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Assessing Minimum Wage Policy Implications upon Income Inequalities. The Case of Romania

Eva Militaru ^{1,*}, Madalina Ecaterina Popescu ^{1,2}, Amalia Cristescu ^{1,3} and Maria Denisa Vasilescu ^{1,2}

- ¹ National Scientific Research Institute for Labor and Social Protection, Bucharest 010643, Romania; madalina.andreica@gmail.com (M.E.P.); cristescuamalia@gmail.com (A.C.); mariadenisa.vasilescu@gmail.com (M.D.V.)
- ² The Faculty of Economic Cybernetics, Statistics and Informatics, The Bucharest University of Economic Studies, Bucharest 010552, Romania
- ³ The Faculty of Theoretical and Applied Economics, The Bucharest University of Economic Studies, Bucharest 010552, Romania
- * Correspondence: militaru@incsmps.ro

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Abstract: Starting from the consideration that excessive income inequalities could hamper sustainable growth, our paper aims to evaluate the impact of the minimum wage policy upon wage and income distributions. Using the European Union Survey on Income and Living Conditions (EU-SILC) database with national representative sample of households, an income distribution analysis was conducted for the case of Romania based on two microsimulation approaches. The first one assumed building a counterfactual income distribution under the hypothesis of no change in minimum wage, while the second one implied a decomposition of the Gini coefficient of income inequalities based on main income determinants, including the minimum wage level and the share of minimum wage earners in the total number of employees. Both approaches pointed to similar findings, indicating a positive effect of the minimum wage on wage inequalities reduction for both genders, although higher for women, as they are more present among lower paid employees. The minimum wage policy can reshape the wage distribution, by enlarging the share of minimum income earners and narrowing the middle. Moreover, the household disposable income becomes less unequal when minimum wage earners come from poor households with numerous children.

Keywords: income inequality; wage inequality; minimum wage policy; impact assessment; microsimulations

1. Introduction

Around economic inequality or its most common form, income inequality, major political, social, economic, and academic debates have arisen. In general, people have negative feelings towards inequalities coming from the common sense that a certain degree of social justice must exist in every society. In recent years, inequalities expressed as gaps in incomes, opportunities, and life chances have extended not only between, but mostly within countries, as a consequence of historical developments, as well as social, cultural, and political contexts.

Inequality of income distribution occurs when individuals belonging to a group (e.g., country) do not possess the same level of income. An excessively unequal income distribution could hamper sustainable growth, while economic growth by itself is not a guarantee for inequality reduction (see [1,2]) even if it contributes to enhancing human development through improvements in the

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standard of living. Sustainable growth refers to the economic development that can be maintained by a country without causing significant economic, social, and environmental problems for future generations. The first sustainable development goal of the United Nations Organizations for 2030 states that in order to put an end to poverty everywhere and in all its forms, equality promotion is a prerequisite alongside the provision of sustainable jobs. Moreover, the 10th goal re-expresses this by aiming at reducing inequality within and among countries. Also, less inequality is important for human development per se.

If we look at inequalities between countries, the future seems critical, as emerging economies would not be able to bridge the gap to developed countries unless they achieve growth rates which are not sustainable [3]. On the other hand, within a country, income differences in time lead to wealth polarization, encourage rent-seeking behavior, lowering poor people's chances to improve their relative standard of living and participate in society [1]. Countries with higher income inequalities have lower life-expectancy rates, a poorer health status, and are confronted with many other negative social outcomes, as compared to more equal countries [4]. On the labor market also, low returns to labor can affect workers' productivity. One of the primary causes of inequality lies in the way technological changes affect labor markets and its capacity to possess or provide human capital stocks to adapt. Lately, the gap between high-skilled workers and low-skilled workers has widened, so human capital is practically at the core of inequality of earnings, but, in turn, there are other factors that contribute to the ability to gain high skills, such as opportunity to access education, which in turn depends on the institutional setting, health system, social protection and taxation, public investments, social systems, etc. [5].

In Romania, inequalities are high (the Gini coefficient was equal to 34.7 for 2017, the third highest in the EU) and have resulted from a range of economic, social, and historical evolutions. The former communist regime has left a powerful mark on the country's development, while the transition to market economy has generated deep and durable inequalities. The transformation of the country in the post-communist period has been accompanied by a harsh economic decline. The privatization of state companies has created an opportunity for resources concentration in the hands of a small elite, which was the beginning of wealth polarization. Corruption as well has contributed to granting unjustified privileges for certain categories, enforcing the societal imbalances. Privatization in agriculture, even if favorable as a general impact, has fostered the creation of an unproductive and fragmented agricultural sector, dominated by subsistence agriculture, which still acts as a safety net for many households, but still well below its productive potential. Informal economy has developed at a fast pace, absorbing important masses of labor force and reinforcing income inequalities. Massive migration for work abroad, despite contributing to improved standard of living for the families left home, has exacerbated the existing inequalities through generating labor market imbalances. In regions with greater relative specialization of economic activities compared to regions having a diversified economic structure, the effects of external shocks on labor market were stronger [6], deepening regional inequalities. On the other hand, social policy has compensated only partially the negative developments during transition. Therefore, we can say that transition from planned to market economy has created opportunities for some categories, but at the same time has reduced prospects for others, thereupon a certain stratification based on education, ethnicity, age, and region has deepened in time.

The Romanian National Strategy for Sustainable Development 2030 addresses these issues, having as objectives, among others, the reduction of social polarization through gradually and constantly increasing the incomes of the poor, supporting economic activities in rural areas, promoting and monitoring of legislation in the area of social inclusion. At the same time, the targets for 2030 include labor market, social protection, and fiscal policy adjustments for improving equality between citizens and bridging the gap between Romania and EU for the sustainable development indicators.

