The Influence of Labour Market Determinants on Economic Inequality Measured by Gini Coefficient in Montenegro

NEMANJA POPOVIĆ
MILIVOJE RADOVIĆ
JOVAN ĐURAŠKOVIĆ
University of Montenegro
Faculty of Economics
Podgorica, Montenegro

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In this paper an analysis is conducted with the aim of a better understanding how the labor market and income inequality in society are connected, examining the relationships between the variables that describe economic inequality and the labor market in Montenegro. The analysis involves the use of econometric techniques and VAR models, which, with the use of impulse response functions and variance decomposition, best reflect the impact of selected labor market variables on economic inequality. The results of the analysis show that the variables of the labor market, namely the unemployment rate and the long-term unemployment rate, proved to be significant in explaining economic inequality, measured by the Gini coefficient. The results of the research can be useful to various researchers dealing with the issue of economic inequality in Montenegro, providing an additional mechanism for analyzing flows and predicting the future values of the determinants of economic inequality. The results also enable a different approach in the analysis of the labor market and the economic inequality in Montenegrin society, which can serve as a basis for many future analyses..

Key words: Gini coefficient, labor market, VAR models, inequality.

INTRODUCTION

Economic inequality and indicators of equal distribution of income along with the analysis of the labor market represent an important tool for measuring the performance of the economy, especially with regard to the analysis of well-being and living standards, but also the overall development of the state (Radonjić et al, 2020). One of the main problems of the Montenegrin economy is the high rate of unemployment, which represents a barrier to the establishment of a more equal distribution of income and more inclusive social development. This is precisely the main motivation for this research, because the goal is to determine whether, and to what extent, the problems, i.e. the performance of the labor market, affect the distribution of income in Montenegro.

Unemployment represents one of the most serious macroeconomic problems.

* Nemanja Popović, University of Montenegro, Faculty of Economics / Univerzitet Crne Gore, Ekonomski fakultet, Cetinjski put 2, 81000 Podgorica, Montenegro / Crna Gora, nemanja.p@ucg.ac.me

The economic consequences of high unemployment are numerous, and are reflected in reduced productivity, lower incomes and slowing economic processes (Babić, 2018). A high unemployment rate, in addition to causing problems in the country's economic system, directly affects the population and social development, which then leads to an increase in poverty, bigger social differences and socio-political crises. As the unemployment problem affects all aspects of social life, both directly and indirectly, the very process of reducing the high unemployment rate and eliminating its negative consequences is one of the biggest challenges in the economic life of every country.

This research on the impact of labor market parameters on economic inequality in Montenegro involves proving two hypotheses related to the impact of different labor market variables on economic inequality. The analysis was carried out with the vector autoregression (VAR) models, which enable multivariate analysis of time series. The results of the conducted research enable a different approach in the analysis of the inequality and labor market of Montenegrin economy, and fill the gap in this scientific field.

The proposed research is characterized by scientific authenticity and originality, while the scientific contribution of this work is promising, bearing in mind the fact that more serious research in academic frameworks was not conducted during the transitional experience of the Montenegrin economy. For this reason, the importance of this research is reflected in the fact that, in a new way for Montenegrin practice, it connects the areas of the labor market and economic inequality and provides a new insight into scientific issues. That is an extremely useful basis for economic policy makers, for the reason that, if the positive influence and correlation of the above-mentioned determinants are proven, a significant signal is obtained about the structural problems of the labor market, which indicates that well-being and a fairer distribution of income cannot be improved without comprehensive reforms in the labor market.

LITERATURE REVIEW

The question of economic inequality and welfare in the economies is becoming more and more topical among today's economists, and it was confirmed through Piketty's extensive work, where his book "Capital in the 21st century", from 2015, which has become a basic reading in the field of economic inequality is highlighted, and which Milanović followed up on when he discussed the issue of inequality in his book "Global Inequality" from 2016. In that period, in addition to the above, the following study which deals with the questioning of the role of the state in the economy can be singled out. Namely, Rueda (2015) claims that, since the nineties of the 20th century the welfare state has transformed into a "working" state. He proposes a stylized framework for understanding the impact of unemployment on inequality and the effects of labor policy. The research results show that the transformation of the welfare state made the effects of unemployment more inegalitarian, and suggest that labor policies promoted higher levels of market income equality only during the traditional welfare period. The results also suggest that the sensitivity of redistribution to unemployment became weaker in the era of the "working" state.

The problem of inequality and the labor market conditions is an interesting topic for analysis among the scientists in the region as well. Thus, Huskić (2018) analyzed the impact of labor market institutions and income inequality on unemployment in Bosnia and Herzegovina.

In the research, an econometric analysis of these relations was carried out through two dynamic models, which rely on the methodology of the Harris-Tordaro model. The research results indicate a positive relationship between income inequality (measured by the Theil index and the Gini coefficient) and the unemployment rate in Bosnia and Herzegovina in the period from 2007 to 2014. It is interesting to note that many developed economies which do not have problems with high unemployment rates have high income inequality, which leaves room for a debate in economic circles about the nature of the influence and effects of labor market determinants on economic inequality. So, it remains very interesting to see what the research on the example of Montenegro will reveal about this area, because it can say a lot about the state of the Montenegrin labor market.

Huskić's research (2018) represents similar research to the one that will be conducted in this paper, due to the fact that both Bosnia and Herzegovina and Montenegro are former states of the Yugoslavia, and in both studies the relationship between determinants of the labor market and economic inequality is examined. The difference is in the methodology that was used to prove the same, as in our research VAR models are chosen, and the reason for that is a better representation of the relationship between the two variables through the impulse response function (IRF) and variance decomposition, where it is precisely seen how much, in different iterations, the two variables influence on each other.

