Estimation of minimum wage in the aspect of preservation human capital

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Abstract

The article presents an overview of the basic models of measuring the value of human capital, which are based on the theory of labor economics. There is also a systematic study of economic constant, which is an integral part of the capital model. An empirical study was presented, which found that economic constant of potential growth was at the level of 0.08 [1/year]. The calculation of the minimum wage for the economy of Ukraine in the light of the theory of measuring the value of human capital is also presented. The percentage of compliance with the statutory and theoretically calculated wages has been calculated. The data obtained are compared with the results of calculations of this indicator for the economy of the USA and Poland. Comparable percentages of minimum wage compliance can be used to build appro-priate country ratings.

Keywords: *Human Capital; Minimum Wage; Economic Constant.*

1. Introduction

The elaboration of the theory of capital growth and the discovery of economic constant made it possible to assess the wages of workers in terms of preserving their individual human capital. In this article two problems are posed: 1) what wage size ensures the employee's human capital is saved from spillage, and 2) which, in the light of the theory of human capital, should be the size of the minimum wage in the country? To answer these questions, the models of human capital costing, based on theoretical basis of the labor economy, are first analyzed and presented. Also, a systematic study, which resulted in the discovery of the economic constant of potential growth.

This article is part of the research that is being conducted to develop a model of capital growth in the economy. Launched in the nineties of the 20th century, a new line of research has been transformed into an original scientific research program known today as Labor Economics. It is based on a key understanding of the nature of capital as an ability to work, and the elaboration of its in-depth theory, which forms the central part of the entire program. The newly launched research program is progressive in terms of Imre Lakatos methodology as more and more economic problems find their way. Confirmation of this is the elaboration of the theory of measuring the value of human capital, the calculation of equivalent wages (fair wages), the establishment of a permissible size of the wage bill in the budget sector and the theory of labor productivity.

In the last part of the article in the light of the theory of human capital presents the results of the calculation of the minimum wage for the economy of the selected countries and the percentage of its compliance with the statutory minimum wage in the country. Comparison of the percentage of compliance for Ukraine, USA and Poland indicates the difference between these countries.

2. Literature review

Since the early nineties, numerous publications have appeared in which the authors investigate the problems of human capital theory, theory of equivalent wage, basic and premium wages, labor productivity theories, and related macroeconomics problems. These theories are the result of working out a basic model for measuring the value of human capital and understanding the relationship between the categories of capital, labor and fair wages. Let us consider in more detail the two main areas of research of authors on this topic in recent years.

2.1. Models of measuring the cost of human capital of an employee arising from the theory of human capital

Capital as the ability to perform labor is the main category in economic sciences. At the moment, the point of view prevails over which capital is perceived as an abstract category [3, 13]. For each individual, the size of his capital is determined by the corresponding costs, such as maintenance costs, expenses for vocational education, capital from experience and expenses of own work (in the case of teachers of higher education institutions) [4]. Identifying cost data and determining the capital gain function as a result of experience gains us into a well-known and well-developed model of human capital. According to this model, human capital is a function of many variables, of

which the values always are: k - monthly maintenance costs; t - time variable; T - the number of years of professional work (experience) and p - economic became a potential increase. The most simple model of human capital is the formula:

$$H(p) = K(p)$$

Where, H (p) - the cost of human capital; K(p) - capitalized maintenance costs when applying economic sustainability p.
The size of human capital, calculated according to this formula, is the basis for establishing the minimum wage in the economy of a particular country, since employees who do not have professional education and professional experience deserve a minimum wage. If a young person decides to obtain a vocational education, then his human capital in training will increase by the amount of capital from vocational education. After graduation, the human capital model of such a person will look like this:

$$H(p) = K(p) + E(p)$$

Where, H (p) - the cost of human capital; E(p) - capitalized costs for vocational education.
A more extended model also includes a variable that is linked to the professional experience gained during the work. This model can be represented as follows [1, pp. 5-24]:

