

# On Measuring and Decomposing Inequality of Opportunity among Children: Evidence from Tunisia

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**Abstract** Building on the current literature that increasingly recognizes inequality of opportunity among children, this paper analyzes to what extent access to basic education and core services is influenced by family and individual background factors in Tunisia. The analysis uses the Human Opportunity Index (HOI) methodology developed recently at the World Bank, and micro data from the National Survey on Households' Budget, Consumption and Standard of Living (HBCLS) for 2010. The main contribution of the study is its in-depth investigation of the key factors affecting child development in Tunisia. The results reveal large and persistent interregional and intra-regional disparities among children, mainly in pre-secondary school enrollment and access to safe water and sanitation services. Such inequalities of opportunity, obviously shown between inland and littoral regions, are found to be driven mainly by geographic factors and parents' education and wealth. These findings may have important policy implications in term of developing better-targeted interventions aiming to reduce inequality in accessing basic services.

**Keywords** Human opportunity index · Inequality of opportunity · Education · Housing services · Children · Tunisia

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**JEL Classification** D63 · I24**Introduction**

Since Arneson (1989) and Cohen (1989), a differentiation has begun to be drawn between inequalities due to the exercise of individual responsibility, and which may subsequently be morally acceptable, and those due to predetermined circumstances, and which may afterwards be arranged as unfair. Then, various prominent authors have considered that inequality in the distribution of specific outcomes is not the appropriate yardstick for evaluating the fairness of a given allocation of resources or social system. In this view, objectionable inequalities are inherent in a plausibly prior space of resources, capabilities, and opportunities for which any individual cannot be held responsible. Roemer (1993, 1998) was the first to introduce the concept of equal opportunities in the economic literature. He is credited with the first clear and comprehensive differentiation between two sets of factors (circumstances and efforts) influencing separately inequality in the distribution of outcomes.

On one side, circumstances are defined as factors over which persons have not any measure of control (such as ethnicity, gender, age, parental education and others individual's socioeconomic characteristics). On the other side, factors that are under individual control (e.g. how long one studies, or how hard one works) are called efforts and persons are considered entirely liable for their own choices and efforts. Given this differentiation, Roemer (1998) identifies equality of opportunity chiefly as a situation in which basic outcomes, named advantages, are scattered independently of circumstances.

It is well known that the Arab Spring started over governments' failure to respond to social requirements of their populations and has led to increasing calls for social inclusion and more equal opportunities. So, it could be argued that the main causes of the recent revolutions occurred in some Arab countries are chiefly social and economic inequality as well as corporate greed and corruption. In Tunisia, for instance, regional development has been more and more unequal between regions since the independence. While the littoral region has generated more employment opportunities, the non coastal one (particularly the Middle Western part of the country, where the recent revolution started) was economically and socially marginalized (see Fig. 2 in Appendix for more details about regions in Tunisia). Further south, specifically in Gafsa, a big protest movement took place in 2008, before the recent revolution, in response to such marginalization.

Focusing only on fighting economic inequality, policymakers risk missing the opportunity to tackle the main causes of social instability and persistent inequality, which commence early before young people protest, often before they can even walk or talk, in early infancy. Deficits accruing through diverse developmental domains all over early childhood compound each other and place children for a lifetime of threat and diminished human capital (Helmers and Patnam 2014). In spite of the magnitude of childhood development, there is restricted research on this topic in Tunisia. Even after the 2011 revolution, childhood development remains not present in political agendas, inappropriately studied, and under-resourced.

Housing and education indicators such as access to improved water and sanitation facilities and school attendance (primary and pre-secondary levels) are used commonly to evaluate the level of human development in a society. Many economists, sociologists, demographers, and some other development researchers consider these simply indicators as key tools for capturing and monitoring social improvement in a given society. However, these indicators remain incapable to capture the differential intensity of development across a variety of socioeconomic subgroups. Studying deeply obvious and persistent differences in basic opportunities statistics can put emphasis on the main factors contributing to overall poverty rate and thus prioritize the decisions needed to be undertaken to support regional development.

In this regard, a synthetic measure of inequality of opportunity, called the Human Opportunity Index, has been first developed by the World Bank (2006). This index, applied initially to Latin America and the Caribbean by de Barros et al. (2009) measures how individual circumstances (such as birthplace, wealth, race, and gender) influence a child's probability of accessing the services necessary to succeed in life (such as timely education, running water, and connection to electricity). It focuses mainly on coverage and inequality of access to such services among children for two main causes. Firstly, unlike adults, children frequently have not the capacity to access to these main goods by themselves; Thus, access can be considered in the case of children as opportunity that depends strongly on the family's circumstances. Secondly, interventions for alleviation of inequality between subgroups early in the lifecycle (childhood) of an individual are noticeably more cost effective and relevant than interventions done later in life.

Over the last decades, the World Bank and other international agencies have characterized Tunisia as one of the fastest growing economies of the African continent. However, growth benefits and economic development opportunities, in this country, are not equally distributed among regions and population groups. Such regional disparity was and remains to be a driving factor behind the Tunisia's socio-economic and political unrest. So long as Tunisia's inland region continues to be marginalized relative to its more-developed littoral zones, discontent and instability will plague its political and economic recovery.

In this paper, we endeavor to investigate the level of inequality of opportunity among children in Tunisia using the HOI methodology developed at the World Bank, and assess afterward the contribution of each individual socioeconomic and demographic circumstance to this inequality. As noted above, the used HOI permits us to determine how far a region is from the objective of providing fair and universal access to a set of core services to all, and the degree to which each child has an equal opportunity to benefit from those services. In this paper we compute the HOI for each region using the 2010 National household survey in order to establish a comparison between different region's values of the index and also compare obtained results with those found in other studies such as Jemmali and Amara (2015).

