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Empirical Analysis of In-Work Poverty in Iranian Economy: 2004-2020

Hosein Rabiee[1]*, Seyyed Mohammad Ali Kafaie[2]

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ABSTRACT

The nature of in-poverty and the necessary policies to reduce it are different from general poverty. Therefore, and considering the importance of this phenomenon in Iran, in this research, its indicators were calculated with the approach of income poverty for the years 2004-2020 and the factors affecting the probability of reducing in-work poverty were investigated. The results show that these indices have fluctuated in this period, but have a rising trend in recent years. The headcount ratio of in-work poverty is lower than the general poverty of the population and the difference between them has increased at the end of the period. Also, the average number of employees of the poor population is less than the average number of employees of the entire population. Based on the results of a logistic model estimation was determined that gender, the square of age, elementary education, being unskilled, being a wage earner (rural areas), the dimension of the household and working in the agriculture sector increase the probability of poverty, while degree of household independence, literacy of the household head, age, number of hours and days of work, multiple job holding, academic education, being an employer, working in the public sector and working in the industry reduce the probability of poverty.

1. Ph.D. in Economics, Faculty of Economics and Political Sciences, Shahid Beheshti University, Tehran, Iran.
2. Assistant Professor, Faculty of Economics and Political Sciences, Shahid Beheshti University, Tehran, Iran.
*** Corresponding Author Email Address**: hosein.rabiee@hotmail.com
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1. Introduction

Poverty is still one of the most important issues facing many human societies, a predicament with social, political and economic effects. A World Bank report says that "poverty reduction has suffered its worst setback in decades, after nearly a quarter of century of steady global decline on extreme poverty". The report uses the data set representing Covid-19 virus era and its impact on poverty, a result could be explained by "job losses and deprivation, hitting already poor and vulnerable people hard, besides changing the profile of global poverty" (World Bank, 2020: 1)[1]. The absolute poverty rate in Iran has increased from 20% in 2014 to 30% in 2021 too, according to the report of the Ministry of Cooperation, Labor, and Social Welfare of Iran or short MCLSW (MCLSW, 2022: 31). Although it was thought that finding a job could resolve the problem, but the data on poverty shows something else; there are many workers who are being identified as poor (the phenomena called in-work poverty). This has motivated research on this subject. Note that most of the world's poor people are employed, but despite trying to live, their income is not enough to fulfill their basic needs (Lohmann and Marx, 2018: 1). According to the statistics of the International Labor Organization (ILO)[2]; 6.4% of workers over 15 years of age (in the whole world) have a daily income of less than 1.9 US dollars (on the basis of purchasing power parity). This ratio for low-income countries is 38.6%.

Although in-work poverty has existed in underdeveloped countries for a long time, in recent decades, this phenomenon has increased in developed countries as well, which seems to be caused by the elimination of industrial jobs and the expansion of service sector jobs known as "McDonald's" jobs (Lohmann and Marks, 2018: 3). This has led to a numerous applied work on this subject and expanded its literature. Despite the fact that this issue has been raised and discussed in scientific circles, but unfortunately with no

1. World Bank, Poverty and shared prosperity, 2020.
2. https://ilostat.ilo.org/data

significant and dependable results or policy implications. Working poor refers to a working person who lives in a poor household (Lohmann, 2018: 7). But to measure the poverty of working people, one must first explain exactly the meaning of "worker" and "poverty". That is the concept of poor worker is a combinational term based on person's position in the labor market and his standard of living. Being employed is defined by the number of working hours of a person during a specific time period. In Iran, a worker is a person aged 15 years or older who has worked for at least one hour during the reference week or has temporarily quit his job for one reason or another, similar to the definition of the ILO (Statistical Centre of Iran (SCI), 2019: 12). The definition of household poverty (contrary to the 1st term) is not unique and acceptable to all, but very diverse and based on different approaches. The oldest definition, which is not without problem, is based on the household income or expenditure being lower than a minimum threshold (called poverty line). The income poverty line is measured either relatively (as in the European Union) or absolutely (as in the United States). In Iran, calculating the poverty line is one of the general tasks of the MCLSW[1], which is being published in recent years along with poverty indicators in "poverty monitoring reports", but unfortunately no poverty indices of Iranian workers have been calculated or reported. The poverty of workers, by given GDP, can be explained by four specific factors: a) the way income is distributed in the labor market, b) the division of labor within household, c) the life style of household, and d) redistribution of income through taxes and transfer payments (Lohmann and Marx, 2018: 3). The main distinction between research in in-work poverty and in general poverty is mostly related to the first factor and partly to the second factor, which will be elaborated later on. For alleviating general poverty, governments usually adopt policies to promote employment growth, or welfare programs (Herman, 2014, Gangopadhyay et al., 2014, and Chukwuemeka, 2021), while in order to eliminate in-work poverty, they usually engage in policies such as increasing

1. https://www.mcls.gov.ir/fa/aboutus-%d8%af%d8%b1%d8%a8%d8%a7%d8%b1%d9%87-%d9%85%d8%a7

the minimum wage, training programs to improve skills of workers, developing technological production, and changing the production structures (Thiede et al., 2015, Ziomas et al. 2019, Herman, 2014).

The nature of in-work poverty is different from general poverty, and the policies to reduce these two types of poverty are also different, and since a large part of poverty in Iranian economy is the type of in-work poverty, attention to this phenomenon is very important. On the other hand, the theoretical and empirical literature of this field in Iran is very limited and the policy solutions in this regard are also very diverse[1]. The aim of this research is to reduce this knowledge gap. First, with a descriptive method, indices are presented and calculated to express the current situation. Due to data limitations, the period of investigation covers the years 2004 to 2020. Then, by using the appropriate econometric model and to the extent of the available data, the factors affecting the in-work poverty are investigated and finally, based on this analysis, policy recommendations are presented. What distinguishes this research from the other of poverty researches in Iran is, firstly, focusing on the poverty of the workers and secondly, paying attention to the specific variables affecting this type of poverty.

