School dropout risk in Tunisia: Impact of facilities and neighborhood characteristics

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Abstract

This study tries to determine the spatial factors that explain school dropout risk across Tunisian delegations. The spatial exploratory analysis allowed us to map the hotspots of school dropout risk. This phenomenon is spreading like a pandemic with spillover effects on neighboring delegations leading to high school dropout clusters probability in the northwest and south of the country. Durbin's spatial model reveals that a territory characterized by high illiteracy rates and marginal construction, business and non-public service jobs increases school dropout risk. Women's education level and their participation in economic sectors like industry, agriculture and public services reduces the probability of dropping out in the neighborhood. Accessibility to educational, cultural and sports facilities in the neighborhood contributes to reducing school dropout risk. Inability of the regional labor market to absorb university graduates favors early school dropout.

Keywords: *school dropout, neighborhood characteristics, accessibility to facilities, women's activity.*

Jel codes: C21; I28; I29; R23

1. Introduction

A recent study published by Unicef [i] has shown that the dropout rate for lower secondary school students in Tunisia rose from 30% in 2006 to 50% in 2013. 10% of children between 12 and 14 years old, who normally are at the end of primary school or at the lower secondary, no longer attend school. 85% of these dropouts left school after spending a few years in secondary school and the rest stopped school without even reaching a secondary school class. The highest dropout rates are recorded in the North-West and Central-West regions of the country. Dropping out is generally more common in rural areas, among poor households and especially when the mother's level of education is very low. Beginning in the 1990s, Tunisian authorities attempted to introduce reforms to the education system to reduce high dropout rates. The aim of these reforms is to improve the quality of education, modernize teaching tools, install audio-visual equipment, promote NITs, and improve teaching supervision capacities at the national level and in rural areas in particular [ii]. In spite of these reforms, the number of dropouts has continued to increase from one year to the next, reaching an alarming figure of 100,000 students as illustrated in the WASH Thematic Report published by the UNICEF in 2018[iii]. The dropout rate from education a year before the revolution during 2010/2011, was about 9,9% compared to 11.2% in 2011/2012, marking the beginning of an increase of dropout rates from year to year, as a result of the spread of violence, especially in the school environment. Moreover, there was a decline in state resources which resulted in a decline in investment and economic growth, it has become unable to finance free high-quality education in a suitable infrastructure.

In a report published in 2015[iv], the National Institute of Statistics stated that during the 2013/2014 school year more than 112,000 students dropped out of school, of which 40.4% are girls and 59.6% are boys. All students combined, the distribution shows that 9.5% of dropouts are in primary school, 42.5% in

middle school and 48% in high school. 48.3% of the boys' dropouts took place in middle school, while 41.9% of the girls' dropouts took place in high school. Several reasons have been put forward to explain this phenomenon, such as difficulties in transitioning between education cycles. This is especially true in the transition to the second cycle of basic education (middle school), i.e. the 7th year (1st year of middle school), and the first year of secondary school. Surveying a sample of 601 dropouts, (Boughzou, 2016) found that the main dropout reasons report to the difficult school programs, the decline in the provision of poor students, many of them are facing long walks and stay in school for a whole day, with snacks in addition to dilapidated school infrastructure, especially sanitation facilities.

Young people from poor households, residing in rural areas, and whose parents received little schooling, are more likely to drop out of school. Ramzi, Afonso and Ayadi (2016) found that the northwest and central-western regions offer more effective educational programs, in terms of quality and success rates, than the interior regions. These results show that regional disparities in employment rates and poverty rates have a significant impact on dropout rates. Examining data from the 2012 PISA survey, Ben Yahia, Essid and Rebai (2018) pointed to the inefficiency of the education system in reducing school dropout rates; such an objective requires a better allocation of monetary and budgetary resources. These resources account for 6% of the country's GDP. The published study conducted by Tunisian Forum for Economic and Social Rights (FTDES) in 2014, showed that the poor accessibility of schools in several regions led students to drop out due to the absence of a school canteen, the long daily walking taken by the student in the morning and especially in the afternoon, and the fatigue of a long day away from home preventing the students from revising their classes in the evening. In the same line of thought, Jellali (2019) revealed the importance of the place of residence in understanding this phenomenon.