The remainder of the paper is outlined as follows. The following section provides background information regarding the context of the study. The third section is devoted to providing more details on used data and applied methodology. Finally, before concluding and providing some policy recommendations in the last section, we present, in the fourth section, a summary of the main findings arising from the current empirical analysis.

## Study Background

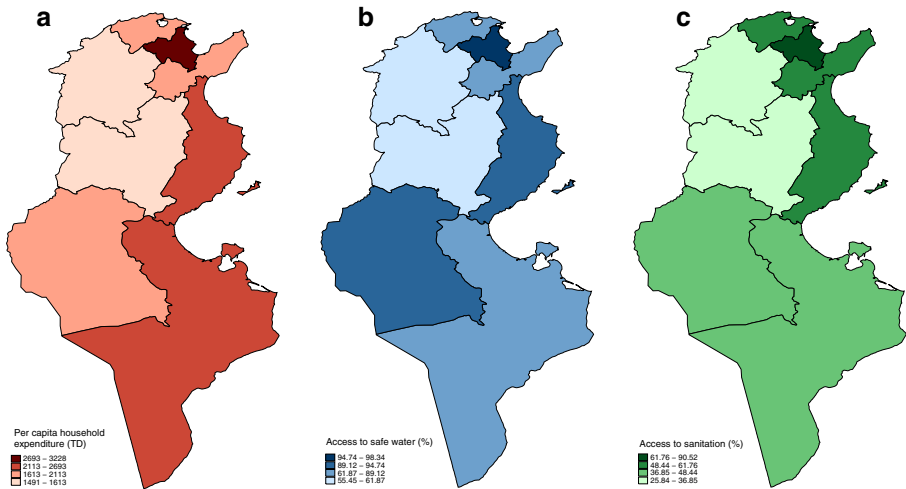
During the last decades, Tunisia has made a number of strategic decisions aiming at human development promotion and poverty alleviation. These are done basically through increasing investment in basic education and enhancing access to basic services (water, sanitation and electricity...). However, the majority of public policies have been focusing only on economic growth and poverty reduction ignoring the need to tackle inequalities between and within regions. Last decade, real consumption per capita in Tunisia grew at an annual rate of about 3.31% between 2000 and 2005 and about 2.5% between 2005 and 2010 (base 100 in 2005). Nevertheless, this remarkable increase in per capita consumption was accompanied by a tiny augmentation in inequality Gini coefficient from 40.81% in 2000 to 41.42% in 2005. The diminution of poverty rate was, then, impeded by the increase in consumption disparities and economic inequalities suggesting that economic growth was biased in favor of the non-poor population and privileged regions. More than 90% of total employment opportunities are generated in coastal area of the country (Dlala 1997; Amara 2009; Amara and Ayadi 2013, 2014), while we can easily observe that inland area had the highest unemployment rate (18.5%).

The main reasons of such disparities were twofold: The first reason, the majority of basic infrastructure for production and distribution facilities were implemented since the French colony in coastal regions near main harbors. The second one, the private capital investment and competitive poles, companies and jobs, characterized by a high regional over-concentration, are still located mainly along the coastline (Amara and Ayadi 2014). In opposition to the goals announced in several regional development programs, the Tunisian coastal area and especially the metropolitan area (Great Tunis) remain the most attractive zone to invest compared to others regions.

Figure 1(a), (b), and (c) illustrate respectively the geographical distribution of per capita expenditure, access to drinking water and improved sanitation among regions. It appears from the first figure that the per capita expenditure is fairly heterogeneous across regions suggesting high inequality in consumption between households living in littoral and inland regions. This uneven distribution of wealth and economic opportunities has resulted in significant regional disparities of poverty rates and access to basic social services like education and healthcare (Boutayeb and Helmert 2011). Similarly, Fig. 1(b) and (c) point up a quite obvious disparity in the distribution of basic housing services (water and sanitation) across regions. These figures reveal, too, that the majority of households with regular access to safe water and improved sanitation facilities live in the coastal regions of the country. It is well recognized in the development literature that no development can be sustainable with such unfair inequalities

## Data and Methodology

This section presents the data and the methodology used in the analysis to estimate the different values of the HOI for each service and region and the relative contribution of each individual circumstance variable in the observed inequality of opportunity.



**Fig. 1** **a** Spatial distribution of per capita expenditure. **b** Spatial distribution of access to drinking water. **c** Spatial distribution of access to improved sanitation

## Data

We use data from the 2010 National Survey on Households' Budget, Consumption and Standard of Living conducted by the National Statistical Institute of Tunisia (NSI).<sup>1</sup> This survey was based initially on a random sample of 13,392 households representing 0.55% of total households in the country (55 surveyed household for every 10,000 households). It is a representative sample distributed across 1116 districts at the national level, in both urban and rural areas, for the twenty four governorates and for the seven economic regions of the country (Great Tunis, North East, North West, Middle East, Middle West, South East and South West). The 13,392 households were drawn using a two stage stratified random sampling in each governorate. Table 1 shows the distribution of districts and households sampled by regions.

The analysis includes five outcome variables: (i) primary school attendance among children aged 6–11 years, (ii) pre-secondary school attendance among children aged 12–17 years; (iii) access to electricity, (iv) access to safe water, (v) and access to sanitation. Similarly, we used a set of circumstance variables which comprises: (i) gender (0 if female and 1 if male), (ii) residence area of household (1 if urban and 0 if rural), (iii) education of household head (1 if the household head has secondary or higher education level and 0 otherwise), (iv) per capita household expenditure (in Tunisian National Dinars (TND)), (v) age of household head (in year), (vi) gender of household head (0 if female and 1 if male), and (vii) household size. Table 2 shows a summary of descriptive statistics of the circumstance variables used in the estimation of the different HOIs.