The applicability of the VAR model is wide, and Omran and Bilan (2021) are starting from these significant characteristics of the VAR model, and with the use of them and the IRF function showed a positive influence between inflation and the unemployment rate. Papers which stand out regarding the application of the VAR model and the IRF function are Atems and Jones (2015), as well as the research of Katris (2021). In their researches, they use all the possibilities that VAR models provide. Namely, with the use of the VAR models, Atems and Jones prove that shocks to the Gini coefficient significantly reduce the level of income per capita. On the other hand, Katris in his research analyzes the relationship between the unemployment rate and the crisis caused by the COVID-19 pandemic. In his analysis the impulse response function occupies a special place, for the reason that he also uses it to predict the future impact of the COVID-19 pandemic on unemployment, and compares the predictive power of the VAR model with the ARIMA and ANN models.

That VAR models are not something new in econometric research is shown by the research of Akinbodola and Saibu (2004), who analyzed fundamental trends in per capita income, government capital expenditure, human development index and unemployment rate in Nigeria. Using a vector autoregression model (VAR), they found that reducing the unemployment rate improves human development and consequently reduces poverty. So they concluded that policies that initially reduce unemployment will eventually improve the living conditions of Nigerians. Their findings, dating back to 2004, are in complete agreement with the conclusions of this research on the example of Montenegro, that the problem of poverty and unequal distribution of income cannot be solved without reforms and strong institutions in the labor market.

In previous works, it can be seen that the Gini coefficient and the inequality rate are often used indicators in examining the mutual relationship, or their relationship with other determinants, and this is exactly what Vakili et al. (2022) show while examining the strength of the influence of financial cycles and their components on real components, that is, on the Gini coefficient and the unemployment rate.

It can be concluded through the literature review, that economic inequality and the labor market are closely related, which is the basic assumption of this research. This was also recognized by Dosi et al. (2018) who analyzed the effects of structural labor market reforms using the "K+S" AB model (Agent-Based Models). The model shows how structural reforms, which reduce workers' bargaining power and lower wages, tend to increase unemployment, functional income inequality, and personal income inequality.

These studies show how topical and important the topics of economic inequality and the labor market are for the economic life of a country. When it comes to Montenegro, there are very few scientific works that deal directly with these topics, and those that analyze their interrelationship through econometric models, are non-existent. For this reason, this research can be of great importance, not only to other researchers in this field, who can extend the analysis to a larger number of countries, or to more indicators, but also to economic policy makers, who must approach problems regarding inequality and the labor market gradually and comprehensively.

HYPOTHESES DEVELOPMENT

The main reason for such research is the high unemployment rates that have been present in Montenegro since the beginning of the 21st century. Such situation has brought numerous problems to the Montenegrin economy and the general development of society. It can even be concluded that the "natural" rate of unemployment in Montenegro rose above 15%, which indicates numerous structural problems. Because of this, there was a huge motivation to examine the influence of the determinants of the labor market on economic inequality, in order to try to numerically describe that relationship, but also to draw valuable conclusions, which will lead to a better understanding of the problem of poverty in Montenegro, which can lead to its faster resolution and accession to the EU.

Gini coefficient was chosen in the analysis, as the variable which best reflects dynamics of economic inequality. The Gini coefficient is often used in research, and has proven to be a reliable variable in econometric analyzes. As for the labor market variables, the unemployment rate and the long-term unemployment rate were chosen as the ones that best reflect trends in the labor market. The aspect of long-term unemployment is of particular importance, if we bear in mind the characteristics of the Montenegrin economy. The hypotheses in this paper are:

Hypothesis 1: There is a statistically significant influence of selected labor market factors on economic inequality in Montenegro;

Hypothesis 2: There is a positive correlation between selected labor market factors and determinants of economic inequality.

In the correlation analysis of the variables VAR models were constructed, one for each variable from the labor market and for the Gini coefficient. The reason for the above is to better capture their mutual influence, but also to avoid the problem of matching series.

DATA AND METHODOLOGY

VAR models were developed as an alternative to simultaneous equation models. All variables that appear in the model are assumed to be endogenous. In the VAR model, it is assumed that all variables are linearly dependent on their own lags, but also on the lags of other variables in the model. The number of lags for all included variables is the same, while the number of lags depends on the number of observations in the model, data periodicity and information criteria (Akaike, Schwarz and Hannan-Quinn). If one vector denotes all the variables in the system, that vector can be represented as a linear function of the eigen delays and the vector of random errors. This is exactly where the name of vector autoregressive models comes from (Jovičić and Dragutinović-Mitrović, 2011: 182-183). An example of a simple system with two variables of the second order (two lags) in standard form is (Chatfield, 2000: 74):

$$y_t = y_{10} + y_{11}y_{t-1} + y_{12}y_{t-2} + y_{13}x_{t-1} + y_{14}x_{t-2} + u$$

$$x_t = y_{20} + y_{21}y_{t-1} + y_{22}y_{t-2} + y_{23}x_{t-1} + y_{24}x_{t-2} + u_{xt}$$

The assumptions are that the series are stationary, and that the errors fulfill all stochasticity assumptions of the Classical Linear Regression Model. The method of ordinary least squares, assuming no autocorrelation of the residuals, is used when evaluating the VAR model. VAR models are particularly suitable for testing causality using Granger causality. The existence of this causality is confirmed when the level of one variable significantly depends on the delays of another variable, and not only on its own delays (Jovičić and Dragutinović-Mitrović, 2011:180).

