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Open source currency and balanced credit size

K e y w o r d s: credit size, money creation, labour productivity

S u m m a r y: What is the adequate size of credit for a given economy? What variables are essential in order to solve this problem? A solution of this task points to variables: the volume of compensations, the real labour productivity ratio, and the percentage of pays changed into bank deposits. These three categories determine the maximum value of credit, and this size does not boost inflation. However, compensations should be in accord with the amount of employees—the human capital. Considerations and computations presented here are in tune with perceiving capital as an abstract category of the capacity of doing work, and money as work receivables as discussed in the earlier papers. Considering the triad: capital—labour—money is the key for finding the solution of the agenda. In addition, the accurate concept of capital leads to an innovative interpretation of the economic matters. In the paper the solution of the problem is introduced as a part of theoretical clarification of the open source currency economic system.

1. The open source currency agenda

According to the idea presented in the earlier papers (Dobija, 2007; 2008; 2009b) money arises as the accounting record of the accomplished work. It is the process of labour which creates money, and productive labour makes wealth. In the last years many papers have discussed the problem of *open source currency.* One recognised author is Douglas Rushkoff (2008, p. 244) who has written articles about open source currency. We read: "(...) Open source or, in more common parlance, 'complementary' currencies are collaboratively established units representing hours of labour that can be traded for goods or services in lieu of centralised currency. The advantage is that while the value of centralised currency is based on its scarcity, the bias of complementary or local currencies is towards their abun-

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dance. So instead of having to involve the Fed in every transaction—and using money that requires being paid back with interest—we can invent our own currencies and create value with our labour …"

The most recognised author is Bernard Lietaer (2001) who wrote the significant book *The Future of money: Beyond greed and scarcity*. He promotes the idea of complementary currency as a source of benefits for communities. This author admits existence of a national currency together with a complementary one. It is a progress but not sufficient, since creating money is a process that acts against the fundamental laws of reality. The author sees the worsening of economic matters and so he states: "Specifically in Europe, the traditional ways to handle unemployment are increasingly failing. In areas with high unemployment, people have already demonstrated that living conditions can be significantly improved by creating their own complementary currencies instead of just relying on welfare. Surprisingly, it is in fact not the first time that such solutions have been successfully implemented in the Modern world. During the 1930's many thousands of such initiatives were operational in the US, Canada, Western Europe and other areas affected by the Depression. Complementary currencies could become a key tool to buffer a region from the shocks caused by failures and crises in the official money system. Finally, this approach is a win/win for both locally owned businesses and society at large."

Another author, Thomas Greco, writes books about future money titled: *Money: Understanding and creating alternatives to legal tender* (Greco, 2001) and *The end of money and the future of civilisation*. His books show ways of monetary liberation, empowering communities and building economies that are insulated from the financial crises. He shows how an individual and a community could liberate themselves from the centralised and politicised money power.

Then, Ellen Hodgson Brown (2007) is the author who reveals the shocking truth about contemporary money systems. She claims that in the USA "… the creation of money has been 'privatised' or taken over by a private money cartel. All money are created as loans advanced by private banking institutions. Banks create the principal but not the interest to service their loans. To find the interest, new loan must continually be taken out, expanding the money supply, inflating prices—and robbing you of the value of your money … ."

The statement that a correct idea of money as work receivable and its theoretical clarification appear gradually in economic thoughts is not untrue. Nowadays the idea of money formed by work is being reborn. Truly speaking, the idea that money arises as a result of labour is as old as human civilisation. The earliest idea of money created by labour and measured in adequate labour units was applied millennia ago in the ancient cities-states. Vasilii Vasilevich Struve (1969) provides an explanation of the measurement and labour registration practices in the Sumerian economy. He argues that the analysed accounting documents show that workforce was measured in time units (on a daily basis) and productivity ratios. According to Struve (p. 152), fractions

smaller than one, e.g. 5/6, 2/3, 1/2, were applied to the measurement of working time. This led to the establishment of a common calculation unit, and in this way the main function of money was created.

The idea of money related to work is earlier than clay tablets with records of work done. It was the central idea of token accounting discovered by Denis Schmandt-Besserat (1988). As his research (2007) shows the tokens having the shape of a tetrahedron (Figure 1) stood for money units in the earliest economic system of labour accounting.

