

## Regional Inequality in Iran and the Impact of Economic Factors: A Spatial Econometric Approach

Alireza Pourfaraj<sup>1</sup>, Nader Mehregan<sup>2</sup>,  
Saeed Karimi Potanlar<sup>3</sup>, Mohammad Reza Eskandariata<sup>\*4</sup>

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### **Abstract**

Regional imbalanced growth and the factors affecting it are one of the most important economic issues in developing countries. In this research, after evaluating the regional inequality at the provincial level of Iran, in order to examine the effect of economic factors on it, it was considered as a spatial econometric model using panel data during the period of 2001 to 2015. The evaluation of Theil inequality indices and Population-Weighted Coefficient of Variation (PW-CV) shows that Iranian provinces are extremely unequal. The results of the estimation of the research model indicate the spatial dependence among the provinces. So that the regional inequality index of each province is affected by neighboring provinces with a coefficient of 34%. In the analysis of economic factors affecting regional inequality; the increase of foreign direct investment and the ratio of industrial production, reduce the inequality of the provinces. But increased provincial spending will increase regional inequality and the tax policy has failed to succeed in redistributing revenue. The results of the study of the direct and indirect effects of explanatory variables on the PW-CV shows that regional inequality is mainly influenced by direct effects, and the effect of the total coefficients on the inequality index is significant.

**Keywords:** Regional Inequality, Economic Factors, Spatial Panel Data, Iran Provinces.

**JEL Classification:** D63, C31, R11.

### **1. Introduction**

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١. Faculty of Economics and Administrative Sciences, University of Mazandaran, Mazandaran, Babolsar, Iran (Pourfaraj@yahoo.com).

٢. Faculty of Economics and Social Sciences, Bu-Ali Sina University, Hamedan, Iran (Mehregannader@basu.ac.ir).

٣. Faculty of Economics and Administrative Sciences, University of Mazandaran, Mazandaran, Babolsar, Iran (S.karimi@umz.ac.ir).

٤. Faculty of Economics and Administrative Sciences, University of Mazandaran, Mazandaran, Babolsar, Iran (Corresponding Author: M.eskandariata@stu.umz.ac.ir).

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Duality in urban development and significant regional inequalities are considered as the main features of developing countries. The existence of this phenomenon is regarded as one of the main inhibitions of balanced development in these countries of which the major consequent is creating the consolidation and extension of deprivations. The inequality along with the extensive poverty can provide some grounds for public discontent, and accordingly it is viewed as one of the concerns of socio-economic policy makers.

There are inequalities, inappropriate reproduction of unequal relations of power and wealth and its division into related categories. However, the expansion and deepening of inequalities not only may lead to the spread of ignorance and poverty in related societies which it guarantees the stability of inequalities but also it provides a context for the collapse and transformation of political systems (Raghfar et al., 2011). Regional inequalities and generally the economic activities in a special area causes the greater population density, higher pollution, the increase in traveling time and it generally imposes the extra expenses to the society (Karimi Moghari and Barati, 2017).

Manifestations of inequality can be investigated in a variety of contexts including economic inequality, social inequality, cultural inequality, political inequality, ethnic inequality, race inequality, religious inequality, and gender inequality, nutrition inequality, education and health inequality. As the main goal of development is the elimination of inequalities, the best concept of development is growth along with social justice. Thus, the general goal in regional planning or economic development is the establishment of social justice and the distribution of wealth and well-being among people in society. Imbalance among regions in the course of development creates gap and concentration of regional inequalities which is an obstruction in development path.

In spite of all efforts in this respect, a lot of researches have confirmed that Iranians have been under economic pressure during the past decades. Based on the management and planning organization report, inequality index has been increased in all provinces of Iran over 8 years (2005-2011). The Figure (1) shows the average of inequality of provinces based on population weighted coefficient of variation index (PWCV) and Theil index which both are estimated

according to changes in per capita gross domestic product (GDP) over the years from 2001 to 2014. As it is observed, both indices have been decreased after of an incremental period which the decreasing severity in Theil index is more than weighted coefficient of variation index, however the latter has relatively small changes at the end of the period. In the Figure (2) average of weighted coefficient of variation of each province is presented during the years 2001 to 2015. According to this chart, the inequality distribution is different among provinces, Khuzestan has the highest index and Qazvin has the lowest one of all provinces of Iran.

