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STRUCTURE OF THE ECONOMY

This paper aims to clarify how the concept of the cycle of money reveals the structure and the dynamic of the economy. The estimations of the index of the cycle of money of Latvia, Serbia, Bulgaria, Greece, Thailand, and Ukraine are prior works of real case scenarios which compared with the global average index of the cycle of money. In the future will follow paradigms and from other countries. The calculations indicated that these countries comply at least with the average global value and the acceptable minimum rate of 0.2. The studying period of real case scenarios was from 2012 - 2017, which the EU and general Europe faced a strong economic crisis. The GDP does not reveal the structure of the economy, but the characteristics of the economy. But, the first derivative of GDP defines the structure and the dynamic of the economy. This paper uses a visual economy to identify the connection between the cycle of money and the index (general) of the cycle of money. This work reveals from the derivatives of GDP that the society is the same as the economy, so appropriate distribution and reuse of money inside an economy, defines the amelioration of that economy. In this sense, the economy is in the form of society.

Keywords: *mathematical structure, economy, society, GDP, the cycle of money, index of the cycle of money.*

Fig. 3. Tabl. 2. Form. 12. Lit. 25.

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СТРУКТУРА ГОСПОДАРСТВА

Ця стаття має на меті з'ясувати, як концепція кругообігу грошей розкриває структуру та динаміку економіки. Оцінки індексу грошового циклу Латвії, Сербії, Болгарії, Греції, Таїланду та України є попередніми роботами реальних сценаріїв, які порівнюються з глобальним середнім індексом грошового циклу. У майбутньому будуть слідувати парадигмам і з інших країн. Розрахунки показали, що ці країни відповідають принаймні середньому світовому значенню та прийнятному мінімальному показнику 0,2. Період вивчення реальних сценаріїв припадав на 2012-2017 роки, коли ЄС і Європа в цілому зіткнулися з сильною економічною кризою. ВВП розкриває не структуру економіки, а характеристики економіки. Але перша похідна ВВП визначає структуру та динаміку економіки. У цьому документі використовується візуальна економіка для виявлення зв'язку між кругообігом грошей та індексом (загальним) циклу грошей. Ця робота показує на основі похідних від ВВП, що суспільство таке ж, як і економіка, тому відповідний розподіл і повторне використання грошей всередині економіки визначає покращення цієї економіки. У цьому сенсі економіка виступає у формі суспільства.

Ключові слова: *математична структура, економіка, суспільство, ВВП, кругообіг грошей, показник кругообігу грошей.*

Introduction. This paper assesses the issue of the structure of the economy according to the theory of the cycle of money. To be able to analyze the structure of the economy should determine the behavior of the economy, applying the GDP to the form of its derivative. The analysis is twofold, as the GDP according to the theory of the cycle of money it is not closed, but contemporaneously is framed. As in

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mathematics frame of a set of numbers is not similar to the sense of a close-set of numbers, then a framed economy is an economy where the authorities apply a protective policy but simultaneously remain open to other economies. The sense is that GDP expresses the parameters of the economy but doesn't interpret the structure of the economy, unless it is used it is the first derivative, which reveals the structure of the economy. The theoretical background of the cycle of money indicates that the dynamic of an economy is formed on the concept of the number of times that money is used in an economic system. An economy should be considered not as a closed system, but as a system with fragments; in the way that analyzed aforementioned. An amount of money in many cases is getting out from an economy to external banks, or other economies. Then, the main concept is that the bigger enterprises and the international enterprises in most cases are saving their money to external banks and economic heavens. Thus, the tax authorities should imply an additional tax on these kinds of enterprises to diminish the losses to the economy. In addition, the smaller enterprises and the freelancers should be taxed with lower tax rates. In that way, it would be plausible to increase the dynamic of the economy. Also, the factories, the know-how services of big companies, the health care system, and the educational system comprise a special case for the economy, as belong to those cases where the taxes improve the quality of the economy. The factories and the big know-how companies increase the cycle of money, as they do not substitute the activities of the small-medium companies and the freelancers. The educational and health care systems improve the quality of the economy, making the whole economy better.

Therefrom, this paper well establishes how the theoretical background of the cycle of money, acts in the structure of the economy, defining the dynamic of any economy through the first derivative of the GDP. Actual case scenarios are from the paradigms of Latvia, Serbia, Bulgaria, Greece, Thailand, and Ukraine. The index of the cycle of money suggests how an economic system could react to a monetary crisis and examines the rate of how well-structured is a country's economy. The estimations from the cases of the prior countries reveal that social prosperity abides by the cycle of money.

