Examining the Effects of Socio-Economic Variables on Rural Migration in Iran: A Fuzzy Regression Approach

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Abstract:
Rural migration crisis is considered one of the most challenging in the socio-economic space of Iran. In this study, the fuzzy approach is applied to examine the effects of some variables like poverty, rural unemployment rate, the rural Gini coefficient, urban to rural wage ratio, drought situation and literacy rate on migration. The Tanaka and FLSR fuzzy regression approaches are compared to get the appropriate model. The effects of the socio-economic variables on rural migration in Iran are examined during the period 1990-2018.

1. Introduction

Migration, which has attracted the interest of many researchers in the recent years, is when the people of one geographical region temporarily or permanently move to another. There are various types of migration as, rural-rural, rural-urban, urban-rural and urban-urban which People choose internally for many reasons, (Oucho & Gould, 1993). It is a process based on socio-economic, cultural, political, educational and environmental reasons.

Rural-urban migration, in particular, results from wealth inequality and the difference between the quality of life in rural and urban areas. It causes many problems as destruction of the rural economy, food insecurity and poverty in both (Mini, 2003).

Some of the main factors that are responsible for migration from rural to urban includes work availabilities, unemployment and differences in the social and political systems of the country, like social discrimination, social prejudice, fanaticism and political chaos (Farhana, Rahman & Rahman, 2012). It can also be associated with the lack of infrastructure, high-quality schools, appropriate

healthcare facilities and public transportation. Some personal reasons, such as educational opportunities, age, freedom of marriages, and skills can also motivate people to migrate, natural disasters like flood and drought are the other factors related to the migration (Yüksel, Eroğlu & Özsarı, 2016). Over the years, wealth inequalities and, the variety of economic activities and services in urban centers motivate people to migrate and take the advantages of better economic opportunities, higher wages and better basic facilities available in urban areas, which in turn lead to the deterioration of rural environments (Ajaero & Mozie, 2011; Harris & Todaro, 1970). In this regard, Mayda (2007) focused on migration due to income dispersion between the origin and the place of the destination, and concluded that income opportunities in the destination were significant pull factors that increased the size of migration rates. Landlessness, which decreases per capita share of the labor in agricultural lands, also acts as a motivational pull factor of migration (Farhana et al., 2012).

Generally, migration, both national and international, has stayed a topic under rigorous academic discussion (Adams Jr & Cuecuecha, 2013). What has been achieved currently, especially in poor developing countries, is the increasing number of volunteers for rural-urban migration to increase their quality of life (Adepoju, 2000). Economic growth, along with structural transformation, decrease the contribution of agricultural sectors in the economy, and increase the share of the industrial sectors., urbanization is the other phenomenon happens by increasing the employment opportunities in urban areas, which attracts people who are in search of better job opportunities. (Ishtiaque & Ullah, 2013). Urbanization, as the main driver of migration in most countries, will increase the problem of housing and employment, and will intensify the needs of these two sectors, in the destination.

The process of rural-urban migration in Iran is also an old subject and has dominated both policy and economic concerns. Well-developed cities in Iran attracts people from rural areas, where subsistence agriculture prevails. The movement is associated with social factors such as accompanying the family, achieving adequate housing and searching for jobsAccording to the 2011 census carried out in Iran by the Statistical Center.

In Iran, between 1995 and 2011, a total of 4,177,679 people migrated within the country. Also, from the total number of domestic migrants in this period,

- 2,852,349 people (68.3%) moved between urban areas,
- 608,031 people (14.6%) moved from rural to urban areas,
- 210,383 people (5%) moved between rural areas, and
- 506,916 people (12.1%) moved from urban to rural areas (The National Statistical Center of Iran).
- However, the process of migration is much diversified, and originated from many factors. but poor socio-economic determinants are the main object of this study.