**Figure 1: Average of Theil and PW-CV Indices of Provinces**

**Figure 2: Average of PW-CV Index for Provinces during 2001 and 2015**

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Spatial inequality is defined as those circumstances in which different spatial or geographic units are placed in different levels in the case of some variables (Kanbur and Venables, 2005). On the other hand, spatial inequality means unequal distribution of opportunities and social positions in space which can be formed differently in each society. Spatial inequality can include inequality between large and small cities, geographic inequality within large cities, and inequality among deprived and beneficiary areas (Dadashpour et al., 2011). In the majority of developing countries, one or at least several regions have appropriate conditions for public services, economic and social flourishing which can play a main role in generating income and national production. This issue is occurred at the expense of holding back the other areas and increasing gap among them (Lotfi and Shabani, 2013).

Balanced regional development is a significant prerequisite for a coordinated development in a country and it doesn't mean an equal development in all areas of the country. The balanced regional development doesn't aim at achieving the industrial self-sufficiency or using the same economic pattern for all provinces. Instead, the balanced regional development is use of development potential of all provinces with regard to the capacity of each region so that it benefits economic growth of the residents of different regions in a country. So, Regional balance refers to the uniform distribution pattern of a planned investment in different areas in a country. On the other hand, regional balance seeks investment distribution of a kind that the rate of growth in different areas of the country becomes equal and this means the elimination of all regional inequalities. Consequently, for reaching the regional balance the rate of growth in underdevelopment regions should be more than the rate of growth in developed ones (Capello, 2015).

Therefore, the reducing regional inequality means concurrent economic development of areas, raising per capita income and also increasing living standards by using both natural and human resources of each region. In researches which have done to find the reasons of inequality in provinces of the country, adjacency effects argument has been one of the most ignored phenomena in many studies so far. Accordingly, the present study tries to address the role of economic

liberalization, industrialization, tax revenues, and provincial budget factors in regional inequality at the provincial level distribution along with the main focus on adjacency effects. In the following, first the background research, second theoretical concepts, then the research methodology and finally the results from the estimated model will be presented.

## **2. Literature Review**

The growth of the regional imbalance over the several recent decades has been greatly noticed by economists. The existence of poles of growth, regional duality, decline of large cities, marginalization in cities, the migration of the population, and the north-south problem confirm this fact and a large number of studies have been done related to each issue. The scholars have agreed upon the fact that normally two factors are involved in this matter. The first factor is the distribution of economic activities in different areas of a country and consequently it becomes influential as a positive factor in a tendency to equal income and per capita production among different areas. The other one causes the concentration of economic activities in specific areas which result in increasing of inequality among different countries (Sabagh kermani, 2001).

Theoretically and experimentally, the lack of regional balance has been the matter of controversy. Regional studies with the main focus on the national dimensions in the developed countries, due to the concurrent and symmetric development of provinces and states, haven't been the major of concern over years. In contrast, regional inequality in developing countries is regarded as an important issue and many studies have been done in this respect. In the case of the subject of the present study, different studies have been done in developing countries such as China, Indonesia, Taiwan and South Africa and a few ones have been done in America, Canada and Italia.

