Statistical Analysis of the Asymmetrical Unemployement in Albania

Ornela Shalari[1], Anita Gumeni[2], Pranvera Mulla[3]

Abstract: The asymmetry of the business cycle has concerned economists for a long time. The main objective of this study is testing asymmetries of the business cycle in Albania, using quarterly rates of unemployment. The extant literature shows that economic time series data changes faster during contractions than expansions. We use information received from unemployment to test the asymmetries in the Albanian business cycle. The use data from January 01, 2000 to September 31, 2017. The data are received from the Bank of Albania. In this analysis we use non-parametric method. We conclude that the moments of the distribution analysis is not a powerful method to reach conclusive results.

Keywords: asymmetry; business cycle; steepness; deepness

1. Introduction

Let $x_1, x_2, \ldots, x_n$ be a random sample from a continuous probability distribution $F(x)$ with density $\varphi(x)$. Recently, a very important problem is the symmetry of $\varphi(x)$ about some unknown values. The symmetry of $\varphi(x)$ is essential for determining which location parameters represent the probability distribution the most. The presence of the mean, median and mode doesn't function in the asymmetry's case. Labeling with μ the mean or median of $\varphi(\bullet)$, the null hypothesis for the symmetry can be formulated as:

$$H_0 : F(\mu - x) = 1 - F(\mu + x) \qquad \forall x$$

Against the alternative hypothesis of asymmetry:

$$H_1 : F(\mu - x) \neq 1 - F(\mu + x)$$

for at least an x. Various procedures to test the asymmetry of the probability distribution are proposed in the economic literature. These can be classified according to the use of calculating the coefficient of skewness. The skewness index is presented from the third standardized moment $\gamma_1 = \mu_3 / \sigma^3$, where μ_3 and σ are respectively the third central moment $E[(X - \mu)^3]$ and the standard deviation. In an obvious manner $\gamma_1 = 0$ if the distribution is symmetric. Although γ_1 is the traditional measure of skewness, it

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nevertheless has its flaws. The coefficient of skewness is sensitive to outliers and can be vague when it comes to heavy-tailed distribution. Moreover, even when it is equal to zero for the symmetric distribution, a value equal to zero doesn't necessarily signify that the distribution is symmetric (Bacci & Bartolucci, 2013).

The notion, that the economic time series can evolve in an asymmetric way during the business cycle, has taken a lot of attention on the economy. A business cycle is symmetric when the recessions are mirror images with the expansions (Boldin, 1999) or is asymmetric when expansions are not the same with the recessions (Sichel, 1993). Sichel pointed out that the expansions often consist in smaller deviations of the economic time series from the trend more than the recessions. He called this quality, asymmetry deepness. If the same quality applies to the growth rates of the economic time series, then it can be stated that the series have asymmetry steepness.

This study tests the steepness and deepness asymmetry, using the moments of the distribution. For this purpose we use times series data for the unemployment rates from 1 January 2000 – 31 September 2017 in Albania.

The study's structure is like it follows: The second section starts with a summary of the asymmetry and the moments of the distribution. The third part informs about the results and analysis, while the last section presents the conclusions.

2. The Asymmetry and the Moments of Distribution

Moments of distribution give us a useful summary of the probability distribution. For a symmetric probability distribution, the coefficient of skewness is going to be zero[1] and the mean will be equal to the median. A positive coefficient of skewness shows that the probability distribution inclines to the right, which means that the right tail of the probability distribution is longer than the tail on the left. Vice versa, a negative coefficient shows that the probability distribution inclines to the left. However, if the contractions are shorter and more severe than the expansions, the probability distribution should be negatively skewed and it should induce an important coefficient of skewness in frequency distribution (DeLong & Summers, 1986). DeLong and Summers focused on the changes' magnitude and according to them this probability distribution should have considerably less than half of observations below the mean; just like the average deviation from the observations' mean below the mean should be significantly bigger than the average deviation from the observations' mean above the mean. The median should surpass the mean by a considerable amount. According to Sichel, this phenomenon is known as deepness hypothesis:

> "If a time series exhibits deepness, then it should exhibit negative skewness relative to mean or trend; that it is should have fewer observations below its mean or trend than above, but the average deviation of observations below the mean or trend should exceed the average deviation of observations above…" (Sichel, 1993, f. 227).