One way to achieve less income inequality is through wages, as they represent the most important part of earnings. The provision of a statutory minimum wage is regarded as a public policy element that basically reduces poverty and inequality. It represents "the minimum sum payable to a worker

for work performed or services rendered, within a given period, whether calculated on the basis of time or output, which may not be reduced either by individual or collective agreement, which is guaranteed by law and which may be fixed in such a way as to cover the minimum needs of the worker and his or her family, in the light of national economic and social conditions" [7]. But, in turn, minimum wage is also changing the incentives people face on the labor market and their decisions, as well as firms' behavior. Recently, there is an increasing concern on minimum wage setting policy in the European Union, as Germany joined the group of EU countries with statutory minimum wages. This fact has triggered even more intense debates in countries like Finland and Italy, where collective agreements have full control upon the minimum wage level. The question of the effectiveness of a minimum wage European coordination in a common market is also brought to debate (see [8]). However, given the current differences in the existing minimum wage mechanisms around the world, a European minimum wage setting policy remains unlikely to be adopted in the near future. So far, there are various minimum wage setting mechanisms already implemented in the world, from collective agreement systems (such as the case of the Nordic countries, Austria, and until recently, Germany too) to government-set minimum wage mechanisms, where public authorities have full control upon the level of the minimum wage. In between this spectrum, there are, however, quite a large variety of mechanisms. For instance, some follow an automatic indexation formula (such as the case of Luxembourg), while other rely mostly on the recommendation of an expert body. Similar to Spain and Czech Republic, the minimum wage in Romania is set by the government after consultation with social partners. In general, consultations may occur directly with social partners (as in the case of Czech Republic and Romania) or could involve an expert body (such as the case of many other countries like France, United Kingdom, the Netherlands, Portugal, Ireland, Latvia, Lithuania, Malta, Hungary, and Bulgaria) (see [9–11]).

The Romanian minimum wage setting policy has a long history starting with 1990, when it was included in the labor market regulation and the social policies. However, the permanent structural economic changes faced by Romania in the transition period from central planning to market economy weakened the Romanian labor market flexibility and capacity to reform efficiently. Thus, the weakly correlated adjustments of the minimum wage with the economic performances during the first two decades turned the minimum wage more into an instrument to counteract in-work poverty and wage inequalities than to support decent employment.

Moreover, the privatization process along with the legislation on collective labor contracts have considerably affected both the trade union membership rate (which dropped from 90% in 1990 to around 20% in 2013) and the bargaining coverage rate (which is less than 25% of total employment). Nowadays, according to latest estimations, there are around 1.3 million employees paid at the minimum wage level in Romania (which nearly accounts for 30% of all employees), facing a high asymmetry in the employees' income distribution, which is concentrated below average wages. Moreover, during the last decade the value of the statutory gross minimum wage has increased to 3.5 times its initial level [12].

According to the European Commission's recommendations, Romania is currently facing the challenge of building a transparent minimum wage setting mechanism based on objective criteria, reliable data, and effective consultation with social partners [13]. The way to do that implies, therefore, conducting impact assessments and scenario analysis of the effects of minimum wage upon labor market before any decision is taken. In this sense, studying the impact of minimum wage on income distribution, in general and on wage inequalities, in particular, using different methodological approaches based on microsimulations of incomes could offer valuable insights regarding policy implications by bringing evidence upon the possible expected chain of events triggered by such governmental decision. Even though studying the effects of minimum wage upon employment is a matter of equal importance, as supported by numerous international studies in this field ([14,15]), our paper aims only at investigating the income inequality effects of minimum wage increases in Romania, leaving other potential labor market implication open for debate. The main reason for this was that no

plausible behavioral changes following a minimum wage increase could be incorporated in the model because of the divergent empirical findings existing so far for the Romanian case (see [16–18]).

Our paper specifically targets the period between 2013 and 2014 when the minimum wage increased by more than 26% from the beginning to the end of the period, but each year there were two raises, practically the average annual increase weighted by the number of months has been equal to 14%. The data we use is annual, being collected through the European Union Survey on Income and Living Conditions (EU-SILC). The reason for choosing this particular period between 2013 and 2014 was because during these two years the country has experienced the highest relative increase in the minimum wage level within the last 10 years, with the exception of 2018 for which the EU-SILC microdata has not yet been released, thus not allowing for analysis for the moment.

The remainder of the paper proceeds as follows: Section 2 is dedicated to the literature review in the field, while the methodology and data are described in Section 3. The main results of the impact evaluation of minimum wage increases on income inequalities are presented in Section 4, while the last section is dedicated to the discussions and the concluding remarks of the paper.

2. Literature Review

In any society, either highly developed or less developed, there is a certain degree of inequality in income, which not only cannot be avoided, but is also necessary for a sound economic functioning [19]. However, even if the concept of inequality is not an issue per se, the causes and especially the consequences of income inequalities, as well as their growth, must be taken into account. Inequalities are related to a wide diversity of phenomena, ranging from poverty to health and life expectancy, crime, community breakdown, intergenerational immobility, and the inter-generational spread of poverty, with all of these phenomena being of utmost importance to any society [20]. When income inequality influences or is influenced by such phenomena, its understanding becomes a top research theme (see [21,22].

The pioneers of income inequality studies are [23] and [24]. The former demonstrated that between economic development and income inequality there is an inverted "U"- shaped relationship, which means that, at lower levels of development, economic growth is associated with increasing inequalities, and when the curve becomes decreasing, the increase of economic development is associated with the decrease of income inequalities. The determinants of the initial positive relationship between the degree of economic development and income inequality were industrialization and labor migration from agriculture to industry where wages were higher. Kuznets's relationship has been empirically tested over time by many researchers, with quite different results, demonstrating that this issue, the relationship between economic development and income inequality in a country, is far from being clarified [25–27]. This happens because there are many other variables that influence the level of income inequality, such as the demographic, sociological, and cultural characteristics of the population [28]. The political dimension also has a very strong influence on the evolution of income inequality in a country [29]. In the case of highly developed countries, more recent research suggests that Kuznets's relationship changes again at some point, looking more like a "N" ([30,31]). On the other hand, if we study the inverse relationship, many researchers have shown that income inequality has a negative effect on growth and sustainability [32]. For instance, Herzer and Vollmer [33] brought empirical evidence of a negative long-run effect of inequality on income per capita, both for developed and developing countries, while Marrero and Rodriguez [34] found negative correlations between inequality of opportunity and growth. Barro's [35] findings on the Kuznets curve also sustain the fact that higher inequalities affect growth in poor countries but encourage it in richer countries. The effects of income inequalities on growth over the medium term were also studied by [36], who have shown that higher income shares for the poor and the middle-income class lead to higher economic growth, and, on the contrary, increases in the income shares of the rich affect growth negatively.