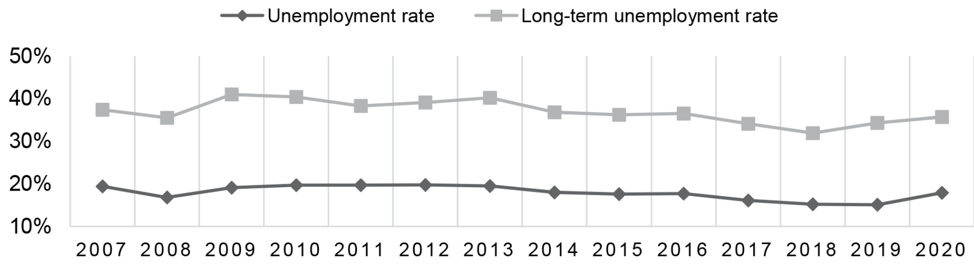
Limitations to the undertaken research refer to the data related to the Gini coefficient in Montenegro. Namely, the data on the Gini coefficient, created by the Directorate for Statistics of Montenegro (Monstat), are inconsistent due to a change in the methodology. In 2013 Monstat started implementation of the Survey on Income and Living Conditions was conducted in accordance with the European Union regulations.[1] Until 2013, the Poverty Analysis had been carried out according to the methodology of the World Bank (consumption method), within which the Gini coefficient was also calculated, based on the Law on Official Statistics (Monstat, 2022).

This problem was overcome by applying mathematical methods, that is, by forming an equation with one unknown. Namely, since the data for the Gini coefficient in Montenegro for the year 2013 are available for both methodological approaches, it was possible to calculate a common factor, which was used to recalculate the Gini coefficient, which was calculated according to the methodology of the World Bank, for the period from 2006 to 2013. This procedure resulted in a homogeneous series for the entire considered period, i.e. from 2006 to 2020. A detailed calculation procedure is presented in the appendix of this paper. Certainly, the time series span remains the biggest limitation in the research, because a longer time-series data would provide the greater reliability of the obtained results. Data related to the labor market: unemployment rates and long-term unemployment rates were taken from the website of the Statistical Office of Montenegro (Monstat), for the period from 2007 to 2020. In all econometric tests, the significance level is 5%, while the software tool Eviews is used in the analysis.

Labor market indicators, unemployment rate and long-term unemployment rate for the period from 2007 to 2020 are shown in Graph 1.

[1] Regulation of the European Council and Parliament number 1177/2003.

Graph 1
Unemployment rate and long-term unemployment rate in Montenegro

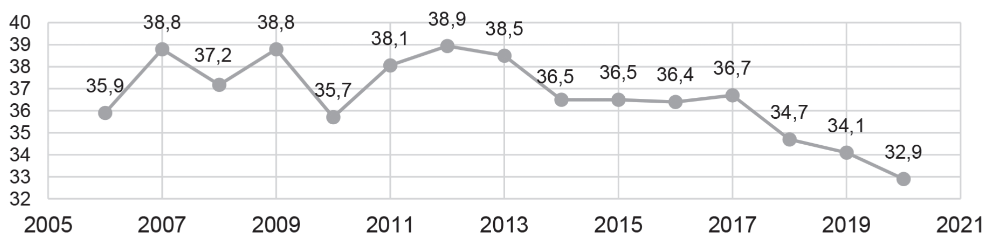


Source: Monstat, https://www.monstat.org/cg/page.php?id=22&pageid=22

In the observed period it can be seen that the unemployment rate (UR) fluctuated less than the long-term unemployment (LTUR) series, while the unemployment rate series does not show a clear downward trend. The lowest unemployment rate was recorded in 2018 and 2019, and was around 15%, while the highest was in 2012 and 2020, and was around 20%. It is interesting to note that the mentioned years were marked by crises. The lowest unemployment rate in the observed period, which was recorded in 2019, is significantly higher than the average unemployment rate in the EU, which, according to Eurostat data, was 6.7% in 2019. In the observed period, long-term unemployment moved in line with EU levels, and in 2009 it was at its highest level, 41%, while in 2018 it was 31.9%, which is a significant decrease, being 35.7% in 2020.

Measuring inequality is a complex field, with numerous approaches and methods (Šućur, 2021). In this research, the starting point is the Gini coefficient, whose values improved significantly in the analyzed period, indicating greater equality in income distribution in Montenegro, graph 2.

Graph 2
Gini coefficient in Montenegro for the period 2006-2020



Source: Authors' calculation and Monstat data, https://www.monstat.org/cg/novosti.php?id=3671

In the period from 2006 to 2011, there were oscillations in the value of the Gini coefficient, while in the period from 2014 to 2017 stagnation in the value of the Gini coefficient was recorded. However, the decreasing trend of this indicator can be clearly observed by the end of the analysed period. Thus, in 2020, the Gini coefficient was 32.9 points, while the EU average, according to Eurostat data, was 30 points in the same year.

EMPIRICAL RESULTS AND DISCUSSION

The values of descriptive statistics for the series of the Gini coefficient, unemployment rate and long-term unemployment rate are presented in Table 1.

Table 1
Values of descriptive statistics of the displayed series

	Median	Std. Dev.	Jarque-Bera / Probability	Skewness	Kurtosis
Gini coefficient	36.5	1.81507	0.72108 / 0.69729	-0.44463	2.39757
Unemployment rate	17.95	1.65965	1.22205 / 0.54279	-0.50519	1.96363
Long-term unemployment rate	36.65	2.64013	0.35139 / 0.83887	-0.10278	2.25158

Source: Authors' calculation.