Examining inequalities in educational opportunities among young Tunisians, the author affirms that opportunities for access to education diminish in rural areas compared to urban areas. This is due, on the one hand, to a lack of well-equipped school infrastructure and, on the other hand, to the distance separating these establishments from the places of residence of students. These results encouraged the initiation of a more in-depth analysis that tries to highlight the link between location characteristics and school dropouts. These characteristics are expressed in terms of spatial accessibility to schools and other sports and cultural activities (Gibbons and Vignoles, 2012; Türk, 2017). The choice of this spatial dimension to study school dropout strongly bears on the importance of these residential factors in the development of an adequate policy to reduce the number of dropouts by considering coordination with the different stakeholders in youth supervision and student supervision policies.

2. Literature review

In their study on the determinants of Dutch students' post-secondary enrolment choices, (Hunt *et al.*, 2008) presented a large number of studies that examined the dropout issue from several approaches. A survey of these studies led to the conclusion that dropping out is a complex process resulting from the interaction of several factors rather than the result of a single factor. However, most of these studies indicate that dropping out of school is essentially explained by school, family and personal factors (Rumberger and Lim, 2008; Bonnéry, 2011). Another line of research assumes that dropping out of school is a risk factor while staying at school is a protective factor. The school dropout phenomenon can be explained by students' cognitive and non-cognitive factors (Fortin and Picard, 1999; Knesting and Waldron, 2006; Lessard *et al.*, 2009; O'Connell and Sheikh, 2009). Moreover, dropping out of school is associated with student characteristics such as academic performance. This latter is determined by motivation to learn and participation in classroom activities (Sum

et al., 2009; Lyche, 2010). The literature states that educational policy, the rules that govern the educational curriculum, and the climate in schools correlate with decisions to drop out (Lloyd, Mensch and Clark, 2000; Easterly, 2009). Family characteristics that include the parents' educational level and their socioeconomic status, the quality of the student's relationship with parents and siblings do have a decisive role (Okumu, Nakajjo and Isoke, 2008; Easterly, 2009).

In addition to school environment, other studies have concluded that this phenomenon is affected by community factors. Urbanization is considered a factor that increases the probability of dropping out (Nguyen and Taylor, 2003; Traag and van der Velden, 2011; Krstic, Stepanovic-Ilic and Videnovic, 2017). Distance from schools, poor education quality, inadequate facilities, overcrowded classrooms, inappropriate instructional language, teacher absenteeism, and girls' safety in schools are common dropout reasons (Colclough, Rose and Tembon, 2000). Inspired by the theoretical model of Hartog and Diaz-Serrano (2007) and of Hogan and Walker, (2007) space and geographical variables have a significant impact on a young student's decision to pursue university education after they complete high school. These authors found that urbanization has a positive effect on the decision to pursue post-secondary education while city size has a negative effect. Unemployment (average unemployment duration) for a person with a secondary education has a positive effect on their decision to attend university.

(Sá, Florax and Rietveld, 2006) found that the socioeconomic characteristics of the region in which the educational institution is located have a significant impact on the decision to drop out. These characteristics include average per capita income and the rate of local infrastructure development, approximated by population density. These latter tend to affect the choice of pursuing higher

education or vocational studies. Geographic accessibility is another variable that determines the choice between dropping out or enrolling, as well as the choice of the type of studies to pursue.