When analyzing income inequality, it is relevant to establish the income used: market income (earnings, income from self-employment, income from investments), net income, or disposable

income [37]. This is important, as economic growth can contribute to higher income inequalities, but well-designed social and fiscal policies can offset these effects. It was observed that the level of social protection expenditure and the level of income inequality are in an inverse relationship [38].

The income inequality analysis framework is most often based on the analysis of household income distribution, which is the focal point of economic inequalities. We have to say that there is not yet a unified theory of income distribution, let alone in terms of income inequality [39]. The distribution of household incomes is primarily influenced by household members' labor earnings. Therefore, in order to understand the distribution of household incomes, we need to focus on how individuals earn their income on the labor market, but also on the composition of households in relation to the labor market. From this perspective, labor market institutions (trade unions, employers unions, minimum wage regulation) have a very strong influence on the distribution of labor earnings, with significant differences in the level of earnings among groups of workers by gender, ethnicity, education, etc.

The approach to income distribution analysis should be the study of the dynamics and instability of income, as income is not static over time, and one of the major advances made in the literature is the recognition of the need to adopt a dynamic approach to income studies [20]. The dynamic approach refers both to the evolution of household and household incomes, as well as to the inter-temporal trajectories along the career pathway and the mobility of income from one generation to the next. Changes in household structure, migration, and other demographic phenomena may have an important influence on income dynamics and income inequality.

In general, income distribution changes quite slowly during short intervals of time ([40,41]) for various reasons: Individuals are generally reluctant to change their jobs, income is perpetuated from one generation to the next [26,28,42], etc. On the other hand, it is true that between two closely related moments (for example, two months), we can notice changes attributable to seasonal factors (e.g., agriculture, etc.), or to labor market transitions. Annual aggregates can alter certain changes in income distribution, so changes in this range may appear to be minor [43]. Economic cycles can greatly influence income distribution and the evolution of income inequalities ([44,45]).

Other theories such as the "median voter model" support the idea that increased wage inequality pushes towards redistribution through social transfers and taxes [46], or, on the contrary, high wage inequality is correlated with less redistribution of income in favor of the poor [47]. Moene and Wallerstein [48] have shown that increased wage inequality is conducive to increased demand for redistribution, and, as a consequence, in countries with a more egalitarian wage distribution, social spending is higher. Acemoglu [49] argues that the recent increase in inequality worldwide is due to the acceleration in skill bias occurring when technological change advantages skilled over unskilled workers, as the relative productivity of the former improves increasing its relative demand and also the associated skill premium.

As far as the impact of the minimum wage on the labor market is concerned, it generally does not explicitly lead to a reduction of wage/income inequalities, although the increase of the minimum wage could be associated with a possible reduction of wage/income inequalities and of in-work poverty. Usually, the minimum wage compresses the distribution of wages by raising the lowest levels, thus leading to a reduction in inequalities, provided that the minimum wage growth is not offset by comparable evolutions of other wages. If the minimum wage increase affects employees with incomes below the poverty line, the minimum wage could also reduce poverty. But the magnitude and relevance of such effects is mostly an empirical problem, which is highly dependent on the number of employees influenced by the minimum wage growth and on the broader distribution of household income.

Internationally, most research on the subject demonstrates that the minimum wage and its development play a crucial part in clarifying the models of wage inequality, through the direct and contagion effects [50]. In the United States, Card and Krueger [51] analyzed the distributional effects of the minimum wage and concluded that the minimum wage growth generally tends to increase the mean wage at the bottom of the wage distribution. In another study conducted for the period 1979–1988 in the United States of America, DiNardo et al. [52] used the counterfactual approach in the study of wage

distribution and concluded that the high level of wage inequality at the lower end of the distribution was due to the erosion of the real minimum wage at that time. The analysis also showed that a 25% increase of wage dispersion was the effect of the minimum wage raise. Moreover, Teulings [50] and Lee [53], using different methodological approaches, have found that the real minimum wage decline accounted for the 1980s rise in wage inequalities.

Autor et al. [54] tested the effects of minimum wage for various points on the wage distribution and salary ratios (P50/P10) using a regression model. Their analysis has shown that minimum wage erosion has led to increased inequalities at the bottom end of the wage distribution. Their empirical study basically brought evidence that in the 1980s the United States minimum wage erosion was partly responsible for increasing income inequality and the low-wage workers' average salary.

For the case of UK, Dolton et al. [55] associated the minimum wage increases in 1999–2007 with an annual drop in wage inequalities at the bottom of the distribution. However, Dickens et al. [56] found that for percentiles 5 and 10, the effects were significant at 10%, while for higher percentiles, the effects were not statistically significant. Estimated coefficients have decreased in amplitude by a large percentage. When introducing lags into the analysis, it was found that the results are generally insignificant, with the exception of the 25th percentile, where it was statistically significant. Their findings suggest that the minimum wage impact on wage distributions has a time delay, while the effects tend to be much more important over some time. This could explain to some extent why previous studies, such as that of [57], found only a negligible effect of the minimum wage on wage inequalities.

More recently, Lee's model [53] was extended by Autor et al. [58] by including fixed effects at state level and trend by using a longer period of time (1979–2012). They noticed that the minimum wage has a statistically significant effect on the lower end of the wage distribution, spreading across the other percentiles up to the median, for both men and women, and cumulated across the population.

