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Calculation Method of the Proposed Unemployment Gender Inequality Indicator

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Abstract

The paper describes a new calculation method of the unemployment gender inequality indicator, that was based on the enhancement of the ratio of the unemployment rate of men and women, and on the restriction with the levels of the average unemployment rates. The proposed method of the calculation of the gender inequality indicator eliminates weak spots of the known two methods. Our proposed method was explained and compared with the known two methods, with practical examples using data of Spain, over the sample period 1972-2016. The result of the proposed method is the indicator of the unemployment gender inequality and severity intervals of gender inequality. With severity intervals of the gender inequality, we determine the importance of the gender inequality issue based on the calculated unemployment gender inequality rate.

Keywords: gender; inequality; unemployment; indicator.

JEL classification: C02; C82; J16.

1. INTRODUCTION

Inequality between genders persists in many aspects of the economy, labour market was not an exception. While gender inequality was analysed in wages, in participation rates in the labour market and in employment, gender inequality in unemployment did not received much attention before year 2000. Since 2000, Azmat *et al.* (2004) and Queneau and Sen (2007) gave the basis of its analysis. Gender inequality in participation rates in labour market and in employment was analysed and described by Boskovic and Njegovan (2012), Çemrek and Yenilmez (2016) and Georgiadis and Christopoulos (2017). Wage inequality was analysed and described by He and Wu (2017); Kennedy et al. (2017); Kutateladze and Lawson (2017); Lee and Wie (2017); Popli and Yilmaz (2017).

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This paper contributes to the gender inequality analysis in unemployment, with the suggestion of the new indicator, that could eliminate weak spots of the Azmat *et al.* (2004), and Queneau and Sen (2007) unemployment gender inequality indicators. We have introduced a new approach to calculation of the unemployment gender inequality indicator, extended and adjusted to levels of the average unemployment rates. The aim of this paper was not to analyse gender inequality, but to propose the new method how to prepare data for analysis, and how to obtain the most accurate unemployment gender inequality indicator, that should have the highest value for the future work of researchers and any interested subjects.

The paper is structured as follows. We started with literature review of the previous gender inequality studies, following by the description of the indicators that were widely used by authors to determine gender inequality in unemployment. Further, we have described our proposed indicator in detail. Thereafter, we have tested proposed indicator on practical example and we compared it with the results achieved by known indicators. Spain unemployment rate data by gender were used, due to Spain's turbulent unemployment rates that were varying from very high rates to very low rates and reverse, more than one time during the observed period. Another reason was Spain's uncertain and dynamic unemployment gender inequality over the chosen sample period. Therefore, Spain is the perfect sample country and the sample period on which we could test our indicator and prove that returns accurate results regardless of level of unemployment rates. Finally, we gave our conclusion.

2. LITERATURE REVIEW

Gender inequality could have its roots at the stereotype perception of women as weak and fragile, who should take care of household rather than work. This negative perception of women goes very far into the past, and the consequences of it exist even today (Krainska, 2016). Achieving gender equality, according to Klugman *et al.* (2014) is not related to increasing women's participation in the workforce, but it was caused by giving women the same rights, in the world of work, as men have. This problem won't be solved only using government actions and policies, but the private sector should adjust likewise. Decreasing gender inequality, could lead to increase of growth, according to Klasen and Minasyan (2017), while Bandiera and Natraj (2013) claim that there is a lack of proof of dependence between men and women and that the further analysis is needed.

While the calculation of inequality in the labour market in such aspects as wage and employment existed and were usually researched, gender inequality in unemployment was neglected before Azmat *et al.* (2004). Queneau and Sen (2007) started to research it and defined rules of it calculation. They have introduced calculation of the gender gap as a ratio of unemployment rate of women to men, denoted as $u^R = u^F/u^M$, where u^F is the unemployment rate of women and u^M is the unemployment rate of men. Azmat *et al.* (2004) likewise calculated gender inequality as a difference between unemployment rate of women and men, denoted as $\Delta u_t = u_t^F - u_t^M$.