<sup>1</sup> The 2010 National Survey on Households' Budget, Consumption and Standard of Living can be downloaded from the official website of the Tunisian National Institute of Statistics ([www.ins.nat.tn](http://www.ins.nat.tn)).

## Computing the Human Opportunities Index

As noted above, the HOI combines into a unique indicator assessments of both the absolute level of the main opportunities and how fairly those opportunities are scattered in a society. The first component of the index measuring the average coverage rate for a specified opportunity can be easily estimated using household survey data, while the second one measuring the fairness of opportunity distribution necessitates a more complicated calculation.<sup>2</sup>

Using the same methodology, followed by de Barros et al. (2009) and Son (2013), and recently used by Jemmali and Amara (2015), and given a random sample of the population, we define a dichotomous variable  $z_i$  that takes a value of 1 if the  $i$ th person of specific group has access to basic opportunity (for instance safe water and sanitation) and takes a value of 0 if he lacks access to the considered opportunity. It can be readily proved that  $E(z_i) = p_i = P(z_i)$ , where  $p_i$  is the average accomplishment related to the dichotomous outcome ( $z_i$ ) with respect to a specific group of the sample.  $p_i$  could be defined otherwise as the probability that the  $i$ th person has access to a given opportunity. It depends on a vector of exogenous variables indicating the socioeconomic circumstances (such as gender, age, area of residence...) of each group; the total number of characteristics being  $k$ . It is worth to note that there can be as many probability gaps between individuals/groups as there are possible combinations of group-identifying circumstances (income groups, household-size groups, gender groups...).

Given a set of  $k$  circumstance variables  $x_{i1}, x_{i2}, \dots, x_{ik}$ , we estimate the probability  $p_i$  for each child<sup>3</sup> by means of a separable logistic model. Accordingly, we have the following expression of  $p_i$ :

$$p_i = \frac{e^{(\beta_0 + \sum_{j=1}^k \beta_j x_{ij})}}{1 + e^{(\beta_0 + \sum_{j=1}^k \beta_j x_{ij})}} \quad (1)$$

Estimates of the parameters  $\beta_j$  obtained from the logistic regression denoted by  $\beta_j$  are used to obtain the maximum likelihood estimate of the probability  $p_i$  denoted by  $\hat{p}_i$ . Any measure of the probability gap between groups will be an assessment of the inequality of opportunity that depends on the considered circumstances variables.

<sup>2</sup> The present section merely gives the basic conceptual method for calculating the Human Opportunities Index. For further details and discussion, refer de Barros et al. (2009) which has a more exhaustive explanation of the procedure for computing the second component of the HOI, the Dissimilarity index (D-index), for estimating inequality of opportunity in access to given services. The methodology used in this section hence follows analogous notations as far as possible in order to retain coherence and comparison.

<sup>3</sup> In this study we focus particularly on children as we assume that many of the differences in opportunities are generated during childhood and carried out the whole life. In fact children's access to basic services or lack thereof will surely determine, in the future, their education, health and labor market outcomes, and hence their income-earning potential as adults. Several longitudinal studies have argues that investments in children from poor and vulnerable families can translate into higher earnings in adulthood, later in life, then helping break the cycle of poverty.

**Table 1** Distribution of districts and households sampled by regions

Region	Total		Sample size		Household sample percent (%)
	District	Households	District	Households	
Great Tunis	7863	617,523	240	2880	0.47
North East	4446	348,691	156	1872	0.54
North West	3821	293,535	144	1728	0.59
Centre East	7379	552,666	216	2592	0.47
Centre West	3871	305,022	144	1728	0.57
South East	2711	202,006	108	1296	0.64
South West	1644	124,685	108	1296	1.04
Total	31,735	2,444,128	1116	13,392	0.55

National survey on Household Budget Consumption & Living Standard (HBCLS), 2010

Using these predicted probabilities, the World Bank (2006) defined the D-index,<sup>4</sup> aimed to assess the dissimilarity of access rates for a given service, as a relative mean deviation; so that the index is estimated as follows:

$$D = \frac{1}{2\bar{p}} \sum_{i=1}^n w_i |p_i - \bar{p}| \quad (2)$$

Where weight  $w_i$  is equal to  $1/n$  with  $n$  is the size of the considered sample.  $\bar{p}$  is the average prevalence of access to a service in the sample, which is computed using the following formula:

$$\bar{p} = \sum_{i=1}^n w_i p_i \quad (3)$$

After calculating the two components of the HOI, the average access to opportunity ( $\bar{p}$ ) and the D-index ( $D$ ), the final index is given by:

$$HOI = \bar{p}(1-D) \quad (4)$$

It is noteworthy that the estimated HOI will usually be less than or equal to  $\bar{p}$  which means that there will usually be loss of average opportunities available to the society since D-index ranges from 0 to 1 (0 to 100 in percentage terms) (see Eq. 2).

### Inequality Decomposition by Causal Factors

The D-index as defined in Eq. (2), is an estimate of the total contribution of circumstance variables to the inequality of opportunity. However, it is more

<sup>4</sup> The D-index, as noted in de Barros et al. (2009), is a version of the dissimilarity index ( $D$ ) broadly used in sociology and applied to dichotomous outcomes.