The structure of the article is as follows; in the next section, the methodology of measuring the in-work poverty is presented. The third section reviews some of the more recent empirical research on in-work poverty. In the fourth section, Iran's for the period of 2004 to 2020 is used first to measure the in-work poverty and then to identify affecting factors of the probability of the in-work poverty by an econometric model, which could be identified as the main contribution of this research. The use of job information of household members as well as job characteristics of working household members is considered the most important experimental innovation of this article. The final part is dedicated to providing a summary of the article and conclusions.

1. An example of this diversity can be seen every year from the discussions around to the determination of minimum wage, which in March reaches its peak.

2. Theoretical foundations

In the general study of poverty, the household is usually considered as the unit of study, because it is difficult to know how resources are distributed within the household. According to the traditional definition of poverty due to Amartya Sen, calculating the poverty index of a society is done in two stages: identification and aggregation. In the identification phase, two steps should be taken. First, a criterion for measuring poverty should be selected, which is usually household expenses or income. In the second stage, a threshold for being poor must be determined, which is called the poverty line. A household that falls below that threshold according to the selection criteria will be considered poor. In the aggregation stage, an index for the poverty of the society is defined and calculated with different methods. One of these indices is known as the "Foster-Greer-Thorbecke (FGT)" index:

$$FGT_\alpha = P_\alpha(y;z) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^\alpha \quad (11)$$

Where, n is total number of households in the sample survey, q is number of poor households, z is poverty line, y_i is the poverty measure of the household i, and $\alpha \geq 0$ is a "poverty aversion" parameter. Usually, three values of zero, one and two are considered for this parameter. For α =0, the index equal to headcount ratio index ($\frac{q}{n}$), indicating the extent of poverty. When$\alpha = 1$, it shows the poverty gap and if $\alpha = 2$, the squared poverty gap index is obtained. In recent decades, especially after Amartya Sen's criticism of the monetary criteria for measuring poverty and the idea of capability poverty, another method to measure poverty, parallel to the traditional method (or income poverty) became more popular, which is called multidimensional poverty. In the multidimensional method, poverty is defined and measured according to the household's deprivation of some capabilities (dimensions). These dimensions themselves are broken into measurable indicators. So, in this method, selection of dimensions and indicators is a necessary step before measuring the poverty index, which

deals with normative matters such as community capability priorities. Taking this step depends highly on the availability of data. The multidimensional approach has its own specific method (the Alkire-Foster is one), for identifying and aggregating. Two approaches are being proceed in the literature for investigating in-work poverty (Thiede et al., 2015: 276). In the first approach, "working household" is the unit of study. A working household is a household in which at least one of its members is working. In the second approach, "working members of the household" are the unit of study. So, after detecting the poor households, then working members of these poor households are called poor workers. The poverty headcount ratio of working people is defined as the ratio of the number of poor working people to the number of working people (and not to the number of poor people). If the distribution of workers between households are such that the average number of workers in poor households is more than that of non-poor households, the second approach will show a larger headcount ratio compared to the first approach. In this article, the second approach is followed. If "work" is the main source of income, the prevalence of poverty among the employed (headcount ratio) is expected to be lower than among the unemployed and households with more workers are less likely to suffer from poverty. in this case:

$$\frac{\frac{q_e}{n_e}}{\frac{q}{n}} < 1 \quad \rightarrow \quad \frac{q_e}{q} \times \frac{n}{n_e} < 1 \rightarrow \quad \frac{q_e}{q} < \frac{n_e}{n} \tag{2}$$

Where, q_e is the number of working poor, q is the number of the poor, n_e is the number of the employees, n is the population, $\frac{q_e}{q}$ is the average number of workers in the poor population and $\frac{n_e}{n}$ is the average number of employees in the total population. Based on this relationship, if the poverty headcount ratio of the employed is lower than the poverty headcount ratio of the whole population, then the employment among the poor is lower than that among the total population. In the investigation of the factors affecting the in-work

poverty, often the risk factors that increase the probability of the poverty of the workers are discussed. In these researches, with longitudinal or cross-sectional data, qualitative dependent variable models are used. The investigation is usually done by focusing on three categories of factors (Maes, 2023): 1) labor characteristics such as self-employed/employee, part-time/full-time, contract duration, and economic sector (agriculture, technology, etc.) 2) personal characteristics such as age, education, skill, gender, marital status, health, and type of citizenship (immigrant or native), and 3) household characteristics such as household size, distribution of employment in the household, and disability in the household. Crettaz and Bonoli (2010: 10) summarize these characteristics in three mechanisms: low income, low labor force attachment, and a large number of dependants. In the next section, some research related to this field will be stated and this literature will be used in the last section.

3. Literature Review

Abdur Rahman (2011) has studied the relationship between in-work poverty and household characteristics in Bangladesh with a logit model. He showed that when the household head is a youth and low income, with low education level or a woman, the probability of in-work poverty rises. Besides, when some of household members have some kind of disabilities, or with an increase in the size and dependency ratio of the household, the probability of in-work poverty increases. Also, workers in the manufacturing industry sector are poorer compared to agriculture, transportation, services, and construction sectors, mostly because of informal jobs with lower than minimum wage.