$$H(p,T) = [K(p) + E(p)] \cdot [1 + Q(T)]$$

Where, H (p,T) is the cost of capital attributed to a person with experience of T years of work; Q(T) is the incremental factor for T years of professional work.
The above model is a derivative of the general model of capital, which is presented in the work of M. Dobie [3]. According to this model, human capital is subject to natural, spontaneous scattering, the average size of which reaches the level of 8% within a year. The above model can also be presented in the additive form [4, p. 79-80]:

$$H(p,T) = K(p) + E(p) + D(T)$$

Where, D(T) means capital from the experience of professional activity during T years of work and $D(T) = H(0) \cdot Q(T)$, with $D(0) = 0$. This model is more convenient for the analysis and formation of the wage pay.
The model of human capital can be supplemented by the indicator of capital of creativity (R) or variable U_i, which is used in the model for determining the size of human capital of science workers [7]. It indicates the size of the capitalized costs for obtaining the i-th degree (where t_i - denotes the number of years from the receipt of the corresponding qualification degree by the time of the measurement). All model data is systematized in Table 1.
With the above models we can calculate the human capital of any employee, and the resulting amount will be the basis for calculating his salary. It should be emphasized that the level of capitalization, which, as will be shown in this article of the research, is 8% within the year, is also important.

2.2. Establishing the size of economic constant

At the beginning of the third millennium, an important discovery was made in the economic sciences - the first in the history of the economic potential of the potential growth (p). Steel in the physical and technical sciences became a commonplace thing for mankind. To date, there are dozens open them. It is they who hold the environment around us in the state we see it. It would have been sufficient for one physical constant to change its meaning, and who knows what might have happened to the world in which we live.
D. Danin writes [2, p. 237]: "Let's let go of the corners of our imagination and imagine a different world that differs from ours only in the size of the constant Planck. In our world, this became equal to h = 6,6237 · 10 - 27 ergoseconds. Let it be measured in the same units as ours on Earth - in our grams, centimeters, and seconds - this quantity in our imagined world will be, say, a hundred times smaller. Quantums of red light and there would be quanta of red light, since the frequency of electromagnetic oscillations would remain the same as we have, and the color depends on the frequency of such oscillations. Electrons would be electrons, and protons were protons. However, in this imaginary world, all the radiation quanta and all elementary particles would have been a hundred times less "energetic" and, accordingly, a hundred times less massive than ours. This fact would not have remained unnoticed. The forces of gravity, which depend on the sum of the masses of the attracted bodies, would be not one hundred, but 10,000 times weaker. An imaginary Earth would rotate around the Sun in a completely different orbit, and the amount of blessed radiation that would fall on it would be completely different ... ".
In the light of the above quote, we can draw an important conclusion about the role of economic constant (p), which determines at what rate capital growth occurs in the economy. It is of paramount importance and should be taken into account in the analysis of economic processes, since determines the current state of the economy and its future potential. At the moment, a sufficiently large number of studies have been carried out that confirmed the size of the economic sustainability potential growth (p) at the level of 8% within the year [9], [14], [15], [19]. One such research is the calculation of wages for a 17-year-old American teenager at various values of economic sustainability [18, p. 182]. This person begins to work in his first job after completing compulsory schooling. Comparing the size of his salary with its size, established by American law, that is, the law on minimum wages, we will accordingly have an opportunity to conclude that they correspond.
Costs of maintenance are estimated at $ 450 per month. These costs represent the amount necessary for a young person to develop correctly in a family of 4 people (totaling $ 1,800 per month). As we see, applying the value of p = 8% provides the most approximation to the statutory minimum wage ($ 7.25 per hour), which is recognized as relevant to the practice of life and activity in a given country (Table 1). This simple test rejects the size of economic sustainability at the level of 7% and 9%.

Table 1: Calculation of the Salary at Different Values of the Constant P

The size is stable	p = 7%	p = 8%	p = 9%
Capitalized maintenance costs (H(p))	$176 432	$195 493	$217 091
Annual labor costs (p·H(p))	$12 350	$15 639	$19 538
Monthly labor costs (p·H(p)/12)	$1 029	$1 303	$1 628
Wages per hour (p·H(p)/12/176h), h – hour	5,84 $/h	7,4 $/h	9,25 $/h

Source: [18, p. 182].