For developing countries, much fewer studies have been devoted to this topic. For example, in the case of Brazil, Neri et al. [59] presented empirical evidence that the minimum wage has a strong positive impact on the entire workers' wage distribution-relatively low on the upper side of the distribution and more intense for those below the minimum wage level, indicating "collateral" effects upon wage distribution. Some similar results have also been formulated by Fajnzylber [60]. Azevedo et al. [61] have studied the main determinants of income inequality in Latin American countries following a decomposition approach and their analysis shows that most part of the reduction in income inequality over the past decade is due to the increase of low incomes. Brito et al. [62] have analyzed the contribution of the Brazilian minimum wage policy on reducing household income inequality and found that the minimum wage had a 64% contribution to the decline in income inequality during 1995–2014. Analyzing for the period 1996–2001, Neumark et al. [63] proved that the minimum wage pushes wages from the lower area of the distribution to a higher level, as growth was mandatory for low-wage workers, but no impact was identified on the wages of top-level workers. Exclusion of time effects has generated an increase of the impact on salaries of formal sector workers, further reducing the inequality of wage distribution. When time effects were introduced for both formal and informal sector workers, statistically significant and positive effects were obtained until the 20th percentile, and then a reduction occurred, while in the formal sector, the positive effect lasted only for the 10th percentile. Further on, Lemos [64] studied the impact of the minimum wage for the period 1982–2000 and found that the minimum wage strongly compressed the wage distribution in both sectors. In the formal sector, the effect of wages declined throughout the whole distribution, while the informal sector first registered a rise and then a decline in the distribution of wages.

Following the economic crisis in 2008, there has been a stronger interest in studying the minimum wage, viewed as a useful and relevant policy tool, as more and more countries were facing both wages increases and worsening wage inequalities. For example, Rani and Ranjbar [65] have attempted to analyze the impact of minimum wage on workers' salaries using quantile regression for various wage distribution levels in five developing and emerging economies (India, Indonesia, Mexico, Brazil, and South Africa). However, they only looked at the impact of minimum wages on workers' wages at

different levels of wage distribution for two moments in time. First, they examined the wage distribution around minimum wages for employed workers (considering gender, industrial groups, formal, or informal sectors) and then quantified the marginal effects of the minimum wage at various levels.

To sum up, the empirically based studies on the effects of the minimum wage on wage or income distributions show a greater impact of the minimum wage in developing countries than in developed countries. Moreover, evidence in favor of positive effects of the minimum wage is also brought to light. The effects of the minimum wage prove to be strong in developing countries for minimum wage workers, and these effects diminish and disappear in time far more slowly than in developed economies. From a political perspective, the minimum wage plays an important role on the labor market, being often introduced with a clear welfare purpose of raising the wages of low-income workers and of improving wage or income distributions [66].

At national level, the literature on the study of wage or income inequalities and the effects of the minimum wage on them is not very generous and addresses only some aspects. Molnar [67] analyzed the income distribution, estimated the level of income inequalities, and explained the main causes of their occurrence, but the analysis covers a period up to 2008. Precupeţu [68] examined the dynamics of income inequalities in Romania in the post-communist period, focusing primarily on estimating the effectiveness of social policy in combating these inequalities. Zamfir et al. [69] focused on one of the income components that, in 2008, gained increasing importance in households' total income, remittances, and concluded that they had led to a reduction in inequalities between and within urban and rural areas. Militaru and Stroe [70] examined the income dynamics in Romania during 2000–2007, using the income incidence curves approach, and showed that the economic growth period was in favor of the poor.

The regional distribution of income was studied by Dachin and Mosora [71] who argued that the structure of regional employment and the share of subsistence agriculture were the main factors contributing to shaping income distribution by regions. The impact of the austerity measures implemented by the Romanian government in 2010 on the distribution of income was analyzed by Avram et al. [72], who found that people with higher incomes lost more of their income because of the austerity measures. Voinea and Mihăescu [73] estimated the impact of introducing the flat tax on income and inequality and showed that it has led to increased income for rich people and higher income inequality. The analysis of fiscal policy and its role in the evolution of income distribution conducted by Avram et al. [72] shows that the change in social contributions in 2011 has led to a rise in income inequality in Romania. For Romania, wage inequalities were recently studied in terms of determinants [74], dynamics [75], and regional profile [76].

Also, from the perspective of evaluating the effects of the minimum wage on wage inequalities, it is worth mentioning the study of [77], who proposed an approach to assess the impact of minimum wage changes in Romania by building a counterfactual scenario using micro-data from the Labor Force Survey (AMIGO) for the second quarter of 2014 (just before the minimum wage was modified) and the third quarter of 2014 (when the minimum wage has changed). The main assumption of the counterfactual scenario was that wages would remain unchanged between the first and third quarter, if the minimum wage did not change. The counterfactual hypothesis is justified because the empirical evidence shows that, generally, in the case of Romania, in the short term, there is a considerable stability concerning the distribution of wages (see [78,79]). The main benefit of counterfactual scenario analysis is the possibility of estimating the net impact of a change in the minimum wage on wage distribution based on comparing the wage level immediately after the change and the wage level in the absence of a change in the minimum wage. The results of the evaluation showed that minimum wage leads to a reduction in wage inequalities between men and women, as men's chances to earn more than women reduce by almost 46 percentage points.

In another recent study on the influences of minimum wage on the labor market in Romania [12] identified some of the most relevant socio-economic factors that could be employed for shaping the minimum wage policy, distinguishing between impact assessment indicators and minimum wage

setting indicators. Thus, in the category of impact assessment indicators, we can find the socio-economic variables on which it is recommended to periodically quantify the effects of raising the minimum wage by means of scenario analyses (such as the ratio between the gross minimum wage and the median gross wage, the employee compensation share in Gross Domestic Product (GDP), in-work poverty, employment rate, etc.). On the other hand, the minimum wage setting indicators refer to those socio-economic factors whose developments can be used to establish certain objective and transparent criteria for the minimum wage adjustment (such as the average gross wage, consumer prices index, GDP per capita, and the minimal consumer basket). Based on these indicators, scenarios and impact assessments were further developed. The results showed that the total number of employees with a minimum wage increases strongly with the minimum wage growth. Furthermore, the ratio between the gross minimum wage and the median gross wage (Kaitz index) tends to follow an upward trajectory with the minimum wage growth, while the poverty rate among the employees turned out not to adjust in concordance with the minimum wage increase.