Kangopadhya et al. (2014) use a MIMIC model with 13 exogenous variables and 4 endogenous ones to construct a poverty (destitution) index for Bangladesh and estimate it with a sample of 660 households from urban and rural areas in 2008 and 2009. The poverty threshold criterion was set at a daily per capita income below 1 U.S. dollar. Their conclusions are as

follows: 1) ownership of land and housing and local public goods help the workers to escape from poverty. 2) The inappropriateness of assets is positively correlated with in-work poverty. 3) Previous job problems could also effective in the continuation of poverty. Finally, they conclude that destitution of women and the elderly will be reduced asymmetrically. This research emphasizes that poverty is a multidimensional phenomenon.

Bodea and Herman (2014) examine the factors affecting in-work poverty in Romania between 2007 and 2011, a country with the highest in-work poverty in the European Union. They showed that the main reason for the in-work poverty was vulnerable and precarious employment, since the structure of employment in this country is inefficient. They argue that this inefficiency is the outcome of high shares of agricultural sector, self-employed jobs, low productivity workers, and low share of people with college education in the workforce. The poverty rate of workers was less than the total poverty rate but the difference reduced from 4.5% to 0.9%, mainly due to the reduction of total poverty rate from 22.8% to 19.8%.

Barbieri et al. (2018) examine the trends and determinants of in-work poverty in Italy between 2000 and 2014 with longitudinal household data. They showed that during this period, the in-work poverty has increased slightly, but remained around 10% on the average and the probability of in-work poverty depends on education, age group, contract status and individual position in the labor market, as well as household employment pattern and household composition. There are three important aspects in this analysis that require more attention. First, the traditional model of family employment is unable to protect workers against poverty. The low participation of women in the labor market in In Italian households, as caused couples to be “sole breadwinners”, which itself is an important factor for being exposed to poverty, especially when combined with employment in the secondary labor market (low-paid, marginal jobs, etc.). Second, even when a couple both are employed, staying out of poverty is not guaranteed, if the workers are in unstable jobs (temporary jobs), part-time jobs or both

have low-paid jobs. Third, the risk of continuation of poverty and/or its comeback increases for workers who are not secured from poverty, which results in not only higher economic and social risks, but also in higher inequality between households. It is also showed that how the characteristics of the households and individuals are mutually related to the certain events such as the birth of a new child, increase the dynamics of the poverty trap and intensify the risks related to social inequality as well as the intergenerational transfer of social deprivation.

Maurizio (2018) examines in-work poverty in 5 Latin American countries. The selection of 5 countries is justified on the ground that it represents a diverse picture of the entire region. In this article, in addition to the conventional method (using total household income), the poor workers living outside the family are also being considered in the analysis: a) those who are poor by themselves, but are not poor because of their family financial supports, b) workers who are not poor if live alone, but are considered poor since living in a poor household. Besides that, the "exit rate of poverty after receiving transfer payments" is also calculated for these 5 countries. This rate is defined as the ratio of poor workers who become not poor because of transfer payments. Their definition of poverty in the analysis of affecting factors, was based on four criteria (household income, individual income, household income from work, and post-transfer poverty exit rate). The results show that for each of the four criteria, some factors such as being a female and educated to some extent reduces the probability of poverty among workers in all 5 countries, but some factors such as the age of workers and marital status have a decreasing effect in some countries and an increasing effect in some other countries.

Cheung et al. (2019) have investigated the in-work poverty in Hong Kong by multidimensional poverty approach with 31 indicators in four dimensions. They interviewed 3565 heads of households, and identified a household as a poor, if is deprived in at least three indicators). The results show that 17.8% of sample households are in poverty. The estimation of the

logit model shows that being an immigrant, low educated, and the need to receive government assistance are the most important factors that increase the probability of poverty.

Ziomas et al. (2019) have analyzed the in-work poverty in Greece for the period of 2012-2017. Although, in this period, the in-work poverty has decreased from 15.1% to 12.8%, but it is mainly the result of significant decrease in the median of household disposable income, 60% of which is considered as the poverty line. Examining the sub-indicators show that self-employment, temporary contract, and part-time work increase the probability of in-work poverty. Also, older people, men, and people with low education are facing higher probability of poverty.

Weon (2021) examines the in-work poverty of South Korea in 2018 with the use of working household (household with a working head) approach. In order to measure the poverty, a combination of income and multidimensional poverty technics is used. The combined poverty line is determined in such a way that the difference between the poor and the non-poor groups is maximized while the difference within them is minimized. Working households are also divided into four groups; "non-poor", "rising", "vulnerable", and "poor". The analysis shows that 65.5% of employed households are non-poor and only 0.48% of them are poor. But income and multidimensional poverty do not necessarily overlap. By estimating a logit model, he shows that households with an elderly head, non-married, tenant and working in subsidized employment have the highest probability of being poor. The subsidized employment is a part of active labor market policy (ALMP) that provides jobs to people who cannot find jobs in the regular labor market and whose household income is less than 50% of median income.

Chukwuemeka (2021) has investigated the in-work poverty in Nigeria. In this research, the unit of study is the working poor household. Two criteria are considered for poverty, one according to the definition of the ILO (daily per capita income of 1.9 dollars) and the other based on the difference between income and basic expenses, if this difference is less than 10% of the

household income, it identifies the household as a poor one. The analysis shows that from 2000 to 2017, in-work poverty had a rising trend. In this study, the affecting factors are divided into three categories; household characteristics, working conditions and type of employment, and economic factors (like cost of food, fuel, housing, health, and education). The results of the logit model show that the probability of poverty is higher for households headed by a woman, parents with low level of education, large household dimension, spending decision-making is with men, and women who work long hours in small enterprises.