**Table 2** Descriptive statistics of the circumstance variables (by region)

Region	Gender of child	Residence area	Education level of HH	Per Capita expenditure (TND)	Gender of household head	Household size	Age of household head
Great Tunis	52.23	92.44	47.66	3498 (2981) [446–0106]	86.47	3.985(1.601) [1–11]	54.158(12.426) [25–93]
Northeast	50.92	59.52	29.63	2241 (1301) [370–1351]	89.97	4.238 (1.592) [1–11]	51.816 (12.552) [23–94]
Northwest	50.56	39.85	23.09	1754(1369) [148–8480]	82.81	4.155 (1.819) [1–15]	54.482 (13.764) [18–95]
Middle East	51.86	75.38	40.42	3081 (2480) [223–9253]	89.23	4.478 (1.781) [1–14]	51.844 (13.117) [25–99]
Middle West	50.51	33.16	21.08	1623 (1377) [191–3329]	83.81	4.622 (1.999) [1–14]	52.324 (13.986) [21–98]
Southeast	47.88	74.93	34.38	2464 (1909) [245–45,163]	86.05	4.796 (2.129) [1–15]	52.817 (13.771) [25–94]
Southwest	52.96	70.27	31.15	2064 (1751) [281–22,248]	87.62	4.770 (1.980) [1–14]	54.731 (13.697) [22–97]
Tunisia	51.10	67.59	35.22	2601 (2278) [147–60,106]	86.87	4.340 (1.810) [1–15]	53.013 (13.199) [18–99]

Note: The Table reports the mean, the standard deviation (in parenthesis) and the minimum and maximum values (in brackets) of each quantitative variable. For the categorical variables, we just report the percentage of the reference category (Male, Urban, Formal education (Secondary or higher education))



useful to policymakers to know the impact of each individual circumstance variable. The main objective of estimating these individual contributions is to recognize circumstantial variables that impact more significantly the inequality of a considered opportunity. Below, we present in details the required steps to estimate such relative contributions.

Firstly, a variable  $y_i = \frac{p_i}{1-p_i}$  is defined as the ratio of the odds  $z_i = 1$  (access to the service) against  $z_i = 0$  (no access). The greater is  $y_i$ , the larger are the odds that the  $i$ th individual have access to the basic opportunity. The maximum likelihood estimation of the variable  $y_i$  is afterward given by:

$$\ln(y_i) = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} \tag{5}$$

Where  $\beta_j$  is the maximum likelihood estimate of the parameter  $\beta_j$  mentioned in Eq. (1), and  $y_i$  is the estimate of the  $i$ th individual’s odds ratio that depends on a vector of circumstances variables  $x_{i1}, x_{i2}, \dots, x_{ik}$ .

Given that  $y_i$  is a monotonically increasing function of probability  $p_i$ , inequality of estimated variable  $y_i$  will be equivalent to inequality of predicted probability  $p_i$ . Therefore, inequality of opportunity explained by circumstantial variables can be measured by computing the inequality of variable  $y_i$ . As noted above, the World Bank (2006) and de Barros et al. (2009) have used the D-index (Dissimilarity Index) to evaluate inequality of opportunities. In the present study, we choose the log variance measure of inequality as it has a more attractive feature of decomposability.

Secondly, we take the variance of both sides of Eq. (5) following Fields (2003), Son (2013), and Jemmali and Amara (2015) to get:

$$\text{Var}(\ln(y_i)) = \sigma^2(\ln(y_i)) = \sum_{j=1}^k \beta_j \text{cov}(x_{ij}, \ln(y_i)) \tag{6}$$

This formula permits the decomposition of the inequality of opportunity in term of the contributions made by each individual circumstance variable. Then, to obtain the percentage contribution of the  $j$ th circumstance variable, we divided both sides of the Eq. (6) by  $\sigma^2(\ln(y_i))$  as follows:

$$C_j = 100 \times \frac{\beta_j \text{cov}(X_j, \ln Y)}{\sigma^2(\ln Y)} \tag{7}$$

Where  $X_j = (x_{1j}, x_{2j}, \dots, x_{nj})$ ,  $\ln Y = (\ln(y_1), \ln(y_2), \dots, \ln(y_n))$  and  $C_j$  is the percentage of contribution of the  $j$ th circumstance variable to the inequality of opportunity. Using this formula, the sum of all contributions will be equal to 100%. The idea of such decomposition based on the log variance is derived from the analysis of variance that is broadly used in statistics to assess contributions of different variables to the total variance. Moreover, it should be noted that  $C_j$  assesses the net contribution of the  $j$ th circumstance variable after accounting for all interactions between circumstance variables (Son 2013). The contribution  $C_j$  will generally be positive, as shown in the Eq. (7), since  $\beta_j$  and  $\text{cov}(x_{ij}, \ln(y_i))$  are expected to be of the same sign. Nevertheless,

in some cases we may obtain a negative value of contribution  $C_j$  due to interactions among different circumstance variables. In that case, the contribution of the  $j$ th circumstance variable, which is largely expected to be statistically insignificant, may be deemed as neutral to total inequality (Son 2013). It is noteworthy that the decomposition presented in Eq. (6) is founded on the log variance as a measure of inequality. This may appear to be a restricted result but it is straightforward to show this result holds for a wide range of inequality measures such as the Gini index, the Atkinson index, the generalized entropy family, and the coefficient of variation when using the famous Shorrocks (1982) theorem (Son 2013; Zhuang et al. 2014).

## Main Results

This section presents measures of inequality of opportunity in access to basic education and infrastructure services among Tunisian children living in different regions, using the methodology previously described. As described above, inequality of opportunity is defined as inequality in access to basic education and housing services due to differences in circumstances beyond children's control. Eight logistic regressions are estimated to focus on these inequalities at the national scale and within the seven regions.

### Inequality of Opportunity in Access to Basic Education

Two main educational indicators are used to assess inequality of opportunity in access to basic education. The first one, which is related to enrollment for the first compulsory level, is assessed by the probability of enrollment for children aged 6–11 years in primary school. The second one is measured by the probability of enrollment for children in aged 12–17 years old in preparatory (pre-secondary) school.