Based on descriptive statistics, the median of the Gini coefficient series in the sample is 36.5. Standard deviation is 1.81. The value of the Jarque-Bera statistic is 0.72, while the associated probability is 0.70. The probability is significantly higher than 0.05, so it can be concluded that the series has a normal distribution.

The median of the series unemployment rate in the observed period is 17.95%, while the standard deviation is 1.65. The Jarque-Bera statistic is 1.22 with an associated probability of 0.54, so the null hypothesis is confirmed about the normality of the distribution, with a 5% risk of error.

The central value, median, of the long-term unemployment rate is 36.65%, while the standard deviation is 2.64. The Jarque-Bera coefficient is 0.35 with an associated probability of 0.84, hence the null hypothesis of normality of the distribution can be accepted.

For all three time-series the coefficient of asymmetry is less than zero indicating that there is an asymmetry to the left. The flattening coefficient is an indicator that shows the degree of concentration of characteristic values around the mean value - in this case it is less than three (critical value), for all series, which indicates that the observed series are flatter than the normal distribution.

The test of stationarity of time series, which is a necessary condition in the time series analysis, is shown below. Series are logarithmized for better comparability.

Testing of the stationarity of the used time series

In order to examine the stationarity of time series, first order autoregression models were evaluated for the used time series, in order to reveal the absence or existence of heteroskedasticity and autocorrelation of the error variance.

Table 2

AR(1) model of the series Gini coefficient

Variable	Coefficient	Std. Error	t-Statistic	Prob
LogGini(-1)	0.99825	0.00346	287.7537	0.0000
Model Evaluation				
R-squared			0.18057	
Adjusted R-squared			0.18057	
Durbin-Watson stat.			2.54681	

AR(1) model of the series Unemployment rate

Variable	Coefficient	Std. Error	t-Statistic	Prob
LogUnemRate(-1)	0.98572	0.01243	79.29204	0.0000
Model Evaluation				
R-squared			-1.04905	
Adjusted R-squared			-1.04905	
Durbin-Watson stat.			0.87758	

AR(1) model of the series Long-term unemployment rate

Variable	Coefficient	Std. Error	t-Statistic	Prob
LogLTUnRate(-1)	1.00161	0.01825	54.86132	0.0000
Model Evaluation				
R-squared			0.22935	
Adjusted R-squared			0.22935	
Durbin-Watson stat.			2.24881	

Source: Authors' calculation.

Based on the Durbin-Watson statistic value of 2.54, it can be assumed that there is no autocorrelation problem or that there is negative autocorrelation in the case of the Gini coefficient series. The Durbin-Watson statistic value of 0.88 indicates the possible existence of positive autocorrelation in the unemployment rate series. The possibility of a positive correlation can also be seen in the long-term unemployment rate series, given that the value of the DW statistic is 2.25. Certainly, the existence of autocorrelation in the models is tested with appropriate empirical tests, the result of which is given in Table 3.

Table 3

Breusch-Godfrey Serial Correlation LM Test

Model	F-statistic	Prob. F(1,12)	Prob. Chi-Square (1)
AR (1) model – Gini coefficient	2.614336	0.1319	0.1135
AR (1) model – Unemployment rate	0.49539	0.4950	0.4563
AR (1) model – Long term unemployment	0.32713	0.5789	0.5400

Source: Authors' calculation.

The Breusch-Godfrey autocorrelation test indicates that there is no autocorrelation problem in the models, that is, with a risk of error of 5%, the null hypothesis cannot be rejected. In the case of all three models, the test showed that the probability is significantly higher than 0.05, so the null hypothesis of no serial correlation cannot be rejected.

In order to determine which stationarity test should be applied, it is also necessary to examine whether there is a problem of heteroskedasticity in the models. The results of Harvey's heteroskedasticity test are shown in Table 4.

Table 4
Heteroskedasticity Test: Harvey

Model	F-statistic	Prob. F(1,12)	Prob. Chi-Square (1)
AR (1) model, Gini coefficient	0.03400	0.8568	0.8423
AR (1) model, Unemployment rate	2.29284	0.1559	0.1340
AR (1) model, Long term unemployment	1.12862	0.3108	0.2714

Source: Authors' calculation.

Based on the obtained results, it can be concluded that the value of Harvey's heteroskedasticity test statistic for three AR models is greater than the critical value of 0.05, so the null hypothesis cannot be rejected and the conclusion is that there is no problem of heteroskedasticity in the models, i.e., the variance of the random error is constant for all observations in the models.

The Kwiatkowski, Philps, Schmidt, Shin (KPSS) test will be used to test stationarity. The KPSS stationarity test can also be described as an alternative test, given that the null hypothesis is that the series is stationary. The reason for using the KPSS test according to Shin, Schmidt (1991) is its slightly higher power in testing stationarity, compared to other available tests, including the most commonly used augmented Dickey-Fuller test, for the case when the sample is less than 100 observations.

Table 5 shows the results of the KPSS stationarity test for the logarithmic series of the Gini coefficient, the unemployment rate and the long-term unemployment rate.

Table 5
Test of stationarity of analyzed series

Series	KPSS test statistic	Asymptotic critical values, 5% level
Log Gini coefficient	0.41852	0.4630
Log unemployment rate	0.36229	0.4630
Log long-term unemployment rate	0.36847	0.4630

Source: Authors' calculation.