- To accomplish this aim, the appropriate fuzzy method is applied to examine the effects of such variables as poverty, rural unemployment rate, the rural Gini coefficient, urban to rural wage ratio, drought and literacy rate on rural-urban migration in Iran.
- The rest of the paper is organized as follows. Literature review is presented in Section 2, while Section 3 provides the theoretical background of fuzzy regression. Estimation of the fuzzy regression is done in Section 4. Finally, the conclusion comes in Section 5, where some policy suggestions for the reduction of migration are suggested.

2. Literature review

Rural-urban migration refers to the displacement of people from less-developed rural to the developed urban areas, which has been a common episode in Iran in the recent years., the literature on the subject is reviewed in this section to analyze the main existing determinants considered. The results create awareness to policy makers of unplanned migration identify the problems and providing more opportunities in rural areas.

The determinants of rural-urban migration have long been studied in the literature, and depending on the structural and conceptual frameworks, theories interpret the migration differently. The neoclassic theory of rural-urban migration, introduced by Sjaastad (1962), considers the influence of migration as an equilibrium mechanism in a changing economy, which increases the efficiency of resource allocation. His theory, , emphasizes the importance of return to investment in migration rather than the rates of migration to income differentials.

The theory which considers migration as an investment refers to costs and returns. The theory predicts that people who are educated have a great tendency to migrate compared to uneducated ones, as they are more productive at the destination and the cost of migrating is lower for them. Furthermore, young people tend to migrate more, as they expect to reach a better life in the future with a positive ambitious return on migration (Mbonile, 1996). To find whether the migration from rural to urban areas was based on a rational human capital investment considering costs and returns, Khan, Shehnaz, and Ahmed (2000) analyzed the internal migration process in Pakistan, under the general theoretical framework of human capital theory. The findings showed that most of migrants moved to cities for non-economic reasons during 1996-97.

Vero (2021), study the determinants of rural-urban migration and conclude that unemployment rate and educational reasons are the main factors which threaten the community spirit of the villagers. Wang et al., (2019) using spatial panel econometric analysis for Russia indicates that, unemployment and infant death rate are push factors significantly related to migration, while urbanization rate, urban scale and life expectancy are the main pull factors.

The model of Leasure and Lewis (1968) implies that unlimited access to labor supply is the reason the supply of labor at the constant real wage exceeds the demand, so that employers extract the agricultural surplus and keep the rural income low. Todaro (1969) offered an economic behavioral model in developing countries which explained the movement through rural-urban "expected" income differential. He argued that, as long as there is the expectation of relatively higher permanent incomes in the urban areas, rural residents migrate even more into the congested urban areas. The theory of amenities states that the presence of amenity resources and the qualities of a region are among the reasons of rapid migration. Finally, the new theory of labor migration argue that people migrate temporarily to achieve set goals and then turn back to their home (Ishtiaque & Ullah, 2013).

Along with the theoretical studies, there have been wide empirical studies on the issue of rural-urban migration. Studies have been focused on different factors associated with the movement, depending on the region, culture and social beliefs. It is very important to evaluate the factors affecting rural to urban migration, as it is a common concern in all countries, especially in the developing ones. For example in Brazil, about 20 million people migrated from rural to urban areas from the 1950s to the 1970s, what led in the urbanization and decentralization of the cities (Yap, 1976). In India in the 1990s, about 20.5 million people migrated from rural to urban areas, which constituted 30% of the national growth (The census of India, 2005).

Among the vast number of empirical studies on the socio-economic determinants of rural-urban migration, Badolo (2020) using a survey questionnaire of Ghana proved that income, employment and education play as main status of migration to urban areas. Ullah (2004) analyzed the factors contributing to rural-urban migration in Bangladesh, interviewing 197 randomly selected migrants. The study showed that push and pull factors such as job opportunities, poverty, landlessness and joining the family forced people to move to cities, where most of them live in slums. The analysis of rural-urban migration in India reveals that social factors are the main determinants of rural migrations, while searching for job and business are the next main factors (Hassan & Khan, 2012). In a research carried out in Pakistan, Arif (2005) found that most male migrants migrated from rural to urban areas because of economic motivations, whereas female migrants decided to migrate for non-economic considerations. Imran, Nawaz, Asim, and Hashmi (2013), with a sample of 120 respondents, detected weak educational, healthcare and recreational facilities, the lack of appropriate infrastructure and economic opportunities as the main socio-economic factors of migration in Sargodha City, Pakistan. Factors such as job and better income opportunities, as well as education, healthcare and security have been recognized to play significant roles in internal migration during the period 2008-2012 in Turkey (Doğan & Kabadayı, 2015).