Consequently, it can be formally deduced that wages, which do not allow the dispersion of human capital of an employee, is established by the formula:

$$L = p \cdot H$$

where, H - the human capital of an employee; L - salary established on the basis of the employee's human capital. If the wage is determined by an arbitrary k, then the current cost (PV) of the wage flow determines the formula:

$$PV = q \cdot H/s$$

where, q is the rate of capital dispersion (p = E(q)). Accordingly, if q = p, then PV = p · H / q = p · H / p = H. It follows that wages at p · H do not allow for the reduction of the employee's human capital. On the basis of this, the problem of determining the variable H when using accounting data is solved. The variable H is calculated by the formula:

$$H = L/p$$

The variable L represents the amount of accrued wages and is available in the accounting system. In turn, one should ask what monthly wage will be appropriate: at USD200 or at USD200,000? Common sense suggests that wages at the level of USD200 are very small, and USD200,000 seem to be overestimated. This understanding arises from the perception of wages (W) as a percentage of human capital (H): W = u · H (where, u - the corresponding percentage). Calculations of this kind [1] indicate that the relevant rule, which determines the size of the minimum wage, is at the level of p = 8%. One of the most significant studies of the constant p was conducted by W. Kozioł, which, based on the analysis of a large number of employees, confirmed its size at 8% [8].

The constant p can also be identified and measured on the basis of data on periodic earnings and returns on stocks. Such research has previously been done in assessing "risk premium". This amount, defined as the difference between the real rate of return and return on Treasury Bills in the USA, is among others, a component of the model CAPM [6]. It is matter of fact that CAPM deteriorates its value at the present time. M. Dobija [21] changed the approach omitting the value of Treasury Bills, turning it into a percentage of inflation. It appears a question where periodic income comes from? An answer is associated with the recognition that income on an efficient market are the result of, among others, the action of natural forces. After all, raw material was paid, employees received their wages (costs), depreciation of fixed assets also increased costs, so it is possible that the forces of nature are the source of periodic increase in invested capital. Therefore, the value of p is assessed as a real rate of return achieved in an effective market (table 2).

Table 2: Summary Statistics for Rates of Return on Stocks, Bonds and Treasury Bills in the United States (1926-2004)

Type of securities	Average arithmetic	Average geometric	Standard deviation
Stocks	12,39%	10,43%	20,31%
Long-term government bonds	5,82%	5,44%	9,30%
Treasury bills	3,76%	3,72%	3,14%
Inflation	3,12%	3,04%	4,32%

Source: [6, p. 35].

To calculate the rate of return based on the data in Table 3, the percentage of inflation was subtracted from the return on stocks, which gave the value: 12.39 – 3.12 = 9.27% calculated according to the arithmetic average. Whereas, according to the geometric average it is 10.43 – 3.04 = 7.39%. This range (7.39–9.27) includes the average long-term rate of return achieved on the American capital market. To arrive to score was calculated the arithmetic mean of these two numbers and was obtained a value of 8.285%. For stock market and reporting corporate profits, the data indicates the value at the end of the accounting year. Therefore, if capital grows at the rate of 8% (ex ante), then at the end of the year (ex post) it reaches level $e^{0.08}$ - 1, which is about 8.33%. Thus, the estimation specifies p = 0.08 [1/year].

Similar results are obtained during the study of the growth rate of capital in business. Investigation of the rate of return from the capital invested in the capital firm (appropriately established by ROA), which was conducted by B. Kurek [10, p. 375-392], clearly indicate that the economic stage, which determines the growth potential, is at the level of 8%. This study was based on the financial statements of 1,500 S & P 1500 companies over the 20-year period.