Literature Review. Cases of Latvia, Serbia, Bulgaria, Greece, Thailand, and Ukraine presented the circumstances where a country's economy could react to an economic crisis, according to the index of the cycle of money. The mainstream is that the authorities should keep the taxes as low as is plausible, for the medium or small economic units (meaning any kind of economic unit e.g. freelancers), and companies(Kostynets, 2017; Kyseliov, 2017; Sadykov, 2017). The arm's length principle is the principle where the authorities apply the taxes to the international group of companies. ((ATO) et al., 2012; King, 2009; Lerner, 1936; Lindй & Pescatori, 2019; McKay, Nakamura, & Steinsson, 2016; Meyer & Rosenbaum, 2000; Mirman, 1971; OECD, 2015, 2017; Ossa, 2014; Ross, 2010; Zax, 1988).

The authorities using the arm's length principle, it is tough to identify the controlled transactions, as the international companies offer similar data with that of the uncontrolled transactions and they hide with a purpose to avoid paying taxes. Thus, the government should apply the fixed-length principle.

The Fixed-Length Principle indicates that the companies of controlled transactions manage transactions and achieve avoiding tax paying. Then, according to the

Fixed-Length Principle, international companies should pay plus a fixed amount of tax. Thus, the cycle of money is enhanced, because the larger companies generally send the money out from the society and the economy and save these amounts in international banks. Therefore, that money is lost from society, decreasing consumption (Soboleva I.V., 2019; Tydir N.I., 2019; Zayats O.I., 2019). Then, according to the fixed-length principle, the local companies which save their money in local banks should have lower tax rates (Constantinos Challoumis, 2020, 2021a, 2021e, 2021b, 2021c, 2021d). The last decision of 15 % minimum tax for the international companies complies with the Fixed Length Principle of the cycle of money; where last years suggested an additional standard tax to these companies as they don't reuse the money to country's economy, but they save money to tax heaves and international banks (Constantinos Challoumis, 2021f).

Methodology. According to works about the index of the cycle of money of Latvia, Serbia, Bulgaria, Greece, Thailand, and Ukraine: "The methodology applied for the current study is presented below, being in the same line with the presented theory. The calculations of the cycle of money are clarified by the following mathematical types:

$$c_y = c_m - c_\alpha \tag{1}$$

$$c_y = \frac{dx_m}{dm} - \frac{dx_m}{da} \tag{2}$$

$$i_{cy} = Y * b_d \tag{3}$$

$$g_{cy\ Country} = \frac{c_{y\ coyntry's}}{c_{y\ Average} + c_{y\ coyntry's}} \text{ or } \frac{i_{cy\ coyntry's}}{i_{cy\ Average} + i_{cy\ coyntry's}} \tag{4}$$

$$g_{cy\ Average} = \frac{c_{y\ Average}}{c_{y\ Average} + c_{y\ Average}} \text{ or } \frac{i_{cy\ Average}}{i_{cy\ Average} + i_{cy\ Average}} = 0.5 \tag{5}$$

The c_m is the velocity of financial liquidity, c_α is the velocity of escaped savings and c_y is the cycle of money. The i_{cy} is the index of the cycle of money, Y is the national income or GDP, and b_d is the bank or financial deposits, pending the case, of the country. Moreover, $g_{cy\ Country}$ symbolizes the general index of c_y of the country, $c_{y\ coyntry's}$ is the index of c_y of the country, and $c_{y\ Average}$ is the global index of c_y. Finally, $g_{cy\ Average}$ is the general global index of c_y, and is obtained as a global constant.

Therefore, the main hypothesis is to establish the connection between the index of the global average c_y, and the bank deposits and the GDP per capita, with an econometric approach. Then the initial hypothesis that the cycle of money in Ukraine is close to the global average index of the cycle of money is confirmed. The eq. (4) and (5) mean that an economy close to the value of 0.5 can face an economic crisis. Results close to this value represent an appropriate index of the cycle of money, revealing an adequate economic structure of the society and then the fine distribution of money between the citizens – consumers.

The proper hypothesis is to establish the connection between the index of the global average c_y, the bank deposits and the GDP per capita, with an econometric approach. Then is confirmed the initial hypothesis is that the cycle of money in the current country is above the global average index of the cycle of money. The eq. (4) and (5) mean that an economy close to the value of 0.5 can face immediately an economic crisis. Results close to this value represent an appropriate index of the cycle of money, revealing an adequate economic structure of the society and then the fine distribution of money between the citizens – consumers. Eq. (1) is the term for the cycle of money which used to define the $c_{y\ coyntry's}$ and $c_{y\ Average}$ of eq. (2).

