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THE CHALLENGES OF ECONOMIC SCIENCE AND PRACTICE IN THE 21ST CENTURY

THE DISTRIBUTION OF WEALTH OF 1000 THE WORLD'S RICHEST PEOPLE

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Abstract: *In this paper, we examine the distribution of wealth among the 1000 richest people in the world before and after the economic crisis. The paper presents obtained values for the Pareto exponent and the Gini coefficient and analysis of these obtained values. It was established that in 2008, when the economic crisis began, that inequality of distribution was the largest and that in 2009 year the value has improved significantly. But, in 2010 inequality of distribution was at the same level as in 2007. Also, we found the structure of the distribution of wealth on the basis of the country in which they live. The largest share of billionaires is from the United States. The economic crisis has left the consequences on the structure. The consequences of the crisis mostly affected the Russian billionaires. It was found that the number of Chinese billionaires grows and if we take into account that Hong Kong is part of China since 1997, the Chinese billionaires take second place in share of the wealth of the 1000 richest men in the world.*

Keywords: *Pareto distribution, Lorenz curve, Gini coefficient, Pareto exponent, the distribution of wealth*

Introduction

Wealth is defined in different ways depending on the author and the time when the definition was created. Current definition of wealth is: „wealth in economic terms includes: a) all the things that have monetary value or are interchangeable, b) anything that has utility and the ability to be allocated or exchanged.“ [1].

Wealth is the subject of numerous works. Starting from Mercantilist's who see wealth only in precious metals, through Adam Smith who, in his capital work "Wealth of Nations" he defined wealth as a combination of material wealth, labor, land and technology so that their combination give profit. In this way, he criticized the mercantilist conception of wealth [2, p.90]. This theory was further elaborated by other members of the classical economics such as the David Ricardo, John Locke, John Stuart Mill and others.

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On the other hand, Marxists, have also dealt with the issue of wealth. Marx, through his labor theory of value in his work „Attachment critique of political economy“ makes a distinction between material wealth and human wealth. Source of human wealth are human relations, and source of material wealth are work the land [2, p. 245].

Wealth is measured as net wealth of the individual, household or nation. This is the value of property when it is reduced by the amount of liabilities at a given time period (assets – liabilities).

A large number of authors dealt with the study of the distribution of wealth. In those researchs they have used different models and types of distribution, in which Pareto model of distribution is, for now, the most common [7], [8]. Econophysicist have developed new models that are increasingly used to describe distribution of the wealth. Those models are used by physicists for a long time and are similar to the gas models, they are: models without savings, with uniform savings and uneven form savings [3], [4], [5].

In this paper we deal with the study of the distribution of the wealth of 1000 richest people on the Forbes list in period from 2007 to 2010. This group makes the top of the distribution. For this analysis we used Lorenz distribution and Pareto distribution. The aim is to determine the inequality of wealth distribution, before and after the world crisis, and possible causes of changes in the distribution.

Methodology

Analysis of the distribution of wealth can be done in several ways. One of them is by using the Lorenz curve and Gini coefficient. In economics Lorenz curve is often used to study the distribution of wealth, income and assets. x-axis shows the cumulative percentage of the population from poor to rich, and the y-axis shows the cumulative percentage of wealth and population. Lorenz curve shows us how the distribution of wealth is done among the members of the population. Many economists argue that the Lorenz curve measures social inequality in society. This curve was developed by Max Lorenz in 1905 in order to present unequal distribution of wealth [6].

In theory, Lorenz curve has two extreme positions of the graphic. Line $y = x$ is a line of perfect equality of distribution. If it's broken line the values in the first part $y = 0\%$ and in the second $x = y = 100\%$, it is totally uneven distribution line where only one person has the whole wealth of the population (Figure 1.). Gini coefficient tells us about inequality of wealth distribution. It's value is a percentage of the area between the line of perfect equality of distribution and the Lorenz curve observed in the field between two extreme positions of the Lorenz curve. The higher the ratio, inequality of distribution of wealth is higher [5, p.1].

Another way to study the distribution of wealth is by using the Pareto distribution. Pareto distribution of wealth is the relationship between the individual positions which person occupies in the list of wealth and that persons wealth.

$$w_n = A \cdot r^{-\beta} \quad (1)$$

where: r – position in the list according to the amount of wealth,
 w_n – net wealth of individual,
 A – constant,
 β – exponent which is in relation to the Pareto's exponent,

$$\beta = -\frac{1}{\alpha} \quad (2)$$

where α is the Pareto's exponent. [7, p. 90]

Pareto exponent shows inequality in the distribution of wealth. If the Pareto exponent decreases, it means that the distribution of wealth is more unequal. This means that a larger part of total wealth goes to the individual.