3. Methodology and Data

In order to assess the impact of minimum wage adjustments on household income inequality and wage inequality, two methodological approaches have been used. Both approaches use income microsimulation, which allows us to model for each household in the sample the eligibility for social benefits, the amount for each social benefit received, the income tax and the social contributions, as well as any modification in wages. The advantage of using microsimulation also consists in the fact that the results obtained are extensively detailed. Moreover, microsimulation allows us to build scenarios and evaluate hypothetical situations.

Our first methodological approach consisted in assessing the impact of the minimum wage adjustments over the period 2013–2014 on the wage distribution and household income distribution. The difficulty of such an assessment stems from the fact that during the analyzed period, several phenomena that affected the income distribution to some extent have occurred (i.e., changes in the eligibility conditions for several means tested social benefits, general growth of wages or minimum wage increases). Specifically, in order to delimit the effect of the minimum wage adjustments from other influences on income distribution, one suitable methodological approach implies comparing the final state (registered in 2014 after the change of the minimum wage) with the scenario of no change in the minimum wage level. Because this latter scenario, generally used to assess the net impact of policies, cannot be analyzed, the practical solution is to build a counterfactual to answer the question "What would have happened in 2014 with the income distribution in case the minimum wage had not changed?" In our case, the counterfactual scenario was built from the household income database of the initial year (2013) and which was modified in order to update the household income from each income source with the average growth rate between the years 2013 and 2014. Moreover, all gross wages were increased in the counterfactual with the average gross wage growth between 2013 and 2014 drawn from administrative statistics. There are various practices of building the counterfactual in terms of income distribution, such as uprating with the inflation rate, change with the average or median income growth, or change with the income growth rate by deciles, quintiles etc. [62,80]. For reasons of availability and data accuracy, in this paper, we have chosen to build the counterfactual by modifying the household income with specific average growth rates. In order to reduce the errors that may result from applying one single growth rate for every type of income, the same hypothesis has been applied to each source of income. The resulted income distribution expressed through its corresponding Gini coefficient for inequality was compared with the 2014 distribution, and the main conclusions are presented in the following section. The Gini coefficient is one of the most popular measures of income inequality, being based on the Lorenz curve framework. Its values can range between 0 and 1 or can be presented as a percentage from 0 to 100, with 0 denoting perfect equality when all income is shared in a society, while 1 (or 100) denoting perfect inequality when one person has all the income. We are aware that the Gini coefficient has some limitations, namely that it cannot

differentiate between different patterns of income inequalities when Lorenz curves intersect (i.e., it is not the case in our analysis), it is very sensitive to inequalities in the middle part of the income distribution, and it is not very intuitive. However, despite these shortcomings, the Gini coefficient has several desirable properties, such as mean independence, population size independence, symmetry and Pigou-Dalton Transfer sensitivity, and it is widely used in research on income inequalities [40].

The second methodological approach was based on the decomposition of the Gini coefficient's changes between 2013 and 2014 and the estimation of the contribution of the minimum wage to this change. The method used measures the contribution of the determinants of a household's income to the change in the income distribution and was proposed by Barros et al. [81] and later on developed by Azevedo et al. [61]. First, the household income is considered to be consisting of the following two items: labor income and non-labor income. Second, inequalities between households in terms of income arise from the way in which these two categories of income are distributed across households. Thus, changing the distribution of these incomes leads to a change in the total distribution of income, and consequently in the size of inequalities. To be more precise, by successively substituting the values of each determinant (source of income in our case) at the starting point (2013) with the values at the final moment (2014), we can estimate their marginal contribution to the total change in income inequality. Because our goal was to estimate the impact of the minimum wage adjustment upon income inequality, following Brito's approach [62], the household income has been divided into two major components: labor income and other sources of income, while each of them, theoretically, can further on be divided into incomes related to the minimum wage and incomes that are not related to the level of the minimum wage.

Thus, we can write that:

$$y_H = y_L + y_{NL} \tag{1}$$

where y_H , y_L , and y_{NL} are per capita total household income, labor income, and other household income, respectively.

Next, it has been determined how the minimum wage influences labor income and the other income categories. First, the employees who were paid at the minimum wage level were identified in the EU-SILC database (for the year 2013).

Further, we extended Equation (1) by:

$$y_H = p_{MW} \times MW + y_{LNMW} + y_{NL} \tag{2}$$

where p_{MW} represents the share of employees paid at the minimum wage within the household, *MW* is the value of the minimum wage, and y_{LNMW} represents other wages exceeding the minimum wage.

Concerning the other y_{NL} household incomes, such as pensions, social benefits, transfers from other households, income from investments, etc., we assume they are not linked with the minimum wage level in Romania. There are frequent cases of other countries where the value of pensions or other social benefits is closely related to or even capped at the minimum wage level. All income is expressed in per capita terms.

Thus, we can write that:

$$y_H = p_{MW} \times MW + y_{NMW} \tag{3}$$

where y_{NMW} represents per capita labor or non-labor income that is not related to the minimum wage level.

Or, in other words, the per capita income of the household depends on the minimum wage level, the share of employees paid at the minimum wage level, and the per capita value of other income (other wages, social benefits etc.) that do not depend on the minimum wage:

$$y_H = f(p_{MW}, MW, y_{NMW}). \tag{4}$$

Of course, we could say that there are also other elements that alter the distribution of income, such as the tax system that can influence the income from each of the categories above, or significant changes in the household structure or the socio-economic attributes of its members [82]. However, in this paper we did not consider these elements because the one-year period between the two moments is too short to assume any major changes of this kind taking place.