3. Results

3.1. Econometric calculations for the percentage of compliance of wage to human capital value

An empirical study conducted at the Volodarsk-Volynskyi District Employment Center in Zhytomyr Oblast also showed that individuals registered in RZZ want to receive wages at an average of 8% of the size of their human capital. This empirical study was conducted in the form of questionnaires, in which 135 unemployed took part. The questionnaire contained six questions about: age, specialty, number of years of study in a specialty, the amount of tuition fees, length of service, and the amount of wages they would like to receive in the event that a suitable place of work was found. These data made it possible (based on the formulas presented in [4, pp. 78-79]) to calculate the capitalized costs of maintenance, capitalized costs of vocational training and capital from the experience of each person who participated in the questionnaire. Having these three values at their disposal, the level of human capital of all respondents was calculated. This made it possible, using the formula L = p · H(p)/12/1,372 (where, p - economic became (8%), L - basic salary), also calculate the level of monthly salary to be received by individuals Participated in the survey, based on the value of human capital accumulated by them. Wages at such a level do not allow for the dispersion of human capital of an employee.

For a more detailed calculation of the arithmetic average percentage of compliance u was used a statistical program, which calculated the confidence interval in a group of 135 people. Trust interval is the interval within which a given probability of probability can expect the value of the estimated (sought) random variable (in our case, the percentage of matching the size of the desired wage with the total amount of human capital interviewed). The results of econometric calculations are presented in Table 3.

Table 3: Results of Econometric Calculations of the Average for the Percentage of Compliance U (The Size of the Study Group - 135 People).

	Average value	The lower value of the confidence interval (95,0%)	The upper value of the confidence interval (95,0%)	Standard deviation	Median
Percentage of compliance	0,080667	0,076020	0,085313	0,027296	0,080000

Source: own development.

As can be seen from Table 3 in the group of 135 people, the average percentage of the proportion of the desired wage to the total amount of human capital of the interviewee is at the level of 0.080667 (that is, at the level of 8%). Trust interval ranges from 0.076020 to 0.085313. With 95% probability, we can assert that the average percentage of compliance percentage in the general population, which belongs to this group of 135 people, is between 0.076 and 0.085.

Multiple regression was used here [Sobczyk, 2010] to analyze the variables and that allows to predict the level of employees' wages better. The dependent variable in this example is the variable The expected wage (W), and the independent variables (predictors) – The age and The years of education.

In accordance with the principles of gradual regression, the variable The years of education describes better the The expected pay (W). So the regression equation is:

$$Y = B_2 X_1 + B_1 X_2 + B_0$$

The regression coefficients (B_0, B_1, B_2) can be found in Table 4, which contains a summary of the regression. If there is no linear relationship among the variables X_1, X_2 and Y, thus the directional coefficients of the regression in the population (the parameters b_1 and b_2) are equal to zero. Therefore, we confirm that existence of this relationship is not direct. We test the hypothesis that true values of the coefficients b_i are equal to zero (H_0: b = 0), on contrary to the alternative hypothesis (H_1: b ≠ 0). If during the verification of the hypotheses we reject the null hypothesis in favor of the alternative one (H_1), it means that we can use statistical methods to confirm the impact of the variables X_1 and X_2 on the variable Y, and we can name it an important evaluation parameter. This means that the variable X has a significant impact on the dependent variable Y. To verify the hypotheses we use the Student's t-test. This test is as follows:

$$t = \frac{b_i}{s(b_i)}$$

Where b_i – the coefficient of the regression line, and $s(b_i)$ – the standard error of the estimator b_i.

Table 4: The Summary of the Regression of the Dependent Variable the Expected Wage (W)

N=135	B*	The standard error of B *	B	The standard error of B	t (132)	The level of p
Free term	-	-	1320,739	226,9345	5,819913	0,000000
Variable 2	0,421248	0,077139	217,394	39,8092	5,460903	0,000000
Variable 1	0,185028	0,077139	13,181	5,4952	2,398636	0,017854

Source: author's calculations.