If the information on the range and richness of the individual placed in the log-log scale the graphic to get linear dependence of position and wealth.

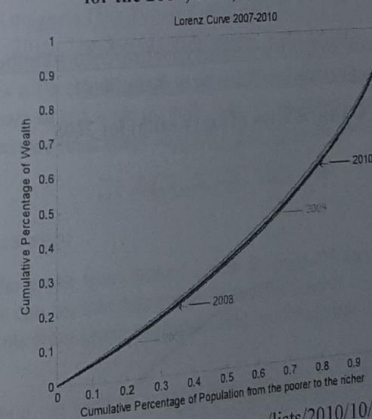
The distribution of wealth is usually studied by using data on the number of individuals within each group of resources (for example, between \$ 5,000 and \$ 10,000 shows the number of individuals with the amount of wealth between these two values). For this research we used another approach. We used the Forbes list with 1000 of the world's richest individuals. Instead of group we used each individual and datas about his wealth, thus avoiding the problem of aggregation that occurs in the first method. Of course the problem is that we observed only a limited number of individuals, who are actually the top of the distribution of wealth. [8, p. 291]

Forbes magazine publishes an annual list of richest people. This list shows the net wealth of each individual as well as information on the operations which led to the wealth. In this study, we used data of net worth of 1000 of the world's richest individuals in the 2007, 2008, 2009 and 2010.

Results and discussion

Analysis of the distribution of wealth will begin with a Lorenz curve. Figure 1 shows the resulting graph of the Lorenz curve, and in Table 1 are Gini coefficient values for observed period.

Figure 1: Lorenz curve distribution of wealth of 1000 richest people in the world for the 2007, 2008, 2009 and 2010



Source: Forbes magazine (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

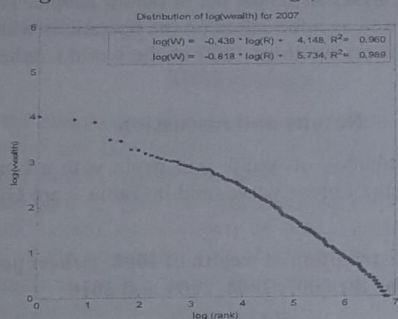
Table 1. Gini coefficient from 2007 to 2010

Year	2007	2008	2009	2010
Gini coefficient	0,27809	0,28973	0,25490	0,27756

Source: Forbes magazine (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

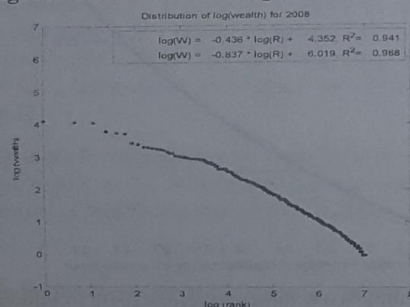
Based on the values from Table 1, we can see that in the year when the crisis began (2008) Gini coefficient value was higher in comparison to the 2007. It shows that in 2008 distribution of wealth was more unequal than the previous one. There were many texts about the causes of the crisis (including that the quantitative analysts are to blame for creating the crisis with the development of financial derivatives) [9]. Here we see that one of the causes of the crisis is the uneven distribution of wealth that existed. In 2009, we see that the value of the Gini coefficient decreased and actually tells us that there was a more even distribution of wealth. In 2010 the Gini coefficient increased and at the level of the 2007. This tells us that in the period ahead, if conditions do not significantly change, may be a further increase of inequality of wealth distribution among the 1000 richest people in the world. Now we go to the analysis of Pareto distribution of wealth of 1000 world's richest people.

Figure 2: Distribution of log (wealth) for 2007



Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

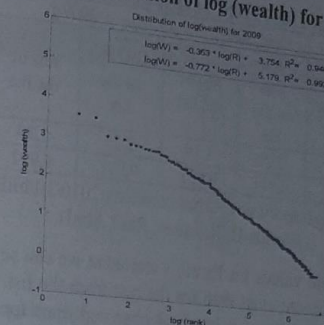
Figure 3: Distribution of log (wealth) for 2008



Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

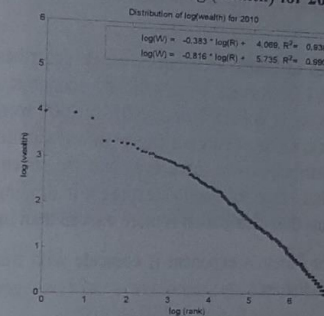
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Figure 4: Distribution of log (wealth) for 2009



Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

Figure 5: Distribution of log (wealth) for 2010



Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

Figure 2 is a Pareto distribution of wealth of 1000 richest men in the world for 2007. Graph is shown in log scale on both axes. If we want to obtain the graph fitting with function (1) then we must adapt function (1) to log scale and then we get the function

$$\log w_n = -\beta \cdot \log r + B \quad (3)$$

where $B = \log A$ is constant

If we fit the graph from Picture 2 with function (3) then we should get straight line. From graph we can see that data points form some kind of curve, so because of this we have fitted data points from graph two times, first we fitted first 20 points, and then rest of data points.

Same method we used on graphs from picture 3, 4 and 5 and we gained values which are presented in table 2.

Table 2. Gained values for Pareto's exponent for period from 2007 to 2010

Year	2007		2008		2009		2010	
	1st-20th on the list	rest of the list	1st-20th on the list	rest of the list	1st-20th on the list	rest of the list	1st-20th on the list	rest of the list
α	2,27	1,22	2,29	1,19	2,75	1,29	2,61	1,22
R^2	0,959	0,988	0,941	0,987	0,941	0,992	0,937	0,990

Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

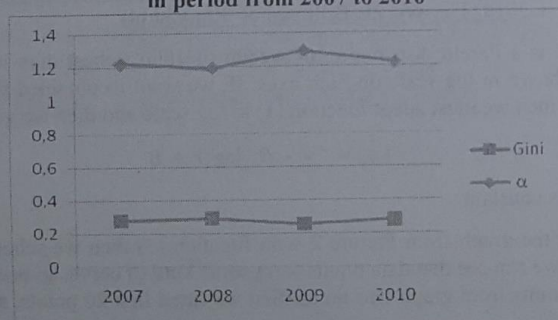
If we observe gained values for Pareto's exponent we can see that wealth distribution for first 20 from the list is more even than for the rest from the list. If we put our attention on correlation coefficient (R^2) average value for 4 observed years for this coefficient of first 20 from the list is 0,96 which means that Pareto's wealth distribution is not so good model for describing wealth distribution in this section, but value for rest of the list is 0,99 which means that this model is very good describing wealth distribution among these group.

Now we analyze wealth distribution for billionares from 20th position to the end of the list.

By analyzing values of Pareto's exponent, which describes inequality of wealth distribution, we can see that in 2008 (year when officialy economic crisis started) wealth distribution was very uneven, more uneven then in 2007. In 2009 world economy started to recover from economic shock, value of Pareto's exponent was significantly larger than in 2008, which means that distribution was more even and the sistem was recovering and repairing. In 2010 we see that value for Pareto's exponent is dropping again, and it is near level from 2007, which means that distribution is more uneven than in 2009.

Trend of values for Pareto's exponent is coincide with trend of values for Gini coefficient, as analyze of this values.

Figure 6: Graph of trend of values for Pareto' exponent and Gini coefficient α in period from 2007 to 2010



Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

Now we will analyze participation in wealth of 1000 richest people on the world by their nationality, and its changes in period before and after economic crisis.

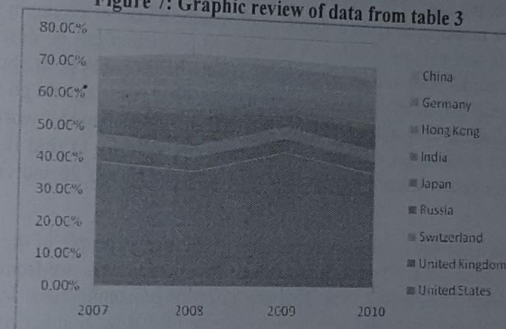
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Table 3: Participation in wealth of 1000 richest people on the world by their nationality from 2007 to 2010

Country	2007	2008	2009	2010
USA	39,05%	36,46%	43,48%	37,22%
United Kingdom	4,70%	4,54%	4,51%	4,21%
Switzerland	3,92%	3,46%	3,88%	3,35%
Russia	7,46%	10,41%	3,98%	7,10%
Japan	1,91%	1,55%	2,01%	1,96%
India	4,45%	6,49%	3,54%	5,33%
Hong Kong	3,73%	3,51%	3,14%	3,83%
Germany	5,86%	5,45%	6,70%	5,04%
China	0,81%	2,09%	1,90%	4,15%

Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

Figure 7: Graphic review of data from table 3



Source: Forbes magazin (http://www.forbes.com/lists/2010/10/billionaires-2010_The-Worlds-Billionaires_Rank.html)

Majority of this 1000 richest people on the world is from USA (average 40%) in observed period of time. We can see here that economic crisis didn't have large effect on participation people from USA on this list. In 2008, their share dropped, but in 2009 it scaled at value of 43,48%. In 2010 their share dropped again, but it is because economy of other countries has recovered and wealth of their richest people rised.