Many authors used a ratio of unemployment rate of female to male to discover gender inequality. Among them are Bakas and Papapetrou (2014), who analysed gender inequality by comparing the average unemployment rate, unemployment rate of men and women, unemployment rate female to male ratio and difference between them. Peiro *et al.* (2012) investigated the influence of business cycles on average unemployment rates,

unemployment rates of women and men and on annual changes of average unemployment rates and unemployment rates of women and men.

Among the other methods of gender inequality calculations, Koutentakis (2015) proposed method to analyse unemployment gender inequality by constructing steady-state unemployment gap from job finding and separation rates. He also constructed two gender gaps, one from differences in job finding rates and one from differences in the separation rates. Further, gender inequality in unemployment, was researched using probability analysis of men's and women's inflows and outflows from the unemployment to the employment and reverse. Authors, that analysed gender inequality using this method, were Ollikainen (2006); Theodossiou and Zangelidis (2009); Sahin *et al.* (2010); Tansel and Tasci (2010); Gokulsing and Tandrayen-Ragoobur (2014); Gonul (2014); Baussola *et al.* (2015).

3. WEIGHTED UNEMPLOYMENT GENDER INEQUALITY RATE (WUGIR)

Unemployment gender inequality rate, introduced in this paper, is based on the unemployment rates of men and women. We followed Azmat *et al.* (2004) and Queneau and Sen (2007) calculations of the gender gap as a ratio of female to male unemployment rate with some modifications and we have introduced the scale of the gender inequality in unemployment. The unemployment rate of men was the same as the unemployment rate of women only in rare occasions, there is always some difference between them, one is always higher than the other. Fluctuations in the labour market are inevitable and because of that, total equality would not occur in most of the cases. The question remains, how much inequality could be considered as equality, resp. unthreatening inequality. To answer this question, we have proposed a new method of calculation of the unemployment gender inequality indicator that reduces the shortcomings from the established two indicators.

Let denote u_t^F as the unemployment rate of women and u_t^M as the unemployment rate of men in time *t*. Further, let propose the basic scale to distinguish which unemployment rate is higher, of women or men. Total equality would be at zero on this scale, meaning that $u_t^F = u_t^M$. If only women were unemployed ($u_t^F > 0$) and no men ($u_t^M = 0$) then absolute inequality that put women in disadvantage would be at -1. If only men were unemployed ($u_t^M > 0$) and no women ($u_t^F = 0$) then indicator of the absolute inequality arises that put men in disadvantage would return value 1 (Figure no. 1).

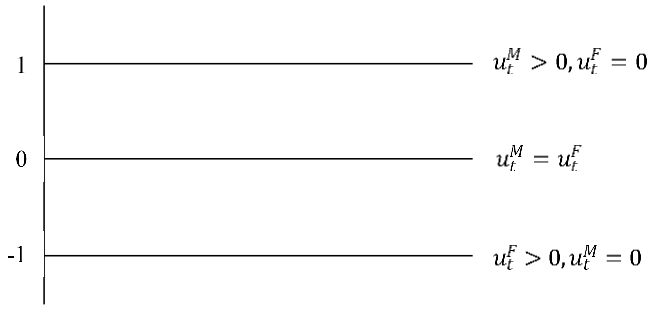

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Figure no. 1 – Basic scale of gender inequality

The basic scale (Figure no. 1) depicts boundaries only for the extreme cases. For example, if the unemployment rate of women is 5% and the unemployment rate of men is 0%, we obtain value -1 on this scale, but we would also obtain value -1 if the unemployment rate of men is 0% and the unemployment rate of women is whichever number higher than zero. However, in this case, there is no necessity to measure the inequality between unemployment rates since one of them is zero, and another whichever number distinct than zero, inequality is undeniable.

Now, when we can clearly distinguish, that when women are worse off than men in unemployment, the obtained value of the unemployment gender inequality would be from interval [-1,0] and in reverse case, when men are worse off than women in unemployment obtained value of the unemployment gender inequality would be from interval [0,1], we were able to adjust this scale and incorporate ratios of the gender unemployment rates in it.