Basically, any measure of inequality depends on the distribution of income across households. Let $F(y_H^t)$ be the cumulative distribution function of the per capita household income at moment t, which depends on the components mentioned above (minimum wage level, share of minimum wage earners, etc.). Thus, any inequality measure (e.g., Gini coefficient) can be expressed as a function of these components, and let $G^t = g(F(y(p_{MW}^t, MW^t, Y_{NMW}^t))))$ be the Gini coefficient at moment t. At any two moments of time, the Gini coefficients of income inequality can be estimated, whereas the difference between the two indices can be decomposed by measuring the contribution of each of the three components in Equation (4). Thus, if we have two moments of time, denoted 0 and 1, we can express the difference between the corresponding Gini coefficients as:

$$G^{1} - G^{0} = g(F(y(p_{MW}^{1}, MW^{1}, Y_{NMW}^{1}))) - g(F(y(p_{MW}^{0}, MW^{0}, Y_{NMW}^{0}))) = g(F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{0}))) - g(F(y(p_{MW}^{0}, MW^{0}, Y_{NMW}^{0}))) + (F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{1}))) - g(F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{0}))) + g(F(y(p_{MW}^{1}, MW^{1}, Y_{NMW}^{1}))) - g(F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{1})))) - g(F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{1})))).$$
(5)

In order to be able to carry out the above decomposition, we have to simulate counterfactual distributions of household income by replacing, in a sequential manner, the values of each component at moment 0 with the corresponding value at moment 1. For each simulated distribution, the estimated Gini coefficient measures the inequality that would have been registered if the component(s) had the value observed at time 1.

Thus, the three counterfactual distributions are obtained successively in the above order. The first difference estimates the contribution of the minimum wage to the change in income inequality; the second difference estimates the contribution of other non-wage-related incomes, while the latter estimates the contribution of the share of employees remunerated to the minimum wage level. It is important to note that this sequential approach may be affected by the order in which the simulations occur, which frequently happens in case of index decompositions [83], which is a limitation of our study. We should also specify that the method is appropriate for decomposing the changes in the distribution of total household income, but we have also estimated the Gini coefficient for wage inequality in each of the situations simulated in order to see to what extent the change in the household income affects the wage distribution. The synthesis of those stated above is found in the following table (see Table 1).

Table 1. Decomposition of the Gini coefficient and the calculation of income determinants' contribution.

Assessed Inequality/Counterfactual	Determinants of the Household Income	Calculation of the Contribution	
$G^{0} = g(F(y(p_{MW}^{0}, MW^{0}, Y_{NMW}^{0}))))$ $G^{MW} = g(F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{0}))))$ $G^{NMW} = g(F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{1}))))$ $G^{1} = (F(y(p_{MW}^{0}, MW^{1}, Y_{NMW}^{1})))$	Minimum wage Other income The share of employees paid by	$G^{MW} - G^{0}$ $G^{NMW} - G^{MW}$	
$G^{1} = g(F(y(p_{MW}^{1}, MW^{1}, Y_{NMW}^{1})))$	the minimum wage	$G^{I} - G^{IVIVIV}$	

Sources: authors' own calculations based on EU-SILC data and EUROMOD model.

The two methodological approaches proposed were based entirely on data from the EU-SILC conducted annually by the Romanian National Institute of Statistics (NIS), the microdata being provided by Eurostat. The EU-SILC microdata used was collected in 2014, with the reference year

of incomes being 2013. Furthermore, it should be noted that this survey is representative at national level for households in Romania, relying on a sample of approximately 7500 households. The data collected refers to household members who are at least 16 years old (about 17,300 individuals) and who were interviewed individually. However, relevant household information was also collected from the household reference person. The variables of interest for our assessments are related to the incomes of both individuals and households, detailed by income sources, and the socio-demographic characteristics of the household.

In order to carry out the assessment, the first step consisted of identifying the employees remunerated at the minimum wage level. The variable in the database that records the remuneration received by employees gathers the total gross earnings from dependent employment, which in addition to the gross base salary includes other amounts received by employees, such as compensations for extra hours, for night shifts, bonuses, etc. Thus, our selection was based on the total gross earnings, which was equivalized by the number of hours worked. Because the survey collects annual earnings and we needed monthly earnings, the annual amounts were equally spread among the months in which the person was employed. Finally, we selected the employees paid at the minimum wage level under the condition that the gross monthly earnings from employment fall within the range (0.8–1.1) of the statutory minimum gross wage. We chose to make the selection based on an interval rather than on a point value in order to limit certain exclusion errors entailed by the calculation of the equivalent gross wage, respectively, by the use of total earnings rather than the base to which the minimum statutory wage applies. We assumed that when the statutory minimum wage increases, the only employees affected are those paid at the minimum wage level, whose incomes would increase accordingly. However, the relevant literature in the field brings evidence to support the fact that a minimum wage growth can also have contagion effects on other wages going beyond the lower half of the wage distribution; but we did not simulate any other changes on wages higher than the minimum for reasons related to the ease of interpretation of results. It should be also noted that a fairly large number of employees had wages well below the lower limit of the interval. Since this finding cannot be explained with certainty as it could be due to data collection errors, registration errors, informal employment, etc., these employees were excluded from our analysis.

Our simulations use the EUROMOD tax-benefit microsimulation model [84], which enables the estimation of tax liabilities and social benefit entitlements by applying a set of user-defined policy rules to representative micro-data of households and individuals. EUROMOD encodes the social and fiscal policies of a country starting from the year the model was developed in that country and up to date (for Romania, it starts with 2007). The encoded parameters of the implemented policies can be changed, policies can be removed, or new policies can be added. The model covers all 28 member states of the European Union, its aim being that of providing a tool for consistent and comparable income distribution analysis for the EU countries. The model is built upon the EU-SILC database and it allows for simulations concerning changes in individual or household income (e.g., social benefits, taxes, and social contributions, etc.) and for the calculation of different income concepts, such as original income, disposable income, and net wages. Original income (or market income) is defined as all earned income (wages and salaries), income from capital (dividends, rents, profits, and so on) and private transfers (remittances, alimonies, etc.), whereas disposable income is obtained by adding social benefits to original income and subtracting direct taxes and social contributions. We define gross wages as the total monthly earnings from dependent employment, while net wages are obtained by subtracting social contributions and personal income tax from gross wages. These income concepts are used for income inequality estimations.

EUROMOD is a static model as the behavior and the socio-demographic characteristics of the population are assumed constant over time. Therefore, the model is able to estimate the first-order direct effects of income components on household income, not being able to simulate the second-round effects induced by behavioral changes. It can be used to assess the effects of past, actual, and potential reforms on income distribution, inequality, and poverty. Also, the model enables cross-country

comparative analysis on the redistributive effect of tax-benefit systems showing how different policies work in different countries in order to achieve common objectives. EUROMOD can also be used for the estimation of several work incentive indicators, which could give some ideas on the potential impact of policy reforms on labor supply. The model captures the interaction between policies, thus the change of one policy could affect the eligibility for other policies. The EUROMOD results are macro validated by comparing simulated aggregates with data from administrative sources or national accounts.

