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Digital Development and Economic Growth in Rural Areas

Hamid Sepehrdoust and Saber Zamani Shabkhaneh
Department of Economics, University of Bu-Ali-Sina, Hamedan, Iran

Corresponding Author: Hamid Sepehrdoust, Department of Economics, University of Bu-Ali-Sina, Hamedan, Iran

ABSTRACT

The arrival of computers and Internet access in the second half of the twentieth century has revolutionized the field of information and communication technology (ICT) and macro-economic variables such as income distribution index within developing economies. The purpose of the study was to evaluate the impact of information and communication technology development on income distribution index of rural communities in Iran. For this purpose and in order to test the Kuznet's inverted U theory, regarding the relationship between economic growth and distribution of income, econometric method and panel data regression were designed to analyze the effect of information and communication technology on income distribution of 30 provinces in Iran during the period of 2001-2010. The results show that information and communication technology development had a positive effect on income distribution of country's rural communities, resulting in more equitable and justified distribution of income among the rural societies. Moreover, the study approves the validity of Kuznet's inverted U theory regarding the relationship between the economic growth and income distribution of rural areas for the time period of study.

Keywords: Income distribution, ICT, panel data, rural community

INTRODUCTION

Classical theories of income inequality show that it provides the necessary incentives for capital accumulation and economic growth. This thought, has been dominant for many years in the economic area and was regarded as an indisputable fact in the economic development programs of developing countries (Paul and Verdier, 1996). Therefore, people like Hirschman have focused on the implementation of economic policies and believed that economic growth will lead to a more equitable income distribution. While expressing the relationship between economic growth and income inequality, Kuznets (1955) suggested the hypothesis that in the way of economic development in each country, income inequality first rises and then will gradually decrease after it remains constant at a certain level. This pattern is known as Kuznet's "U-inverted" curve, because the Kuznet's theory graphically expresses a relation in the U-inverted form between economic growth and income distribution. With a simple numerical example, Kuznets (1955) showed that change in inequality is the result of a population transfer from agricultural to non-agricultural sector (Takahiro and Sachiko, 2007) and the distribution of individual incomes in less developed countries is more unequal than in developed countries (Atkinson, 1970). Kuznets (1955) regards economic development as a process of transition from a traditional or rural economy to a modern or urban economy and ends that income distribution worsens in the early stages of development because few people can be transferred to the modern sector. In later stages of development, the income distribution will improve because a larger number of people are attracted to the modern sector and gradually, the shortage of labor force leads to increase in wage

in the traditional sector and approaches the wages in modern sector. However, economic growth does not necessarily follow a more equal income distribution. The facts show the unfavorable phenomena that economic growth also leads the absolute reduction in income for certain classes (Adelman and Cynthia, 1973). The unequal income distribution, in turn, is a factor that has prevented further growth (Adelman, 1978).

The Kuznet's theory can be mathematically expressed as Eq. 1:

$$Gini = \beta_0+\beta_1 GDP+\beta_2 GDP^2+\varepsilon \quad (1)$$

where, Gini index is a measure of income distribution, GDP (Gross Domestic Product) is gross domestic product and ε represents the distortion component. If β_1 is a positive number and β_2 a significant negative number, then the Kuznet's theory can be accepted. It shows the fact that in the case of any increase in GDP per capita, income inequality will initially rise and then will gradually decrease after it remains constant at a certain level. Information and communication technology is another variable affecting the income distribution. Ulrich (2003) believed that information and communication technology includes all forms of the technology of manufacturing, storage, exchange and use of information in various forms. Given its extent and potential facilities, the information and communication technology has provided suitable grounds for improvement of human life. In addition, the role of training and development of academic and practicable skills will undoubtedly be very important in the process of comprehensive development of a community.

Rural areas are among the social sectors where the need to develop information technology is necessary because the concentration of capital and consumer market for a variety of goods in urban areas have always been one main obstacle to development of rural areas that create the gap among rural and urban areas. In the information age, the amount of information (instead of the concentration of capital and money) is very valuable. Computer and communication technology, professionals and highly skilled people are governing elements and rather than physical effort, the necessity of the power of thinking is emphasized (Gerald-Fitz and Gerald, 1981). Thus, the development of information and communication technology can be a good opportunity for economic growth and development of rural areas and reduction of the gap among urban and rural areas. In addition, the ICT reduces the distance among social classes and groups and gradually eliminates the gap between rich and poor. In Asia, Africa and Latin America, initiatives and innovations have been created for the primary purpose of the use of ICT to increase agricultural production and reduce poverty, which leads to the development of human societies around the world, both urban and rural areas (Anonymous, 2003). In general, it can be said that the development of information and communication technology have some affect through different channels on the rural development, whose important indicator is the reduction of income inequality.