Let denote unemployment gender inequality as u_t^i and let compute it by following the next rules:

(1) $$u_t^M = u_t^F \Longrightarrow u_t^i = 0$$
(2) $$u_t^M > 0 \wedge u_t^F = 0 \Longrightarrow u_t^i = 1$$
(3) $$u_t^F > 0 \wedge u_t^M = 0 \Longrightarrow u_t^i = -1$$
(4) $$u_t^F < u_t^M \Longrightarrow u_t^i = \left((u_t^F/u_t^M) - 1\right) \times (-1)$$
(5) $$u_t^M < u_t^F \Longrightarrow u_t^i = (u_t^M/u_t^F) - 1$$

With fourth and fifth rule, we have obtained the values of the unemployment gender inequality indicator. In case of women being worse off than men in unemployment, this value was from interval [0,-1], and in case of men being worse off than women, this value was from interval [0,1]. Without this calculation (rule 4 and 5), that is bounded with described intervals, that are restricted above and below zero depending on the gender, we would only obtain values from interval [0,1] and we would not obtain information about gender that is worse off in unemployment, but we would obtain information about seriousness of the gender inequality. This was the shortcoming from the gender inequality in unemployment indicator of Azmat *et al.* (2004) and Queneau and Sen (2007), who calculated gender inequality as a ratio of female to male unemployment rate ($u^R = u^F/u^M$). By calculating gender inequality as a ratio of higher unemployment rate to lower we have bounded unemployment gender inequality under boundary from -1 to 1. Basic scale of unemployment gender inequality was then extended to fit the boundaries of u_t^i (Figure no. 2).

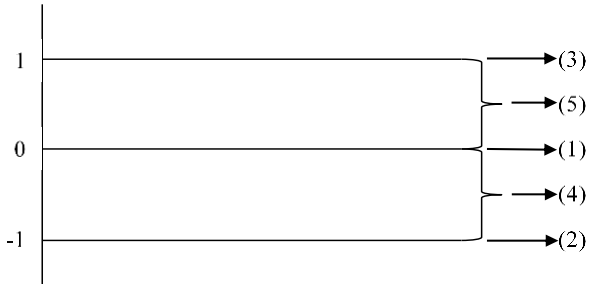

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Figure no. 2 – Extended basic scale of gender inequality

Unemployment gender inequality (u_t^i) calculated as mentioned above, has its disadvantages in not being related to the levels of the unemployment rate. This could cause the confirmation of gender inequality in cases the one does not exist, in cases when unemployment rate is low. Therefore, we have weighted the unemployment gender inequality (u_t^i) with the average unemployment rates (u_t). Weighted unemployment gender inequality was then denoted as

$$u_t^{wi} = u_t^i \times \frac{u_t}{100}. \quad (1)$$

By dividing the average unemployment rate (u_t) by hundred, we have achieved that all inflicted data are of the same scale from zero to one. Since multiplication of small numbers gives even smaller numbers which are hard to interpret. We have converted the result to rates by multiplying the result by one hundred. Now, we have obtained the unemployment gender inequality rate denoted as:

$$u_t^{inq} = u_t^{wi} \times 100. \quad (2)$$

Using our proposed calculation of the unemployment gender inequality indicator, diminished the shortcomings from the established well-known methods regarding the same unemployment gender inequality ratio of distinct levels of unemployment rates and misinterpreted inequality.

3.1 Shortcomings of the unemployment gender inequality indicator calculations

In this section we would like to provide review of the weak spots of the distinct calculations of the unemployment gender inequality indicators and describe how could method we propose, eliminate these shortcomings. To provide evidence of the shortcomings of the methods, we have generated 5000 unemployment rates for each gender and calculated unemployment gender inequality indicator using all three calculation methods. Unemployment gender inequality indicator calculated as ratio of female to male unemployment rates was in further text mentioned as “Ratio Indicator”, next one that was calculated as difference between unemployment rate of female and male unemployment rates was in further text mentioned as “Difference Indicator” and our proposed indicator was labelled as “WUGIR Indicator”.

The most widely used methods for calculation of the unemployment gender inequality indicator, as ratio of female to male unemployment rate, and as difference between them, usually returns inconsistent results. While one provides evidence of high unemployment gender inequality other claim that opposite is true (Figure no. 3). The issue arises due to lack of implementation of levels of unemployment rates into the calculation through weighting. Which method we propose does, and in some way, combine the advantages from both and propose their extension.

