gheorghiu, A. (2007) classifies different economic models and uses a number of models from physics to analyze economic phenomena. Gheorghiu, A., Spanulescu, I. (2007) they studied aspects related to the application of physics and mathematics in economic theories. Gligor,M.,Ignat,M. (2003) they analysed the applications of theoretical physics in macroeconomic modeling. Iacob Ş.V.(2019) it investigates the methods of economic and physical analysis and the analogies between the phenomena that occur both in physics and in economy, through concrete analyses made to distribution companies in Romania. Pecican E.S. (2005) approaches the regression models (linear unifactorial or multifactorial), the significance and the insignificance of the dependence between variables. Radner R. (2003) which analyses the setting of strategic prices for a service in relation to the viscosity of demand.

#### Research methodology, data, results and discussions

In order to quantify the effect determined by the dissemination of information in the market on the level of sales of the economic agents and the market resistance of a number of companies depending on the different media more or less favorable to the development, I will use the simple or multiple linear regression, a model with a wide use in the study of econometrics phenomena. The results of the regression analysis are to be statistically verified (t test, F test, etc.) to be able to assess the influence of the cause modification on the effect.

Following the physical phenomenon of molecular diffusion, I will turn my attention to the economic agents that carry out their commercial activity through shops present in the big shopping centers or on the big commercial thoroughfares and who have adopted the variant of promoting the products and services in the virtual area.

Thus, we will follow how the information will be transmitted to the consumer through this computer channel and how close it is to the physical phenomenon known by molecular diffusion.

The econometric model that can be used in this case is simple linear regression. The regression equation has the following form:

$$y_t = a_0 + a_1 \cdot x_t + e_t \tag{1}$$

where:  $y_t$  represents the dependent variable  $x_t$  represents the independent variable  $a_o, a_1$  represents the regression parameters  $e_t$  represents the residual value

After collecting and synthesizing the statistical data referring to the sales receipts that the economic agent had during the period between 2014 and 2018, that is for a period that amounts to fifteen years, and the prices practiced by this company, I will calculate the annual quantities sold by reporting sales at prices charged by economic agents. These will be scored with M.

To simulate the dissemination of information about the products marketed by the economic agent in the market, I will introduce the alternative variable that we note with  $V_A$ . This will have zero value until 2011, the moment of implementation of the new strategy of attracting new customers and retaining the existing ones, followed by the value one for the period between 2012 and 2018, the period for conducting the online information dissemination campaign.

Thus, the linear one-factor regression model specific to the analysed case will be written:

$$M = C_1 + C_2 \cdot V_A + e \tag{2}$$

The econometric analysis of the presented economic phenomenon was done using the least squares method, using the E views economic analysis program, and the results are shown in figure 1:

#### Figure 1:

Sample: 2004 2018				
Included observations: 15				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	1036.500	100.2053	10.34376	0.0000
V <sub>A</sub>	1206.786	146.6856	8.227023	0.0000
R-squared	0.838877	Mean dependent var		1599.667
Adjusted R-squared	0.826483	S.D. dependent var		680.4015
S.E. of regression	283.4235	Akaike info criterion		14.25533
Sum squared resid	1044275.	Schwarz criterion		14.34973
Log likelihood	-104.9150	F-statistic		67.68390
Durbin-Watson stat	1.774582	Prob(F-statistic)		0.000002
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Data source: http://www.mfinante.ro/infocodfiscal.html

https://www.listafirme.ro/search.asp

Dependent Variable: M Method: Least Squares

According to the results presented in figure 1, in the case of the company analysed between 2004 and 2018, it is observed that F-statistic has the value 67.68 thus validating the model used.

If we analyse the model from the prism of the t-statistical test, we notice that the value for the alternative variable is 8.22, being higher than the

table = 2.131 which indicates an increase of the turnover of the distribution company when the cause changes. At the same time, the probability of error for the alternative variable is minimal.

The value of R-squared is 0.83, being close to the unit value.

The solution adopted by the administration of the distribution company analysed had the expected results, managing to attract new customers from the online area, customers who could not benefit only with the physical store. Thus, the sales proceeds registered significant increases due to the dissemination of information in the online environment about the products marketed and the services offered by the economic agent.

The information transmitted through the Internet broadcasting channel was received by consumers and as a result they came to the physical store, which offers the comet's logistical support of this type and made purchases, thus increasing the turnover of the economic agent.

Next, I propose to analyse how "viscous" the different business environments are and how close this feature is to the physical property of liquids called viscosity.

The "viscosity" of a business environment can be highlighted if we consider aspects such as the possibility of a new economic agent to access a certain market and also to resist as much as possible in that business environment. For this we have collected data on sales and prices from economic agents in two business environments.

One involves products with a lower market value, and the other involves products six times higher, although the products have the same physical volume and weight, which involves similar purchasing, storage and distribution logistics costs. In both cases, eighteen economic agents were analysed over a period of fourteen years.

Since the analysis involves two independent variables: sales revenue and prices, I will use the case of multiple or multifactorial linear regression.