Li and Fang (2013) conducted a research on the analysis of regional inequality in China. They investigate the different factors effective on china economy from 1992 to 2010 by using of spatial combined data model. The result of study confirmed the regional convergence and the effect of productive factors on regional

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development. Marketization, industrialization and underlying factors are of the factors which explain regional inequalities in China. Lin et al. (2014), investigated the income inequality with the main focus on population ageing and space imbalance approach of the lack of spatial balances among provinces of Taiwan from 1998 to 2006. The results show that the ageing and income inequality are positively correlated and also inequality level in income distribution of a province is affected by the inequality of adjacent provinces and convergence of beta and Sigma has been confirmed. Wright (2015) analyzed the economic inequality and the fact of social capital during 1976\_2009 in the USA. He states that social capital is mainly related to the social and economic concepts which it leads to an increase in economic inequality through time and sections. Mc Combie et al. (2015) tried to determine productivity growth and spatial inequality and efficiency versus scale in provinces of China. They examine the reasons for inequality in terms of productivity growth to explain the development of China based on different growth patterns. Likewise, they described the inequality with Theil inequality index for provinces from the viewpoint of space econometric approach. The results from the estimation of above mentioned factors show the statistical significance of Wordwon laws coefficients for industrial production and efficiency to the increasing scale is confirmed. Likewise, the cities with the advanced technology have less inequality; education and infrastructure play the major roles in income inequality.

Mortazavi et al. (2011) studied the relationship between income inequality and economic growth in urban and rural areas by using Kuznets curve. In their study, they tried to understand how changes in income inequality in rural and urban areas of provinces have occurred in the process of economic growth during 2000-2007 by means of Kuznets curve. The results show that there is the relation of N between income inequality and per capita income of urban areas of provinces. Contrastingly, the relation of reversed N is observed in rural areas. Likewise, 1% of increase in per capita income of provinces approximately leads to 44% increase in income inequality in urban areas; however, this 1% change in rural areas causes a reduction of 41% in income inequality. Akbari et al. (2011), based on cross-sectional data during 2001-2006 and geographical weight

regression approach in their study tried to find spatial analysis of the effects of government expenditures on inequality in Iran by using Gini coefficient inequality index. According to the results, an increase of the per capita current expenditures is accompanied with an increase in inequality and per capita developmental expenditures and along with an improvement of income distribution. The amount of effectiveness of current government expenditures variable on income inequality in these years, in contrast with developmental expenditures, have been raised from East to West. Mahmoud zadeh and Elm (2012), in a study tries to examine the effects of inequality on economic growth in Iran by considering economic, geographical and technological factors in the framework of sustainable economic growth pattern during 2000-2007. The results show that socio-economic and geographical factors affect the economic growth in all provinces. Mehr Ara and Mohammadian (2015) inspected the effects of 18 economic variables on Gini coefficient by using of BMM methods and weighted average least square (WALS) over 1976-2001 in economic system of Iran. The results from two methods show that the growth ratio of GDP variable with positive sign has been the most important and effective variable on Gini coefficient in Iran in the sense that the increased economy growth which is generally affected by oil rents give rise to more income inequality. The other factors such as the current government expenditures, oil revenues ratio, degree of openness, and changes in exchange rates are considered effective in inequality. Mehregan et al. (2016) examined the industry space concentration and its effective factors among provinces of Iran by using of Ellison and Glycer concentration index according to value added variable over 2006-2013. The results arising from estimation of used space combined data show that the distribution of industrial activities among provinces in Iran is extensively unequal. Thus, East Azerbaijan, Markazi, Qazvin, and Tehran are respectively the most industrial provinces and Boushehr, Hormozghan, and Ilam are the least industrial ones in turn. The results also confirmed the spatial dependence among provinces.

### **3. Theoretical Background and Model**

The establishment of a well-organized society is considered as one of the goals of realization of justice which one of evident characteristic

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in such society is balance and moderation in distribution. The society in which social gap and social distance are widespread, it would be encountered with different forms of insecurity including social, economic, cultural and judicial insecurities. This kind of society is far from the concept of desirable society. The recognition of effective factors on emergence of different forms of socio-economic inequality and an effort for establishing a more balanced society are of the main goals of the governments in order to promote social and political security. Hence the study of different socio-economic society is highly recommended. The reduction of severity of poverty and inequality in comparison to the past and the development of supportive institutions such as social security fund, fund for the protection of children, women and pensioners and many others are arising from the changed attitude and the increased attention.