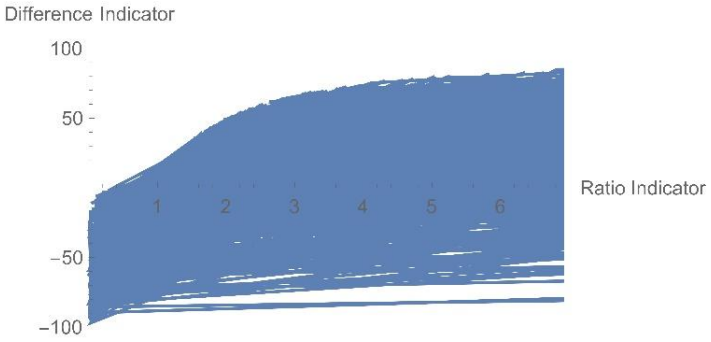

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Figure no. 3 – Relation between Difference and Ratio Indicator

One of the main issues of the calculation of the unemployment gender inequality as ratio of female to male unemployment rate, consists of unequal determined indicator of unemployment gender inequality. This occurs due to calculation of gender inequality always as ratio of female to male unemployment rate, and never as ratio of male to female unemployment rate. Therefore, we could find higher value of unemployment gender inequality indicator in cases when male unemployment rates were higher than women unemployment rates. If we in this calculation, switch values from nominator and denominator, we would obtain lower value of the unemployment gender inequality indicator, when compared with value of equality, which is set to one. We should also mention that intervals are set to [0,1] for unemployment rate of men being higher than unemployment rate of women, and to [1,+∞) in opposite case. Having unequal intervals makes it difficult to compare severity of the unemployment gender inequality (Figure no. 4).

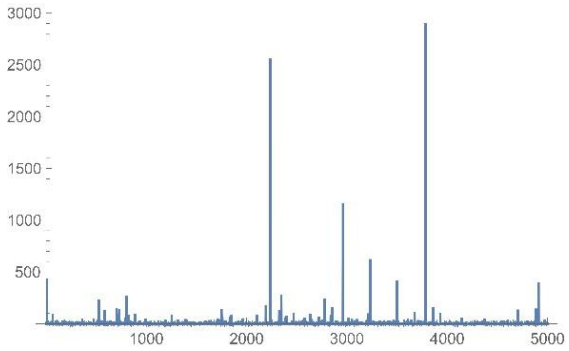

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Figure no. 4 – Ratio Indicator

Principal issue with the unemployment gender inequality indicator calculated as difference between unemployment rate of women and men, consists of ignorance of unemployment rates. Therefore, returns the same value of unemployment gender inequality, regardless of being calculated from averagely high or low unemployment rates, which makes them incomparable. In times of high unemployment rates could specific value of this

indicator imply negligible unemployment gender inequality, while in times of low average unemployment rates could report severe gender inequality, unemployment rate of one gender could double or triple the unemployment rate of other gender. Therefore, when compare without information of average unemployment rates, values of unemployment gender inequality indicator wouldn't provide relevant information about gender inequality, hence gender inequality would be misinterpreted.

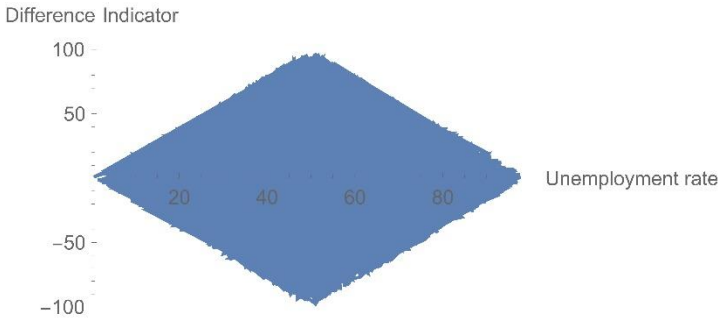

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Figure no. 5 – Relation between unemployment rates and Difference Indicator

Figure no. 5 depicts the issue with higher unemployment rates. Since it is not weighted with unemployment rates, limitations are strict and report lower gender inequality, and doesn't consider severity of the issue. With higher unemployment rates, the issue with high gender inequality is more critical, since the policy makers must deal with two issues, high gender inequality and high unemployment rates.