Also, numerous studies have been conducted to explore the determinants of rural-urban migration in Iran. Among them, Mirfardi et al., (2020) Using a survey

questionnaire for Yasouj and Madevan cities during 5 past years, find that social capital, education level as well as age in general explain 26.1% of rural-urban migrants. Esfandiari and Nabieian (2018) using the ARDL model, indicated, that poverty, the ratio of wages and the difference between Gini coefficients had a significant and positive impact on rural-urban migration during the period 1985-2013. Namdar and Bouzarjomehri (2016) collected data from 150 households in the village of Zarindasht, and found drought and the reduction of production efficiency as the main factors in rural migration in this village. While rural-urban migration describes more than half of the growth of most Iranian cities, Yazdan-Panah and Zobeidi (2017) investigated in their study such social-psychological factors as satisfaction related to living in urban areas and job opportunities affecting rural young people to migrate to Khuzestan Province.

According to Shamsoddini and Gourjian (2010), people move to cities to fulfil their cultural feelings and their socio-economic requirements. Focusing on Rostam2 district, they found that almost eighty percent of migration in this village occurred because of such economic factors as job opportunities and income differentiation. Sharifi and Zare (2018) investigated the reason people in Garizat rural district in Yazd Province of Iran migrated to cities. Using a survey method and a sample of 343 residents aged 15-55 years, they found that the disappointment and economic repulsion of villages, age and mother education were among the important factors in people's decision to migrate.

The conclusion is that, different socio-economic factors motivate people in different areas to migrate individually or together with family.

3. The theoretical background of fuzzy regression

In a fuzzy environment, fuzzy models are used to evaluate the relationship between the input and output variables functionally. There are two types of fuzzy regression models, namely, the models which are based on Tanaka's linear planning, and fuzzy least-squares approaches. Fuzzy linear regression analysis is an essential approach used instead of the methods which are based on statistical regression. To analyze the causal relationships in the models' involved ambiguity or human judgment, fuzzy linear regression introduced by Tanaka et al. (1982). The approach minimizes the deviations subject to constraints of the degree of membership fit, where the inputs are crisp and the output is a fuzzy number. Alternatively, a fuzzy least-squares approach uses the measure of best fitting according to the distance by consideration the input-output data set.

Several fuzzy models can be used to estimate the expected dependence based on the available data. Models are classified in three general categories, given the observations of dependent and independent variables that can be either real or fuzzy numbers. These are fuzzy regression models in which

1- all inputs, outputs and parameters are fuzzy;

2- outputs and parameters are considered to be fuzzy, but inputs are non-fuzzy (crisp);

3- outputs and inputs are fuzzy, while parameters are non-fuzzy.

This study has used real independent variables and, fuzzy dependent variables and parameters. Models in this category consider inputs x as non-fuzzy numbers, and observations of outputs y as fuzzy numbers, $((x_i, \tilde{y_i}), i=1,2,…,n)$. For such data, parameters are considered to be fuzzy, and the fuzzy regression model is described by

$$\tilde{y_i} = \sum_{j=0}^{k} \tilde{\beta_j} x_{ij}, \quad i=1, 2,…,n.$$

Here, k is the number of inputs, n is the number of observations, $\tilde{\beta_j}$ is the fuzzy parameter and the term $\tilde{y_i}$ indicates the fuzzy output. More precisely, $\tilde{\beta_j} = (c_j, l_j, w_j)$ is a triangular fuzzy number in which c_j, l_j and w_j are the center and the left and right spreads of $\tilde{\beta_j}$, respectively. If w=1, then $\tilde{\beta_j}$ is asymmetric. Otherwise, the number is non-asymmetric. The term $\tilde{y_j} = (y_i, l_{y_i}, w_{y_i})$ represents the values of the fuzzy output. The fuzzy coefficients are shown with the following membership function in the asymmetric triangular fuzzy number.