Piketty ( 2014) found that the capital share of income is growing in the developed world and theorizes that it will further increase. Indeed, he connects the capital share to the growth of developed country's economy, predicting an inevitable increase in the capital share, while the growth of developed countries population and economy declines. Therefore, Piketty's "Laws of Capitalism" predict that, with the end of the industrialization process, economic growth would naturally decline and inequality would inevitably rise.

A more optimistic argument is made in the seminal work of Kuznets (Kuznets, 1955; Kuznets and Jenks, 1953). The pioneering work of Kuznets was developed in 1955 and was based on data concerning only the US between 1913 and 1948. According to Kuznets, in the process of economic development in particular in the intersectional transition from agriculture based economy to an industrial one a general relation which ties wealth and inequality to pay subsists. When the passage towards industrialization takes hold there is an injection of cheap rural labor to the cities that holds down wages. At the same time, whoever owns capital has more investment possibilities and increasing the return on investments. These factors increase both the capital share of income and the inequality of labor income as the economy starts its industrialization. This provokes a wide urban-rural gap and a consequent rise of inequality. Kuznet's innovation stands in the relationship between economics and policies.



He predicts that, when capitalism enters in its advanced phase, the labor force bargains to improve pay and work conditions through social struggle, ultimately leading to a strengthening of the welfare state, and a process of democratization is triggered in which modern industrial relations are created and inequality decreases. The overall increase and decrease of inequality in the development of a country defines the inverted-U “Kuznet’s curve”.

Frrantic (2004), Fan and Zhang (2005) and Kaldron and Servin (2003) have concluded that government expenditures for infrastructures have the positive statistical significant effect on reducing the inequality in China and Latin America. In contrast, the study by Brakman et al. (2002) concluded that government expenditures in infrastructures have increased the regional inequality in Europe. Turnovsky (2012) also stated that government expenditures depending on source of financing of these expenditures cause the reduction in income inequality in a short term though it will be increased in long term duration. So, it seems that the kind of government expenditures (developmental or current), its source of supply (natural resources or taxes) and the quality of government practice have different influence on inequalities.

In terms of the effect of tax on income distribution, some studies show that this effect is dependent on the kind of adopted tax system. The most important kinds of received direct tax which are applied by the government in Iran include income tax on natural persons, company tax, and wealth tax. In the case of lack of tax fraud and the application of tax in the form of progressive rates, it can be expected that the application of direct taxes leads to the improvement of income distribution. Indirect taxes are more likely create disturbance in income distribution than direct taxes (Kamali and Shafiei, 2011).

Commercial or economic liberalization is another effective factor on inequalities. Theoretically there are two different viewpoints in terms of the influence of commercial reform on poverty and income distribution. Based on the theory of the advantages of liberalization, an increased foreign direct investment is considered as the fundamental factor in attaining a stable economic growth and reducing of poverty in developing countries. According to business theories, it seems that the increasing of economic growth provides grounds for improvement of

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income distribution (Sharma, 2003). However the critics believe that the theories on which the advocates of liberalization rely on are not applicable particularly for poor or developing countries due to the application of unrealistic assumptions. In a short term, the factors in particular labor market and business liberalization due to a market adhesion will create an increase in unemployment and poverty (Agenoria, 2004). Thus, it seems that the influence of open economy on inequality is vague and its consequences depend on country structure.

#### **3.1 Spatial Econometrics**

In the recent studies, the majority of studies which deal with the effect of different factors on regional inequality have used spatial models. Spatial econometric is a branch of econometrics which implements spatial effects to the application of cross-sectional or panel data models. Spatial effects are two types of factors which are related to variable location and they can be explained in terms of spatial dependence, spatial autocorrelation and spatial heterogeneity. This branch of econometrics has similarities with Geostatistics and spatial statistics but its difference is the same as its difference with statistics (Anselin, 2008).