As a limitation of the model, which impacts the results of our study as well, we must mention that the EUROMOD model is based on several strong assumptions, such as no tax evasion (for Romania, except for the social contribution of self-employed in agricultural activities), all contributions and taxes due are paid accordingly, and all social benefits are claimed immediately and received by all persons/households that meet the eligibility conditions. Given our purpose was an illustration of the impact assessment of minimum wage changes on income distribution, we estimated the static first-order effects of minimum wage changes on household disposable income and abstract from any behavioral changes following a minimum wage increase. One further limitation of the data we use is that since the EU-SILC database was designed to be representative at household level, not being a representative sample for employees, the number of employees is over-represented in the sample, while the gross earnings is under-valued.

4. Main Results

The wage and the income distribution of households have changed in the period between 2013 and 2014. We estimated an average household income growth of 6%, slightly higher for original income or market income as compared to disposable income. The mean of the wage distribution is lifted up by almost 8%, more for gross wages than net amounts. While it is intuitive that the minimum wage had a positive influence on these outcomes, the extent of its contribution is difficult to foresee because in the same period, we have to consider at least other two elements with strong influence on the wage distribution: (1) the amounts of two of the main means tested benefits (social allowance and family support allowance) have increased and also the thresholds for means testing have been lifted and (2) wages experienced a general increase.

In order to illustrate the changes that have occurred in the income distribution during the timeframe under analysis, we have estimated the percentage changes for the average measures and the Gini coefficient for several distributions: household disposable income, household original income, gross, and net wage (see Table 2). As we have mentioned earlier, the changes in the mean are more pronounced for the gross wage and for original incomes than for net wages and disposable incomes. This is naturally indicating that the social benefit and tax system lowers, to some extent, the gross gains by equalizing more on net wages and disposable incomes, as it can be seen below. In other words, the average growth drops from gross to net incomes because the higher part of the income distribution loses more through taxation, while the poorer part gains more through social benefits. On the other hand, comparing the Gini coefficient's evolution between the two years, we remark a decline in inequality as shown by the wage and disposable income's distributions, in spite of market income inequality increases. Therefore, it shows the progressivity of the tax-benefit system, which redistributes to poorer households. We should mention that disposable income has been calculated as the difference between original (market income) and taxes (personal income tax and social contributions) and adding social transfers received. Both disposable and original income are equivalized at household level through the OECD modified scale in order to account for household size and composition.

	Household Disposable Income	Household Original Income	Gross Wages	Net Wages
Percentage change (%)	6.1	6.3	7.9	7.5
Baseline Gini coefficient (2013)	0.3369	0.4208	0.2478	0.2318
Final Gini coefficient (2014)	0.3335	0.4256	0.2439	0.2289
Counterfactual Gini coefficient	0.3412	0.4308	0.2553	0.2397
Change in Gini: 2013–2014 (relative change %)	-1.0	1.1	-1.6	-1.2
Change in Gini: counterfactual-2014 (relative change %)	-2.2	-1.2	-4.4	-4.5

Table 2. Income distribution statistics, 2013–2014.

Sources: authors' own calculations based on EU-SILC data and EUROMOD model.

In Figure 1, we have plotted two wage distributions; one is that of 2013, the baseline, before the minimum wage modification, while the other one is after the minimum wage level has been increased. What we can easily observe is that the wage distribution clearly shifts to the right after the minimum wage increase, with the share of employees paid at the minimum wage level becoming higher. Also, it is obvious that besides the minimum wage's influence, the distribution is affected by a general increase of wages.



Figure 1. Wage distributions before and after minimum wage increase, 2013–2014. Source: authors' own calculations based on European Union survey on income and living conditions (EU-SILC) data and EUROMOD model. Note: Kernel density, Epanechnikov function.

As it follows, we shall discuss the estimated impact of the minimum wage increase on the income distributions' developments employing the two methods described in the previous section of the paper.

The first and most relevant finding is that our estimations show a beneficial impact of the minimum wage on income inequalities, as each unit percentage increase in the gross minimum wage level lowers Gini coefficient of net wages distribution by 0.3%. Second, not only earnings are distributed more equally thanks to the minimum wage increases, but also overall household incomes. Thus, the Gini coefficient of household original income that incorporates earnings from employment decreases by approximately 1.2%, while that of household disposable income decreases by more than 2.2% (see Figure 2).



Figure 2. Percentage change of Gini coefficient as a result of minimum wage increase, 2013–2014. Source: authors' own calculations based on EU-SILC data and EUROMOD model.

Third, we have analyzed the outcomes in inequality reduction for each gender and found out that both men and women are better off after minimum wage raise, and the women's wage distribution is more significantly improved (6% decrease of Gini coefficient vs. 3.4% for men). This is relevant because women account for more than 56% of the minimum wage earners and are more likely to have lower wages than men. What is also worth mentioning is that after the minimum wage increase, the wage gap between men and women did not fall, remaining at around 88% in favor of men.

Concerning the second analysis approach that we have undertaken-the Gini coefficient decomposition—its outcomes are convergent to what we have found so far through counterfactual analysis. To sum up, we have estimated the contribution of the minimum wage level and the minimum wage earners share to income inequality reduction. We find out that the minimum wage increase, as well as the growing share of minimum wage earners contribute to enhanced household income equality. Of all factors, the level of the minimum wage contributes, by almost one-third, to income inequality reduction for household disposable incomes. On the other hand, the share of minimum wage earners in the total number of employees contributes to disposable income inequality reduction by 125%. The percent exceeding 100 shows that, in fact, there are other factors that contribute to inequality increases, such as other wages or incomes, which have no connection with the minimum wage developments. This means that if it were not for those negative influences on income inequality, the minimum wage's impact would have been more substantial on the distribution of household disposable income. However, even if the contribution of minimum wage as share in total inequality reduction is important, the absolute contribution is rather small as the total change in Gini between 2013 and 2014 is not higher than 1%. If we look at the wage distribution, it seems that the minimum wage has made it more equal through its level, but more unequal through the share of minimum wage earners. Alongside the raise in the minimum wage, the general change of wages has lowered wage inequalities.