$$\mu_{\tilde{\beta_j}}(a_j) = \begin{cases} 1 - \dfrac{|c_j - a_j|}{w_j}, & c_j - w_j \leq c_j + w_j, \quad j=0, 1, …, k \\ 0 & \text{otherwise.} \end{cases}$$
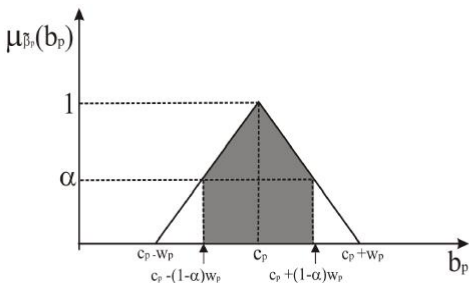

Figure 1. The triangular membership function of the fuzzy regression

Therefore, the fuzzy regression can be written as follows.

$$\tilde{y_i} = (c_0, w_0) + (c_1, w_1)x_{1+…+} (c_k, w_k)x_k$$

The estimation of parameters using the Tanaka fuzzy regression model is obtained by minimizing the bandwidth as follows[1].

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[1] Additionally, it is recommended that the future studies pursue the application of fuzzy least-squares regression methods presented by Sanchez and Gomez [29, 30] and, Yang and Lin [31], which are familiar in the literature. Moreover, researchers can investigate the migration changes and also other economic topics using the linear programming techniques presented by Tanaka and Watada, [32], Bradossy et al. [33], Savic and Pedrycz [34], Ozalekan and Duckstein [35], Chang and Ayyub [36], etc.

$$\min \sum_{i=1}^{n} \sum_{j=0}^{k} w_j x_{ij}$$

$$\text{s.t.} \ \sum_{j=0}^{k}(c_i + (1-\alpha)w_j)x_{ij} \geq y_i + (1-\alpha)e_i$$

$$\sum_{j=0}^{k}(c_i - (1-\alpha)w_j)x_{ij} \leq y_i - (1-\alpha)e_i$$

$$w_j \geq 0 \quad j=0,1,\ldots,k \quad i=1,2,\ldots,n \ , x_{i0} = 1.$$

Here, j refers to the number of independent variables, x_{ij}s show the independent variables and, e_i and y_i respectively are the spread and center of the dependent variable. Moreover, α refers to the membership function of the fuzzy variables that controls the confidence intervals of the observations. An increment in the component α extends the right and left spreads. The sum of squares error standard used as the criteria for determining α. Fuzzy least-squares regression (FLSR), proposed by Diamond, is one of those approaches which are based on measuring the distances of the left, right and center spreads of the two numbers. The function used as target is introduced as follows.

$$\min \sum_{i=1}^{n} d\left[\tilde{y}_i, \sum_{j=0}^{k} \tilde{\beta}_j x_{ij}\right]^2$$

$$D = (c_0 + c_1 x_{n1} + \cdots + w_0^R + \cdots + w_k^R x_{nk} - y_n + W_{yn})^2$$
$$+ (c_0 + c_1 x_{n1} + \cdots + c_1 x_{nk} - y_n)^2$$
$$+ (c_0 + c_1 x_{n1} + \cdots - w_0^C - \cdots - w_k^C x_{nk} - y_n + L_{yn})^2$$

Here, C refers to the center of the fuzzy parameter, the term w_0^R indicates the right spread of the fuzzy parameter, w_0^C is the left spread, Ly_n shows the left and Wy_n is the right spread of the fuzzy independent variable. The independent variables are crisp and dependents and triangular fuzzy in this method. This means that they can be written as $\tilde{y}_j = (y_i, l_{y_i}, w_{y_i})$, where y_i, l_{y_i} and w_{y_i} are the center, the left and the right spread, respectively. Moreover, the parameters have three values for the center, left and right sides.