Spatial dependence is defined as the existence of the relation between what happens at the point in a space with what occurs in another point. Two matters may create this dependence. The first is the existence of measurement of error related to the different areas. The second is the more fundamental reason and it is concluded from different phenomena about spatial reactions (Anselin, 2008). In general, there are two approaches related to the spatial dependence. The first approach is based on theory which a structure for spatial dependence is supposed. This structure is used in a formal model for statistical analysis. The second approach is based on data and it presents an interpretation of appropriate form of dependence by using some indices including interdependence and autocorrelation statistics.

The term spatial heterogeneity refers to the deviation in relations among observations at the level of Geospatial locations in space. If the variable locations are considered as a basis for spatial effects, different methods for considering the spatial relationship of two hypothesized

variables will be applicable. Adjacency, spacing distance, economic distance and use of social networks are of main factors to be noticed. Nevertheless, what is clear in spatial studies is the special correlation of variables is stated in pairs and numerical forms. There are two main methods for considering spatial effects on conventional regression equations. The first is through dependent variable ( $y$ ) and the other is error sentences path ( $u$ ). In the first method,  $y_i$  with respect to spatial weight of each other area which is  $W_{ij}$  and regression coefficient ( $\lambda$ ) is related to value of  $y_j$  which  $i \neq j$  (Fischer and Getis, 2010).

According to the above description, Spatial Lag Model and Spatial Error Model for panel data explained as follow (Millo, 2014):

$$y = \lambda(I_T \otimes W_N)y + X\beta + u \quad (1)$$

$$\begin{aligned} u &= (I_T \otimes I_N)\mu + \varepsilon \\ \varepsilon &= \rho(I_T \otimes W_N)\varepsilon + e \end{aligned} \quad (2)$$

In relation (3),  $\mu$  is the vector of an  $n \times 1$  with normal distribution and fixed variance.  $y$  is the vector of  $NT \times 1$  from observations as dependent variable and  $x$  is the matrix of  $NT \times K$  from explanatory variables of model.  $W$  is the spatial weight matrix of  $N \times N$  which usually is the first-order adjacency matrix. For determination of adjacency we can use the adjacency and correlation method. In this method, adjacency matrix is formed based on the determination of which regions are neighborhood or adjacent and so regarding spatial dependence, units which have neighborhood or adjacency relations represent more dependence degree than further spaces.

### 3.2 Measuring Spatial Inequality

Spatial inequality matters because it might be a consequence of ethnic discrimination or market failures such as excessive migration (Mills and Ferranti, 1971; Boadway and Flatters, 1982). But spatial inequality also matters because it is a component of overall inequality (Kanbur et al., 2005). Large horizontal inequality between the regions of a country might cause large vertical inequality between all

individuals (Stewart, 2000; 2002).

In order to measure regional disparities at the provincial level, we use the population-weighted coefficient of variation (PW-CV) logarithmic form, which is a measure typically used in the literature focused on regional disparities that is independent of the scale, population size and number of province considered, and moreover satisfies the Pigou-Dalton principle (Cowell, 1995; See also Williamson, 1965; Ezcurra and Pascual, 2008; Rodríguez-Pose and Ezcurra, 2010; Lessmann, 2014). Specifically:

$$PW - CV = \left[ \sum_{i=1}^n p_i (\ln \bar{y} - \ln y_i)^2 \right]^{1/2} \quad (3)$$

Where  $y$  is the country GDP per capita average,  $y_i$  and  $p_i$  are the GDP per capita and population share of province  $i$  and  $n$  is the number of provinces. The advantages of this measure are that it is mean-independent, independent of the sizes and the number of spatial units, and robust against single extreme observations, and that it satisfies the Pigou-Dalton transfer principle (Dalton, 1920; Pigou, 1912), which states that a transfer from poor to rich regions should unambiguously increase the inequality measure (see Sen, 1973).