ICT and agricultural development: Anti poverty and food insecurity policy is necessarily a long-term effort to develop agriculture, which occurs through the qualitative and quantitative development of rural and agricultural products as well as economic diversification in an effective manner by breaking the temporal and spatial dimensions. Information and communication technology increase productivity and causes the information to be accepted. Thus, ICT plays an important role in the fight poverty and creates opportunities for e-readiness for the sustainable development of human societies. Thus, information and communication technology has an effective role in the development of the agricultural sector, by which it can lead to a better income distribution in rural communities.

ICT and employment: Employment has been always one of the most important economic variables influencing the income distribution, so that if the employment rate increases, the income distribution would be done in more appropriate manner. According to Vivarelli (2007), information and communication technology affects employment in several ways. It could be said briefly that information and communication technology increases the demand for product and labor followed by reducing transaction costs and overall cost reduction. In addition, cost reduction, according to him, will lead the new venture and will increase employment. Ultimately, he believes that the development of information and communication technology is a key factor in creating new products and services, which themselves are a drive to increase employment.

ICT and immigration: One reason for migration from rural to urban areas is the facilities and opportunities that are available in urban areas, not in rural communities. As was mentioned, one function of ICT is that it has eliminated the geographical distance and actually has diminished the information gap among urban and rural areas. Thus, due to the creation of new opportunities, the development of information and communication technology can be a factor in reducing rural migrations that are often seen among the youths. As the growth of urbanization is one important factor in creating and aggravating poor income distribution in rural communities, it is expected that the development of information and communication technology can be a factor in improving the income distribution in rural communities.

ICT and national production: Today, the centrality of knowledge in economic output, whose special aspect is the development of information and communication technology, is of particular importance to economic experts. The experience of many countries has shown that the development of ICT infrastructure can be an important factor for economic growth. The use of ICT in different sectors of the economy can lead to lower production expenditure and thereby social welfare. Since, according to Kuznet's theory, the volume of domestic products and economic growth is an important factor in the income distribution, ICT can be effective in the income distribution in rural communities, through the impact on domestic products and economic growth. In a study conducted by Siriginidi (2004) in India, the need for ICT offices in rural areas for maintaining regional balance has been emphasized to reduce the digital divide between urban and rural areas. As was said, the rural migration is an important factor in the income distribution. Concerning the impact of urban-rural migration and urbanization variables on the income distribution index, many studies have been proposed and executed. No doubt, the economic growth and development of each country depends largely on the rate of urbanization in the manner that in the last century, no country has achieved an income above-average unless there was a significant transfer in population to the cities (Spence *et al*., 2009). Over the last fifty years, the growth of urbanization has increased faster than the farther decades. In addition, compared to other parts of the world, the growth of urbanization was higher in Asia, where the growth of urbanization and industrialization took place at the same time, i.e., in the seventies (Abu-Kawsar, 2012). Some of the available studies on urban areas have been undertaken on the impact of urbanization on the income distribution (Qin and Zhou, 2009).

Generally speaking, most of the studies that have been initiated and inspired by Paul and Verdier (1996), have introduced three fundamental categories of macroeconomic variables that affect the income distribution and include economic growth with a positive impact, inflation and unemployment with a negative impact. In addition, some economic variables such as

productivity, direct tax and labor productivity have been reported in the literature as influencing variables with lower priority. Information and communication technology (ICT) is one of the most important variables affecting the income distribution, which now has an important position because in the present era, man is experiencing an ICT-based community. Considering the importance of income distribution and the role that information and communication technology can play in this regard, a question may arise:does development of information and communication technology have an impact on the income distribution in Iran's rural communities? The purpose of this study is to answer the question and was conducted using the econometric method of panel data for the data from 30 provinces in Iran for the years of 2001-2010.