4. Estimating the fuzzy regression

In this section, the appropriate fuzzy approach is considered to examine the relationship between migration and socio-economic variables like poverty, rural unemployment rate, the rural Gini coefficient, urban to rural wage ratio, drought situation and literacy rate in Iran, during the period 1990-2018. To fulfill this goal, the following functional form of rural migration in Iran is considered.

$$\widetilde{im} = \widetilde{\beta_0} +$$
$$\widetilde{\beta_1} Gini + \widetilde{\beta_2} \left(\frac{w_u}{w_r}\right) + \widetilde{\beta_3} U + \widetilde{\beta_4} pov + \widetilde{\beta_5} drought + \widetilde{\beta_6} Lit + \varepsilon$$

$$GINI = \frac{1}{2\mu} \cdot \frac{1}{n^2} \sum_{i=1}^{n} \sum_{i=1}^{n} |X_i - X_j|\ \cdot$$

Here, $\widetilde{im}$ is the ratio of rural migration to city to rural population, $Gini$ is the rural inequality coefficient, $\frac{w_u}{w_r}$ is the urban to rural wage ratio, U is the rural unemployment rate, pov indicates poverty in rural households, the *drought* variable demonstrates drought situation, and LIT is the literacy rate. Information on immigration rates and the Gini coefficient, unemployment and literacy rates were extracted from the Statistical Center. The data of the Statistical Center of Iran have also been used to calculate the poverty index, and the data for the calculation of rural and urban wages were taken from The Central Bank and the Statistical Center. The drought data were obtained from The Meteorological Organization.

Calculating migration from rural to urban areas	$M_t = P_{ut} \cdot (1+g)P_{ut}-1$	The rate of migration from rural to urban areas equals to M_t, the urban population of the country in the current year is shown by P_{ut}, and the urban population of the country in the last year equals P_{ut}-1. The natural growth rate of the country is indicated by **g**.
Calculating the ratio of urban and rural wages (WR)	$w_{At} = \dfrac{Y_{At}}{p_{At}}$ $w_{Ut} = \dfrac{Y_{Ut}}{P_{Ut}}$ $wR = \dfrac{\frac{Y_{Ut}}{P_{Ut}}}{\frac{Y_{At}}{p_{At}}}$	Here, P_{At} and P_{ut} show the number of active rural and urban populations, respectively, Y_{At} and Y_{Ut} show the value-added of rural and urban sectors, respectively. So, WR is the ratio of urban to rural wages, and is also an indicator of the gap between urban and rural wages.
The Sen poverty index	$P = H[I + (1-I)G]$ $H=q/N$	The quantity **H** is the percentage of poor people, **I** equals to the income gap, and **G** represents the Gini coefficient of income distribution among the poor. The quantities **q** and **N** represent the number of poor people and the total number of people in the community, respectively.
Labor productivity in the agricultural sector	$GAP = \dfrac{Y_{At}}{L}$	The quantities Y_{At} and L show the value-added of rural and labor forces, respectively.
Gini	$GINI = \dfrac{1}{2\mu} \cdot \dfrac{1}{n^2} \sum_{i=1}^{n} \sum_{i=1}^{n} |X_i - X_j|$	Gini is the rural inequality coefficient.

Before estimation, we examine the time trend of the variables. For example, the time trend of relative poverty in the country is divided into five different time periods according to the Sen poverty index chart, and based on the inverse of the Engel coefficient of the poor.

The first period is from 1985 to 1989, when with the exception of 1986, poverty had a steady trend. Although the country has been embroiled in an imposed war during this period, poverty has not increased due to the government's supportive policies in the rural sector at this time. The second period is from 1990 to 2000, when the time trend of poverty has had an upward trend. This upward trend may be due to the fact that with the end of the imposed war in 1989, the government has focused on rebuilding the damaged areas during the war and despite government support for the rural sector, poverty has increased in rural areas. The third period involved years between 2001 and 2006, when the trend of poverty was downward. During this time, the country was in a favorable position in terms of macroeconomic indicators, and the country's economy experienced an almost stable position. It is conceivable that the suitable economic situation has affected the poverty index and prevented the increase of relative poverty in rural areas. The fourth period dates backs to the years between 2006 and 2010, when poverty rate increased again. The lack of proper employment along with negative economic growth can be counted as the main challenging issues in the aforementioned period. A glance at the employment data between 2006 and 2010 reveals that employment in the initial year was 20.84 million people, and in 2010 decreased to 20.66 million people. Accordingly, about 185,000 jobs were lost during this period. The importance of the problem becomes apparent when it is found that despite the continuous population growth in the last decade, the number of active population has not increased that much for such reasons as an increase in the number of years devoted to being educated.