As illustrated in Table 3, the primary school attendance among children aged 6–11 years is not highly variable across regions in Tunisia. The high value of the HOI for primary education is mainly found in the Southern regions, where nearly 79% of the primary school services are available and equitably distributed. This means that fewer families in this region do not carry their children to primary school. It is gleaned, too, from the Table 3 that three regions (i.e. Middle East, Northwest and Middle West) have lower values of the HOI than the national level (77.04%). It is worth to note that two of these regions are in the inland part of the country. As mentioned above, families living in this zone have suffered from socioeconomic difficulties such as poverty, unemployment, and lack of infrastructure since the independence.<sup>5</sup> When comparing the results of current study and those of Jemmali and Amara's (2015) preceding study, we don't find any substantial improvement in accessing to compulsory education over the period 2005–2010 in those lagging regions. This leads to conclude that inequality in primary school attendance has persisted in these regions, despite the great efforts of government and non-governmental organizations to spread education to all children.

However, results in Table 3 reveals that values of HOI relative to access to primary education in coastal area may exceed or close to the national level of HOI (77.04%).

<sup>5</sup> Because of these difficulties and social exclusion, Sidi Bouzid and Gafsa (located both in the Middle Western region) were the bed of the recent Tunisian revolution.

**Table 3** Average opportunity, Dissimilarity Index (D) and Human Opportunity Index (HOI)

Region	Primary education			Pre-secondary education			Electricity			Access to sanitation			Water access		
	Average opportunity	D-index	HOI	Average opportunity	D-index	HOI	Average opportunity	D-index	HOI	Average opportunity	D-index	HOI	Average opportunity	D-index	HOI
Great Tunis	80.70	2.59	78.62	55.63	11.33	49.33	99.40	0.41	99.00	90.12	5.74	84.94	98.30	1.44	96.88
Northeast	80.52	1.89	79.00	46.34	15.94	38.95	98.70	0.40	98.30	64.18	25.90	47.55	83.37	10.67	74.48
Northwest	78.40	2.22	76.66	49.01	18.14	40.12	97.75	0.82	96.95	39.44	49.56	19.89	63.65	22.36	49.42
Middle East	78.97	1.20	78.02	47.36	16.20	39.69	99.38	0.21	99.17	57.12	24.80	42.95	94.98	3.29	91.86
Middle West	76.65	2.61	74.65	45.06	17.99	36.95	98.11	0.60	97.53	30.44	59.68	12.27	58.65	27.29	42.65
Southeast	81.23	2.25	79.40	51.53	13.25	44.70	97.95	0.91	97.06	41.76	25.42	31.15	87.93	6.83	81.93
Southwest	80.90	2.36	78.99	56.01	8.10	51.47	99.66	0.16	99.50	49.95	21.84	39.04	94.23	4.06	90.40
Tunisia	78.60	1.98	77.04	52.78	10.50	47.24	99.36	0.37	98.99	55.01	29.73	38.66	83.45	11.99	73.50

Authors' calculations based on 2010 HBCLS survey

This leads to conclude that Tunisian government has, more or less, succeeded in implementing universal access to primary schools in these regions. Since gaining independence, successive education system reforms have laid the foundations for integrated education that is free and compulsory for all children from different regions. From the mid-1990s, achieving universal primary education has been a priority for all Tunisian governments. The well-established goal was coupled, too, with the objective of improving its quality.

Comparing the primary education results to those of pre-secondary education (both in Table 3) we find that children in the pre-secondary-school-age group (12–17 years old) at regional and national levels are more likely to have lower levels of equitably allocated education services than their younger cohorts. The different values of the HOI for pre-secondary school attendance are far lower, at the two levels, than those of the HOI for primary school attendance. In fact, the estimated HOI for this second level of education, at the national scale, is lower than 50%, suggesting that less than half of pre-secondary education services required for universal coverage are available and distributed equitably. At the regional scale, the estimated HOI ranges from a high of 51.47% for the Southwestern region to a low of 36.95% for the Middle Western region. So, it appears to conclude that this range of variation of the HOI is far higher than that of the HOI for primary school attendance.

As shown in Table 3, three regions (i.e. Great Tunis and the two Southern regions) have higher HOIs for enrollment in the age group of 12–17 years old than the national level (42.94%) while both Central and Northern regions have the lower HOIs. When comparing these results to those obtained above, it is easy to conclude that those lagging regions face mainly greater challenges in equitably ensuring that all children aged 12–17 attend school than ensuring that all children of primary school age attend school. These findings may be expected since the opportunity costs of sending children to school are higher at the pre-secondary than at the primary level in these regions. The majority of preparatory schools are more concentrated in cities; then children from small village and rural areas must spend a lot of time on roads to reach such schools. For this reason, a large part of children, living in these lagging regions, choose to leave school and start working at a very early age. This implies that financial incentives such as conditional cash transfer programs could be more effective in targeting children in order to enhance school enrollment in those regions.

To examine deeply the origins of both primary and pre-secondary educational inequalities, we estimate at the two scales (sub-national and national) the relative contribution of each circumstantial variables to the considered inequalities of opportunities. As different circumstance factors may interact with each other, we compute the net contributions after taking into account all interactions among circumstance variables.