4. Data Analysis

4.1. In-work Poverty Indices

In order to measure the in-work poverty, it is necessary to examine the poverty of the entire population first, and then poor population being identified. For this purpose, absolute and relative income poverty indices are used in this research. Islamic Parliament Research Center (2018) has calculated the absolute poverty line with the basic needs method and made the details available to the public.[1] The MCLSW (2022) has used the same information in the poverty monitoring report of 2020. The relative poverty line will also be is defined as “50% of non-durable household expenses average”. Using the data reported in Household Expenditure and Income Survey (HEIS) by SCI[2] for 2004 to 2020, the poverty line is calculated and the poor population is identified. Then the workers are divided into two categories of "poor" and "non-poor". Finally, the FGT indices are calculated for the employees for the data at hand. For a better understanding of the results, the analysis is done separately for urban and rural areas. Also, the weight of the household in the aforementioned survey (indicating that each household is representing how many households in the society) is used in the calculation of the indicators.

1. https://github.com/IPRCIRI/IRHEIS
2. https://ssis.sci.org.ir/

Before presenting indicators of in-work poverty, a brief look at the status of some labor market indicators can be useful. The average (during this period) participation rate in rural areas (43 percent) is higher than in urban areas (38 percent). In the same period, the participation rate has decreased, but the decline rate is higher in rural areas. The employment to population ratio is almost 5% less than the participation rate, but it is in line with it. The range of unemployment rate in rural areas is from 9.49% to 13.34%, with an average of 12%. Unemployment rate is higher in urban areas and has increased from 15.45 to 17.61 percent with an average of 17 percent during this period[1]. Below working age Population (under 15 years old) in urban (and rural) areas has decreased by 3% from 23.68 to 20.25 (and 28.82 to 25.70%). In short, during the period under consideration, unemployment rate is increasing and the participation rate decreasing, which means that, the situation of rural and urban areas is converging. According to the definition of in-work poverty, we can rewrite the equation (11) with of course the assignment of households' weight, the FGT index for in-work poverty is obtained:

$$FGT_{\alpha} = \frac{\sum_{k=1}^{n'} \sum_{l=1}^{n'_k} v_k g_k^{\alpha}}{\sum_{i=1}^{n} \sum_{j=1}^{n_i} v_i} \tag{3}$$

Where, n' is the number of working poor households, n'_k is the number of workers in poor working household k, v_k is the weight of the working poor household k, n is the number of working households, n_i is the number of employees in the working household i, and v_i is the weight of working household i and $g_k = (\frac{z-y_k}{z})$. Based on this, the in-work poverty index with two absolute and relative poverty criteria for urban and rural areas are presented in Table 1 and their graphs in Fig 2.

1. The HEIS information compared to the information extracted from the Labor Force Survey (prepared by the SCI) shows a relatively similar participation rate, but 4% higher unemployment rate on average.

Table 1. Percentage of in-work poverty census for urban and rural areas (percentage)

Year	Urban areas		Rural areas	
	Absolute poverty	Relative poverty	Absolute poverty	Relative poverty
2004	11.35	29.89	5.89	25.38
2005	10.15	28.51	5.36	24.35
2006	13.54	31.43	6.04	25.04
2007	12.54	30.14	6.42	24.31
2008	14.87	27.65	7.97	21.68
2009	17.13	28.87	7.77	22.28
2010	16.96	27.48	8.31	22.23
2011	16.60	23.81	6.99	16.72
2012	19.27	23.88	6.21	15.89
2013	17.07	21.60	6.95	13.58
2014	14.74	22.56	8.29	15.12
2015	14.62	23.15	6.98	14.86
2016	14.74	24.19	6.45	14.05
2017	14.63	24.87	6.95	15.79
2018	19.45	27.58	9.33	17.23
2019	24.18	26.63	14.20	16.45
2020	25.62	26.65	16.20	17.69

source: research results

According to the Fig 2, the headcount ratio index (FGT_0) in urban and rural areas have been on mostly on rise in terms of absolute poverty (dotted lines show trend), with a decline in a few years. In terms of relative poverty, although this index first decreases and then increases, it has a downward trend in both regions. While FGT_0 is an indicator of the extent of poverty, FGT_1 is an index for poverty gap, showing the distance between the poor and the poverty line. The graphs show that in terms of the absolute criterion, the poverty gap has increased in both regions, which means that the poor have become poorer, but in terms of the relative criterion, it had a decreasing trend until 2013 and then an increasing one afterwards. The squared poverty gap index of FGT_2, which represents the situation of the poorest of the poor,

has a slight upward slope and its steep decline is similar to the poverty gap index. In general, it can be said that based on the absolute criterion, the poverty has increased continuously, but based on the relative criterion, it first decreased and then increased. Since relative poverty indicators are sensitive to income distribution, their ups and downs usually coincide, i.e., the decrease of the indicators in the first half of this period and their increases in the second half coincide with the decrease and increase in the inequality of income distribution (based on the Gini coefficient) in the same intervals, as can be seen in Fig **2.** of the attachment.