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[1] Note, even though skewness and asymmetry are not synonyms, the symmetry means that the left and right parts of the distribution are the same, while skewness' coeficient compares the tails' density in a relative distance with the mean. It is possible that a distribution can be asymmetric and its skewness' coeficient might be zero. However, a distribution with a skewness' coeficient equaling zero can be asymmetric.

Besides this, if the macroeconomic variables in the study fall quickly from the trend, the negative deviation's slope should be steepened. This means that the distribution of the first differences should be skewed negatively as well. The number of observations beneath the mean should be lower than the number of the observations above the mean, even though the average deviation from the observation's mean beneath the mean should be greater than the average deviation from the observation's mean above the mean. This is recognized as the steepness hypothesis (Sichel, 1993).

> "....if a time series exhibits steepness, then its first differences should exhibit negative skewness. That is, the sharp decreases in the series should be larger, but less frequent, than the moderate increases in the series" (Sichel, 1993, f. 228)

3. Results and Analysis

After the relevant statistics are calculated, the result are shown in Table 3. We test the following hypothesis:

- **Null hypothesis**: The quarterly rates of the unemployement in Albania does not have deepness/steepness asymmetry;

- **Alternative hypothesis:** The quarterly rates of the unemployement in Albania does have deepness/steepness asymmetry.

The figure 1 shows the frequency probability distributions for the quarterly rates of unemployment rate in Albania and the first differences, given the null hypothesis of the symmetry against the alternative hypothesis of the asymmetry.
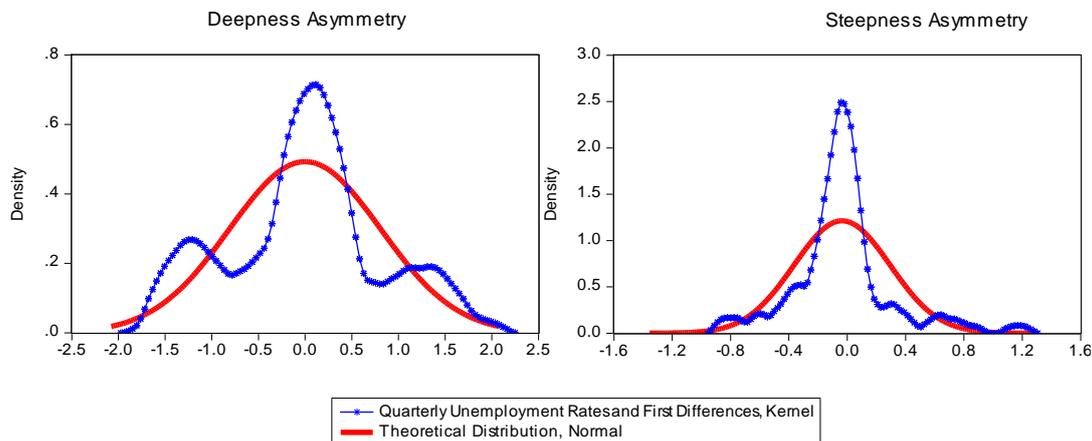

Figure 4. Probability distribution of times series data, refering to the null hypothesis of the symetry

In favor of the above's characteristics, facts about the asymmetry deepness in the distribution of the unemployment rate are shown in the table 1, which illustrates the asymmetry deepness hypothesis. When studying the unemployment rate, presented as variables against the cycle, it can be seen that the coefficient of skewness is positive and close to zero, the mean and the median are also very close to zero. This signifies that this variables does not show asymmetry deepness. This can be confirmed even if we won't take the relative number of the "beneath the mean" observations and the relative average

deviation in the matter. The number of observations beneath the mean is greater than half of the observations above the mean while the average deviation is smaller. For unemployment raport A should be greater than one and raport B should be less than one to support the deepness hypothesis. However, the data in table 1 does not support deepness hypothesis.