As the KPSS test statistic is less than the critical value, which is 0.463, for all analyzed series, the null hypothesis about the stationarity of the series can be confirmed, i.e. the series do not have a unit root, with a risk of error of 5%. The stationarity of the time series, which has been confirmed, is a prerequisite for the formation of vector autoregressive models, VAR models.

Vector autoregression models and the Granger causality test

The first VAR model includes the unemployment rate and the Gini coefficient (in log values), while the second VAR model analyzes the long-term unemployment rate and the Gini coefficient.

VAR model of unemployment rate and Gini coefficient

Several VAR models were specified, some of which contained a constant and some did not, as well as those with one or more lags. In the appendix, conducted test results for evaluating the optimal number of lags based on the value of the information criteria are given. The model with the best characteristics (Table 6) is the VAR model with one lag.

Table 6
VAR model of the unemployment rate (UR) and the Gini coefficient

	LogGini	LogUR
LogGini(-1)	0.436058 (0.25431) [1.71468]	0.44789 (0.57775) [0.77524]
LogUR(-1)	0.179035 (0.06506) [2.75186]	0.28371 (0.14781) [1.91949]
C(constant)	1.50550 (0.88237) [1.70620]	0.44008 (2.00460) [0.21954]
Model Evaluation		
R-squared	0.56639	
Adjusted R-squared	0.48755	
Akaike information criterion	-5.62690	
Schwarz criterion	-5.35302	

Source: Authors' calculation.

The vector autoregressive model, which contains UR and the Gini coefficient, is also given in Table 7 in the multi-equation notation.

Table 7
VAR (UR and Gini) Model - Substituted Coefficients

LOGGINI = 0.436058003228*LOGGINI(-1) + 0.179035142477*LOGUR(-1) + 1.50550147036
LOGUR = 0.447894167118*LOGGINI(-1) + 0.283711130101*LOGUR(-1) + 0.44008134622

Source: Authors' calculation.

Based on the record of the model in the form of multiple equations, in the first equation, which is also the subject of interest, it is noticed that the Gini coefficient moves in the same direction as the Gini coefficient from the previous *(t-1)* period, but also in the same direction as the unemployment rate from the previous period. The roots of the polynomial are inside the unit circle, so it can be concluded that the observed VAR model is stable. This representation is shown in the appendix of this paper.

Conducted tests of autocorrelation and the normality of the distribution of residuals, as well as tests of heteroskedasticity, are shown in the appendix. The conducted tests confirms that there is no autocorrelation in the model, i.e. the errors in the model are not mutually dependent, and also the null hypothesis of normality of the distribution cannot be rejected, as well as the null hypothesis of homoscedasticity of the residuals, with the risk of error of 5%

Further analysis implies the implementation of the Granger causality test, since the model is characterized by: absence of heteroskedasticity, absence of autocorrelation, normality of residuals and stability of the model. The results of the Granger causality test are given in Table 8.

Table 8
Granger causality test

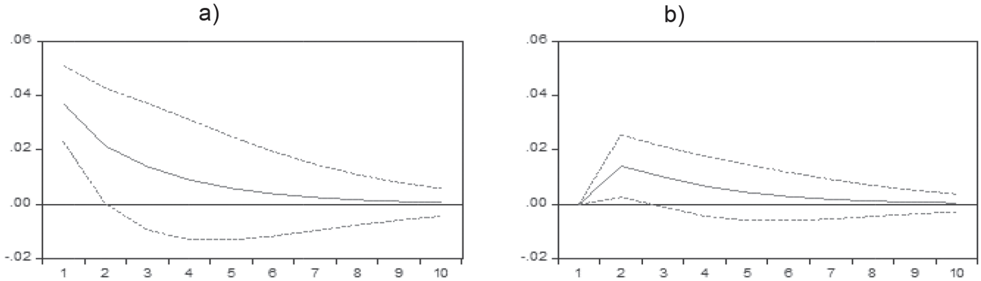
Dependent variable: LogGini			
Excluded	Chi-sq	df	Prob.
LogUR	7.57274	1	0.0059
All	7.57274	2	0.0069

Source: Authors' calculation.

Of interest for the analysis is the impact of the unemployment rate on the Gini coefficient. The corresponding probability of 0.0059 is less than the critical value of 0.05, which means that the null hypothesis, which postulates that the unemployment rate does not affect the Gini coefficient, can be rejected. That being said, with a 5% risk of error, it can be concluded that the unemployment rate Granger causes movements in the value of the Gini coefficient series.

Economic theory (Milanovic, 1998), indicates that a higher unemployment rate will have a negative impact on the Gini coefficient. Through the record in the form of multiple equations, it could be seen that there is a positive correlation between the lagged values of the unemployment rate and the current value of the Gini coefficient. Graph 3 shows the impulse response function of the VAR (UR and Gini) model.

Graph 3
a) Response of LogGini to LogGini, b) Response of LogGini to LongUR



Source: Authors' calculation.

Of importance for the analysis is the graph (3b) that illustrates the impact of the unemployment rate shock on the Gini coefficient series. The Gini coefficient in the case of shocks due to a series of unemployment rates, reacts immediately at the beginning with an increase that lasts until the second time period (second year, given that the data are annual), after which it gradually decreases, but never takes negative values.

Table 9 shows the decomposition of variance, which shows how much of the variation of one variable is explained by the variation of another variable. Cholesky ordering is: LogGini, LogUR.

Table 9
Variance Decomposition of LogGini in VAR model (Gini coeff. And UR)

Period	S.E.	LogGini	LogUR
1	0.03703	100.00	0.00000
2	0.04507	90.24408	9.75592
3	0.04823	87.06689	12.93311
4	0.04953	85.91368	14.08632
.....			
10	0.05047	85.13229	14.86771

Source: Authors' calculation.