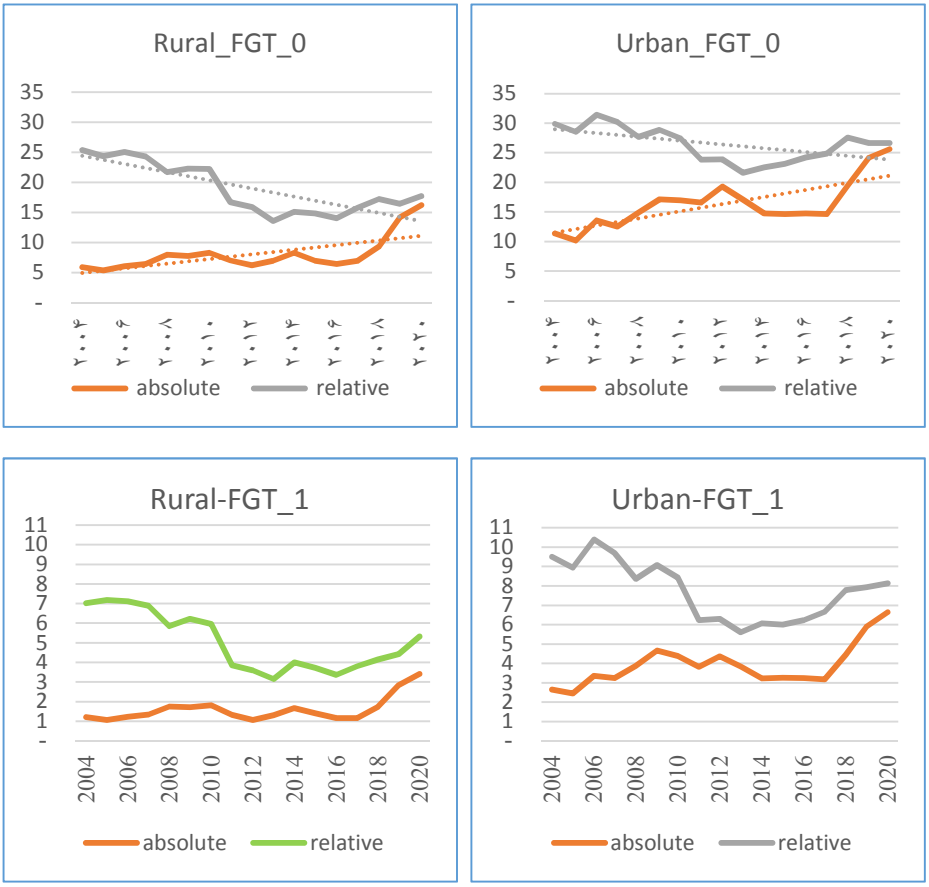

Fig 1. The trend of in-work poverty indices for urban and rural areas (percent)

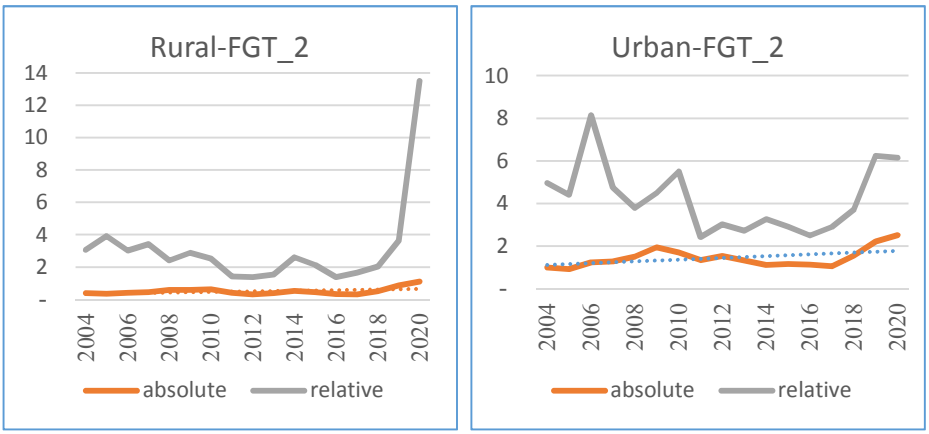

Fig 2.
source: research results

It can be seen easily that in urban areas poverty indices are higher than in rural areas. This can be explained by higher urban poverty line relative to that of rural areas, which is caused by the higher standard of living in urban areas.

What is the difference between the proportion of poverty of the employed and the poverty of the population and what are its implications? In Table 2, this comparison is made for urban areas. A similar situation exists for rural areas as well (Table 4).

The first two columns on the left-side show that according to both relative and absolute measures, the ratio of poverty among workers is lower than population poverty. With the increase in absolute poverty in recent years, the gap between in-work poverty and population poverty has increased, although this increase is slight. According to the next three columns, the number of workers in the poor population is less than the total population. This shows that although some of workers are poor, the impact of employment on reducing poverty is obvious. The result of the t test for the null hypothesis that the average index of population poverty ratio is higher than that of working people shows that for both urban and rural areas and both absolute and relative indicators, working people's poverty is lower than

population poverty (absolute poverty in urban areas is at the level of 90% and the other three at the level of 99%). We also tested the null hypothesis of "the average number of employees per 1000 people of the population is higher than the average number of employees per 1000 people of the poor population", and it was not rejected at the 99% level using a t-test.

Table 2. Comparison of population poverty and in-work poverty and the number of working people in the total population and the poor population of urban areas

Year	The difference between population poverty and in-work poverty		Number of employees per 1000 population	Number of employees per 1000 poor population	
	Absolute poverty	Relative poverty		Absolute poverty	Relative poverty
2004	1.69	3.26	283	246	255
2005	1.38	3.21	284	250	255
2006	1.77	2.97	289	255	264
2007	1.82	3.92	291	254	257
2008	1.52	2.68	282	256	257
2009	1.78	2.64	274	248	251
2010	1.14	2.64	269	252	245
2011	1.61	2.40	262	239	238
2012	1.54	2.19	269	249	247
2013	1.80	2.76	270	244	239
2014	1.67	2.72	266	239	238
2015	2.07	3.30	267	234	233
2016	2.10	3.12	267	233	236
2017	2.26	3.95	273	237	236
2018	2.27	3.10	273	245	246
2019	2.60	3.18	266	240	238
2020	2.37	3.07	259	237	232

source: research results

In rural areas, the pattern of the difference between the headcount ratio of in-work poverty and the population poverty is similar to urban areas, but the numerical value of the difference is higher (in absolute poverty from 1.51 to

4.78 and in relative poverty from 2.96 to 7.76). The number of workers in the total population and the poor population is more than urban areas, which means higher economic participation in rural areas. The difference between the number of working people per 1000 population and the number of poor population is more than urban areas (64 to 113 in absolute poverty and 36 to 97 in relative poverty).

