

# Regional Development and Inequality of Income Distribution

Nasfi Fkili Wahiba

Doctor of Economics, Research Unit "Enterprise Economy Environment" Higher Institute of Management University of Gabes, Tunisia

Email: Nasfiwahiba@yahoo.fr

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## Abstract

This paper is interested in the study of income distribution among Tunisian governorates on the basis of an analysis of regional inequalities taking into account the disparities between the different governorates. The calculation of inter-regional inequality wage distribution is conducted by the Gini index.

The estimation of an econometric model for the case of Tunisia proves that interest should be given to improving infrastructure and to better location of foreign direct investment. Similarly, consideration should be given to regional development through the strengthening of the means to support each region in order to consolidate the decentralization of investment.

Thus, in order to guarantee equal opportunities for all Tunisians, regardless of their geographical location, Tunisia must raise the Regional Development as the top priority because it represents a powerful tool for the realization of equality.

**Keywords:** Distribution, income, inequality, regional development, Tunisia.

JEL CODES: D31, D33, O1.

## Introduction

The study of inequality in wage distribution differs depending on the distribution of individuals by occupational category or by governorates, in the first, we treat people according to their occupation in a clearly defined sector, while the second, is the belonging to a governorate which is the basis of the study, note that the second aspect draws our attention in this paper, related to the inter-regional disparities through wage distributions within each governorate.

We seek in this context to understand the interaction of several variables with the distribution of income among governorates. We focus on the effect of official development assistance, infrastructure projects, foreign direct investment, unemployment and rural exodus. Our study is based on a calculation of the inter-regional inequality by means of an indicator of measuring inequality, hence the need to present the various indicators in order to choose among them most useful for our econometric estimation.

**Indicators for measuring inequality:**

The major concern of economists interested in the theory of inequality is the development of criteria for the distinction between different distributions of income. Thus the use of a set of measurement indicators that may be positive or normative as is the case in the paper of Ahluwalia (1976), Deininger and Squire (1996 and 1998), Bourguignon and Verdier (2000), Dollar.D (2005)...

Moreover, an indicator is considered relevant for the measurement of inequality if it meets the following characteristics: Be calculable, have a significance of its variation with reference to an explanatory theory, have an unambiguous interpretation, takes into account all the income of the population and be sensitive to a transfer of income between rich and poor.

Indicators of inequality measures can be indicators of dispersion, entropy indicators and normative indicators (Bourguignon 1976). We present the characteristics of each of these measures.

**Indicators of dispersion:**

Among the indicators of dispersion: Relative mean deviation, variance and Gini.

**Relative mean deviation:**

It is measured by:

$$\text{DMR (Y)} = \frac{1}{2\bar{X}} \frac{1}{\eta} \sum_{i=1}^n \sum (X_i - \bar{X})$$

With

$X_i$  = Income of unit  $i$ .

$\bar{X}$  = Average of all income.

$\eta$  = Total number of units.

**Variance:**

The variance is used in case of inequality decomposition into sub-groups or components of income, it is defined by:

$$\sigma^2 = \frac{1}{n} \sum_{g=1}^{\sigma} ng \sigma_g^2 + \frac{1}{n} \sum_{g=1}^{\sigma} ng (\bar{X}^g - \bar{X})^2$$

With

$\sigma$ : A number of groups forming the population .

$ng$ : A number of individuals in group  $i$ .

$\bar{X}^g$ : Average income of each group  $g$ .

$\sigma_g^2$ : Variance of income of each group.

The first term of variance reflects the average of the variances ( $\sigma_g^2$ ) of  $G$  groups weighted by the corresponding number in group (intra-group variance), while the second term corresponds to variances for means of groups (inter-group variance).

**Gini indicator**

The Gini indicator is equal to double the area comprised between the Lorenz curve and the diagonal of the square of side equal to unity. This indicator is defined as follows:

$$G(X) = \frac{1}{2n^2 \bar{X}} \sum_{i=1}^n \sum_{j=1}^n |X_i - X_j|$$

It is a direct measure of income, this indicator is thus an exhaustive measure of inequality, it is between 0 and 1, this coefficient registers zero when inequality is minimal in this case, each member of the population receives exactly the same income, On the contrary, it is equal to 1 when one member receives all the income, inequality will in this case maximum.