Table 2. Deepness Hypothesis[1]

Description	U
Skewness	.053
Mean	.00
Median	.09
Observations	**71**
Number of observations I: $(x - \mu) < 0$	28
Number of observations II: $(x - \mu) > 0$	43
Ratio A: (Obs I/Obs II)	**0.65**
Deviation I: $(\lvert x - \mu < 0 \rvert)$	.502
Deviation II: $(\lvert x - \mu > 0 \rvert)$	.536
Ratio B: (Vroj I/Vroj II)	**0.94**

The hypothesis of steepness are illustrated in the table 2. The unemployment rate variables have a positive coefficient of skewness, meaning that the growth of these macroeconomic variable above the trend can be very quick.

For the unemployment rate, taken as variables against the cycle, it can be noticed that the coefficient of skewness is different from zero and that the mean exceeds the median. The results shows little evidence of steepness concernin labour market, which can be confirmed even if the relative number of the observations below the mean and the average relative deviation is observed.

Table 3. Steepness Hypothesis[2]

Description	U
Skewness	.73
Mean	-.036
Median	-.038
Observations	**70**
Number of observations I: $(x - \mu) < 0$	36
Number of observations II: $(x - \mu) > 0$	34
Ratio A: (Obs I/Obs II)	**1.06**
Deviation I: $(\lvert x - \mu < 0 \rvert)$	.22

[1] The I and II observations are respectively the number of deviations of these variables under and over the relevant mean. The I and II mean, respectively shows the deviation's mean of the variables beneath and above the mean. If raport A is less than 1, we have to deal with a "ephermal" recession and if raport B is bigger than 1 we have to deal with a deep recession. The deepness hypothesis seeks that Raport A < 1 and Raport B > 1, while when it comes to variables that are against the cycle like unemployment, Raport A should be >1 and Raport B < 1.

[2] The I and II observations are respectively the number of deviations of these variables under and over the relevant mean. The I and II mean, respectively shows the deviation's mean of the variables beneath and above the mean. If raport A is less than 1, we have to deal with a "ephermal" recession and if raport B is bigger than 1 we have to deal with a deep recession. The deepness hypothesis seeks that Raport A < 1 and Raport B > 1, while when it comes to variables that are against the cycle like unemployment, Raport A should be >1 and Raport B < 1.

Deviation II: ($\|x - \mu > 0\|$)	.29
Ratio B: (Vroj I/Vroj II)	**0.76**

The number of observations under the mean is greater than half of the observations above the mean while the average deviation is smaller. All of these characterise an asymmetry steepness.

4. Conclusion

In this study, the empirical results show that the time series are not affected by the asymmetry deepness. Likewise, there is little evidence of steepness asymmetry on the labour market varibales in Albanian economy. This suggests that the troughs in the business cycle the unemployment rises rapidly in recesinons and recovers slowly during economic expansions.

When the unemployment rate is asymmetrical it will behave differently throughout the business cycle. However, the business cycle oscillations cause asymmetry only in their speed and not in the crescent movement's level against the incident ones. These finds have an important effect: Firstly, if the size of the expansion's peaks and recession's troughs or the speed with which they approach changes, this will have consequences for the implementation and the economic policy impact. Secondly, the asymmetry will affect the accuracy of the econometric models (notably, the models which are symmetric and linear), where the economic oscillation's interpretation based on these models can be inaccurate while the linear models are unable to generate asymmetric oscillations (Sichel, 1993). Consequently, the policy compilers should pay more attention to the asymmetry when the model macroeconomic series that show asymmetric disorders (Hamilton, 1989), (Sichel, 1993), (Narayan & Narayan, 2008). When there is asymmetry, according to (Rothman, 1998), the unemployment level will rise fast in the recession, but it will drop relatively slow during the expansion, which can be considered nonlinear phenomena.