4.2. Factors Affecting In-work Poverty

In the previous sub-section, the poverty situation of the workers was described in a descriptive way. But for policy making, in addition to knowing the current situation, the effective factors must also be identified. In section 0, along with a review of the empirical studies, some effective factors as well as econometric methods were presented. In this part, because of the nature of the dependent variable, which is a binary, based on the reviewed literature, an empirical logit model for identification of affecting factors of in-work poverty in Iran is compiled[1]. Therefore, a logit model:

$$L_i = c + \sum_k \beta_k X_{ki} + u_i \quad (4)$$

Is defined and estimated, using the data of the employees of the 2020 HEIS, where $L_i = ln(\frac{P_i}{1-P_i})$, P_i is probability of being poor of ith employee, and X_{ki} denotes the ith observation for the kth explanatory variable. As a dependent variable, the poor worker gets a value of 1 and a non-poor worker gets a value of zero. Explanatory variables or effective factors (X_k) are divided into two general categories: Household level factors and individual level factors. It should not be forgotten that poverty is measured at the household level and it is assumed that the resources are collected and distributed at the household level, so that the expenses of each member are fulfilled (up to the household ability), no matter how much he is contributed to the family income (a kind of revenue sharing scheme). In addition to the theoretical

1. The results of applying an alternative method, probit, are not much different from the results of the logit method.

considerations, the availability of reliable data for the variables used is a necessity and lack of them, sometime make the analysis totally fruitless.

Based on the empirical studies and the availability of the data, the following variables were considered as possible effective factors; household size, degree of household independence (the ratio of the number of employees in the household to the household dimension), the literacy of the household head, the gender of the worker member (man=0, woman=1), the age of the worker, the square of the employee age, the number of working days in week*, the number of working hours per day*, multiple job holding*, educational level of the employed member, employment status*, activity sector* (public, private, cooperative), skill level*, and the economic sector* (agriculture, industry, services). The variables marked with "*" are extracted from two income tables, which are presented in the data set mentioned above. One of the strengths of this research is the use of these variables. In addition to the income of the workers, the two mentioned tables have valuable information for getting to know the situation of the workers. Also, for people who have more than one job, there are some data in these tables, as a result, for some workers, there are more than a single value for some of the variables. For example, a worker can be both an employer and a wage earner, or be employed in both industry and agriculture sectors. There are two ways to deal with this situation. First, if the variable is a binomial, one can assign "one" to all situations he is engaged in (for example, if a person works in both agriculture and industry sectors, he would get 2 "one" for these 2 sectors and "zero" for the service sector. The second way is to determine the main job of such a worker (based on the maximum revenue), and focus only on that job and ignore the data for other jobs (variables with asterisks). In this research, the second approach is used. The number of observations in urban and rural areas are 16432 and 18060 respectively. The highest value of variance inflation factor (VIF) is 3.47 (except age and squared age), which shows that there is no unacceptable collinearity between the variables. The result of logit model estimation is shown in Table 3.

Table 3. The results of logit model estimation to determine the factors affecting the probability of in-work poverty

Variable	Urban areas		Rural areas	
	Absolute poverty	**Relative poverty**	**Absolute poverty**	**Relative poverty**
intercept	1.927***	2.643***	-0.259	-0.161
	(0.260)	(0.256)	(0.244)	(0.237)
household dimension	0.352***	0.375***	0.288***	0.284***
	(0.017)	(0.017)	(0.015)	(0.015)
degree of household independence	-1.345***	-1.665***	-1.070***	-1.080***
	(0.132)	(0.127)	(0.126)	(0.122)
household head literacy	-0.683***	-0.715***	-0.457***	-0.424***
	(0.061)	(0.061)	(0.051)	(0.050)
gender	0.407***	0.158**	0.294***	0.181**
	(0.074)	(0.071)	(0.074)	(0.072)
age	-0.077***	-0.080***	-0.057***	-0.045***
	(0.009)	(0.009)	(0.008)	(0.008)
squared age	0.001***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
working hours per day	-0.033***	-0.067***	-0.077***	-0.079***
	(0.011)	(0.011)	(0.012)	(0.011)
working days per week	-0.130***	-0.101***	-0.096***	-0.128***
	(0.017)	(0.016)	(0.014)	(0.014)
multiple job holding			-0.179***	-0.332***
			(0.061)	(0.060)
education level of the employee (reference: secondary education)				
elementary education	0.688***	0.586***	0.553***	0.443***
	(0.049)	(0.048)	(0.052)	(0.051)
academic education	-0.940***	-0.854***	-0.907***	-0.671***
	(0.063)	(0.056)	(0.133)	(0.116)
job status of the employee (reference: family, unpaid or independent job)				
employee	-0.049	-0.158***	0.155**	0.137*
	(0.050)	(0.048)	(0.073)	(0.070)
Employer	-0.718***	-0.695***	-0.116	-0.252**
	(0.128)	(0.114)	(0.130)	(0.128)

Variable	Urban areas		Rural areas	
	Absolute poverty	**Relative poverty**	**Absolute poverty**	**Relative poverty**
employed activity sector (reference: private and cooperative sector)				
public sector	-1.077***	-0.883***	-1.115***	-0.910***
	(0.089)	(0.077)	(0.211)	(0.184)
employee skill (reference: semi-skilled)				
expert	-0.149***	-0.195***	-0.030	-0.140
	(0.054)	(0.051)	(0.089)	(0.087)
unskilled	0.561***	0.704***	0.666***	0.590***
	(0.060)	(0.058)	(0.071)	(0.069)
economic sector of the employee's activity (urban reference: agriculture, rural reference: industry)				
industry	-0.178**	-0.228***		
	(0.073)	(0.072)		
service	-0.112*	-0.253***	-0.033	-0.116
	(0.068)	(0.066)	(0.079)	(0.077)
agriculture			0.206***	0.267***
			(0.064)	(0.062)
AIC	15,923.2	17,192.9	14,020.6	14,813.8
BIC	16,061.9	17,331.6	14,168.8	14,962.0
Log Likelihood	-7,943.6	-8,578.5	-6,991.3	-7,387.9
Deviance	15,887.2	17,156.9	13,982.6	14,775.8
Numbers in parentheses are standard deviations.				