RESEARCH METHODOLOGY

Since, the number of independent variables in the model should be limited for a useful and reliable test, several independent variables of gross domestic product, the gross domestic product square, the ratio of urban population to total population (urbanization ratio), unemployment rate of rural areas and number of computers per rural household are used and other factors are not considered. To calculate the income distribution, different criteria were provided, among which Gini coefficient, Thiel index, the ratio of the highest-income quartiles to the lowest-income quartiles that, in turn, have their advantages and disadvantages can be cited. In this study, the ratio of high-income quartiles to low-income quartiles was used as a measure of income distribution. On the basis of theories and empirical studies explained, that is expected that the ratio of the expenditure of fifth quartiles to first quartiles would be a positive function of variables such as unemployment, urbanization rate and gross domestic product and that it has a negative correlation with the number of computers per rural household and gross domestic product square. Thus, the following function would have a suitable model for estimating the income distribution index in rural areas of the country, based on the introduced variables Eq. 2:

$$G = F (UR, UN, GDP, GDP^2, COM) \quad (2)$$

Where:

G = Ratio of the expenditure of high-income quartiles to low-income quartiles
UR = Ratio of urban population to total population
UN = Unemployment rate in rural areas
GDP = Gross domestic product at constant prices of 2004
GDP^2 = Gross domestic product square at constant prices of 2004
COM = Number of computers per rural household

RESULTS

Before estimating the model's coefficients of variables and to examine the stationary of variables, the unit root test was performed (Bai and Ng, 2010). The results of this test were reported in Table 1. The significance values for the ratio of expenditure (0.01), gross domestic product (0.00) and other variables as such (0.00) indicate that data collected for variables are stationary in the time span of period.

In addition, after the null hypothesis (hypothesized relations 3) on the homogeneity of cross sections is examined and tested, it will be clear that the pool data method would be used for the homogeneity of cross sections and, otherwise the method of panel would be used:

Table 1: Unit root test of model variables

Variables	G	GDP	GDP^2	UR	COM	UN
Statistic	-2.2	-5.05	-3.63	-12.69	-15.17	-27.8
Probability	0.01	0	0	0	0	0

-G: Ratio of the expenditure, GDP: Gross domestic product, P-GDP^2: Gross domestic product square, 4UR: Ratio of urban population to total population, -COM: Number of computers per rural household, -UN: Unemployment rate

$$\begin{cases} H_0: \alpha i = \alpha_N \\ H_1: \alpha_i \neq \alpha_j, i \neq j \end{cases} \quad (3)$$

In the hypothesized relations above, α_i expresses the individual impacts, for which Leamer F-test can be used Eq. 4:

$$FN\text{-}1, N(T\text{-}1)\text{-}K = (RRSS\text{-}URSS)*(NT\text{-}N\text{-}K)/(N\text{-}1)*(URSS) \quad (4)$$

In Eq. 4, the amount of RRSS represents the sum of squares of useful residual, URSS represents the sum of squares of non-useful residual, K is the number of explanatory variables. N is the number of cross sections and NT is the total number of observations. After completing the Leamer F-test, the results suggest the need to estimate the model using panel data because test statistic (F = 84.26) is higher than the critical point at the 5% level and null hypothesis based on homogeneous cross sections is rejected (Sig. value = 0.00). In this study, panel data were formed according to data released by the Statistical Center of Iran for the years of 2001-2010, which were separated for any province in the country. Then, the generalized method of moments (GMM) was used to estimate the intended coefficients. Therefore, the following panel model (Eq. 5) is taken into account:

$$G_{it} = \alpha_i + \beta_1 UR_{it} + \beta_2 UN_{it} + \beta_3 GDP_{it} + \beta_4 GDP^2_{it} + \beta_5 COM_{it} + \varepsilon_{it} \quad (5)$$

One major advantage of the GMM method is that in both cases of random effects and fixed effects, its performance is sufficient for a good estimation of the model. In addition, by giving appropriate weight to the model variables, this method could eliminate the problem of heteroskedasticity of variance, if any and if there is no heteroskedasticity of variance, no problem will occur and the results of the estimate would be reliable.

Model estimates: One factor that may lead to distort conclusions about the impact of independent variables on the dependent variable is to ignore the issue of making real the nominal data. Some data per se are real, but some of the variables in the economy are expressed in nominal form. All the variables that are expressed as currency units are nominal variables and the impact of inflation should be removed from the variables, given the appropriate price index. After making real the nominal data and panel data, estimates of panel model were made by GMM, whose results are presented in Table 2.