Gini indicator took another form in the literature, it is defined as follows:

$$G(\chi) = 1 + \frac{1}{n} - \frac{2}{n^2 \bar{X}} [\chi_1 + 2\chi_2 + \dots + n\chi_n]$$

avec  $\chi_1 \succ \chi_2 \succ \dots \succ \chi_n$

According to this formulation, the Gini indicator is based on a function of well-being that combines weighting individual income according to their ranks. It is weighted according to their classification following their amount; this indicator verifies the transfer principle according to which a transfer of income from rich to poor reduces inequality.

### Indicators of entropy

The entropy indicators include the Theil index and the logarithmic variance.

#### The Theil index:

Theil proposed an indicator based on the concept of entropy, which is inspired by the information theory, in this context, where  $P_i$  is the probability of an event, the informational contents related to the observation of the event  $i$  can be noted  $h(P_i)$ , this function is supposed to be decreasing curve in  $P_i$ , and when the event is likely, the informational contents of the observation are low. Theil proposed a measure of information content in the realization of the event  $i$  as follows:

$$h(P_i) = \log\left(\frac{1}{P_i}\right) = -\log(P_i)$$

In a system comprising  $n$  events, the total information denoted  $H(P_i)$  will be:

$$H(P_i) = \sum_{i=1}^n P_i h(P_i) = \sum_{i=1}^n P_i \log\left(\frac{1}{P_i}\right) = -\sum_{i=1}^n P_i \log(P_i)$$

For an assessment of inequality associated with income distribution,  $P_i$  may be similar to the share of income held by individual  $i$ , this share is denoted  $x_i$ , we obtain the measure of inequality proposed by Theil:

$$T_{(x,n)} = \log n - \sum_{i=1}^n X_i \log\left(\frac{1}{X_i}\right) = \frac{1}{n} \sum_{i=1}^n \frac{X_i}{\bar{X}} \log \frac{X_i}{\bar{X}}$$

The Theil index has the advantage of being decomposable; it can deduct the contribution of a group to total inequality. Thus, given a population  $P$  of  $n$  individuals, who are divided into  $G$  groups, each of which ( $g$ ) consists of  $n_g$  household, the Theil index will be:

$$T_{(x,n)} = \sum_{g=1}^G V_g T_g + \sum_{g=1}^G V_g \log \frac{V_g}{W_g}$$

With:

Tg: Measurement of Theil corresponding to group  $g$ .

Vg: The income of group  $g$  relative to the total income.

$W_g$  : weight of the group  $g$  in the total population.

### The logarithmic variance

This is an indicator that takes more account transfers to the bottom of the distribution that is to say on the lowest incomes. Formally it is written as follows:

$$VL(X) = \frac{1}{n} \sum_{i=1}^n \left[ \log(X_i) - \left( \frac{1}{n} \sum_{i=1}^n \log(X_i) \right) \right]^2$$

$$VL(X) = \frac{1}{n} \sum_{i=1}^n \left[ \log \left( \frac{X_i}{\bar{X}} \right) \right]^2$$

The logarithmic variance is a decomposable indicator sensitive to changes in poor's income, in the sense that the greater the individual beneficiary of the transfer is poorer, this indicator shows a decrease in inequality. Nevertheless, the use of a simple statistical indicator of dispersion cannot be satisfactory for ATKINSON who says that the shortcomings of these measures are due to not taking into consideration the views of members of society for distributive justice.

### Normative indicators

Normative indicators take into account the notion of inequality aversion that is related to risk theory, this notion was overlooked in positive indicators for measuring inequality in this context, we cite the work of ATKINSON (1970), KOLM(1976 a and b) and DALTON(1920).

### The Atkinson indicator

Atkinson wanted to innovate radically compared with conventional measures of income inequality by introducing the concept of sensitivity to inequality. The indicator is written:

$$A = 1 - \left[ \frac{1}{n} \sum \left( \frac{X_i}{\bar{X}} \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

$\varepsilon$  is a coefficient of inequality aversion can vary between zero and infinity, and this indicator is as the Gini its value is between 0 and 1. The choice of inequality aversion coefficient can be interpreted as that of a weighting of the different income. When this coefficient is high, there is a social preference for equality, and when it is equal to its minimum value (zero), all incomes are included in the calculation. While when the coefficient increases weighting is given to the lowest income. The Atkinson indicator may also be defined by:

$$A = 1 - \frac{Y_e}{\bar{Y}} \quad \text{With} \quad Y_e = \left[ \frac{1}{n} \sum Y_i^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

$Y_e$ : Equivalent income equally distributed, it is presented as income per head that if it was the same for each individual and equally distributed, it would provide a level of well-being equal to the total well-being provided by the present distribution of income.