The cycle of money to a quantity value is expressed by GDP, which is an expression of of $\frac{\partial(\text{GDP})}{\partial(\text{S+I+X})}$, according to $\frac{dx_m}{dm}$ and - $\frac{\partial(\text{GDP})}{\partial(\text{S}\prime+\text{I}\prime+\text{M})}$ hinged on $\frac{dx_m}{da}$.

Then,

$$c_y = d(GDP) = \frac{\partial(\text{GDP})}{\partial(\text{S+I+X})} d(\text{S} + \text{I} + \text{X}) - \frac{\partial(\text{GDP})}{\partial(\text{S}\prime+\text{I}\prime+\text{M})} d(\text{S}' + \text{I}' + \text{M}), \text{ or } c_y = \frac{dx_m}{dm} - \frac{dx_m}{da}. \quad (6)$$

"Then, S is the savings, I is the investments and X is the exports. Then, S', is about the savings which are oriented to banks out of the country's economy, I', is about the investments which oriented to banks out of the country's economy, and M are the imports. Therefore, the cycle of money expresses the GDP as the following one:

$$' = S_T + I_T + (X - M), or\ Y = (S - S') + (I - I') + (X - M) or\ Y = \Delta S + \Delta I + (X - M) \quad (7)$$

According to the theoretical background, for the lost money from the economies, the problem of controlled transactions could be administrated, if an organization could identify the money transitions between the economies, by a comparison of the global economies, by ΔS, ΔI, and (X-M).

Then,

$$c_{ytotal} = \sum_{i=1}^{n} \sum_{t=1}^{m} c_{yi,t} = \sum_{i=1}^{n} \sum_{t=1}^{m} [\frac{\partial(\text{GDP})}{\partial(\text{S+I+X})} d(\text{S} + \text{I} + \text{X}) - \frac{\partial(\text{GDP})}{\partial(\text{S}'+\text{I}'+\text{M})} d(\text{S}' + \text{I}' + \text{M})]_{i,t} \quad (8)$$

Because data from an organization for these activities don't exist follows the application of the index of the cycle of money. The cycle of money is an expression of the minus between the differential equations of the volume of money that is used in an economy and the volume of money that are lost from the economy. This is the reason why the theory of the cycle of money supports the higher tax of companies that make controlled transactions and the bigger companies because with that way the smaller companies are using an amount of money multiple times. An exemption is for the high technology companies and the factories, where their activities cannot substitute by smaller companies. The cycle of money expresses the money which is in an economy, and this is reflected in money that has the commercial banks, and extensively the central bank. Therefore, the relation of the country's GDP with the bank deposits allows determining the current amount of money in an economy. In pursuance of prior mathematical background, it is made an econometric analysis of the

country's index of the cycle of money, using the country's bank deposits per GDP, country's GDP per capita, and the global index of the cycle of money. Hence, using eq. (3) - (5), concluded the index of the cycle of money and the general index of the cycle of money, from the country's and global bank deposits, in combination with their GDP's per capita".

Then, c_m is the velocity of financial liquidity, as expresses the expansion or deceleration of trading volume within an economy. Thus, c_α is the velocity of escaped savings, expressing the volume of transactions that escape the economy. Finally, c_y is the cycle of money, expressing the difference between the rates of the volume of transactions in an economy and the volume of transactions that escape from an economy.

In the current work, through a virtual economy is established the relation between eq. (6), (7), and (8) with that of eq. (4), (5). The structure and the dynamic of the economy are defined by the general index of the cycle of money. The theme in this research is the dynamic and structure of the economy, and that it is something that is offered by the theory of the cycle of money.

Results - Structure of the economy. In the case of hypothetical virtual economy, applying the prior eq. (1) (8), is presented the further case:

$$c_y = (GDP)' = \frac{\partial(\text{GDP})}{\partial(\text{S+I+X})} d(\text{S} + \text{I} + \text{X}) - \frac{\partial(\text{GDP})}{\partial(\text{S}\prime+\text{I}\prime+\text{M})} d(\text{S}' + \text{I}' + \text{M}) \text{ or } c_y = \frac{dx_m}{dm} - \frac{dx_m}{da} = c_m - c_a$$

and

$$x_m = GDP = (\text{S-S'})+(\text{I-I'})+(\text{X-M}), \text{ where } m = S + I + X \text{ and } c_m = \frac{dx_m}{dm} \quad (9)$$

Thus, S', the supplement of S, is the saving that is lost from the economy, because this amount of money is saved outside the economy, to international bank destinations, or tax heavens. Moreover, I' is the supplement of I, which presents the investments those lose from an economy because international companies invest their money outside of the economy which makes their activities. With X to be the exports and M the imports.