Furthermore this measure cannot account for the heterogeneity of regions with respect to (population) size. In countries with large economic differences and a very unequally distributed population, an unweight inequality measure might be difficult to interpret. Therefore, it is necessary to calculate a concentration measure such as the PWCV, which incorporates the different sizes of spatial units within a country (Lessmann, 2014).

### **3.3 Data**

Regarding background research, a different index for explaining regional inequalities are used but as the present study is an intra-country and inter- provinces population weighted coefficient of variation is regarded as more appropriate index for inequality distribution (Ezcurra, 2013; Li and Fang, 2013; Liao and Wei, 2015). Explanatory variables are organized based on economic factors which

creates regional imbalance in terms of the purpose and the literature of the study and also statistical limitation in Iran. For gathering research data from 30 provinces<sup>1</sup>, this study used statistical yearbook of provinces, library resources of organization for management and planning of the country, ministry of economic affairs, human information and publications and central bank assets during 2001\_2015. Output variables are used which are adjusted in a fixed price in 2004. All estimations done in the present study are conducted by R software.

The experimental model from theoretical assumptions of this study is defined as below:

$$PWCV_{it} = \beta_0 + \lambda WPWCV_{it} + \beta_1 LLABOR_{it} + \beta_2 LFDI_{it} + \beta_3 LYIND_{it} + \beta_4 LTAX_{it} + \beta_5 LBUG_{it} + \mu + \varepsilon_{it} \quad (4)$$

$$\varepsilon_{it} = \rho W \varepsilon_{it} + e_{it}$$

In equation (4), *i* represented province and *t* is time.  $PWCV_{it}$  is population weighted coefficient of variation in logarithmic form which is estimated based on equation (1) and is used as a regional inequality,  $LLABOR_{it}$  is logarithm of per capita labor force participating,  $FDI_{it}$  is a foreign direct investment per capita as an index of commercial or economic liberalization,  $LYIND_{it}$  is logarithm of the ration of industrial productions of province to all productions as an index of industrialization,  $LTAX_{it}$  is logarithm of per capita tax income,  $LBUG_{it}$  is logarithm of per capita expenditures of provinces(current and construction). The factor  $\mu$  is fixed effects of time or sections in panel data and  $\lambda$  measures the spatial lag effect and  $\rho$  is error of lag effect.

#### 4. Empirical Results

Stability of the study variables means that the mean and variance of variable during time and covariance of variables were fixed between

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<sup>1</sup>. Statistical information of the province of Alborz that was submitted after 2011 is gathered with Tehran province.

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different years. As a result, using of these variables in this model leads to create false regression. Woodridge (2002) states if the number of cross-section is more than time, static test of combination data will not be necessary. As the number of sections is equal to 30 provinces and the duration of 15 years, there is no need to stability test.

One of the issues which may create unreliable results of regression model is Multicollinearity. Variance inflation factor (VIF) is one of the conventional methods for determining Multicollinearity (Kutner et al., 2004). According to the results presented in table (2), VIF for all explanatory variables is estimated less than 5%. This means that Multicollinearity is not statistically significant.

**Table 2: Multicollinearity Diagnostic Test**

	LLABOR	FDI	LYIND	LTAX	LBUG
VIF	1.23	1.24	1.70	1.47	1.22

For estimation spatial effects first neighborhood matrix should be estimated and then it should be changed into standardized first order adjacency matrix. For formulation of neighborhood matrix, there are different methods such as adjacent linear model, facial model, elephant model, two-way linear model, two-way facial and queen model (Elhorst, 2014). In the present study, based on background research, queen model is used. In the following, before the estimation of model, first final conditional diagnosis of random effects and spatial dependence by Lagrange Multiplier (LM) test is determined for choosing model with lag or error (Baltagi et al., 2013). Then, the existences of the fixed or random spatial effects were analyzed by using spatial Hausman test (Mult and Pfaffermayr, 2011). The results of LM test are presented in table (3).