Table 4 shows that the age of household head is the main driver of the inequality in primary education enrollment in Great Tunis, while the most significant contributors of such inequality in the Middle Western region are: the area of residence (58.02%) and the per capita household expenditure (36.68%). Economic and geographic factors are found then to be the main drivers of the primary educational inequality in this lagging region. Table 4 illustrates, as well, that the most important circumstance variables that influence whether or not a child living in the Southern regions has fair access to education opportunities is the gender of the child and its area of residence (rural or

**Table 4** Contribution of circumstantial variables to inequality of opportunity for primary education

Region	Gender of child	Area of residence	Education level of HH	Per Capita household expenditure	Gender of HH	Household size	Age of HH	Pseudo R <sup>2</sup>
Great Tunis	9.21	-0.06	4.04	2.77	10.55	-0.28	73.77***	0.031
Northeast	2.45	36.59*	-0.83	15.57	1.85	0.36	44.01*	0.006
Northwest	7.20	5.68	18.45	47.66	1.56	10.09	9.37	0.026
Middle East	4.27	36.19	5.77	1.72	-0.03	1.39	50.69	0.01
Middle West	6.67	58.02***	-2.49	36.68**	2.85	-2.29	0.56	0.016
Southeast	27.15**	0.08	5.47	22.40	1.17	14.43	29.30	0.038
Southwest	2.87	34.04**	-0.11	15.44	0.13	15.42	32.23*	0.033

Authors' calculations based on 2010 HBCLS survey. \*, \*\*, \*\*\*: estimated coefficient found to be statistically significant at the 1%, 5%, and 10% levels, respectively, in the logit regression model

urban area). These findings are expected as families living in these regions, more specifically in rural areas, have been even more reluctant to send their daughters to school than their sons, fearing their safety. In the metropolitan area (Great Tunis), the age of household head is addressed as the sole main contributor to primary educational inequality; the gender factor have not any significant effect on primary enrollment.

For the pre-secondary education, it appears from the Table 5 that four circumstances influence largely and significantly the inequality of preparatory educational opportunity in all regions. The main drivers of such inequality is the gender of the child and the area of residence. The contribution of the first circumstance ranges from 3% in the Middle Western region to 29.57% in the Southwestern region, while the contribution of the second circumstance ranges from 9.65% in the metropolitan region to roughly 67.23% in the Northwestern region. This leads to conclude that, for all regions, location and gender factors play a major role in influencing the ability of a child to improve his or her situation over time and access to post-primary education. The Table 5 reveals, as well, that educational level of the household head and the overall standards of living of

**Table 5** Contribution of circumstantial variables to inequality of opportunity for pre-secondary education

Region	Gender of child	Area of residence	Education level of HH	Per Capita household expenditure	Gender of HH	Household size	Age of HH	Pseudo R <sup>2</sup>
Great Tunis	18.92***	9.65**	19.73**	38.47***	-0.48	11.27	2.44	0.121
Northeast	8.18**	22.72***	39.46***	20.59*	0.29	8.79	-0.03	0.054
Northwest	10.26***	67.23***	3.35	18.39***	0.51	-1.16	1.41	0.107
Middle East	20.01***	8.47	39.76***	28.51***	0.37	-0.87	3.75*	0.083
Middle West	3.00**	34.45***	23.35***	27.53***	0.68	7.48**	3.52	0.085
Southeast	15.92***	33.49***	43.39***	10.28	-0.26	-2.56	-0.27	0.047
Southwest	29.57***	22.65**	12.63	10.39	-0.05	15.30	9.51*	0.033

Authors' calculations based on 2010 HBCLS survey. \*, \*\*, \*\*\*: estimated coefficient found to be statistically significant at the 1%, 5%, and 10% levels, respectively, in the logit regression model

households (proxied by the per capita household expenditure) are also important contributors to the observed inequality of pre-secondary educational opportunity in Tunisia. In fact, in the Southeastern region, 43.40% of the inequality of opportunity is explained by the education level of the household head, while, in Great Tunis nearly 38.50% of such inequality is explained by the economic factor, the per capita household expenditure.

At the national level, the decomposition results of primary educational opportunities reveal that the most important circumstance that influences whether or not a child has fair access to primary school is the age of the household, which its contribution exceeds 50%. For the pre-secondary education, Table 6 shows that the location of residence play the key role in the inequality of pre-secondary educational opportunity (31.32%), added to others factors such as educational level (27.40%) and wellbeing of the household head (25.34%) and the gender circumstance (12.42%).

### Inequality of Opportunity in Housing Services

Access to basic housing services, such as safe drinkable water, sanitation and electricity can make significant contribution to health status and overall well-being. In fact, regular and improved access to and more widespread availability of drinkable water and sanitation facilities expands the productivity capacity of the economy by, for instance, enhancing the productivity of labor and improving the quality of products. People, particularly women in poor families, who have access to such basic services can spend more time focusing on important things like taking care of their children and elders, doing household tasks easily, contributing to economic activity and starting their own business.

Comparison of the HOI results relative to the three basic housing services shows that Tunisia faces a greater challenge in providing equitably sanitation facilities and access to improved water to all persons (Table 3). It appears, too, from these results, that much of the Tunisia's population benefits from access to electricity as all regions have HOIs higher than 96.90. This reflects the great efforts made by the Tunisian governments, during the recent decades, to provide this basic service to all people whenever they live.