The theoretical framework adopted by this study is the "collective socialization perspective" theory. This latter theory puts an emphasis on the role played by neighbourhood characteristics in teenage behaviour and its impact on school dropout Crane, 1991; Crowder and South, 2003). The contagion models put forward by Crane (1991) have shown that dropping out of school is a phenomenon that spreads like a pandemic in poor neighbourhoods because of the influence that drop-outs have on their peers in these neighbourhoods. Exploration of these contagion factors led to highly-telling results. For instance, (Schargel, Smink and Smink, 2013) found that school dropout is a phenomenon that affects students who reside in urban areas more than those in rural areas. (Waktola, 2014) reported that dropouts are spatially distributed in clusters that highly correlate with negative social patterns. Nieuwenhuis and Hooimeijer (2016) presented an excellent review of the literature that analyses the effect of neighbourhood on educational achievement. Contagion is a social mechanism to describe the way in which young people are influenced by the attitudes and behaviour of their neighbours. Collective socialisation is another mechanism to describe the collective attitude of the population to overcome social problems. Small and Newman (2001) have shown that young people's access to schools and neighbourhoods and contact with young people from these neighbouring areas conceptualises the indirect effect of residential neighbourhood. Bearing on the above, this study tries to map these hotspots and examines how these hotspots relate to the socioeconomic characteristics of the neighbourhood using the spatial econometrics tool (Nugraha and Asriyanti, 2020).

3. The Tunisian Educational System

Before university, a Tunisian student should go through two main cycles. At the age of 6, a Tunisian child enters school to spend a basic 9-year cycle. This cycle consists of a 6-year primary cycle in an elementary school, and a 3-year preparatory cycle in a junior high school. At the end of each cycle, the student can either voluntarily take a "sixth year" national exam to access a pilot middle school or a "ninth year" national exam to access a pilot high school. After successfully passing this cycle, the student goes through a 4-year cycle in a secondary school by the end of which they sit for the Baccalaureate national exam to access university education.

4. Methodology and Variables

The studied variables represent data collected from two sources. Data on the number of dropouts by delegation[v] are collected from the directories of the Ministry of Development, Investment and International Cooperation. Data on the number of dropouts by delegation for each school year represents the number of students who did not renew their enrolment during that year and who left school for good. Data collected from the 2014 General Population and Housing Census, conducted by the National Institute of Statistics (INS), represents rich information on the socio-demographic characteristics of the population by delegation. The variables are defined in Appendix 1. The choice of variables is guided by the results of previous studies that examined the link between the characteristics of the neighbourhood and dropping out of school (Bell and Bernard, 2016; Paola and Moullet, 2018).

Given that the objective of this study is to examine the spatial distribution of dropouts and to determine the regional characteristics that affect the emergence of this phenomenon in some regions more than others, we will use the exploratory spatial data analysis (ESDA) technique. This latter technique allows

for locating the regions where the relative risk of dropping out is very high and to test the possibility of a spatial autocorrelation for this phenomenon.

The study of the neighbourhood factors that trigger the drop-out phenomenon needs the use of spatial econometrics, a tool that makes it possible to model the spatial interaction between territorial variables and dropping out of school in a given area. Because several studies have shown that the socio-demographic characteristics of the mother affect the decision to drop-out (Ingrum ’06, 2006; Patel *et al.*, 2018), this study considered variables that map the socio-demographic characteristics of women at the delegation level, such as education level and sector of activity. The Tunisian labour market is characterised by gender discrimination and working conditions that offer more advantages to women working in the public sector and in the formal sector and which differs according to the level of education (Moghadam, 2019). The introduction of these variables in this study allows us to determine the impact of the opportunities offered by the regional labour market to the mother on the risk of dropping out of school.