The table shows that in the first time period all variations of the Gini coefficient are explained by that variable, while in later time periods the share of variations of the Gini coefficient is explained by exogenous shocks affecting the unemployment rate increases. After the fourth time period, that share remains at around 14%.

These conclusions show statistically significant influence of unemployment rate on Gini coefficient, as well as a positive correlation of two variables.

A positive correlation indicates that all increases in unemployment will affect the increase in income inequality in society, but if we look at the same relationship, from another angle, this relationship shows us that the solution to the problem of inequality lies in solving problems in the labor market. Nevertheless, in the considered period in Montenegro, the unemployment rate did not significantly decrease, so the second part of this relationship essentially remains unexplored, i.e. what will really happen with the Gini coefficient, when the unemployment rate drops to, say, 7%, whether it will lead to a significant decrease in the Gini coefficient, or this relationship will weaken.

Below, we can see the analysis of the impact of long-term unemployment on Gini coefficient, where the interdependence should be more pronounced.

VAR model of Gini coefficient and long-term unemployment rate

The estimated VAR model, which contains two endogenous variables, the Gini coefficient and the long-term unemployment rate (LTUR), is presented in Table 10.

Table 10
VAR model of Gini coefficient and LTUR

	LogGini	**LogLTUR**
LogGini(-1)	0.38299 (0.36264) [1.05613]	0.38163 (0.73810) [0.51706]
LogGini(-2)	0.02639 (0.38151) [0.06918]	0.43363 (0.77652) [0.55844]
LogLTUR(-1)	-0.03976 (0.21270) [-0.18694]	0.50011 (0.43292) [1.15521]
LogLTUR(-2)	0.48408 (0.21315) [2.27111]	-0.20690 (0.43383) [-0.47693]
C(constant)	2.55833 (2.03186) [1.25911]	-3.64658 (4.13558) [-0.88176]
Model Evaluation		
R-squared	0.71545	
Adjusted R-squared	0.55285	
Akaike information criterion	-6.37783	
Schwarz criterion	-5.97374	

Source: Authors' calculation.

Approximately 72% of the variation of the Gini coefficient, in this model, is explained by endogenous variables. The adjusted coefficient of determination is higher compared to the VAR model previously discussed, and also the information criteria are lower, which points to a slightly better performance of this model. Multiple-equations notation is given in Table 11.

Table 11
VAR (LTUR and Gini) Model - Substituted Coefficients:

LOGGINI = 0.382992162803*LOGGINI(-1) + 0.026394092629*LOGGINI(-2) - 0.0397622178582*LOGLTUR(-1) + 0.484080357868*LOGLTUR(-2) + 2.55833471148
LOGLTUR = 0.381638593644*LOGGINI(-1) + 0.433637059639*LOGGINI(-2) + 0.500110989743*LOGLTUR(-1) - 0.206907021261*LOGLTUR(-2) - 3.64658326357

Source: Authors' calculation.

For the evaluated model, the value of the Gini coefficient at time *t* depends on the value of the Gini coefficient in periods *t-1* and *t-2*, as well as the value of the long-term unemployment rate in periods *t-1* and *t-2*. Also, based on the evaluated first equation, it can be seen that the Gini coefficient in the current period moves in the same direction as the Gini coefficient in the two previous periods, while the growth of the long-term unemployment rate in period *t-1* leads to a decrease in the Gini value coefficient, and in the *t-2* to an increase which is more significant. As the roots of the polynomial are inside the unit circle, it can be concluded that the second VAR model is stable. The graph of stability of the model is shown in the appendix.

The conducted Serial correlation LM test indicates that in the observed VAR model with two lags, there is no autocorrelation problem. In this model, as in the previous one, based on the associated probabilities for Jarque-Bera statistic, with an error risk of 5%, it is confirmed that the residuals in the VAR model have a normal distribution. Based on the calculated probability for Chi-sq statistic, it is concluded there is no problem of heteroskedasticity in the model. The tests for autocorrelation, residual normality and heteroskedasticity are showed in the appendix of this paper.

Conducted tests showed that the prerequisites for further analysis of the observed VAR model were met. The model is characterized by: absence of autocorrelation, absence of heteroskedasticity, stability of the model and normality of distribution.

The results of Granger causality test, for LTUR and Gini in second VAR model, are shown in Table 12.

Table 12
Granger causality test

Dependent variable: LogGini			
Excluded	Chi-sq	df	Prob.
LogLTUR	5.64621	2	0.0457
All	5.64621	2	0.0457

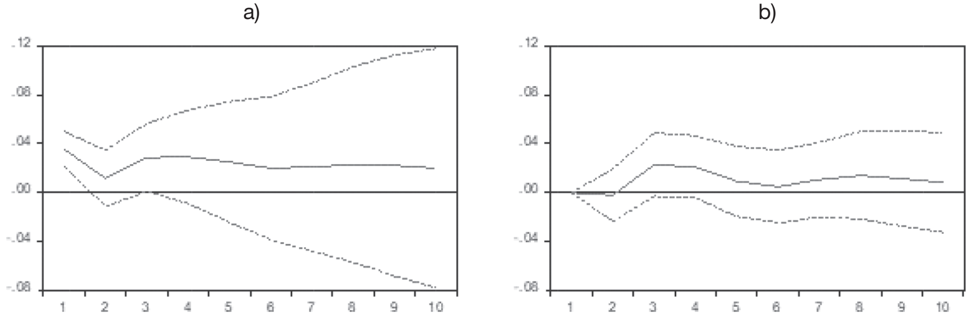
Source: Authors' calculation.