5. References

Bacci, S. & Bartolucci, F. (2013). Mixtures of equispaced normal distributions and their use for testing symmetry in univariate data. _Computational Statistics & Data Analysis_ .

Boldin, M. (1999). Should policy makers worry about asymmetries in the business cycle? _Studies in Nonlinear Dynamics and Econometrics,_ 3(4), pp. 203-220.

Delong, B. & Summers, L. (1998). How Does Macroeconomic Policy Affect Output? _Brookings Papers on Economic Activity_, 2, pp. 433-494.

DeLong, J.B. & Summers, L.H. (1986). Are Business Cycle Symmetrical? (R. Gordon, Ed.) _The American Business Cycle: Continuity and Change_, pp. 166-179.

Hamilton, J.D. (1989). A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle. _Econometrica,_ 57(2), pp. 357-384.

Narayan, P.K. & Narayan, S. (2008). Examining the Asymmetric Behavior of Macroeconomic Aggregates in Asian Economies. _Pacific Economic Review,_ 13(5), pp. 567-574.

Randles, R.M.; Flinger, M.; Policello, G. & Wolfe, D. (1980). An Asymptotically Distribution-Free Test for Symmetry versus Asymmetry. _Journal of the American Statistical Association,_ 75(1), pp. 168-172.

Rothman, P. (1998). Forecasting asymmetric unemployment rates. _Review of Economics and Statistics,_ 80, pp. 164-168.

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Sichel, D.E. (1993). Business Cycle Asymmetry: A Deeper Look. *Economic Inquiry,* 31(2), pp. 224-236.

Verbrugge, R. (1997). Investigating Cyclical Asymmetries. *Studies in Nonlinear Dynamics and Econometrics,* 2(1), pp. 15-22.

Anexes

Table 4. Statistical Values of the Time Series according to the deepness and steepness asymmetry

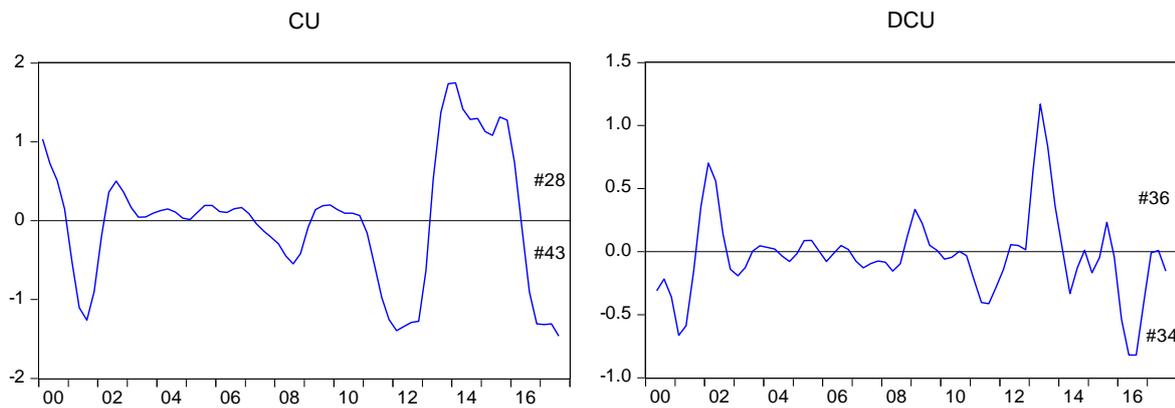|	CU	DCU
Mean	6.99E-13	-0.035699
Median	0.094572	-0.038152
Maximum	1.747871	1.170397
Minimum	-1.462916	-0.821110
Std. Dev.	0.809664	0.328867
Skewness	0.052782	0.731048
Kurtosis	2.604983	5.742214
Observations	71	70

Figure 5. The "deepness" and "steepness" series, given to the unemployment