Russians and Chines are very interesting to analyze. Russian billionares were second on list with their share of 10,41%. Economic crisis had great effect on their share and it dropped to 3,98% in 2009. In 2010 it rised on level of 2007. This was effect of their wrong investments.

China is for now second economy of the world, but one of very rare contries that had GDP growth of 9% in period of economic crisis (in years before economic crisis this growth rate was 10%). Their share in wealth of 1000 richest people of the world is growing from yeat to year and in 2010 it is 4,15%. Economic crisis also had effect on their share, but it wasn't that big effect like on Russians. In 2009, their share was 1,90%. If we take in consideration that Hong Kong is part of China since 1997, and if we add their share to share of people from China, we can see that their total share is larger than Russian, which puts them on second plase of this list (they are better than Russians by 0,79%).

Conclusion

By analyzing values gained for Gini coefficient we can see that in period before economic crisis wealth distribution among 1000 richest people of the world was uneven, and peak of that uneven distribution was in 2008, year when economic crisis started. We can conclude that actions of this group of people in that period and before brought this uneven distribution. This uneven distribution and actions of these people on the stock and real estate market may have caused to economic crisis to expand. This crisis has started on 2009 situation has stabilized a bit and distribution of wealth was more even than it was in period before. Value of Gini coefficient in 2010 tells us that in the future there will be greater inequality in distribution.

Same trend is with value of Pareto's exponent. We can see that Pareto's model of distribution is very good describing distribution of wealth among group include individual from 20th position on Forbes magazin list until 1000th position. For first 20 on the list we can't get adequate function fit on data plot. Our results confirm results of Klass et.al. [8] for usage of Pareto's model to describe distribution of wealth. Works of econophysicist [3, 4, 5] tells us that in fact 85% of distribution in observed population can be described using Boltzman-Gibbs model. Our results partly deny results of econophysicist, but we have observed only small part of total world population. Future researchs should go in direction of better understanding of wealth distribution and to find out which model works better, is it Pareto's model or Boltzman – Gibbs model. Also we should try to find if Boltzman – Gibbs model can better describe distribution of wealth among top 20 individuals from Forbes list.

We found out that most share of wealth of 1000 richest people in the world is in hands of people from USA. Number of individuals from this list that are from Russia has fallen in 2009 from 10,41% to 3,98%. That was effect of economic crisis. In 2010 their number started to grow again and now they are at rate of 7,10%. Number of billionaires from China is growing from year to year and if we take in consideration that Hong Kong is part of China since 1997, we can see that their total share is larger than Russian, which puts them on second place of this list (they are better than Russians by 0,79%). We should find out in what relation is number of billionaires, in one hand, and development of economy of a country, in other hand, and is there any scheme.

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The Distribution of Wealth of 1000 the World's Richest People RASPODELA BOGATSTVA 1000 NAJBOGATIJIH LJUDI SVETA

Rezime: U ovom radu istražili smo kakva je raspodela bogatstva među 1000 najbogatijih ljudi sveta pre i posle ekonomske krize. U radu su predstavljene dobijene vrednosti za paretove eksponent i Gini koeficijent i izvršena je analiza kretanja vrednosti ovih koeficijenata. Utvrđeno je da je u 2008. godini, kad aje otpočela ekonomska kriza, da je stepen neravnopravnosti raspodele bio najveći i da se u 2009. godini ta vrednost značajno popravila, ali u 2010. godini se stepen neravnopravnosti približio nivou iz 2007. godine. Takođe utvrdili smo i strukturu raspodele bogatstva na osnovu države u kojoj žive. Najveći udeo imaju milijarderi iz SAD-a. Ekonomska kriza je ostavila posledice i na strukturu, što se najviše može zapaziti na Rusima. Utvrđeno je i da broj kineskih milijardera raste i ako se uzme u obzir da je Hong Kong deo Kine još od 1997. godine, onda kineski milijarderi zauzimaju drugo mesto po udelu u bogatstvu 1000 najbogatijih ljudi sveta.

Ključne reči: Paretova distribucija, Lorencova kriva, Gini koeficijent, paretove eksponent, distribucija bogatstva