To interpret the Atkinson indicator, we note that the weighting given by the user for different income has the effect of reducing the income of an amount equal to the portion that is willing to sacrifice in order to achieve an equal distribution. Thus, the value specified by the

indicator will be interpreted as the percentage reduction of total income that would provide the user to achieve an egalitarian distribution.

The Atkinson indicator has the disadvantage of being dependent on the user, if he was perfectly indifferent to inequality, he would choose a zero coefficient of aversion, Atkinson measurement would be zero for any distribution.

### The Kolm Indicator

Besides Atkinson indicator, Kolm provides income transfers explicitly dependent weighting of the user of the indicator, the formula for this indicator is as follows:

$$K = \frac{1}{\beta} \log \frac{1}{n} \sum_{i=1}^n e^{\beta(\bar{x}-x_i)}$$

The coefficient  $\beta$  is similar to that of Atkinson representing the degree of inequality aversion. Kolm index may increase following a positive change in the same proportion of all income; this indicator varies accordingly in the same proportion.

If the coefficient of inequality aversion is zero, the Kolm indicator will be also and if he tends to infinity, the indicator will tend towards the gap between the average income and the lowest income.

### The Dalton indicator:

Dalton is the pioneer to have proved that inequality can be derived directly from the social welfare function; it showed a measure which he defined as the proportional welfare loss resulting from income inequality. Dalton's hypothesis is that the sum of individual utilities is the function of social welfare and the marginal utility of income is decreasing.

Dalton's proposed measure is as follows:

$$D = 1 - \frac{\sum_{i=1}^n U(Y_i)}{N U(\bar{Y})}$$

In this context, equality is perfect when  $D = 0$  but inequality is maximized when a single individual provides all income,  $D$  will be:

$$D = 1 - \frac{(N-1)U(0) + U(NY_i)}{N U(\bar{Y})}$$

Based on these indicators, we try to conduct a study of inequalities in income distribution in Tunisia with reference to data relating to all governorates.

### Inequality of income distribution by governorate

In order to clarify the differences between the regions of Tunisia in the distribution of wages, we use an indicator presented above, we use one of positive indicators for measuring inequality which is the Gini index since it has the advantage of being decomposable specifying the origin of constitution of inequality through direct measurement of income.

It remains to point out that the Gini index is used through its expression given above and not subject to a deduction from the Lorenz curve by twice the area between the diagonal and the curve. The disadvantage of this method is that different curves can match the same

value of Gini and it is impossible to say that a distribution is more unequal than others when the curves intersect.

To conduct the study, we propose to estimate an econometric model combining the following variables: IR: Inter-regional inequality of wage distribution, IN: Infrastructure measured by the annual growth rate of electrical energy production, EU: Unemployment rate, FI: Share of foreign direct investment in gross domestic product, RE: Annual growth rate of rural exodus, DA: Growth rate of official development assistance and official aid received.

Thus, we estimate the following model:

$$IR : C + \alpha IN + \beta UE + \delta FI + \theta RE + \sigma DA$$

The study period starts from 1984 until 2011 and the data are relating to the World Bank and the National Social Security Fund Tunisia. To ensure the stationarity of the variables we conducted the unit root tests which show that the variables are stationary at the 1% level. The results of the empirical estimation are shown in the following table:

Table 1  
*Estimation Results*

Variables	Coefficient	t-statistic
C	0.551	2.369
IN	-0.299	-2.178
UE	0.192	4.974
FI	-0.100	-2.447
RE	0.414	2.548
DA	-0.349	-2.953
R-squared	0.888	
F-statistic	33.416	

The study shows that rural-urban migration can affect the wage distribution among regions; it contributes to exacerbate inter-regional inequalities. Indeed, the transfer of individuals from low-productivity rural sector to the urban sector where productivity is higher resulting in disparities in terms of wage distribution among regions.