As is shown in Table 2, the gross national product has a positive relationship with income distribution index. It suggests that income distribution will be more unequal by increasing gross domestic product and keeping pace with economic growth. In addition, the gross domestic product square has a negative relationship with the index of income distribution.

Table 2: Model estimation output

Variable	Coef.	Statistic	Prob.
GDP	3.05	3.7	0
GDP^2	-9 E-5.26	-5.05	0
COM	-0.15	-2.07	0.03
UR	1.2	8.4	0
UN	0.82	9.8	0
Hansen's J statistic = 25.06			

-GDP: Gross domestic product, GDP^2: Gross domestic product square, COM: Number of computers per rural household, UR: Ratio of urban population to total population, UN: Unemployment rate

By examining the coefficients obtained for the above two variables, that is ended that Kuznet's theory because of the U-inverted form of the relationship between economic growth and income distribution is confirmed in rural communities. In addition, the variable of unemployment rate, which is marked with the symbol of UN in this study, has a positive relationship with income distribution index and the derived factor that is equal to 0.82 shows that one unit of increase in the unemployment rate makes more unequal, the income distribution by 0.82.

Similarly, the variable of urbanization rate has a positive relationship with the index of income distribution and the derived factor that is equal to 1.2 shows that one unit of increase in the urbanization rate makes more unequal, the income distribution by 1.2. As far as the variable of the number of computers per rural household is concerned, it should be said that the coefficient obtained for this variable is equal to -0.15, which reflects negative impact of this variable on income inequality. In fact, with the increasing use of computers that is known as the primary means for providing infrastructure of information and communication technology, income distribution is done in rural communities in a more appropriate form. Another important point is related to the goodness of fit index of the model. In the GMM method, R-squared index is no longer reliable and its performance is not enough to measure goodness of fit of the model. In addition, a negative number is also possible to be extracted. Thus, in the GMM method, the J-statistic (25.06) is used to measure the goodness of fit.

CONCLUSION

In previous eras, due to the special political, social and cultural conditions, the economic approaches to data and information had no complex aspect and at different levels of human societies, the need for information was not considered an essential aspect of human life. However, the need for information and access to it is now important for growth and development and is considered necessary. The present era has been called the Information Age. During this period, a growing mass of technical and professional information is generated in the various fields of human science and knowledge and a community that it does not gaining access to the vast amount of information, the situation will remain unchanged. To achieve sustainable development without any preconditions and obstacles, information and especially scientific and technical information in scientific fields should be disseminated to all users. In today's world, professional, technical and scientific information is a base and a launching point for the growth and development of society.

The results of the estimated model showed that gross domestic product has had a significant positive relationship with income distribution, while the gross domestic product square has a significant negative relationship with the index of income distribution, which in this study, is the

ratio of average expenditure for fifth quartiles to first quartiles. Relationship among two variables listed and the index of income distribution confirmed Kuznet's "U-inverted" curve for relationship between economic growth and income distribution.

The estimated model also showed that the urbanization and unemployment rates have a significant and positive effect on the dependent variable. This means that as the purchasing power has been reduced for the active population and low-income households, the income distribution in rural communities has worsened with a rising unemployment rate, because low-income deciles are mainly looking to sell their labor, the unemployment rate in these deciles is more common and increase in unemployment rate has a greater impact on lower-income deciles, compared with higher-income deciles.

Regarding the impact of urbanization on the income distribution, it should be noted that the production of rural goods heavily decreases, due to rural-urban migration of young people from the countryside areas to the cities. As the share of agricultural products of total national production is an important factor in improving the income distribution, the reduction of agricultural production share of national production is a factor in the deterioration of income distribution.

As is shown in the studies about the impact of ICT on the economic and social development, the development of ICT is one of the most important factors in economic development and establishment of social justice. ICT has an indirect impact through various channels on income distribution of rural communities. As is apparent from the estimation of the model results, the significant negative coefficient obtained for the variable of the number of computers per rural household shows that the development of ICT in rural areas of the country is an important factor in improving the income distribution in these communities.

Results from the model estimates confirm previous studies regarding the impact of selected variables including development of information and communication technology on income distribution. Therefore, it can be ended that because of the need to pay attention to economic and social justice and the income distribution in rural communities of the country, the development of ICT can be used as an important tool in achieving national development goals and establishing economic justice.

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