The test shows that there is a significant influence of the LTUR rate on the current values of the Gini coefficient, with an error risk of 5%.

Since the statistically significant influence of another determinant of the labor market, i.e. the long-term unemployment rate, on economic inequality, measured by the Gini coefficient, has been established, we can proceed with the impulse response function and decomposition of variance.

Graph 4 shows the impulse response function of the second VAR model, and part of the graph (4b) that shows response of the Gini coefficient to shocks on the long-term unemployment is important for this analysis.

Graph 4
a) response of LogGini to LogGini, b) response of LogGini to LogLTUR



Source: Authors' calculation.

It can be noticed that the shock on long-term unemployment has a positive effect on the Gini coefficient, i.e. it increases the value of the Gini coefficient after the first period for 4 periods, after which that impact decreases and then increases again, from the sixth period.

The variance decomposition is shown in Table 13. Cholesky ordering is: LogGini, LogLTUR.

Table 13
Variance Decomposition of LogGini in VAR model (Gini coeff. and LTUR)

Period	S.E.	LogGini	LogUR
1	0.04221	100.00	0.00000
2	0.05135	94.90167	5.09833
3	0.05574	90.76722	9.23278
4	0.05796	88.36344	11.63656
5	0.05908	87.09098	12.90902
6	0.05963	86.44112	13.55888
.....			
10	0.06015	85.83098	14.16902

Source: Authors' calculation.

The table shows that the share of variations in the Gini coefficient explained by the long-term unemployment rate increases more slowly than in the previous case (VAR (Gini and UR)), but stabilizes again at a level of around 14%, where it remains.

This analysis and the obtained results, gives econometric confirmations that, on the example of Montenegro, the issue of economic inequality cannot be viewed separately from the labor market. Namely, structural problems, such as high youth unemployment, the difference in the development of the regions and the mismatch between the education system and the labor market, not only affect the labor market itself, generating high unemployment rates, but also the distribution of income in Montenegro. For this reason, the obtained positive correlation between the Gini coefficient and the unemployment rate shows that any increase in unemployment affects the uneven distribution of income. Therefore, the economic authorities must take into account the structural reforms of the labor market, if they want to reduce the unequal distribution of income.

Reform of the labor market in Montenegro would entail strengthening the power of labor unions, in order to create a significant lever that would push the labor market in the direction of improving working conditions and respecting workers' rights. It is also necessary to improve the education system, that is, to reform it, so that it complies with the needs of the labor market, due to the fact that the youth unemployment rate, published by the Statistical Office of Montenegro, which is 36.3% for 2020, indicates major problems during the first employment, which are not related to traditional factors that can be found in all economies.

CONCLUSION

Limitations to the undertaken research refer to the data related to the Gini coefficient in Montenegro. Namely, the data on the Gini coefficient, created by the Statistical Office of Montenegro, are inconsistent due to change in the methodology, so it was necessary to create a homogeneous series of data. But, even after solving that problem, the biggest drawback of this econometric analysis remains the length of the time series, where longer time series would contribute to greater credibility of the obtained conclusions.

Labor market variables that proved to have statistically significant effect and positive correlation with the Gini coefficient are the unemployment rate and the long-term unemployment rate. Such results are not surprising if one takes into account that low unemployment, as well as good conditions on the labor market itself are a prerequisite for equality in income distribution. According to the findings, it can be concluded that an increase in the unemployment rate and long-term unemployment rate will lead to an increase in the value of the Gini coefficient, and the impact will last for several periods. With the use of impulse response function, it was shown that there is a greater influence of the long-term unemployment rate on the Gini coefficient than in the case of the unemployment rate. This leads to the conclusion that both hypotheses are confirmed in the paper.

The conclusion about the positive correlation of labor market determinants and economic inequality coincides with the results obtained by Huskić (2018), who examined this relationship on the example of Bosnia and Herzegovina. This can lead us to the conclusion that the core of the problem of income inequality in the countries of the former Yugoslavia is precisely the labor market and the structural reforms it requires, and of course, the analysis needs to be extended to other countries of the former Yugoslavia. Structural reforms of the labor market in Montenegro would imply the rebuilding of labor market institutions, due to the fact that they have lost their role, thus putting the worker in a subordinate position, which significantly affected economic inequality. In addition, an indispensable part is the reform of the education sector, which would bring supply and demand in the labor market into harmony.

Research in the field of labor market and income inequality is always important and relevant, because of the social side in the development and progress of society, which must not be neglected. Certainly, insisting on the social side, to a large extent, can lead to a situation where it is a limiting factor in economic development (Končar et al., 2020). That is why it is important to find the right balance, which of course is specific to each country. At the same time, the examples and experiences of other countries, both in terms of labor market reform and economic inequality, can serve as a valuable input in the development of the national strategy of any country.

For future research, it remains interesting to see whether the hypothesis of a positive correlation between the labor market and economic inequality will continue to be valid even when conditions on the labor market improve significantly, or whether income inequality is inherent to capitalism. It would also be interesting to extend this analysis to the economies of the region and the entire Balkans. Further, this paper will be the backbone for future researches in this scientific field in Montenegro, for the reason that it is a pioneering work in this field.