The unemployment rate also affects inequality, whereas improving the infrastructure, foreign direct investment and increased official development assistance can reduce the inter-regional inequality.

Indeed, the country's development is based on strengthening the capacity developed for the benefit of each region by mobilizing all energies and forces in the region and removing all obstacles to its development, so it seeks to engage the region in the development process allowing it to develop and fully exploit its resources while promoting the spirit of complementarity between regions to strengthen national cohesion.

Complementarity is able to ensure the dissemination of development to all regions to organize between them the dynamic reciprocal reinforcement of their efforts, these interactions founded inclusive development between different regions, it is in this context, and for a unified and cohesive management infrastructure, large equipment and natural resources, priority must be given in the selection of investment projects, to those involving more than one region.

Foreign direct investment contributes to reduce inter-regional inequalities except that these investments must reach more central regions and most disadvantaged for not to locate in the North and cause inequalities between regions, besides reducing disparities between regions must pass through the decentralization of actions and decisions, allowing investors and developers to realize their projects at the lowest cost and in the most profitable conditions.

Thus, the openness to the global economy will positively affect inequality of income distribution by governorates on the basis of specific regional development programs which should encourage the use of new investment channels with revitalizing the partnership.

In this context, the gradual elimination of distortions protectionism should foster partnership between small and medium Tunisian and European companies. Contemporary economic space can carry interesting opportunities for partnership and investment while exploiting new industrial zones which will have a positive impact on income distribution between governorates.

Indeed, in order to boost economic growth and ensure the narrowing of regional disparities, Tunisia should adopt an economic policy based on specific measures such as:

- The strengthening of the rural development program for minimizing disparities between urban and rural sectors.
- Continued encouragement and aid the craft sector and small businesses.
- Project implementation of integrated development in the most disadvantaged urban areas.

The regional development strategy is expected to devote the right to development of all regions and prepare as it should to the demands of a more pronounced economic openness, focusing more activities in disadvantaged areas and encouraging a majority of smallholders. Moreover, this strategy should be applied taking into account the specificities of each region, such as demographic characteristics and natural endowments seeking the favor of a self-sustaining development and diversification of the productive base conditions.

In this context, the regional development strategy seeks to improve the attractiveness of each region through the establishment of a set of actions encouraging private operators to promote their initiatives, Thus, incentives for investment should affect several parts of the Tunisian territory, in particular those with insufficient in order to fit into the dynamics of the opening. Tunisia has sought the adoption of specific programs whose content depends on the area of intervention such as that on the urban area "Integrated Urban Development Program" or rural area "Integrated Rural Development Program."

Therefore, the regional development programs, which are diversifying represent the basis of policy to promote incomes per their contribution directly to the creation of jobs and income sources. And it is through the implementation of development projects in which aid and loans are granted to citizens based on potential production observed, these credits for regional development programs must be provided with more ease.

In this context, the state should encourage individuals to participate in operations of installation of industrial areas by helping them to acquire land in areas of regional development at nominal prices; these instruments will allow Tunisia to perform significant performance in an environment full of challenges. The appreciation of the national territory is conceived as a privileged instrument of the regional development strategy.

**Conclusion**

We have considered in this paper inequality of wages by governorates, it was to study regional disparities in wage distribution. The econometric study showed that the improvement of infrastructure, regional development and foreign direct investment can reduce inter-regional inequalities.

It follows that the openness with the introduction of foreign investment in several areas of the country can offer numerous employment opportunities; similarly, grants available for investment in disadvantaged areas or regional development can encourage promising investment with minimum capital which promotes employment and thus a narrowing of inter-regional inequalities.

Nevertheless, a number of challenges remain for Tunisia in connection with the processes involved of integration into the world economy concerning regional disparities that persist and which caused Tunisian revolution of 2011 especially with the delay of the areas of west central and southern registering a lag on some socio-economic indicators such as access to certain basic infrastructure, the highest unemployment rate...

Other challenges have also arisen in connection with the liberalization process concerning the maintenance of balance and social gains and which are additional constraints on the distribution of wealth and vulnerability of certain groups of the population in different regions of Tunisia.

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