In the last three columns of Table 4 standard error evaluation values, t test and the level of significance are provided. Level p is the level of statistical significance for the regression coefficients. Using the calculated values from the Table 4 we can suggest that for the data there are statistical bases for recognition that there is a linear relation between the variables, because two variables (Age and Years of education) are highly significant. As the value of the probability p in all cases is less than assumed α = 0,05, that rejects the null hypothesis H_0, we can conclude that the observed relations between The age and The years of education, and The expected wage is not a coincidence.

The extent of beta coefficients allows you to compare the relative contributions that each independent variable brings in prediction of the dependent variable. As you can see (Table 4), the most important predictor (statistically significant) is the variable The years of education (variable 2). The coefficient is positive for the variable The years of education. That means the greater the number of The years of education, the higher is the level of wage.

Finally, our econometric model defines the extent of the expected wage as follows:

$$Y = 13,18 X1 + 217,39 X2 + 1320,74$$

Where Y – the employee's wage, X_1 – the employee's age, X_2 – the number of years of education.

Using the above formula, we can calculate the extent of the minimum wage in, for example, Poland. Every person who is 18 years old and has a basic professional education, deserves minimum wage. For our model let's substitute X_1 by number 18, and X2 by number 1 (the one-year vocational education). Then the result is:

$$Y = (13,18 \times 18) + (217,39 \times 1) + 1\ 320,74 = 1\ 775\ \text{PLN netto}$$

That with social security tax (35%) gives 2,395 PLN. Currently the minimum wage in Poland is 2,600 PLN and is compatible with the presented econometric model.

A comparative analysis of the basic wage, set at 8% of the total human capital, and the wage that would be expected by the persons who took part in the survey, shows that by submitting the corresponding amount of wages, they expect that it will allow them to compensate for the expenses their work. Based on the data presented in Table 4, we see that the amount of wages, which would be sought by respondents, is on average 8% of the sum of their human capital. Therefore, the formula for calculating the level of wages for a particular employee can be filed as follows:

$$W = H(p) \cdot p$$

Where, W – fair wage; H(T) - the size of the human capital; p - economic constant (8% [1/year]).

3.2. Establishing the minimum wage for the Ukrainian economy

In accordance with the Law of Ukraine "On wages" [20], the minimum wage is the statutory wage bill for simple, unskilled labor, below which payment for the employee's monthly work, as well as the hourly rate of work (volume of work) can not be made.

According to the nature of human capital [5], the minimum wage must compensate for the natural dispersion of capital, and its size determines the formula p · H (T). In the process of labor, the use of human capital manifests itself in the form of labor costs, which are formed with assets, form products. The basic wage is represented by the formula p · H (T) balances the data of costs, resulting in the capital of the employee does not depreciate. A large number of studies [9], [11], [12], [19] have confirmed that the risk premium (p) is 8 percent. That is, the annual labor costs of a worker (W) can be calculated using the formula:

$$W = H(p) \cdot 0{,}08$$

In turn, the monthly salary of an employee can be calculated by dividing the annual labor costs (W) by 12 and subtracting from the received quota the amount of deductions for social measures. The resulting final amount in accordance with the theory of human capital will correspond to the wages paid to this employee.

A person who has completed education in Ukraine at the level of a general education school and did not start education at an institution of higher education will consist only of capitalized maintenance costs, i.e:

$$H(p) = K(p),\ T = 0$$

This equation is the basis for calculating the minimum wage. Capitalized maintenance costs are calculated as the future value of the flow of cusp to cover maintenance costs. In this case, you can use continuous capitalization, which leads to the use of the calculation formula [4, p. 78], which is shown below:

$$K(p) = k \cdot 12 \frac{e^{pt} - 1}{p}$$

Where, K(p) - capitalized maintenance costs, k - monthly maintenance costs, p - economic constant = 8%, t - the number of years.