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APPENDIX

Table A1

Information criteria for lag length for the VAR (Gini and UR) model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	36.112	NA	1.80e-05	-5.248	-5.161	-5.266
1	42.626	10.022*	1.25e-05*	-5.635*	-5.374*	-5.688
2	45.721	3.809	1.53e-05	-5.496	-5.061	-5.585

Note: *indicates lag order selected by the criterion; LR - sequential modified LR test statistic (each test at 5% level); FPE - Final prediction error; AIC – Akaike information criterion; SC - Schwarz information criterion; HQ -Hannan-Quinn information criterion.
Source: Authors' calculation.

Table A2

Information criteria for lag length for the VAR (Gini and LTUR) model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	39.820	NA	1.02e-05	-5.818	-5.731*	-5.836
1	44.643	7.422	9.13e-06*	-5.945*	-5.684	-5.999*

Note: *indicates lag order selected by the criterion; LR - sequential modified LR test statistic (each test at 5% level); FPE - Final prediction error; AIC – Akaike information criterion; SC - Schwarz information criterion; HQ -Hannan-Quinn information criterion.
Source: Authors' calculation.

Table A3

Calculation of the homogeneous series of the Gini coefficient

	Calculated Gini coefficient (EU methodology)	Original Gini coefficient (WB methodology)
2006	35.9	24.4
2007	38.8	26.4
2008	37.2	25.3
2009	38.8	26.4
2010	35.7	24.3
2011	38.1	25.9
2012	38.9	26.5

$\text{Gini coefficient}_{2013\ \text{EU method}}\ \text{Gini coefficent}_{2013\ \text{WB method}}\ \boldsymbol{M}$;
$\boldsymbol{M} = 38.5/26.2 = 1.469466$

Table A4
Test of autocorrelation, normality and heteroskedasticity of the VAR (UR and Gini) model

Serial correlation LM test			
Lags	LM-statistics		Prob
1	5.40466		0.2482
2	3.59498		0.4636
Residual normality test – Cholesky (Lutkepohl)			
Component	Jarque-Bera	df	Prob.
1	0.55223	2	0.7587
2	0.56849	2	0.7526
Joint	1.12072	4	0.8910
Heteroskedasticity Test – No cross terms			
Chi-sq		df	Prob.
9.55943		12	0.6545

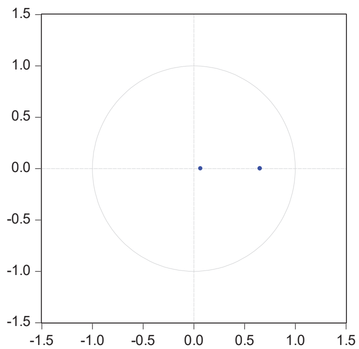
Source: Authors' calculation.

Table A5
Test of autocorrelation, normality and heteroskedasticity of VAR (LTUR and Gini) models

Serial correlation LM test			
Lags	LM-statistics		Prob
1	10.73321		0.0297
2	3.42234		0.4898
3	8.38103		0.0786
Residual normality test – Cholesky (Lutkepohl)			
Component	Jarque-Bera	df	Prob.
1	0.24042	2	0.8867
2	5.17263	2	0.0753
Joint	5.41306	4	0.2475
Heteroskedasticity Test – No cross terms			
Chi-sq		df	Prob.
26.33595		24	0.3363

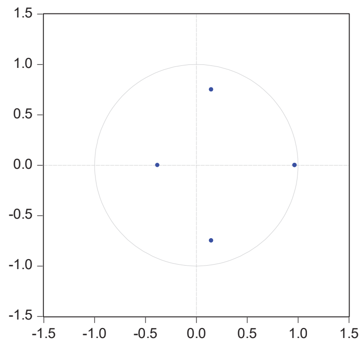
Source: Authors' calculation.

Graph A1
Representation of the roots of a polynomial inside the unit circle for VAR (UR and Gini) model



Source: Authors' calculation.

Graph A2
The roots of the polynomial inside the unit circle for the VAR (LTUR and Gini) model



Source: Authors' calculation.

Sažetak

UTJECAJ ODREDNICA TRŽIŠTA RADA NA EKONOMSKU NEJEDNAKOST MJERENO PREMA GINIJEVOM KOEFICIJENTU U CRNOJ GORI

Nemanja Popović, Milivoje Radović, Jovan Đurašković

Univerzitet Crne Gore, Ekonomski fakultet

Podgorica, Crna Gora

U ovom radu provedena je analiza čiji je cilj bolje razumijevanje koliko su tržište rada i nejednakost dohodaka u društvu povezani, i to kroz ispitivanje odnosa varijabli koje opisuju ekonomsku nejednakost i tržište rada u Crnoj Gori. Analiza podrazumijeva upotrebu ekonometrijskih tehnika i VAR modela, koji uz upotrebu funkcija impulsnog odziva i dekompozicije varijance na najbolji način oslikavaju utjecaj odabranih varijabli tržišta rada na ekonomsku nejednakost. Rezultati istraživanja mogu biti korisni istraživačima koji se bave problematikom ekonomske nejednakosti u Crnoj Gori, i pružiti im dodatni mehanizam za analizu tokova i predviđanje budućih vrijednosti odrednica ekonomske nejednakosti. Rezultati provedene analize pokazuju da su se varijable tržišta rada, odnosno stopa nezaposlenosti i dugotrajna stopa nezaposlenosti, pokazale kao značajne za objašnjenje ekonomske nejednakosti, mjerene Ginijevim koeficijentom. Rezultati u ovom dijelu omogućavaju drugačiji pristup u analizi tržišta rada i ekonomske nejednakosti u Crnoj Gori, što može poslužiti kao osnova za mnoge buduće analize.

Ključne riječi: Ginijev koeficijent, tržište rada, VAR modeli, nejednakost.