*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

source: research results

One of the criteria for measuring the performance of the logit model is the Receiver Operating Characteristic (ROC) curve and area under the curve (AUC). Therefore, for evaluating the performance of the estimated model, the actual data set for 2019 was used for forecasting for rural and urban areas. The results show that the highest predictive power is for relative poverty in urban areas (0.79) and the lowest is for absolute poverty in rural areas (0.72). Another criterion is the "likelihood ratio" test, which examines whether the neutral model (the constrained model that only includes the intercept) provides

a better overall estimate than the original (unconstrained) model. The test results indicate that the estimated model is significantly different from the constrained model and the coefficients are generally significant.

Based on the theoretical as well as empirical evidence, it is expected that with the increase in the household dimension, (ceteris paribus) the probability of the household becoming poor increases. In addition, it is expected that the probability of poverty will decrease with the increase in the degree of household independence, because this increase means an increase in household income, the findings of this research also confirm this view. Literacy is associated with an increased likelihood of finding higher-paying jobs. Literacy has a positive effect on the well-being of the individual and the family from the aspect of multidimensional poverty.

The findings of this study about the influence of the gender of the worker on the probability of poverty are different from some studies conducted in other countries. Our results show that if the employee is a woman, the probability of poverty increases. This result is contrary to some studies (such as Barbieri et al. (2018) and Maurizio (2018, p. 379) with this conclusion that working women face less poverty because these women are usually member of a household with other worker members (usually men) with enough income to get them out of poverty. In any case, the impact of gender on the in-work poverty is one of the most important issues discussed in this field (including Abdur Rahman, 2011 and the collection of articles in the book of Lohmann and Marks, 2018).

The effect of age on increasing income and reducing poverty is not linear according to the theory of life cycles, and for this reason, according to the related literature, the squared age has also been used. The results show that the age coefficient is negative and its square coefficient is positive. If the estimated partial effect of this age variable be approximately presented by $y = c + 0.001x^2 - 0.1x$, then setting its derivative with respect to x (age) equal zero, would end up with $x = \frac{0.1}{0.002} = 50$. This means that the lowest probability of in-work poverty (due to the positivity of the second derivative

with respect to age) occurs at the age of 50 (middle age); the age that people are at their highest productivity level and usually receive their peak income. Some studies for U.S., show that the highest annual personal income occurs between the ages of 45 and 55 (Abdur Rahman, 2011: 137).

Getting more education is one of the effective ways one could free himself from poverty, because it improves the individual abilities (a more productive person) and also increases his ability to work in positions with higher income. Our findings show the same result, since this variable has a significant effect on reducing the probability of poverty. Multiple job holding, which partially represents the "hardness" of workers, in rural areas decrease probability of poverty. Working hours and days have a positive effect on reducing poverty. The effect of these two variables can be considered partly as the positive effect of full-time jobs, with this justification that payments to part-time jobs are usually lower than that of full-time jobs (on the average) for the same number of working hours and days.

The three variables of being an employee, employer, and self-employed are subsets of the main variable "employment status". The results show that being an employer reduces the probability of poverty, but being a wage earner has different effects in urban and rural areas: It reduces the probability of poverty in urban areas (in absolute poverty, the coefficient is not significant) and increases it in rural areas. These results are different from those obtained by Bodea and Herman (2014) and Barbieri et al. (2018). It seems that the economic structure of Iran is the cause of this difference.

Working in the public sector (the only category resulting from the main variable "activity sector") has a negative effect on the probability of poverty, and those who work in this sector (ceteris paribus) face a lower probability of poverty. Considering that the employees of this sector usually have a contract and a relatively stable job, the effect of this variable can be interpreted as the positive effect of job stability on poverty reduction.

The two variables of having and not having skills show that workers with relatively high skills, such as managers, specialists, and technicians, face a

lower probability of poverty, and the probability of poverty for simple jobs is higher, as was expected.

Finally, to investigate the effect of the economic sector, different economic sectors should be used in urban and rural areas (according to the frequency of employment in different sectors). In urban areas, agricultural workers make up only 10% of the employed, while this ratio is 49% in rural areas. The service sector in urban and rural areas includes 55 and 23 percent of employees, respectively. The industrial sector has an average status in both regions. Interpreting the results of these three variables is not so simple. In urban areas, both industry and service sectors, which include 90% of the employed, have a negative impact on the probability of poverty. Therefore, even if other sector has a positive effect on poverty reduction, a proper explanation of the economic sector's impact on poverty is not achieved. While in the rural areas, employment in the agricultural sector increases the probability of poverty, but the effect of employment in the industrial sector on the probability of poverty is not significant. This effect of agricultural sector can be justified by various reasons, one of which is the density of household members in a limited land and agricultural activity, so that low efficiency and low income would be its result.

By comparing the coefficients of the estimated model, one can figure out that among the factors that reduce the probability of poverty, the biggest quantity (coefficients) belongs to “degree of household independence”, “academic education”, and “activity in the public sector”. Among the factors that increase the probability of poverty are “unskilled” and “elementary education”, and to some extent “gender” respectively.