In table (3), null hypothesis in the first section is based on the lack of existence of random spatial effects and spatial dependence. As it is observed, the estimated probability value rejects null hypothesis. Thus, at least one of two effects of random spatial or spatial dependence cannot be rejected. As a result, separate tests were conducted for both two effects probability value in each test reject the lack of these effects. So, both effects are statistically significant. In

order to finalize the model, the spatial Hausman test is shown in the table below.

**Table 3: LM Test Results**

<b>Random Effects and Spatial Autocorrelation(LMH)</b>	
LM statistics	1701.3
P-Value	0.0000
<b>Spatial Autocorrelation(CLM lambda)</b>	
LM statistics	8.0254
P-Value	0.0000
<b>Random Effects(CLM mu)</b>	
LM statistics	40.46
P-Value	0.0000

**Table 4: Spatial Hausman Test Result**

Chi-square Statistics	DF	P-Value
3.2271	5	0.665

The results of table (4) and probability values show that the estimation of random effects method in a model of this study is appropriate. Finally, spatial panel data regression model by using of random effects method in three manners including spatial autocorrelation (spatial autoregressive with autoregressive error model) SARAR, spatial lag model (SLM) and spatial error model (SEM) are estimated.

The information in table (5) is presented based on above-mentioned models. According to the Log-likelihood, the SARAR models seem to perform better than the SLM and SEM. Therefore, our analysis focuses on the results of the spatial autoregressive with autoregressive error model. In SARAR model, the existence of strong spatial dependence is statistically significant between provinces of Iran, which state how spatial inequality is formed. The existence of this kind of dependence can be seen by estimated parameter values of  $\lambda$

and  $\rho$ . In this model, estimated coefficient  $\lambda$  is nearly 34% which in terms of probability level is statistically significant. This parameter value  $\lambda$  states strong intensity of spatial dependence among provinces and the values of inequality of provinces are placed under the neighborhood spillover effect of the provinces. On the other hand, the size of estimated coefficient (34%) represents regional inequality sensitivity of each province in relation to neighborhood provinces and with regard to its positive effect we can say the increasing of regional inequality of each province will lead to an increase in inequality index in adjacent provinces.

**Table 5: Spatial Panel Data Regression Results Using Random Effects Method**

Variables \ Models	SARAR	SLM	SEM
<b>LLABOR</b>	0.2031 (1.6026)	0.2717* (1.8428)	0.2574* (1.7934)
<b>FDI</b>	-0.0143** (-2.7210)	-0.0167** (-2.7829)	-0.0163** (-2.7698)
<b>LYIND</b>	-0.1783*** (-3.9807)	-0.1789*** (-3.8436)	-0.1856*** (-3.9803)
<b>LTAX</b>	-0.0078 (-1.1379)	0.0026 (-0.2980)	-0.0053 (-0.6450)
<b>LBUG</b>	0.0331* (1.9904)	0.0457** (2.2625)	0.0435** (2.2487)
<b>Constant</b>	-2.0411*** (-3.6053)	-2.0984*** (-3.2046)	-2.1557*** (-3.3938)
$\phi$	7.7396*** (3.2318)	6.6177*** (3.4995)	6.5879*** 3.5065
$\rho$	-0.5525** (-2.7433)	-	-0.1528* (-1.9251)
$\lambda$	0.3350** (2.2322)	-0.1147 (-1.5788)	-
<b>Log-Likelihood</b>	1027.225	1025.378	1025.983
<b>Number of Observations</b>	450	450	450

**Note:** t-values are reported in parentheses, \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.



Estimated explanatory variables of research model also convey the important realities of Iran economy. According to the results, coefficients of foreign direct investment variables and the ratio of industrial productions have negative and statistical significant effect on inequality index of provinces. The increase in foreign direct investment as economic liberalization index will cause a reduction of inequality among provinces of Iran. During the present study the value of foreign direct investment in Iran has been hugely little and its main goal of capital flow of some marginal provinces of Persian Gulf have been active in oil sector. It is anticipated we can use the potentiality of other economic sectors for attracting foreign investment for regional balanced development by commitment of parties to Joint Comprehensive Plan of Action (Barjam). Likewise, the sign of industrial productions which has the highest coefficient among other variables presents that industrialization can be one of the policies which is considered in line with social justice realization.