In the last ten years, quite exceptionally, the economy experienced the highest rate of population growth and the lowest rate of employment simultaneously. The fifth period is from 1990 to 2018, when poverty had a downward trend. The main reason was the Iranian targeted subsidy law, which in the early years of its implementation (2010) has reduced the class gap of poverty.
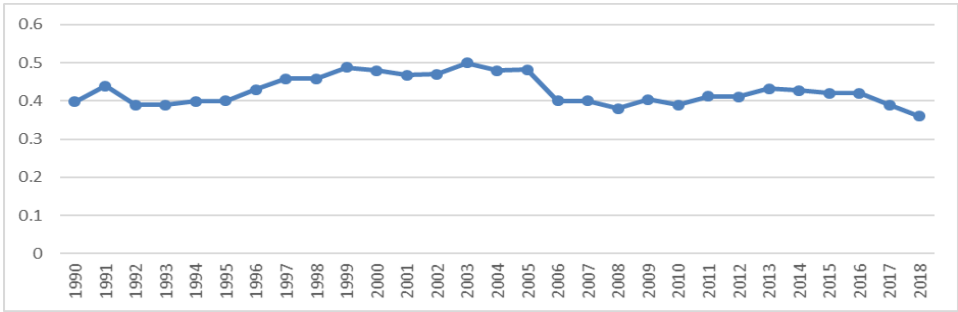

Figure1. The time trend of the age index based on the inverse of the Engel coefficient of the poor

According to Figure 2, migration from rural to urban areas has had an upward trend. Studies have shown that, post-revolution rural development policies were a response to less-developed pre-revolution policies and consequences. In the first period (11 years), no specific strategy was provided, neither at the national nor at the rural level, and policies were usually taken in the form of a social approach and basic needs. However, during this period, to solve the problem of rural and agricultural underdevelopment quickly, the government reorganized the traditional management of agriculture and established support institutions for the implementation of infrastructure programs, etc. But, these policies did not result in considerable success in terms of agricultural production, rural employment and increasing the living standards of the villagers.

In the second period, which is characterized by the formulation of a five-year economic and social plan since 1989, economic growth, and later, industrial development were often pursued within the framework of structural adjustment. In the first and second plans, the focus on the development of the agricultural sector was established, and it was emphasized in the third plan. Also, a significant part of the goals that was not achieved in the second plan, was included in the goals of the third one. Evaluations indicate that despite the focus on agriculture, allocation of funds and investments, this sector has experienced a lot of fluctuations compared to the other sectors. In general, however, the policy of rural, and especially agricultural, development after the revolution was successful in increasing crop production compared to the pre-revolution era. But, this increase did not match the growing demands of the population. In addition, despite significant development and infrastructure activities in rural areas, naturally, these programs have rarely been effective in reducing the existing gaps between groups, increasing the incomes, reducing poverty, and bridging the urban-rural divide. Consequently, the trend of migration after the revolution is upward. However, this trend has fluctuated in the recent years.
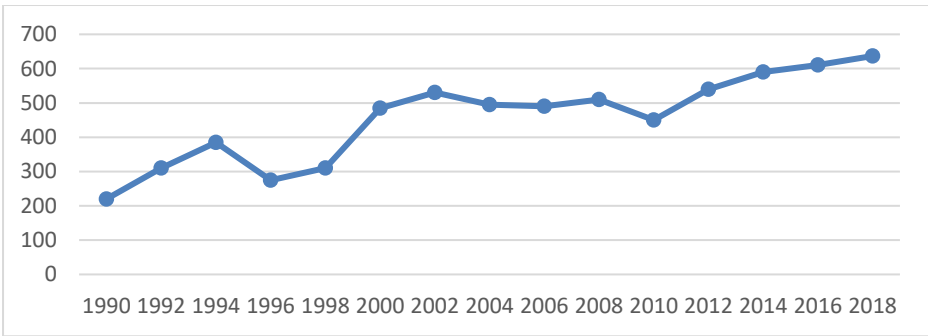