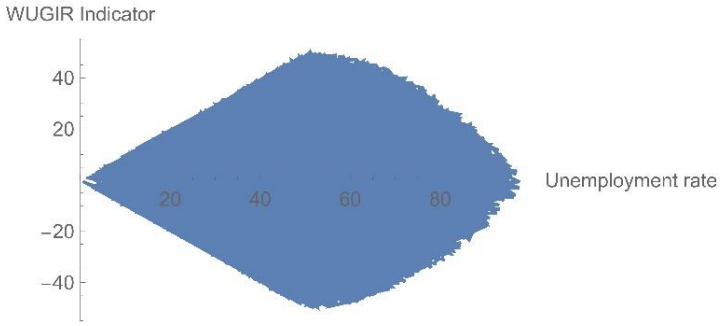

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Figure no. 6 – Relation between average unemployment rate and WUGIR indicator

We could consider as shortcoming of our proposed calculation of the unemployment gender inequality indicator the next phenomenon. We couldn't expect perfect equality of gender unemployment rates, and we have assumed that fluctuations are the same regardless of level of unemployment rates. We considered that gender inequality is insignificant if the unemployment rate is very low, and we have attributed the variation between the genders in to fluctuations between genders in unemployment. Unemployment gender inequality was the highest around 50% unemployment rate, further we go from this value to both sides, the

gender inequality was decreasing. The relation between them was straight increasing in the lower quartile of unemployment rates, while in the upper quartile was spherical decreasing (Figure no. 6). We observe, that it was thicker on the edges, while around zero was sparse. This was due to the probability of gender unemployment rate equality being low and almost not occurring in the labour market.

3.2 Severity intervals of proposed unemployment gender inequality indicator

The extension of the weighted unemployment gender inequality and adapting it as the unemployment gender inequality rate (u_t^{inq}) changed the interval of gender inequality to unemployment gender inequality rate interval, hence interval $\langle -1; 1 \rangle$ was transformed to the interval $\langle -100; 100 \rangle$. This action permitted us to measure and interpret the severity of the gender inequality in unemployment using the proposed indicator of the unemployment gender inequality defined as rate. We suggest that returned values of this indicator that are closer to zero to be considered as indicators of the low inequality and those values closer to 100 or -100 as indicators of the severe inequality. We assume, that the unemployment rate of women would never be the same as the unemployment rate of men, some fluctuations would always exist across them. Therefore, we propose the interval of gender inequality in unemployment, returned values of which could be interpreted as non-existing inequality aka equality. The limitations of this interval were calculated by permitting 1.25% of fluctuation around average unemployment rate from both sides. Fluctuation from the left side was calculated as

$$left\ side = u_t - (u_t \times 1.25\%), \tag{3}$$

and from the right side as

$$right\ side = u_t + (u_t \times 1.25\%). \tag{4}$$

Unemployment gender equality was assumed as interval based on which we sorted the returned values of the unemployment gender inequality rate indicator as non-existent gender inequality, remaining intervals of gender inequality were focused on proposing the measurement scale of the severity of the gender inequality. Likewise, we have calculated unemployment gender equality critical limitation values, we have consequently calculated the limitation values for the 2.5% and 5% fluctuations around average unemployment rate and we were suggesting the three inequality intervals (Table no.1)

Table no. 1 – Intervals of gender inequality in unemployment

Fluctuation of	Intervals	Inequality Category
$\pm 1.25\%$ (2.5%)	$u_t^{inq} \in (-2.469; 2.469)$	Equality
$\pm 2.5\%$ (5%)	$u_t^{inq} \in (-4.878; -2.469\rangle \cup \langle 2.469; 4.878)$	Low inequality
$\pm 5\%$ (10%)	$u_t^{inq} \in (-9.524; -4.878\rangle \cup \langle 4.878; 9.524)$	Medium inequality
$\pm >$ 5% (10%)	$u_t^{inq} \in (-100; -9.524\rangle \cup \langle 9.524; 100)$	High inequality