One of the considerable results is ineffectiveness of tax revenues due to the inequality in the provinces; the coefficient of this variable is not statistically significant. In literature of economy taxes have been known as one of the main instruments in redistribution of revenues. However, the effect of tax on the distribution of income depends on the kind of tax system and economic structure of countries. It seems that in Iran due to the lack of transparency in tax payer's information system and defective tax bases, tax policies cannot be effective on the income distribution and reducing of inequality. Consequently, the reform of tax systems (increase in tax base, tax fraud avoidance) can be considered as one of the priorities of reform in economic structure if Iran. Budget factor which is regarded as expenditures of provinces in the model of the present study has positive and statistical significant effect on inequality index. On the other hand, the increase in expenditures of provinces will create the increase in inequality among provinces which seems that it is affected by current expenditures. Theoretically, the increase in current expenditure of the government generally had negative effect on inequality due to the destructive consequences like increasing of inflation and deficit in budget. The estimated coefficient  $\phi$  is the variance of average random factor in the

model and spatial factor  $\rho$  is statistically significant in SARAR model.

Spatial dependences can be divided into direct and indirect effects. The indirect effects are the result of the effect of independent variables on dependent variables through effectiveness on neighborhood provinces. The results related to the estimation of direct and indirect explanatory variables of estimated model on regional inequality among provinces of Iran are presented in table (6). It is observed that direct effects and total variables effects: foreign direct investment, the ratio of industrial products and expenditures of provinces are statistically significant. But indirect effects were not estimated as statistical significant.

**Table 6: Results of Direct, Indirect and Total Effects**

	Direct Effects		Indirect Effects		Total Effects	
	Coefficients	P-Value	Coefficients	P-Value	Coefficients	P-Value
<b>LLABOR</b>	0.2035	0.1330	0.1019	0.3072	0.3055	0.1625
<b>FDI</b>	-0.0144	0.0082	-0.0072	0.2293	-0.0216	0.0327
<b>LYIND</b>	-0.1787	0.0002	-0.0895	0.1867	-0.2681	0.0077
<b>LTAX</b>	-0.0078	0.2963	-0.0039	0.4328	-0.0117	0.3195
<b>LBUG</b>	-0.0332	0.0336	-0.0166	0.1844	0.0498	0.0426

## 5. Conclusion and Recommendations

The use of spatial models in investigation of economic factors which is effective on regional inequality has not been the major area of interest in the studies in economy of Iran. Spatial analysis of economic reasons of regional inequality can be effective in regional policy making and planning. In this study, the existence of inequality among the provinces of Iran is confirmed by investigating regional inequality in provinces of Iran by indices of Theil and population-weighted coefficient of variation in each province. Then, an analysis was conducted based on effective economic factors on population weighted coefficient of variation index in each province and how the special effect of these factors can influence the inequality during 2001-2015.

The results show that inequality arising from neighborhood has the most important effect on increasing inequality. On the other hand,

spillover effects on provinces are considered as one of significant factors in regional inequality. Likewise, based on the results from the estimation of spatial combined regression model, an increase in the variables of foreign direct investment and ratio of industrial productions will create reduction in inequality in provinces; however, the increase in expenditures of all provinces will enhance regional inequality. Tax policy in Iran also cannot be effective in redistribution of income. Consequently, increase in the absorption of foreign direct investment, industrialization, and reforms in tax policy can be decreased regional inequality. The effects of kinds of tax revenues and government expenditures on inequality distribution can be considered as the fundamental issues for future studies. At last, the attention to important estimated variables in the model under this study and neighborhood of the provinces can be a help in achieving the development of regional balance and macro policies reduction regarding inequality.

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