Figure 1. Plain tokens, Mesopotamia, present day Iraq, ca 4000 BC. The cone, spheres and disk represented various grain measures; the tetrahedron stood for a unit of labour. Courtesy Denise Schmandt-Besserat, The University of Texas at Austin

According to Karl Polanyi (1957, p. 21), the state authorities kept accounts of equities and liabilities of each individual. The work of every citizen was precisely recorded and one was entitled to take as many goods from the temple's storage as his or her amount recorded in an account allowed for. In this way, public authorities could guarantee that everyone in the state would spend no more than what he or she had earned. Tangible money represented by coins was not necessary thanks to the existing system of overwhelming accounting. The Sumerian economy enjoyed the situation of zero inflation because the whole supply of intellectually perceived money was equal to the sum of receivables for work of all citizens. The value of goods was based on the value of work needed to produce them. Metals, like gold or silver, served merely to facilitate calculations and exchanges.

Douglas Rushkoff (2008) comes back to the Middle Ages and writes: "… Throughout most of history, complementary currencies existed alongside centralised currency. While local currency was used for labour and local transactions, centralised currencies were used for long distance and foreign trade. Local currencies were based on a model of abundance—there was so much of it that people constantly invested it. That's why we saw so many cathedrals being built in the late middle ages, and unparallelled levels of investment in infrastructure and maintenance. Centralised currency, on the other hand, needed to retain value over long distances and periods of time, so it was based on precious and scarce resources, such as gold.

The problem started during the Renaissance: as kings attempted to centralise their power, most local currencies were outlawed. This new monopoly on currency reduced entire economies into scarcity engines, encouraging competition over collaboration, protectionism over sharing, and fixed commodities over renewable resources. Today, money is lent into existence by the Fed or another central bank—and paid back with interest … ."

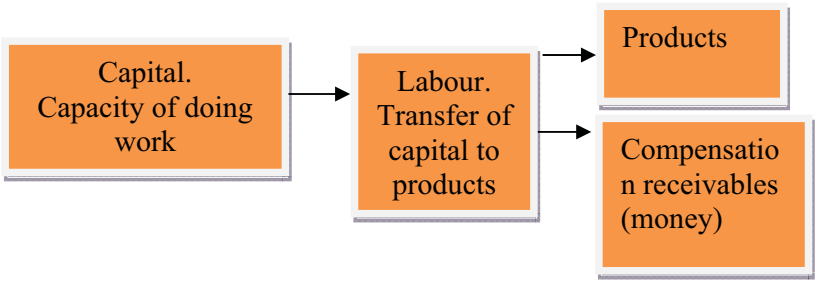
A contemporary follower of the Austrian School Roger W. Garrison (2001, p. 7) underlines the fact that money is a problem: "… Unavoidably, however, the medium of exchange is also the medium through which difficulties in any sector of the economy—or difficulties with money itself—get transmitted to all other sector. Further, the provision of money even in the most decentralised economies is—not to say must be—the business of a central authority. … Money comes into play both as a source of difficulties and as vehicle for transmitting those difficulties throughout the economy … ."

Where, then, is the mistake? The core error that so badly influences macroeconomics and economy in general? The answer is introduced in a recent paper (Dobija, 2010). It is lack of respect to the fundamental law of reality. Economics is not sufficiently concerned with the fundamental laws but one of them is critical. Energy does not arise from nothing. Not everybody is able to create energy, but only the Creator. Monetarism, instead, admits that Central Banks should produce money and transfer it to economy. Capital being the ability of doing work can be transferred merely by labour. This is the process of labour where money can correctly flow to economy. The above-mentioned law is fundamental. Nobody can break it. Therefore Central Banks produce inflation and crises.