**Table 6** Percent contribution of circumstance variables to HOI (national level)

Circumstance	Primary education	Pre-secondary education	Water access	Access to sanitation	Electricity
Gender of child	0.42**	12.42***			
Area of residence	29.69	31.32***	68.91***	74.79***	46.26***
Education level of household head	0.39	27.40***	04.82***	03.89***	8.65
Per capita expenditure	11.07	25.34***	18.28***	08.99***	33.44***
Gender of household head	02.18	-0.04	-0.17***	-0.03	0.72
Household size	0.76	2.91	-1.07***	0.51*	-1.17
Age of household head	55.54***	0.04	0.08**	0.18***	1.02
Littoral	-0.05	0.61***	09.16***	11.66***	11.08**
Pseudo R <sup>2</sup>	0.009	0.051	0.409	0.406	0.168

Authors' calculations based on 2010 HBCLS survey. \*, \*\*, \*\*\*: estimated coefficient found to be statistically significant at the 1%, 5%, and 10% levels, respectively, in the logit regression model

Table 3 shows, as well, that the metropolitan area (Great Tunis) takes the lead in the provision of access to safe water and sanitation services, with respectively HOIs equal to 96.88 and 84.94. In contrast, inland regions, more specifically Northwestern and Middle Western regions have HOIs for the two services far lower than the national levels. These results confirm the economic and social disparities between the inland and littoral regions and nonmetropolitan and metropolitan areas. To explain more deeply these differences we investigate below the contribution of each of the considered circumstances to inequalities of opportunity in accessing basic services.

Results, shown in Tables 7 and 8, reveal that some circumstance variables such as area of residence (rural urban divide) and per capita household expenditure are the main factors that contribute commonly and significantly to inequality of opportunity in accessing to safe water and sanitation facilities in all regions. Even, at the national level, these two factors play a key role in the inequality of opportunity in accessing to these two main services. The contribution of the location circumstance is particularly prominent for the Middle Western region where urban–rural residence accounts respectively for 94.4% and 91.7% of the total inequality of opportunity in access to the two services. In this inland region, which is the cradle of the recent revolution, urban–rural residence is the most important circumstance variable after that we find the per capita household expenditure (5.3% for access to water and 7.24% for access to sanitation). This leads to conclude that children living in rural areas in this unprivileged region have limited access to basic housing services (water and sanitation) due mainly to their remote and mountainous location. Even, the last improvements in the water and sanitation networks into this region have been limited to cities and urban areas. Giving this difficult situation, rural areas in these lagging regions often lack an enabling environment that encourages public and private investment in water and sanitation services leading to low provision of these basic services (WHO and UNICEF 2010).

From the comparison of results, shown in Tables 7 and 8, it is easy to conclude that that location circumstance has the greater effect on inequality of access to sanitation than of access to safe water. This could be explained by the fact that sanitation infrastructures still be restricted to urban areas and cities and no considerable effort was made to improve access to this basic service in rural areas. Besides, the

**Table 7** Contribution of circumstantial variables to inequality of opportunity for water access

Region	Area of residence	Education level of HH	Per capita household expenditure	Gender of HH	Household size	Age of HH	Pseudo R <sup>2</sup>
Great Tunis	30.23***	6.13	57.05***	2.42	2.40	1.78	0.532
Northeast	80.89***	5.74**	13.74***	0.28	-0.78***	0.13	0.313
Northwest	77.41***	3.75*	18.59***	0.25	-0.22	0.23	0.366
Middle East	65.71***	4.96	29.39***	0.44**	-1.75***	1.25*	0.284
Middle West	94.38***	0.13	5.31***	0.27***	-0.11**	0.02	0.436
Southeast	36.37***	14.08***	51.18***	0.55	-2.25***	0.07	0.275
Southwest	75.42***	23.99***	0.61	0.32	0.65**	-0.98*	0.319

Authors' calculations based on 2010 HBCLS survey. \*, \*\*, \*\*\*: estimated coefficient found to be statistically significant at the 1%, 5%, and 10% levels, respectively, in the logit regression model

**Table 8** Contribution of circumstantial variables to inequality of opportunity for access to sanitation

Region	Area of residence	Education level of HH	Per capita household expenditure	Gender of HH	Household size	Age of HH	Pseudo R <sup>2</sup>
Great Tunis	67.81***	5.57	27.71***	0.60	-1.68	-0.01	0.364
Northeast	85.69***	3.18*	10.80***	0.34*	-0.60***	0.59	0.437
Northwest	86.75***	1.88	12.31***	-0.09	-0.91	0.06	0.575
Middle East	78.86***	3.68***	16.81***	-0.01	0.67	-0.00	0.381
Middle West	91.69***	1.20	7.12***	-0.01	-0.07	0.07	0.633
Southeast	77.91***	7.24***	11.64***	-0.09	-1.07*	4.38***	0.206
Southwest	75.46***	2.96	15.41***	0.15	5.17**	0.86	0.199

Authors' calculations based on 2010 HBCLS survey. \*, \*\*, \*\*\*: estimated coefficient found to be statistically significant at the 1%, 5%, and 10% levels, respectively, in the logit regression model

decomposition results reveal that per capita household expenditure has contributed mainly to inequality of opportunity in accessing safe water and sanitation facilities in the metropolitan area. In fact, as can be seen from the third columns of the two Tables 7 and 8, this economic circumstance dominates and explains respectively more than 57% and 27% of the inequality in access to water and sanitation in Grand Tunis.

For access to electricity, the HOI results shown in Table 3 reveals that the majority of people have access to electricity similarly to results found by Jemmali and Amara (2015). This leads to mention the considerable efforts of the government to extend the electricity network to all villages and rural areas. During the last decade, the rural electrification was a priority of all governments despite the high cost of building new electricity infrastructures. As shown in Table 9, the low inequality of opportunity for access to electricity, observed mainly in the inland regions, is mainly dependant on the economic status of the household (as proxied by per capita household expenditure).