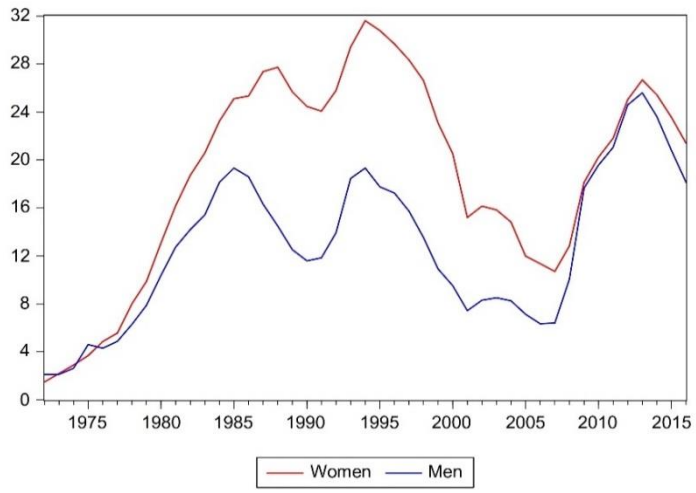
Source: own calculations

Inequality between genders was non-existing if unemployment gender inequality rate (u_t^{inq}) fell to equality category. Hence, we consider that in this case, policy makers interference was not needed, since we assume that the inequality rate fluctuates around its natural inequality rate, that we proposed in this paper. Further, if the value of the u_t^{inq} was classified into low inequality interval, we suggest that policy makers should revise if the gender equality policy was operating as it should and procure that weak spots that lead to gender inequality are eliminated, perhaps a small revision of this policy is needed. If the value of u_t^{inq} was classified to medium inequality interval, we suggest that policy makers should revisit their policy and made changes with which implementation, gender inequality could be decreased, this could take time and the results from its implementation would be visible in medium run. If the value of u_t^{inq} was classified to high inequality interval, we suggest that policy makers should perform an exhaustive study to identify the main root of the gender inequality, which would help them to propose a new effective way to decrease gender inequality. They shouldn't only focus on unemployment, but also on the environment and economy so they could find the proper solution. In this case, new strategy to decrease gender inequality should be made and implemented in stages. To decrease high gender inequality rate would take the time. This is not applicable when gender inequality is the result of the economic shock.

4. COMPARISON OF THE METHODS ON PRACTICAL EXAMPLES

To demonstrate how results obtained from different calculation methods of gender inequality in the unemployment diversify, we have employed Spain annual data on unemployment rates by gender and average unemployment rates over the sample period 1972-2016 that was obtained from the OECD database (2017).

Since 1972 until 2016, the unemployment rate of women was higher than the unemployment rate of men in most cases (Figure no. 7).

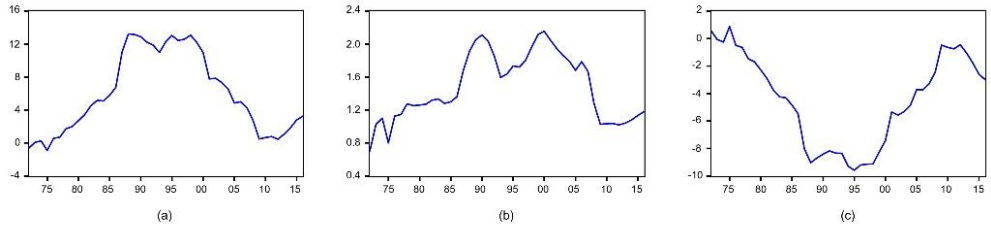


Source: own calculations

Figure no. 7 – Unemployment rate by gender

When observing the unemployment rates inequality, it was evident that they had diversified, but it was not unambiguous how much unequal they were. To determine the severity of the gender inequality, it should be exempt from the trend of the unemployment rates. But there was also a difference between the gender inequality during the times of the low and high unemployment rates. We intend to demonstrate that during the times when unemployment rate was low, it couldn't be reported high gender inequality.

In continuation, we have calculated unemployment gender inequality with all three described methods (Figure no. 8).