Figure2. Approximate rate of migration from rural to urban areas (per /1000)

The results of the regression model are shown in tables 3 and 4.

Table 3. The estimated results of parameters in FLS regression

The variable	Upper bound(r_j)	Center(c_j)	Lower bound(l_j)
Intercept	-2.65	-2.65	-2.65
u	0.061	0.052	0.049
pov	0.015	0.013	0.10
$Gini$	0.007	0.005	0.004
$drought$	0.221	0.197	0.189
Lit	0.041	0.041	0.04
$\frac{w_u}{w_r}$	0.0089	0.0087	0.0086

Source: Current Research, 2020.

The values of the center and the right-left spreads of the Tanaka fuzzy regression, with a triangular membership function for the dependent variable, are presented in the following table.

Table 5: The center and spread of the fuzzy coefficient for the Tanaka method

The variable	Center (c_j)	Spread (W_j)
Intercept	-34.4	0
u	0.098	0
pov	0.036	0.043
$Gini$	0.012	0
$drought$	0.84	0.018
Lit	0.021	0
$\frac{w_u}{w_r}$	0.310	0.261

Source: Current Research, 2020.

The sum of squares for Error for the Tanaka and FLSR regression approaches have been displayed in Table 6. This table demonstrates that the level of errors in FLSR is less than that in the Tanaka approach.

Table 6: The sum of squares for error in different approaches

Method Criterion	The sum of squares for error
Tanaka	264.77
Fuzzy Least-Squares	177.82

Source: Current Research, 2020.

Hence, giving the parameters obtained from the FLSR method, we analyze the factors that affect the rural migration changes. According to the results estimated in tables 3 and 4, we conclude that the $Gini$ coefficient, urban to rural wage ratio ($\frac{w_u}{w_r}$), rural unemployment rate (U), poverty in rural households, drought and literacy rates have positive impacts on migration in Iran.

5. Conclusion

This research was devoted to the evaluation of rural migration changes in Iran. The effects of socio-economic variables including the rural inequality coefficient, urban to rural wage ratio, rural unemployment rate, poverty in rural households, drought situation and literacy rate were examined using the fuzzy least-squares regression and the Tanaka method in a comparative approach. Since the FLSR method had a lower sum of squares for error compared to the Tanaka method, considering the parameters obtained from it, we analyzed the factors that affect the migration changes.

In this study, fuzzy aggression was used to investigate the effect of rural family poverty on rural-urban migration in Iran, during the period 1990-2018. According to the results, the logarithm of the variable of poverty, the ratio of urban to rural wages, and the difference between the rural and urban Gini coefficients have a positive and significant effect on migration from rural to urban areas. Moreover, poverty shows its significant impact on migration. Increasing rural poverty in the form of absolute poverty can directly force people to migrate. But in most cases, it is not the prevailing poverty, but the feeling of poverty (relative poverty) that causes migration.

As a result of the increasing growth of rural-urban relations in developing countries, villagers compare their living conditions with other people in the community (especially urban groups), and in an effort to change this unpleasant situation and to gain more prosperity, they depart to cities and other centers. This process is probably the source of most migrations.

Also, the results of estimating the model indicated that the variable of labor productivity in the agricultural sector had a significant negative impact. Therefore, increasing labor productivity in the agricultural sector decreases rural migration to cities. The reason is that more productivity means higher levels of income for farmers, which in turn motivates farmers to increase their area under cultivation and to attract more labor. On the other hand, with the increase of productivity, wages in the agricultural sector increase, and the gap between urban and rural wages decreases, resulting a decrease in the migration of villagers to cities.