With regard to equal opportunity for accessing basic housing aforementioned services (safe water and sanitation services) at the national level (see Table 6), location variables that

**Table 9** Contribution of circumstantial variables to inequality of opportunity for electricity

Region	Area of residence	Education level of HH	Per capita household expenditure	Gender of HH	Household size	Age of HH	Pseudo R <sup>2</sup>
Great Tunis	0.00	0.00	-2.92	0.00	70.92***	32.01***	0.277
Northeast	0.00	1.94	34.31	0.00	63.98***	-0.23	0.062
Northwest	0.00	2.68	82.43***	5.20	6.00	3.69	0.10
Middle East	0.00	29.62	25.62	30.54	7.87	6.35	0.056
Middle West	39.16	26.01	28.70	0.27	-0.27	6.13	0.06
Southeast	0.00	0.00	104.24***	0.68	-3.15	-1.77	0.133
Southwest	0.67	0.00	25.08	0.00	16.33	57.92***	0.107

Authors' calculations based on 2010 HBCLS survey. \*, \*\*, \*\*\*: estimated coefficient found to be statistically significant at the 1%, 5%, and 10% levels, respectively, in the logit regression model



are area and region of residence (littoral or inland where the child lives) are the most important circumstance condition in Tunisia; they account together for more than 78% of the inequality in access to safe water and 87% of the inequality in access to sanitation facilities. The second important factor, the per capita household expenditure, that contributes to such inequalities explains respectively 18.28% and 8.99% of the total contribution.

## Conclusions and Policy Recommendations

Deteriorating standards of living, high and increasing regional disparity, and rising perceptions of social exclusion were among the many reasons that prompted Tunisian people to revolt in early 2011. Their main claims were a new model of economic, political, and social participation that realizes more fairness and equality across regions in terms of accessing to basic services and development opportunities. In recent years, inequality has become key item in the development agenda and policies in Tunisia as well as in other Arab countries. The demand for more equity between regions and inclusion has brought the inequality of opportunity issue to the front burner of Tunisian governments' attentions.

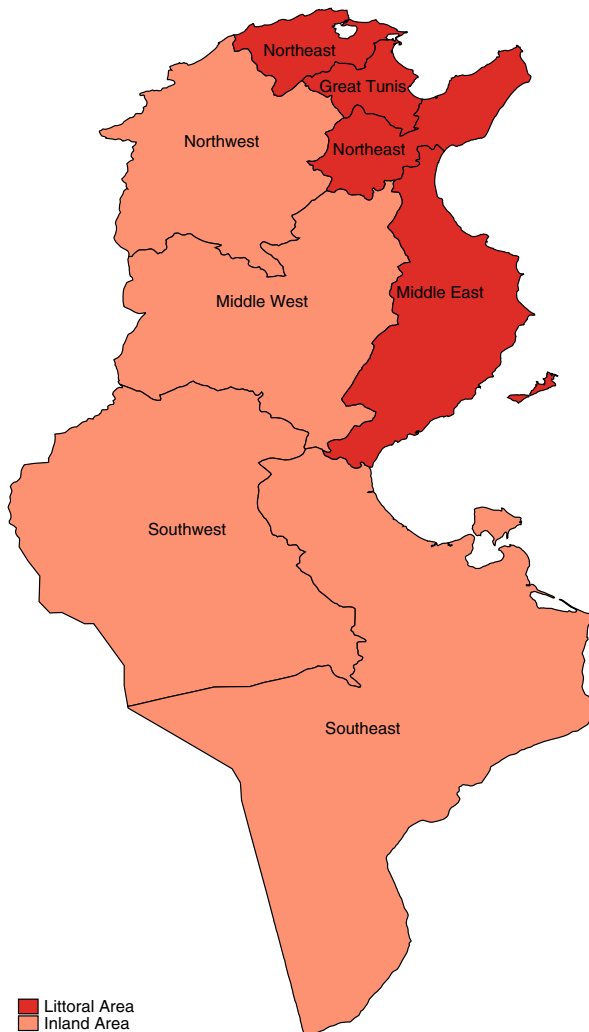
Despite the number of studies that have focused on regional disparities and its main determinants in some Arab countries, the literature on this topic still remains restricted to specific aspects of inequality. This paper is an attempt to address this knowledge gap by contributing to the investigation of levels of inter and intra-regional inequalities in accessing to basic education and housing services in Tunisia with a special focus on the main determinants of such inequalities. The empirical analysis was carried out using the World Bank methodology and micro-data from the 2010 National Household Survey to compute the HOI for different services. The study provides, as well, a method of assessing the relative contributions of different individual circumstance variables to the overall inequality of opportunity.

The Main findings of the study reveal that behind the prominent inequality characterizing the region's distributions of basic services in Tunisia (such as access to improved water and sanitation services and access to basic education), there is an even more distressing inequality of opportunities among children living in non-coastal regions. When comparing the current results of the current study to those of previous studies (i.e. Jemmali and Amara (2015)), it is easy to observe no substantial improvement in combating inequality of opportunity in accessing to pre-secondary education and basic housing services (water and sanitation) in lagging regions. Among the circumstance variables included in the analysis, the rural-urban divide in terms of residence and the household expenditure were found to be crucial in influencing access to basic education and core services. It appears from the results that living in poor households in inland rural areas may hamper children's access to such basic services. In sum, this study has shown a significant correlation between location of residence and socio-economic household background and access and demand for education and infrastructure services.

The methodology used in this study aimed to assess both the level of inequality of opportunity and the relative magnitude of each circumstance, could be an appropriate and relevant tool that may help and guide policymakers in designing and implementing the appropriate and relevant development policies. Based on the found results, it is recommended, that government pursue a more efficient and authentic program of illiteracy alleviation and economic empowerment of parents so that they would be able

to send their children to school. Strengthen the campaign against gender discrimination in educational attendance and improving the standard of living in rural areas in inland regions is highly required to alleviate the observed inequality of opportunity in these regions. It's further advisable that efforts should be made by policymakers and private investors to create employment opportunities for school leavers and all unemployed people in unprivileged regions to provide more incentives to households to increase their demand for education and infrastructure services.

## Appendix



**Fig. 2** Different regions of Tunisia

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