The multiple or multifactorial linear regression model has the form:

$$y_t = a_0 + a_1 \cdot x_t + \dots + a_k \cdot x_{kt} + e_t$$
(3)  
where:  $y_t$  represents the dependent variable  
 $x_t, \dots, x_{kt}$  represents the independent variables  
 $a_o, \dots, a_k$  represents the regression parameters  
 $e_t$  represents the residual value

I will individualize the multiple regression model for the economic agents that market products with a lower market value and the relationship will have the following form:

 $N = C_0 + C_1 \cdot P + C_2 \cdot V + e$ 

The econometric analysis of the presented economic phenomenon was done using the least squares method, with the help of the E views economic analysis program, and the results are shown in figure 2:

Figure 2:

(4)

Dependent Variable: N Method: Least Squares Sample: 1 18 Included observations: 18				1 igure 2.
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	-7.003267	3.655334	-1.915904	0.0746
Р	0.024141	0.005418	4.455585	0.0005
V	4.98E-09	2.40E-09	2.073220	0.0558
R-squared	0.664915	Mean dependent var		9.888889
Adjusted R-squared	0.620238	S.D. dependent var		2.564208
S.É. of regression	1.580190	Akaike info criterion		3.903979
Sum squared resid	37.45500	Schwarz criterion		4.052374
Log likelihood	-32.13581	F-statistic		14.88241
Durbin-Watson stat	1.650809	Prob(F-statistic	;)	0.000275

Data source: http://www.mfinante.ro/infocodfiscal.html https://www.listafirme.ro/search.asp

According to the results presented in figure 2, it is observed that the F-statistic has the value 14.88 thus validating the econometric model used.

If we analyse the t-statistic test, we notice that the value registered for the price is 4.45, being higher than the table = 1.75, which indicates a strong influence of this variable. Also, the value of t-statistic related to sales is 2.07, being higher than expected, thus indicating the influence of the independent variable on the dependent one. At the same time, the probability of error in the case of the t-statistical test for the two variables is almost zero for prices and 5.58% for sales respectively.

The value of R-squared is 0.66 being closer to the unit value than to the zero value.

I am going to analyse the evolution of the economic phenomenon in the case of companies that market products with a high market value. And in this case the relation of the multiple regression model used is given by formula (4).

The econometric analysis of the presented economic phenomenon was done using the least squares method, with the help of the E views economic analysis program, and the results are shown in figure 3:

Figure 3

Dependent variable: N				
Sample: 1 18				
Included observations: 18				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	-23.04120	5.259970	-4.380482	0.0005
Р	0.010443	0.001646	6.344960	0.0000
V	4.44E-08	1.78E-08	2.499033	0.0246
R-squared	0.772758	Mean dependent var		10.94444
Adjusted R-squared	0.742459	S.D. dependent var		2.999455
S.É. of regression	1.522178	Akaike info crite	3.829173	
Sum squared resid	34.75539	Schwarz criterion		3.977569
Log likelihood	-31.46256	F-statistic		25.50448
Durbin-Watson stat	1.110185	Prob(F-statistic)		0.000015

Data source: http://www.mfinante.ro/infocodfiscal.html

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According to the results presented in figure 3, it is observed that the F-statistic has the value 25.50 thus validating the econometric model used.

If we analyse the t-statistic test, we observe for the value the value of 6.34 which is higher than tabulated = 1.75 and which indicates a stronger influence of this variable than in the previous case. Also, its t-statistic value for sales is 2.49, being higher than expected, thus indicating the influence of the independent variable on the dependent one.

At the same time, the probability of error in the case of the t-statistic test for the two variables is almost zero for prices and 2.46% respectively for sales.

The value of R-squared is 0.77 being closer to the unit value than to the zero value.

According to the results recorded in figures 2 and 3 we notice that there is a strong influence of the two indicators (the prices of promotion and sales of the products and those of the sales receipts that the economic agents had), on the possibility of accessing the market by a new economic agent and its possibility to last as long as possible in the respective business environment.

In both cases, the business environment has the same characteristic that we find in liquids that are less viscous when the temperature is higher and become more viscous when the temperature drops. This aspect is confirmed by the results recorded in figure 3, where we observe that both F-statistic and the coefficients of the variables have registered better values, which implies a higher permissiveness of the market characterized by more expensive products than the one that implies the sale of some products. In other words, we can say that as the business environment is hotter, the prices are higher and the turnover is high (similar to the liquid with a higher temperature), then the business environment becomes more permissive in what concerns the integration and development of a new economic agent.

# Conclusions

We find that in all the cases analysed in the present work the behaviors of the economic agents, whether it is the economic situation that involves the dissemination of information in the profile market, or that it is about accessing different business environments and the resistance of companies for a long period, they are similar to those of bodies in physics, in the case of molecular diffusion and that of their property of being more or less viscous.

In other words, we found that the normal movement of bodies in nature and their different behavior, depending on the environment in which they are, influences the entire spectrum of phenomena that occur due to a change of a factor, including economic phenomena.

It is interesting to look at the economic phenomenon from the perspective of the elements of nature and physics, given the similarities between them. Also, the behavior of economic agents in various business environments is analogous to the behavior of bodies that respect the laws of physics that have long been analysed and demonstrated. The support offered by these sciences is a consistent and valuable one for a statistical-econometric analysis of a certain economic phenomenon.

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