A synthesis of the findings can be found in the table below (see Table 3).

Table 3. Decomposition of changes in the Gini coefficient, absolute and relative contributions, 2013–2014.

Household Income Determinants	Gini Coefficient for the Distribution of Household Disposable Income	Contribution of Determinants %		Contribution of Gini Coefficient Determinants % Gini Coefficient for the Wage Distribution		Contribution of Determinants %	
		In total absolute change	In total relative change		In total absolute change	In total relative change	
Baseline 2013	0.3369			0.2478			
Final 2014	0.3335			0.2439			
Total change	-0.00331	100	1.0	-0.00387	100	1.6	
Minimum wage level	-0.00076	22.9	0.225	-0.00087	22.6	0.352	
Other income	0.00158	-47.7	-0.469	-0.00817	211.1	3.297	
Share of minimum wage earners in total number of employees	-0.00413	124.7	1.226	0.00517	-133.6	-2.087	

Sources: Authors' own calculations based on EU-SILC data and EUROMOD model. Note: the "-" sign in columns 2 and 5 of the table indicates reduction in inequality, while the "-" sign in columns 3, 4, 6, and 7 indicates negative contribution to inequality reduction.

5. Discussion and Conclusions

Our paper has investigated the income inequality effects of minimum wage increases in Romania, by paying particular attention to the wage distribution, but also getting a broader view of the household disposable income distribution. The data on which our analysis is based come from the EU-SILC survey, the sample of households being national representative and providing information on income from detailed sources, thus making it most suitable for income distribution analysis. Technically, our approach is built on two impact evaluation methods both relying on microsimulation of incomes. The first one aims at constructing a counterfactual income distribution under the hypothesis that the minimum wage did not change and then, by comparing the final income distribution with the counterfactual, the paper discusses on the effects of minimum wage increase on income inequality. The second approach attempts at a decomposition of the Gini coefficient of income inequalities based on main income determinants, including the minimum wage level and the share of minimum wage earners in the total number of employees.

Our contribution is twofold. First, as research on impact evaluation of minimum wage upon income inequalities are at the pioneering stage in Romania, our estimations are one of the first attempts in this area. Second, we cross-validate our results by using two different methods of evaluation.

Therefore, the first consistent finding of our paper is that the two approaches point to similar conclusions. We find that the statutory minimum wage increase has a positive effect on wage inequalities and both genders benefit of it, but especially women, as they are more present among lower-paid employees. Moreover, the household disposable income becomes less unequal when minimum wage increases, meaning that the income gain spreads over the entire household as most minimum wage earners come from poor households with numerous children. Our findings are consistent with results of similar studies on the topic, such as s [55,61,62,66,67]. On the contrary, we find that the increased share of minimum wage earners has a negative effect on the equality of the wage distribution. Though it is not quite clear, we believe that this shows practically that by enlarging the share of minimum income earners, the middle of the wage distribution narrows, so the distribution becomes more polarized at the tails. So, what emerges from this result is that although minimum wage increase is beneficial for wage inequality reduction, the extent of inequality decrease is linked with the particular context where the change is taking place: the pre-minimum wage increase distribution, the magnitude of the increase, other wages' evolutions, labor market behavior, etc. Our results do not explicitly show how these factors affect inequality, but they certainly influence the concentration of workers at the minimum wage level after the minimum wage raise takes place. Therefore, from a policy perspective, it is important to bear in mind the complex implications associated with a minimum wage increase and that any intervention could distort the entire wage distribution having further negative effects on inequality and sustainability. Our results also reveal the importance of the middle

of the wage distribution in the sense that if wages are not concentrated at the middle, but at the bottom as it is the case of Romania (with more than one-third of the employees paid at the minimum wage), the effects on wage inequalities and broader on income inequalities are difficult to predict. Moreover, focusing extensively on low-income earners, policy makers should not disregard the middle-income class, which is particularly important judging from the sustainability point of view, this being the category investing the most in human development.

In the end, we must mention some caveats. First, the database we used was not planned for representativeness at employees' level, being a household survey data. The number of employees is over-represented in the sample, while the gross earnings are under-valued. Second, our estimations rely on microsimulation of incomes, which is based on several assumptions imposed by data availability and need for simplification in order to manage the interpretation of results. For example, we assume no tax evasion, except for the social contribution of self-employed in agricultural activities, and full benefit take-up. Another limitation of our study would regard the decomposition analysis we have carried out, which cannot settle on whether the inequality decrease is the effect of the changes in the abilities or skills of the population, or the changes in returns to those characteristics matter most. Also, maybe most important, as we do not consider any behavioral changes following a minimum wage increase, our estimations being limited to the first order direct effects. We know that a minimum wage increase induces incentives for both employees and employers, which in turn could affect the income distribution as well. For example, when the minimum wage rises, some of the unskilled employees could lose their jobs, other employees with wages just near the minimum wage could choose to work less, or some employers will choose to raise other wages along with minimum wage increase in order to maintain the hierarchic structure of the wage bill. So, the behavioral aspects are relevant in this context, and our future research will not abstract of this.

Overall, our analysis shows that the minimum wage policy has the power to reshape the wage distribution, being influential for the entire household income distribution as well. Still, the absolute change in the Gini coefficient determined by the minimum wage policy is rather small. Raising the level of minimum wage is one way to reduce income inequality, but there are also other more effective ways through social transfers or fiscal policy. Not only does the level of the minimum wage matter, but also the concentration of workers at the minimum wage level. From a policy perspective, this is very important, as positive effects for the poor are often accompanied by negative effects for the middle-income earners. Therefore, even if it is agreed that through lowering income inequalities, governments would progress towards sustainability, one should consider other costs that could affect the sustainable human development. One way to achieve both inequality reduction and sustainable human development is to accompany minimum wage raises with skills development programs for the low-skilled workers. Also, impact evaluation with behavioral changes incorporated would provide valuable information for policy makers and future research should concentrate on this issue.

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