Source: own calculations

Figure no 8 – Gender Inequality according to three methods

In the figure (Figure no. 8a), gender inequality in unemployment was calculated as a difference between the unemployment rate of men and women ($\Delta u_t = u_t^F - u_t^M$). We could clearly determine by how many percent was the unemployment rate of women higher than the unemployment rate of men. However, ratios of unemployment rate of women to unemployment rate of men ($u^R = u^F/u^M$) (Figure no. 8b), provide evidence of unemployment rates of women being in some cases two times higher than unemployment rates of men. Based on figure (Figure no. 8a) we were not able to determine if the value 7.78% of difference in year 2001 was reporting low or high gender inequality, since we did not had information about the ratio between the gender unemployment rates and we had higher difference between gender unemployment rates, which were higher than 12%. To properly evaluate the gender inequality, we also need information about the ratio for this year, which was equal to 2.05 (Figure no. 8b). At this point we could conclude that the gender inequality was in fact very high and that the unemployment rate of women was twice as high as the unemployment rate of men. This issue was solved using our proposed method (Figure no. 8c). If the unemployment rate of women was higher than the unemployment rate of men, we would report this occurrence in case that the value of the unemployment gender inequality rate (u_t^{inq}) was below zero. By setting the intervals of unemployment gender inequality severity we could determine how severe the unemployment gender inequality was. In the year 2001, the unemployment gender inequality indicator (u_t^{inq}) had a value -5.35%, which was classified to the medium inequality interval. It indicates that gender inequality was very high, and minus before the number indicates that women were at a disadvantage compared to men. In 2001 the average unemployment rate was 10.47%.

Further it was investigated extreme values of the unemployment rates, when the unemployment rate was very low and very high. In 1972, the average unemployment rate was 1.95%, difference between gender rates was -0.63, therefore the unemployment rate of men

was higher than the unemployment rate of women. The ratio was equal to 0.703. While from the difference between gender rates we would conclude that inequality doesn't exist, the ratio could puzzle us. Let recall the scale of ratios for this indicator, values from 0 to 1 indicate that the unemployment rate of men was higher than the unemployment rate of women, and from 1 to infinity, the unemployment rate of women was higher than the unemployment rate of men. This is the disadvantage of this indicator considering it is not clear how much of inequality reports value 0.703 considering scale being different for men and women. We transferred this to our scale (Figure no. 2). According to scale from our proposed indicator of gender inequality ratio, returned value of gender inequality was equal to 0.296. Hence, according to this calculation, gender inequality was also low. When we address to the results from our proposed indicator, value of the unemployment gender inequality rate ($u_t^{inq} = 0.58$) was suggesting, that gender inequality was non-existent. This was legitimate, since the unemployment rate was low, inequality could be ascribed to fluctuations in the labour market.

Opposite example could be found in year 1995, when the average unemployment rate was high (22.68%) and both difference between gender unemployment rates (13.03) and a ratio (1.73) was high. There is no doubt here that gender inequality was also very high. Unemployment gender inequality rate ($u_t^{inq} = -9.59$) indicates that inequality was very high and troubling. Back then, the unemployment rate of women was 30.79%, while the unemployment rate of men was 17.77%, both high, but the level of inequality was astonishing as well.

Based on the evidence provided, results from first and second method didn't always match. While by the first method difference between the gender unemployment rates was small, by ratios inequality was very high. Shortcomings from both methods were eliminated.

5. CONCLUSIONS

Calculation of the unemployment gender inequality indicator was introduced in this paper. The indicator was calculated from modified ratios from the previous method, to extract the severity of inequality from it, then it was weighted with the average unemployment rates to eliminate spurious inequality, when calculating from low average unemployment rates. Fluctuations in the labour market occurred all the time, due of which we suggested rejecting inequality between genders when the average unemployment rate was too low. We then set intervals, according to which we could determine the severity of gender inequality in unemployment. One of the weak spots from the established indicators was spurious inequality, occurring in times when the average unemployment rate was low. Other issue were non-symmetrical intervals of the indicator based on the unemployment rate of women to men ratio. We have demonstrated shortcomings of all indicators on generated data.

We compared all three methods on practical examples, using data from Spain. This data included both high and low unemployment rates and different combinations of gender inequality. The distribution of values was also listed, according to which we have concluded that gender inequality was always low when the average unemployment rates were low and more scattered as the average unemployment rate increases up to 50%, after which gender inequality decreases.

The purpose of this paper was not to analyse gender inequality in unemployment, but to propose a new calculation method of it indicator. Data computed as described in this paper, could be used for further analysis of the gender inequality in unemployment.

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