5. Conclusion and Policy Implication

In this article, from the two approaches of “the working poor household” and “the working poor”, the second approach was used. Poverty is defined at the household level and then workers are divided into poor and non-poor. The income approach is used and poverty is identified based on both absolute

and relative poverty lines. The data set used include the yearly measures for both rural and urban areas of Iran for the period of 2004 to 2020, separately. The calculation of FGT indices for urban and rural areas showed that these indices do not have a linear trend, and in general rising faster in the last years. Meanwhile, the numerical value of relative poverty indices is higher than that of absolute ones. During the period under consideration, poverty index of working people in urban areas was between one to four percent lower than the poverty of the whole population, while for rural areas it was two to eight percent less than the poverty of the whole population. These results indicate that the number of working people in the poor population is less than the number of working people in the whole population. Therefore, it can be said that although employment usually cannot lead to the disappearance of poverty, it helps to reduce it, as it was expected. The analysis of affecting factors of the probability of in-work poverty show that at the household level, the variables “degree of household independence” and in the worker level variables “education”, “employment in the public sector”, “lack of skills”, and “gender” are the most effective factors on the probability in-work poverty. The importance of poverty alleviation is so great that the United Nations has introduced “End poverty in all its forms everywhere” as the first goal among the 17 sustainable development goals.[1]. The increasing trend of poverty in recent years also highlights the need to pay attention to the issue of poverty in Iran. Although the increase in the gap between the poverty of the employed and the poverty of the population shows that the situation of the unemployed is worse, it does not diminish the importance of paying attention to the poverty of the employed.

Paying attention to the fact that the nature of in-work poverty is different from general poverty requires special policies in this area. Increasing economic participation and the degree of household independence is necessary to reduce poverty. Women's economic participation should increase greatly, and this requires the qualitative and quantitative

1. https://sdgs.un.org/

development of the labor market. This research also confirms that education is the most important tool to get out of poverty and educational policies should be a part of the economic and social development policies of the country and of course an important part of it. Of course, training should be aimed at increasing skills and productivity. In Iran, unlike developed European countries, being a working woman increases her probability of poverty. Policymaking in social affairs is necessary to solve the problem of working women. In this regard, the labor law needs attention. The transformation of the agricultural sector should be considered both from the aspect of economic development and reducing the in-work poverty. Increasing productivity is one of its important aspects. The job instability of the workers in this sector (including the seasonality of jobs) requires a specific policy for this economic sector.

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All authors had contribution in preparing this paper.

Conflicts of interest

The authors declare no conflict of interest

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Attachment

Table 4. Comparison of population poverty and in-work poverty and the number of working people in the total population and the poor population of rural areas

Year	The difference between population poverty and in-work poverty		Number of employees per 1000 population	Number of employees per 1000 poor population	
	Absolute poverty	Relative poverty		Absolute poverty	Relative poverty
2004	1.51	2.96	343	273	307
2005	1.56	4.13	342	265	292
2006	1.84	4.65	340	261	287
2007	1.68	4.43	348	276	295
2008	2.53	4.38	337	256	281
2009	2.67	5.05	326	242	266

Year	The difference between population poverty and in-work poverty		Number of employees per 1000 population	Number of employees per 1000 poor population	
	Absolute poverty	Relative poverty		Absolute poverty	Relative poverty
2010	2.29	4.88	329	258	270
2011	2.71	4.67	313	225	245
2012	2.67	4.75	321	225	247
2013	3.07	4.93	314	218	230
2014	4.19	6.24	306	203	216
2015	3.91	6.54	297	190	206
2016	4.05	6.93	292	179	195
2017	4.32	7.76	291	179	195
2018	4.78	7.02	293	194	208
2019	4.66	6.79	294	221	208
2020	4.72	6.09	285	221	212

source: research results

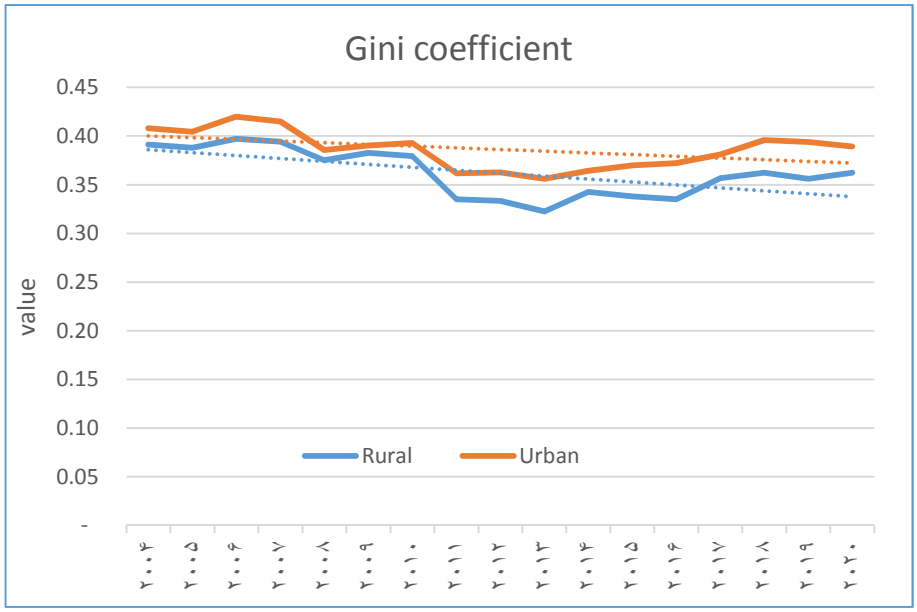

Fig 2. The Gini coefficient of urban and rural areas as a measure of income inequality.

Source: research results