2. The framework of economy with correct concept of money

The key concept which was not sufficiently elaborated in economics is the process of labour. It is essential to recognise that the labour process creates two economic categories; *products* (where capital transferred by labour is concentrated) and *work receivables* as it is illustrated on Scheme 1. The last category is our money and it is exchanged for goods. The abstract and accounting nature of money as work receivables is the essence of the money—goods, economy and correct economic thought. Therefore it is the labour process, which creates our money and balanced economy, not the central bank activities. This institution and its main product: cash, is the reason for poor effects of the contemporary economies and societies. Unemployment, poverty, inflation, weak markets, crises are to some extent the results of the central bank activities and the existence of such an artefact as cash. Money in the correct approach is a part of the triad of capital, labour and money, where capital is an ability to do work, labour is transfer of the capital to product, and money is the equivalent of labour value recorded as work receivables. Understanding of this triad opens way for

a very advantageous economic reform. Decreasing unemployment, decreasing taxes, and decreasing of the budget deficits are the three main benefits. We can gain it since labour is self-financing by definition. The framework of the reform has been introduced in the papers by Mieczysław Dobija (2005; 2007; 2010).



Scheme 1. Triad: Capital—Labour—Money

Capital is perceived as an abstract category of the capacity to perform work, instead value is a concentration of capital in products and objects. The value is measured in numerous approaches: market value, cost value, present value, realisation value, etc. Labour is a transfer of capital to products. Scheme 1 shows an extremely important agenda, that the labour process creates two streams; the first is a stream of products, and the second stream is full of abstract work receivables, that is to say: money. It is a fact, regardless of how contradictory to theories and activities of the central banks.

Correct understanding of the triad capital—labour—money leads to the economic thought consistent with the fundamental laws of Nature. It can be depicted by a set of statements formulated by M. Dobija (2009b; 2010) which form a new approach to economics. This new, consistent, corresponding approach is portrayed as follows.

1. Capital means an abstract capability of doing work and this category is in the economic world as energy in physics.
2. Our reality is subdued to the fundamental laws as: energy conservation, law of capital diffusion, law of the least action, among others.
3. An average yearly growth of capital is limited by the physic-like economic constant of the potential growth $p = 0.08$ [1/year]. This constant manifests Nature. It expresses the natural potential of growth, which can be changed into real one provided with wise labour and management.
4. The above mentioned constant manifests itself in many economic domains, as stock exchanges, average value of the ROA, human capital and fair wages computation, among others. It is differently called in research, as: the risk premium, the equity premium, the natural interest rate, the average yearly return. Let us remind that Physiocrats referred to the potential of Nature as a source of value.

5. Central Banks act against the first fundamental laws as if capital could arise from nothing. It is wrongdoing being responsible for economists and politicians. The present system can be conducted in a better or worse way but it is principally incorrect.
6. Money can only correctly arise as records of work done, that is to say the work receivable. Money is an abstract category.
7. Labour is always self-financing, since it is a transfer of the human capital and the capital embodied in the assets into the products.
8. Therefore labour accomplished in the public sector does not need tax funds and well organised economy is free from budget deficit. Fair pays are free from taxation as well.
9. The main function of the reformed Central Bank is an accomplishing transfer of pays for the public sector employees. This activity is a part of the correct process of 'money creation'.
10. Cash does not exist anymore nor any material artefact called money.
11. The size of the total pays in the public sector is limited by labour productivity ratio Q = real GDP/total cost of labour. The Q is currently close to 3.5 for the USA.
12. The sum of salaries that can be paid out in a year t in the public sector is determined by the natural mathematical formula as follows: ($Q_p \geq Q_{t\text{-}1}$; Q denotes labour productivity, W denotes compensations, $GDPR$ denotes real GDP, p denotes budgeted year).