According to the findings, the variable of wage gap between urban and rural areas has a positive and considerable impact on rural-urban migration. Therefore, disparities in income in rural areas and the expected income in urban areas are among the main factors in the decision of migration. This finding is in line with the Harris-Todaro theory stating that, increasing the gap between agricultural and urban wages leads to greater income inequality in the society. In fact, larger wage gap in urban and rural areas weakens the incentive of the agricultural workforce, and as a deterrent, decreases the level of output. Continuous urban and agricultural wage inequality motivates farmers to depart rural areas aiming to achieve urban occupations.

The Gini coefficient is an indicator that shows the distribution of income among the population receiving it. So, an increase in this index means a bad distribution of income in the country. The findings confirm the positive relationship between the difference of the rural Gini coefficient and urban migration, so that improving the income distribution in the country can reduce poverty. Improving the income levels in any country, especially in developing ones, is very difficult, and the implementation of government policies usually leads to the worsening of this index.

Based on the findings of this study, we propose the following policy suggestions to reduce migration.

1. The government can provide a basis for reducing migration from rural to urban areas, by implementing such policies as

- improving the nutrition of villagers and promoting rural healthcare,
- identifying vulnerable groups (target groups in the reduction of poverty),
- paying attention to rural and deprived areas of the country to eliminate regional imbalances,
- supporting vulnerable groups by providing public healthcare services,
- providing public education, housing and targeted subsidies to vulnerable and needy groups.

2. Low wages in the agricultural sector are due to low labor productivity. So, appropriate measures and policies must be adopted to improve labor productivity. Improving wages in the agricultural sector will reduce the migration trend.

3. Given that the wage ratio has a positive effect on migration from rural to urban areas, this inequality should be reduced by bringing agricultural wages closer to non-agricultural wages. It seems that the best way to do this is to adopt laws to reform the wage payment system in the agricultural sector.

4. Given that the Gini coefficient gap has a positive effect on migration from rural to urban areas, it is suggested that governments pay special attention to the agricultural sector to reduce its growth over time.

It is worth mentioning that due to unrealistic prices of agricultural products in Iran, and the lack of price standards based on the costs of agricultural production, this sector has always been one of the loss-making areas in Iran, and has created a low economic rate of return. Hence, moving towards a fair pricing system for agricultural products, and realizing relative prices in the agricultural sector, will bring about a significant change in the agricultural economy of the villagers, and will create a steady income stream for the villagers, which can be a suitable incentive system for agricultural development and income. Undoubtedly, this will have a logical effect on the migration rate.

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بررسی تاثیر متغیرهای اقتصادی و اجتماعی بر مهاجرت روستایی در ایران (رویکرد رگرسیون فازی)

چکیده:

یکی از چالش‌هایی که در فضای اقتصادی اجتماعی کشور ایران با آن مواجه هستیم، پدیده مهاجرت روستائیان به عنوان یکی از بحران‌های در حال حاضر کشور می‌باشد. در این مقاله تلاش شده است با استفاده از رویکرد فازی، اثر متغیرهایی همچون ضریب فقر در روستاها، نرخ بیکاری در روستا، ضریب جینی به عنوان معیار نابرابری اقتصادی در روستاها، نسبت دستمزد شهری به روستایی، وضعیت خشکسالی و نرخ باسوادی با پدیده مهاجرت مورد بررسی قرار گیرد.

این پژوهش به دنبال آن است که با استفاده از رگرسیون فازی تاناکا و رگرسیون حداقل مربعات (FLSR) به بهترین ارزیابی و برازش مدل دست یابد. شایان ذکر است رگرسیون‌های برآوردی با استفاده از داده‌های سال‌های 1369–1397 به بررسی ارتباط بین متغیرهای اقتصادی اجتماعی در مهاجرت روستائیان در ایران می‌پردازد.

واژگان کلیدی: مهاجرت، متغیرهای اقتصادی اجتماعی، فقر، نواحی روستایی، خشکسالی