In addition,

$$a = S' + I' + M, \text{ where } GDP = (\text{S-S'})+(\text{I-I'})+(\text{X-M}) \text{ and } c_\alpha = \frac{dx_m}{da} \quad (10)$$

Then, in the case of eq. (6), of the equation of the cycle of money, the derivative of GDP, follows a paradigm:

Table 1. **Virtual economy for eq. (6) of the cycle of money (amounts are in billion $),** *author's conclusion*

Period	S = C	I	X	m deriv.	S'	I'	M	α deriv.	Xm	Cm	Ca	Cy
2012	100	50	120	m	50	10	110	α	100	270	170	100
2013	200	100	130	m	100	20	120	α	190	430	240	190
2014	300	150	140	m	150	30	130	α	280	590	310	280
2015	400	200	150	m	200	40	140	α	370	750	380	370
2016	500	250	160	m	250	50	150	α	460	910	450	460
2017	600	300	170	m	300	60	160	α	550	970	520	550

The results are presented in the next graph:

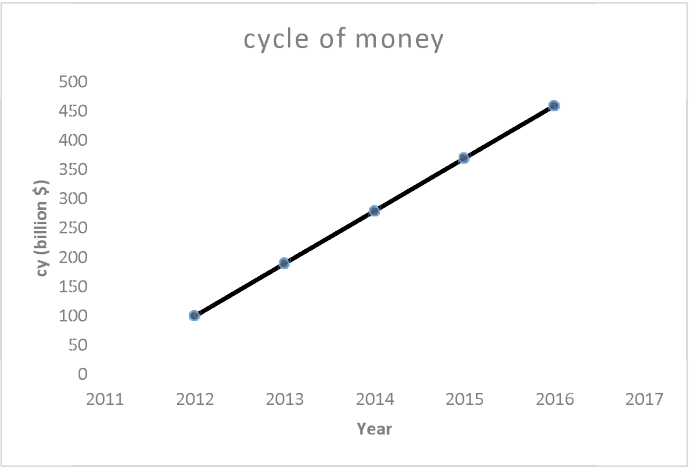

Figure 1. **The cycle of money (c_y)**

An economy that follows the cycle of money has better distribution and reuse of money. The same should happen with the indexes, to ensure that the theory is well established.

Then, applying the indexes of the cycle of money, meaning eq. (4), (5), should have similar behavior with the results of the prior table. Then,

$$i_{cy} = GDP * b_d, \text{ where } g_{cy\ Country} = \frac{i_{cy\ coyntry's}}{i_{cy\ Average}+i_{cy\ coyntry's}} \text{ and } g_{cy\ Average} = \frac{i_{cy\ Average}}{i_{cy\ Average}+i_{cy\ Average}} = 0.5, \text{ with } i_{cy\ Average} = \frac{\sum_{t=1}^{n} i_{cy\ coyntry's_\tau}}{\tau} \quad (11)$$

Thus, i_{cy} the index of the cycle of money and $g_{cy\ Country}$ is the general index of the cycle of money, with $g_{cy\ Average}$ is the general global average index of the cycle of money.

Table 2. **Virtual economy for eq. (4), (5) of the index of the cycle of money (amounts are in billion $) and the general index of the cycle of money,** *author's approach*

Period	GDP	Financial or bank deposits	i_{cy}	$g_{cy\ Country}$
2012	100	10	110	0.23404
2013	190	20	210	0.36842
2014	280	30	310	0.46269
2015	370	40	410	0.53247
2016	460	50	510	0.58621
2017	550	60	610	0.62887

Then, the index of the cycle of money:

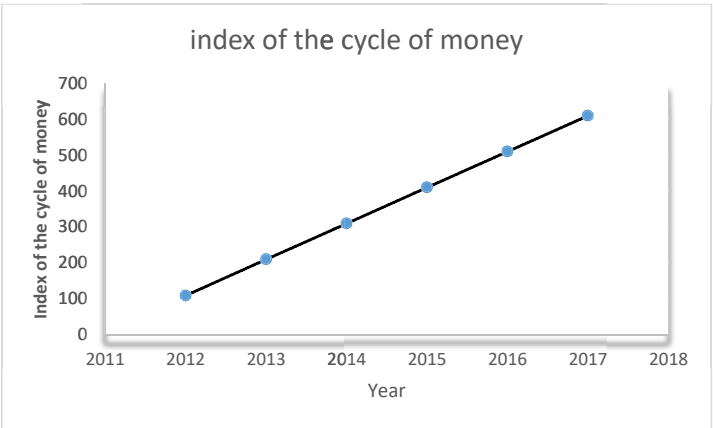

Figure 2. **Index of the cycle of money i_{cy})**

Noteworthy to clarify that the index of the cycle of money is identical with the cycle of money. The graph of the general index of the cycle of money is the following:

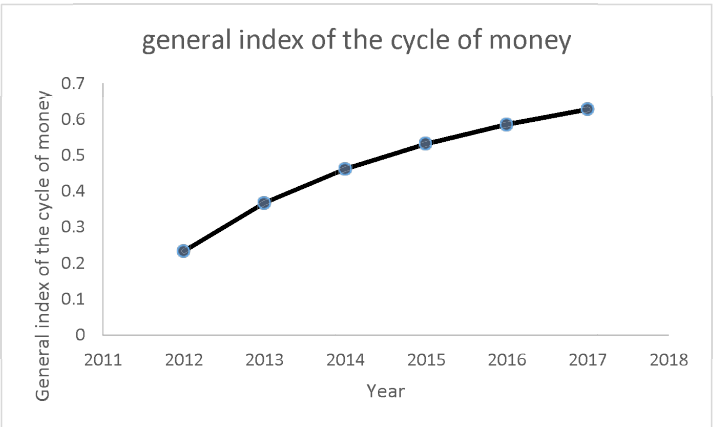

Figure 3. General index of the cycle of money ($g_{cy\ Country}$)

The general index of the cycle of money is approximately the same as the cycle of money. To stabilize the weak deviation of the general index of the cycle of money from the cycle of money should happen the following adjustment:

$$(i_{cy})_b = (GDP * b_d)^b, \text{for } -2 < b < 2 \quad (12)$$

In real case scenarios (countries), are used only the indexes, because the cycle of money plausibly could not be applied, because of lack of data and complexity. Then, pending the case, a fix could be made to any weak deviation of the cycle of money

from the general index of the cycle of money, by fixing the slope. This is plausible because the cycle of money and the index of the cycle of money have the same slope. Then, an adjustment of the general index of the cycle of money could happen by coefficient b, abiding by the index of the cycle. In that way, the cycle of money and the general index of the cycle of money will be identical (same slope).

Therefore, the indexes of the cycle of money comply with the cycle of money, confirming that the increase of the distribution and reuse of money increases the GDP (and accordingly the opposite one). Thus, the structure of the economy is revealed through the way that money is distributed and reused in an economy. So, the fixed-length principle is crucial for the amelioration in an economy, showing that the bigger companies should not substitute the activities of the smaller ones. The high capital companies should invest in factories and high technological units. Authorities should imply higher Should be mentioned one more time that the last decision of 15 % minimum tax for the international companies complies with the Fixed Length Principle of the cycle of money; where last years suggested an additional standard tax to these companies as they don't reuse the money to country's economy, but they save money to tax heaves and international banks.

Conclusions. The current calculations reveal that if a country's economic system belongs to the upper level of the cycle of money, then there has an upper dynamic. The structure of the economy may be boosted, with decreased taxes to the small and medium companies, and an increase of taxes to the bigger companies. The bigger companies have to provide economic activities that smaller businesses can't support, then the authorities ought to imply low taxes to know-how companies and factories. Thus, big companies must no longer replace smaller companies' activities. The investments of a country are forced by the increase in the distribution of money. A country with a well-based economic system is a country with a good cycle of money and therefore it can face an economic crisis. The branches of international banks if are included in the system of the economy are considered as part of this economy, then as international banks are considered the banks which keep the money outside the economic system of each economy (meaning especially banks of tax heavens or international banks which keep money out of the economies as part of black money and huge amounts of money that will not return to the countries' economies). Additionally, if a country has a low rate of bank deposits per GDP, but comply with the theory of the cycle of money, then it is obvious that there is a problem with black money. The black money increases the cycle of money as in some way is reused to the economy but decreases the cycle of money if is deposited outside the economy. Thus, black money belongs to a grey area, for the economy. The index of the cycle of money could indicate that an economy has black money. In addition, the tax policy if it is not able to identify the bigger companies from the smaller companies, means that has a bureaucratic problem, as these identifications should be directly visible by government's data.

The paper proves that the indexes of the cycle of money can be used instead of the cycle of money, allowing quick and accurate results. The cycle of money supports the free competition and the tax policy of the Fixed Length Principle between the economies. The applied economic policy that should be followed by authorities is that companies with big capital should invest in factories and companies of high techno-

logical products, and not substitute products and services that can offer smaller companies. Small and medium enterprises develop the private sector making wider the tax bureau and minimizing with that way the taxes.

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