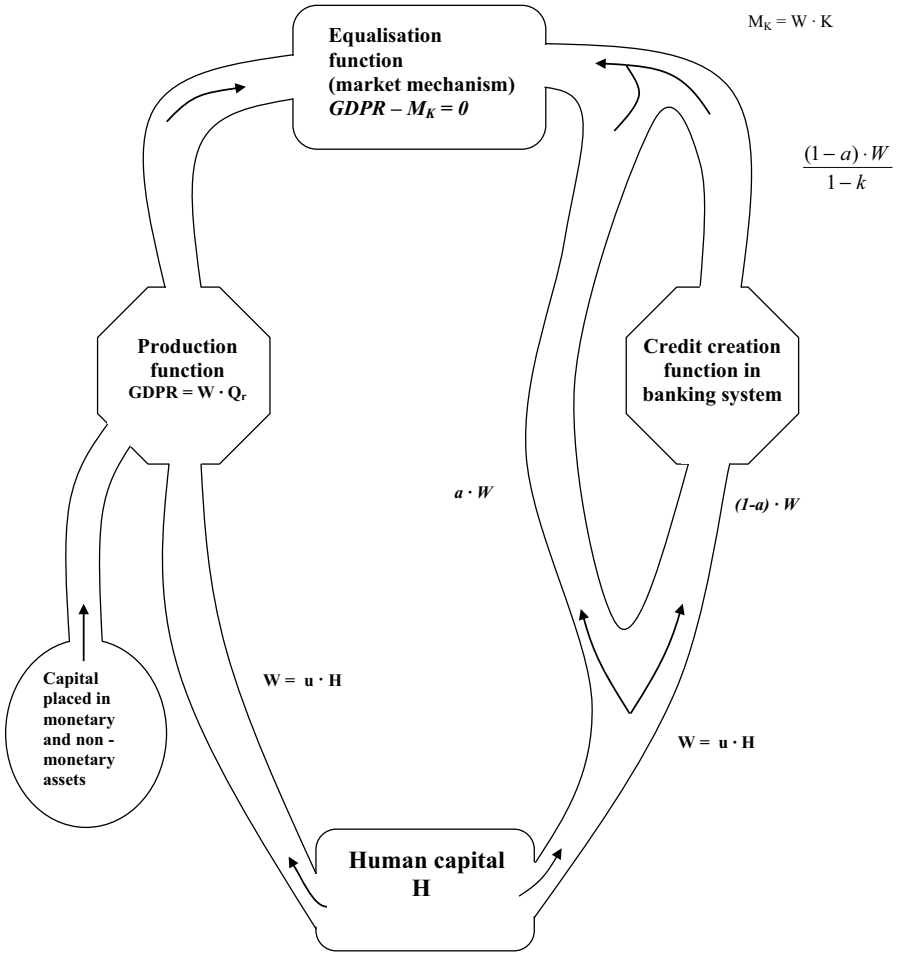
$$W_{public} = \frac{GDPR_p}{Q_p} - W_{private}$$

When the Central Bank transfers pays for work done by employees' in the public sector then it is only the corroboration of accomplished labour, that is to say a human capital transfer. It is not creating money from anything. Commercial banks conduct their credit actions to the extent determined by amounts of deposits. The great benefits of the new approach is deficit less economy, since labour accomplished in the public sector is self-financing. The second advantage is releasing fair pays from tax, which will shape the right demand. In peaceful conditions the way to the tax less economy is open.

3. Flow Model of Money–Goods Economy

To solve the problem of the balanced size of credit we use flow models of the money—goods economy, as described in the paper by Martyna Śliwa and Mieczysław Dobija (2001). Having understood economy as a constant flow of capital localised in

natural, human, intellectual, institutional and physical resources, we attain the most essential description showing the dual nature of the money—goods economy. The essence of money-goods economy is the existence of two streams: the stream of products and the stream of money that is to say wage/salary receivables. The only source of these two streams is labour of human capital that is to say a transfer of human capital to products. Therefore the stream of products arises as a result of a composition of labour costs and of various assets, while the essence of the other stream is work receivables. The second stream is created by a sequence of accounting entries made in respect of compensation receivables and payables transferred into employees' bank accounts. Compensation receivable is employee's money.



Scheme 2.
Market mechanism equalises the stream of products and the stream of money

S o u r c e: Dobija, Śliwa, 2001.

Constant confrontation takes place in the market, between the products composed of different layouts, and the stream of money; and, as a consequence of this confrontation, the value of exchange is determined. This exchange leads to the equation of exchange of money for goods and vice versa. In the process of exchanging goods and money, the basic economic variables and their values are shaped. These variables characterise economy in general; particularly: the Gross Domestic Product, the labour productivity ratio, and the level of inflation. The measurement of these values is based on the performance principle; therefore, it is done in the market value. When we consider the stream of products and the stream of pay receivables, we can talk about the dynamic balance of the goods and the money, in which the above variables are revealed as a result of a given market configuration and the goods—money exchange. The exchange process is illustrated in Scheme 2, which in turn enables the formulation of the equation of exchange. The bottom of Scheme 2 shows that it is an employee (human capital) who sets into motion the labour process. This individual includes some amount of capital denoted by letter *H*, which can be precisely measured in economic terms and the product *uH*, determines pay (*W*).