Based on the models presented above, it is possible to set the level of capitalized costs for the maintenance of any employee, and on the basis of it, in turn, the amount of the corresponding minimum wage that the employee must receive. A person deserves the minimum wage, who, after graduating from general education, immediately goes to work without continuing education in higher education institutions. For an example, let's take an 18-year-old person. Since the value of capital attributed to a model 18-year-old person without capital of professional education and capital from experience corresponds to capitalized maintenance costs, on the basis of this we can establish the level of pay for the given person. It is a wage that balances the natural dispersion of employee capital and reflects the cost of minimum wages. In Ukraine, the monthly maintenance costs depend on the age of the person [20]. To perform the appropriate calculations, we will take the average value of this indicator (1 544 UAH). Table 5 shows the calculation of the human capital of a model 18-year-old person, as well as the corresponding minimum wage level.

Table 5: Calculation of the Human Capital of an 18-Year-Old Person and the Equivalent of the Minimum Wage.

Monthly maintenance costs (k)	1,544.0 UAH
Years of capitalization	18 years
The cost of human capital	745,922.6 UAH
Annual wage (W = H(p) × 0,08)	59,673.8 UAH
Monthly wages (W/12)	4,972.8 UAH
Hourly wages (W/12/176)	28.26 UAH
Legally set hourly wages *	23.60 UAH
Percentage of compliance	83%

*Legislative salary increased by the percentage of employer's social contributions paid (22.0%).
Source: own development.

As can be seen from Table 5, the monthly minimum wage of an employee calculated on the basis of the theory of human capital is higher than the statutory minimum wage level in Ukraine. Ordinary employees receive only 83% of the salary, which, according to the theory of human capital, can be recognized as appropriate. Such a discrepancy between the minimum wage and the cost of the work performed makes it impossible to save the employee's human capital, which leads not only to his dissipation, but also causes the employee's dissatisfaction with his work.

Table 6 provides a comparative analysis of the minimum wages that are legally established in Ukraine, Poland and the United States, with the minimum wage calculated on the basis of the theory of human capital.

Table 6: Minimum Wages for the USA, Poland and Ukraine, Calculated on the Basis of the Theory of Human Capital

Minimum wage	Ukraine (t = 18)	Poland (t = 18)	USA (t = 17)
Legally set hourly wages*	23,60 UAH	13,71 PLN	USD 8,47
Calculated hourly wages	28,26 UAH	14,95 PLN	USD 8,23
Percentage of compliance	83%	92%	103%

* The statutory salary is increased by the percentage of social tax paid by the employer (22.0% - Ukraine, 6.2% - the USA, 20.6% - Poland).

Comparison of the minimum wages of individual countries points to the difference between them. As we see, ordinary employees in Ukraine receive only about 80% of the salary, which, on the basis of the theory of human capital, can be recognized as proper. Since the non-compliance of the wage level with the cost of labor makes it impossible to save the individual human capital of an employee, this becomes the main reason for labor migration from Ukraine. A large number of people travel abroad in search of higher earnings, which will enable them to save their individual capital from dispersal and, if possible, will provide conditions for its development.

4. Conclusions

Capital, being the ability to work, is a potential category. It can be accumulated, but without activity and direct transfer (ie labor) will always increase its level of dispersal. An alternative scientific research program in the field of human capital, initiated at the end of the twentieth century, made it possible to solve the main issues related to the capital category, the problems of establishing the value of individual human capital and the level of its payment. Many indications indicate that the new research program (also known as labor economics) is progressive in terms of the Imre Lakatosh methodology and is effective in solving the problems of setting minimum wages. The results of the econometric study presented in the article made it possible to identify and confirm the existence of economic constant at the level of 0.08 [1/year], which agrees with the results of studies of other authors. The identification of economic constant has allowed us to work out a model for establishing minimal fair wage. The econometric model, based on the collected statistics, also confirmed its practicality.

The calculation based on the proposed minimal fair wage model for Ukraine showed its compliance with the statutory level of 83%, while in the US economy this figure reaches 100%. Therefore, the minimum legal wage in Ukraine is 83% of the amount that can be considered to be appropriate on the basis of human capital theory. This may in some way explain the reasons for labor migration abroad, where the working population goes to earn higher wages.

5. Acknowledgement

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