The left side of the scheme shows the process of producing goods and services. Labour costs (*W*) composed of various sorts of assets make the final products (GDP) measured in historical costs before confronting money claims of payable holders. The relevance of the amount of labour used in a particular instance to the market accepted one is tested in the marketplace. The process of production is modelled by the relevant production function, which can also serve as a determinant of the wage productivity ratio *Q*.

The right side of the scheme shows not material streams but the stream of records arising as a results of pay receivables if considered from employees' point of view, or pay liabilities when considered from the employer's point of view. This is the responsibility of the state, not only of the banking system that exchange of money for products runs smoothly according to the expectations of money holders. The role of the banking system is creation of credit money in a way adequate to economy requirements. We shall see later that that process should depend chiefly on real wage productivity. It depends to some extent on parameter (*a*) which says what percentage of wages is not included in bank deposits serving as the base for credit action. Therefore parameter (*a*) points to the society attitudes (propensity for savings) and after all the degree of surplus.

The upper box shows the constantly accomplished exchanges: money for products and vice versa. This is the essence of monetary economy that the records of wage receivables are exchanged for goods. Despite the fact that these receivables change the owner and play the role of the most required assets for them, they still remain liabilities of the state system. This process can be roughly described by the equation of exchange. Obviously, the more money in respect of bulk of goods, the higher prices, and higher inflation rate. However, the fact that *pay should be in ac-*

cord with value of labour is the only correct conclusion stemming from the above considerations. The value of labour depends on the human capital of an employee and accessible assets. This constant confrontation leads to formulation of the Wage Equation of Exchange.

The Wage Equation of Exchange

Scheme 2 leads to formulation of the equation of exchange which presents relations between the integrated stream of products and the integrated stream of money. Assuming that the market mechanism does equalise value of streams of money and products, the following equation can be written and called 'the wage equation':

$$GDP = GDPR \cdot (1 + i) = W \cdot Q = M_K = W \cdot K$$

where
GDPR denotes real GDP, *i* denotes inflation, *W* denotes compensation stream, *Q* = GDP/W, *K* is credit money factor.

Directly from the equation of exchange stems the following condition:

$$GDP/GDPR = 1 + i = Q/Q_r, \qquad Q_r = Q/(1 + i)$$

where

Q_r denotes real wage productivity.

According to the above formula, in the situation of zero inflation, the nominal labour productivity equals the real productivity. In other words, all processes are managed in such a way that a raise in wages always stems from the growth of labour productivity. In addition, creation of credit money is limited by the real productivity of labour. The concept of inflation understood as a relationship between the nominal and the real labour productivity describes the degree of chaos in a given economy, and this chaos will not be remedied by a contemporary monetary policy. Appropriate management systems assuring consistency of value of labour with compensation are necessary in all organisational units of the private and the public sector.

The Monetarist Equation of Exchange

The well-known monetarist equation of exchange highly appreciated by Milton Friedman (Lüchinger, 2007, p. 144) is as follows:

$$GDP = GDPR \cdot (1 + i) = M \cdot V$$

Thus M is money amount and V is circulation of money velocity. Letter (i) denotes the rate of inflation; *GDP* and *GDPR* denote the nominal and real general domestic product. The commonly known variable M is the principal amount of money (Duwendag et al., 1993; Galbraith, 1982), circulating with velocity V. It is, in our opinion, the main disturbance of disclosing the true nature of money and money—goods economy. Money does not circulate and the principal amount of money does not exist as an essential creative idea. Money arises as an accounting entry as we will prove later. Coins and coined money are the very source of such inadequate concepts. It leads to confusion because money is immaterial. Using the above equation as the tool of a monetary policy of decreasing inflation is the main cause of disturbing economy.

4. Stream of products. Production function

Managers strive for the best combination and orchestration of production factors. Economists describe this task with the production function as an abstract way of discussing how a given company or economy obtains the output from its inputs. The production function relates the output of an enterprise to the amount of inputs, typically capital and labour. It describes, in mathematical terms, the technology available to the enterprise. It is important to keep in mind that the production function describes technology, not economic behaviour. A firm may maximise its profits given its production function but generally it takes the production function as a given element of that problem.

Philip Wicksteed (1894) first proposed the *production function* for an item (y) in the general form: $y = F(x_1, x_2, ..., x_m)$, which relates a single output y to a series of factors of production $x_1, x_2, ..., x_m$. This idea of production function is developed here, not an econometric model. This approach, presented among others in the paper (Dobija, 2009a), involves variables measurable in accounting systems. From the point of view of the costing system product (P), either less or more intellectual in character, produced by companies, is the product of costs (C) and cost profitability ratio r.

$$P = C \cdot (1+r)$$

Taking into account the fact that costs C are the sum of the cost of labour W and other costs one can attain the formula introducing $P = W \cdot Q$ where Q is a function of the six variables as described in the paper (Dobija, 2009a). The labour costs are determined by the product $W = u \cdot H$. This cost represents transfers of the human capital (H) to product P. In addition $u = p + v$, where p is a constant of the potential growth (p = 8%) as discussed in the paper (Dobija, 2009b), and v—is the percent of a premium pay in relation to the human capital H. The constant p determines fair constant pays. Thus u is limited, since p is limited and v is also limited by the return on assets

ratio. Thus a product arises from labour leveraged by factor of wage productivity Q so that $GDP = W \cdot Q$. The Q can also be perceived by formula $Q = e^{FT}$, where F—reflects the level of management, and T reflects the technical equipment of the labour.

Taking into account the above formulas, and applying the natural approach based on the cost accounting, we arrive at a production function with seven specified arguments. As a result, the structure of arguments specifies all significant variables, and the basic analytical formula of the function does not require an estimation of parameters. The production function expressed analytically may be a tool of economic analysis using differential calculus; or it may provide numerous non-linear models describing behaviour of a selected variable. The cost value of production in historical prices of outlays may be expressed as follows:

$$\text{Cost of output} = (W + M - R) = (W + z \cdot A - s \cdot A)$$

where: W denotes costs of labour, A—assets as valued in the balance sheets, M—costs resulting from the use and depreciation of assets, R—natural loss of assets in production processes. Denoting $M/A = z$ and $R/A = s$, we determine value of the product manufactured P, expressed in market prices, as follows:

$$P = (W + z \cdot A - s \cdot A)\,(1 + r)\,(1 + I)$$

where: P value of products in real market prices, z—index of annual assets' turnover in respect of none compensation costs, s—ratio of losses on the assets in the production processes, r—average increase of outlays historical prices to market prices, I—additional increase over average increase of market value as a result of intellectual capital presence in a company and an economy.

After rearranging, the value of production P is determined as follows:

$$P = W \cdot [1 + A/W \cdot (z - s)]\,(1 + r)\,(1 + I)$$

As the variable W is related to human capital, we apply $W = u \cdot H$, where: u is the rate of remuneration of human capital (pay off) and H is the total value of human capital of all employees; thus when we replace the equivalents we arrive at the formula:

$$P = W \cdot [1 + A/H \cdot (z - s)/u\,]\,(1 + r)\,(1 + I)$$

Components of sums follow one approximate zero, therefore when we apply the approximation of: $1 + x \approx e^x$, we may express the production function as the following formula:

$$P = W\, e^{r+I}\,[1 + A/H \cdot [(z - s)/u]\,] = W \cdot Q$$

where Q is labour productivity. Thus work productivity is a dimensionless variable (multiplier) and as a function of several variables, it can be written as follows:

$$Q = \frac{GDP}{W} = e^{r+I}[1 + \frac{A}{H} \cdot \frac{z - s}{u}]$$

Q therefore depends upon the capacity to generate market value ($r + I$), technical equipment for the work (A/H), assets rotation (z), cost of risk ratio (s) and the degree of remuneration for labour (u). Additionally the sales profitability r is the function of the ROA/w, where w—is index of annual assets' turnover towards the total costs.

Then variable Q is the labour productivity ratio understood as a multiplier of labour costs, which generates the production volume and Q represents value of production per one dollar of disposable compensations. There is, therefore, a functional relationship that expresses non-linear relations between the structure of variables and production as expressed in market prices. A rise of productivity ratio Q means an increase in the society's wealth. A decline of the Q means after all a growth in inflation. Nowadays that index is usually higher than one, and for example, in the USA it approximates 3.50. What is more, as commonly known, the real productivity ratio Q is a significant element of the exchange rate theory (Dobija, 2008).

The percentage of pay adequacy expresses the degree of basic pay fairness. According to the human capital theory as discussed in the earlier papers (Dobija, 2001; Cieślak, Dobija, 2007) and others, human capital of employee's is preserved if the present value of the future stream of pays is equal to the employee's capital. This rule holds when the basic pay is determined as 8% of the employee's capital. The research done shows that Western capitalist countries entirely apply this rule when establishing the legal minimum wages. The last one is a benchmark for basic pay for others. This is not a case in for example Eastern European countries. The Ukrainian basic pay is only 52% of that resulting from the human capital calculation. Consequently, the Polish and Ukrainian workers seek employment abroad, usually in the Western countries, where they enjoy fair pay, and these countries gain progress in their labour productivity.

Denominator of ratio Q is the sum of employees' disposable earnings. This means that the size of compensations has an essential impact on labour productivity. In order to make a fair comparison of countries labour productivity the level of remuneration should be examined. The shape of production function points out that an optimal pay level exists, because the compensation payoff ratio (u) appears both in the nominator and denominator.

$$P = u \cdot H\, e^{r+I}[1 + A/H \cdot [(z - s)/u]\ ]$$

This means that ratio u is limited to a determined value. In fact, it is known that the bottom limit of payoff ratio u is 8% of the employee's human capital. The eight

percent determines the basic right pay but some premiums can increase it. A research carried out in Poland points out that a typical payoff ratio (u) is approximately 10% on average in a prospering company. The eight percents determines the basic pay and 2%, which makes 25% in respect of the basic pay, indicates an average size of premium.

The stream model of the money—goods economy also involves products which do not partake directly in the goods-for-money market exchange, which are however generated as a result of work, and therefore, according to the production function. These are public goods such as the safety of citizens, i.e. work of the police and the soldiers, education of children and youths, and so on. The denominator of the $Q = GDP/W$ is the sum of compensations paid both in the private sector and the public sector.

5. Credit money creation function

On the right side of the scheme there is a stream of money that flows into the market. Both streams (products and money) confront each other on the market (exchange of money for products). During the confrontation the size of an inflation or deflation variable is disclosed. The money stream can also be quantified as a function of wages (W). Wages paid to employees split into two lesser streams. The first stream has measure $a \cdot W$, ($0 < a < 1$), and tends directly on the market without the banking system. This means that the exchanges are done immediately. Parameter (a) arrives at this part of wages that are exchanged for products directly, without becoming a bank deposit that is able for a credit action. The parameter can be interpreted as a welfare or poverty level and saving propensity. The second part of the original stream of wages $(1 - a) \cdot W$ feeds firstly the banking system and allows a credit action. Then amplified in the banking system (credit money creation) it flies into the market linking earlier with the first sub-stream. A part of this stream (which is not disclosed on the scheme) is not used by the banking system as the basis for credit creation because of the mandatory reserve system and the requirements of current account conditions. We omit reserves in the present considerations so that the formula is as follows:

$$M_K = a \cdot W + \frac{(1-a) \cdot W}{1-k}$$

where k denotes a parameter of credit money creation in the banking system. The total stream of money is therefore equal to:

$$M_K = W \cdot K = W \frac{a \cdot (1-k) + (1-a)}{1-k}$$

The problem of determining the right value of credit money creation for parameter k (that minimises the level of inflation) can be solved by use of a fragment of the equation of exchange as follows:

$$GDPR \cdot (1 + i) = W \cdot K$$

Solving variable (i) we obtain the formula:

$$i = \frac{K}{Q_r} - 1$$

where $Q_r = GDPR/W$ is the real wage productivity.

Assuming the condition $i = 0 \Rightarrow K = Q_r$ we can find the value of the parameter k that minimises the inflation level. Using the equation:

$$a + \frac{(1-a)}{1-k} = Q_r$$

we obtain the equation:

$$1 - k = \frac{(1-a)}{Q_r - a}$$

Thus the wage multiplier (Scheme 2) is equal to:

$$\frac{1-a}{1-k} = \frac{(Q_r - a)(1-a)}{(1-a)} = (Q_r - a)$$

The ultimate opinion is that the stream going through the banking system can be increased to a level $W \cdot (Q_r - a)$ or in the rearranged form $GDP(1 - a/Q_r)$. The size of the credit depends on the wage level (W), welfare level (a) and productivity level as well. To compute the credit size C for a year the following formula is a convenient tool:

$$C = GDP(1 - \frac{a+b}{Q_r})$$

where b denotes the percentage of the mandatory reserves.

To keep control over the money supply should only mean adequate compensation systems as well as a precise feasibility study in respect of investment projects that involve debt financing in particular. Wages should be derived on a basis of the human capital value as discussed by Dobija (2001), and Cieślak, Dobija (2007). To pay less than 8% the economic constant applied to the human capital of an em-

ployee is a sin against an individual but overpaying is a sin against the society (inflation and depreciation of wage receivables) is a clear conclusion of the consideration.

5.1. Illustrative computation. Case of Poland

The research presented in the paper (Dobija, 2009b) include a table of the Q computed for a group of states. In case of Poland the ratio Q for year 2008 is 1.836. An estimation of the parameter (a) requires a separate research so here only a rough estimation is presented. The level of mandatory reserves, which eliminate deposits from the basis of the credit, can increase value of the parameter (a) as well. Estimating the size of this parameter as $a = 0.8$ (more than half of population in Poland cannot afford savings) one can estimate the size of the credit, which does not cause exposure to inflation.

Computations are as follows: $Q_{2008} = 1.836$, therefore $W_{2008} = GDPR/Q =$ (1 253 560 mln PLN) / 1.836 = 682 767 mln PLN. Thus the upper limit of the credit for 2008; $W \cdot (Q_r - a)$ = 682 767 mln PLN · (1,836 – 0.8) = 707 347 mln PLN. A report of Polish Statistic Office have issued information (date 2009-01-21) about the level of credit in Poland. The amount of credit on this date was 611 billion. Apparently, the reserves and solvency requirements did not allow a credit.

The data for 2009 show that in Poland an average ratio of credits to deposits is more than 112%, so $k \geq 0{,}11$. Therefore one can estimate an adequate level of credit taking into regard the labour productivity level. Assuming for 2010: real $Q = 1.9$, one can write the equation $Q - a = 1.12$, so $a = 0{,}78$, that is to say 22% of compensations become deposits. Estimating the real *GDP* for 2010 with amount of PLN 1300 bn we get a rough amount of compensations 1300/1.9 = PLN 684,2 bn. Thus credits in 2010 in Poland could achieve the level of 684,2 (1.9 – 0.78) = PLN 766 bn. In the years 2008 and 2009 credits reached respectively the levels 611 and PLN 645 bn (GUS, 2009). Citizens buy also the government bonds.

6. Conclusion

The problem of money creation is not properly conceived in the present monetary approach since money arises in the processes of productive work. This statement should be credited with our attention as one of the fundamentals of the money—goods economy. The research shows a significant role of the ratio Q in control of the money—goods economy. The upper limit of the credit for a given economy depends mostly on the labour productivity ratio Q and the size of the parameter (a); a measure of citizens welfare. It depends on savings by assets, which represent the savings. The productive use of assets increases the ratio Q, and therefore the size of credit arises.

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Zmienne kształtujące ograniczenie kredytu w gospodarce

S t r e s z c z e n i e: Jaki jest właściwy dla danej gospodarki rozmiar kredytu udzielanego przez banki komercyjne i jakie zmienne wywierają nań istotny wpływ? Analiza teoretyczna wskazuje, że najbardziej istotne wielkości to rozmiar płac w gospodarce, następnie poziom produktywności pracy. Dodatkowo znacząca jest zmienna określająca, jaka część bieżących zarobków pracowników staje się depozytami bankowymi umożliwiającymi akcję kredytową, czyli wielkość wskazująca na stan zamożności. Rozważania prowadzą ponadto do wniosku, że pieniądze powstają w rezultacie pracy. Współczesne poglądy o roli banku centralnego w kreacji pieniądza wymagają zasadniczej rewizji. W sterowaniu gospodarką towarowo-pieniężną podstawową rolę pełni wskaźnik *Q* wyznaczający poziom produktywności pracy.

S ł o w a k l u c z o w e: rozmiar kredytu, kreacja pieniądza, produktywność pracy