In their empirical work Diaz-Serrano and William (2020) showed that only low-skilled jobs are offered to dropouts. This means that the local structure of the local labour market and its skill composition has an effect on the dropout decision. The spatial distribution of the labour force by sector allows us to detect the impact of the structure of the labour market and its characteristics in terms of sectoral specialisation on the spatial structure of school dropout. the data available from the population census divides the active population by environment according to 8 sectors of activity. the education, health and public services sector accounts for more than 25% of the population. this sector is characterised by stable employment and higher remuneration than the other private sectors. the manufacturing sector accounts for more than 18% of the

active population. the remainder of the population is divided between the trade sector 15%, the agriculture sector 11%, the construction sector 15% and the other services sector 12%.

The spatial structure of the unemployed by education level is used to determine the impact of economic activity in the region on school dropout.

Accessibility to school and other infrastructures, which reflects the educational and cultural supervision of children, is approximated by variables that provide information on the proportion of individuals who travel a maximum of 1 kilometre to reach a college, a high school, a youth centre or a sports facility. It is assumed that the higher the proportion of the population residing within a radius of 1 kilometre of the establishment, the higher the accessibility.

5. Spatial Patterns of School Dropout

To determine the spatial distribution of the school dropout phenomenon, the Exploratory Spatial Data Analysis (ESDA) tool developed by (Anselin, Kim and Syabri, 2004) was used. The ESDA technique allows for drawing a map of the relative incidence or risk of dropping out calculated by the "Empirical Bayes Smoother" method. This technique makes it possible to use the Bayes principle to calculate the relative risk ratios for dropping out at the regional level. The Bayes principle ensures that the calculated risk rates are adjusted according to the information contained in the other regions. The relative risk of dropping out is the ratio between the number of dropouts recorded in each delegation and the likely population, which is the population of individuals between the ages of 12 and 18. The spatial structure used in the calculation of the smoothed relative risk index is represented by a spatial contiguity matrix that gives more weight to contiguous areas and zero weight to non-contiguous areas. Figure 1 shows the spatial distribution of the relative risk of dropping out by quantile. The spatial

distribution of relative risk rates by percentile (Figure 2) highlights the extreme values of this distribution, and locates the regions with the highest risk.

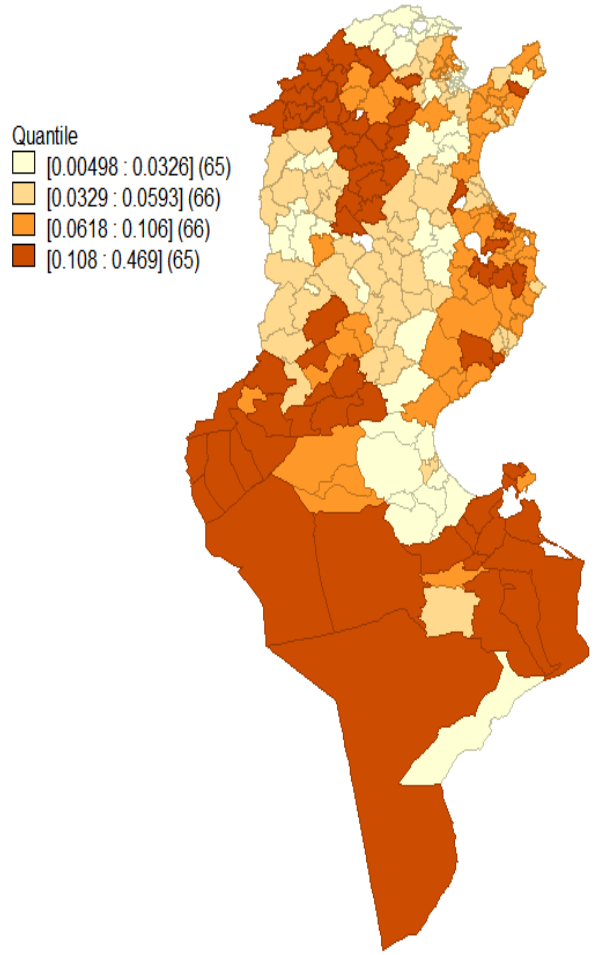

Figure 1: Quantile Map of Relative Risk

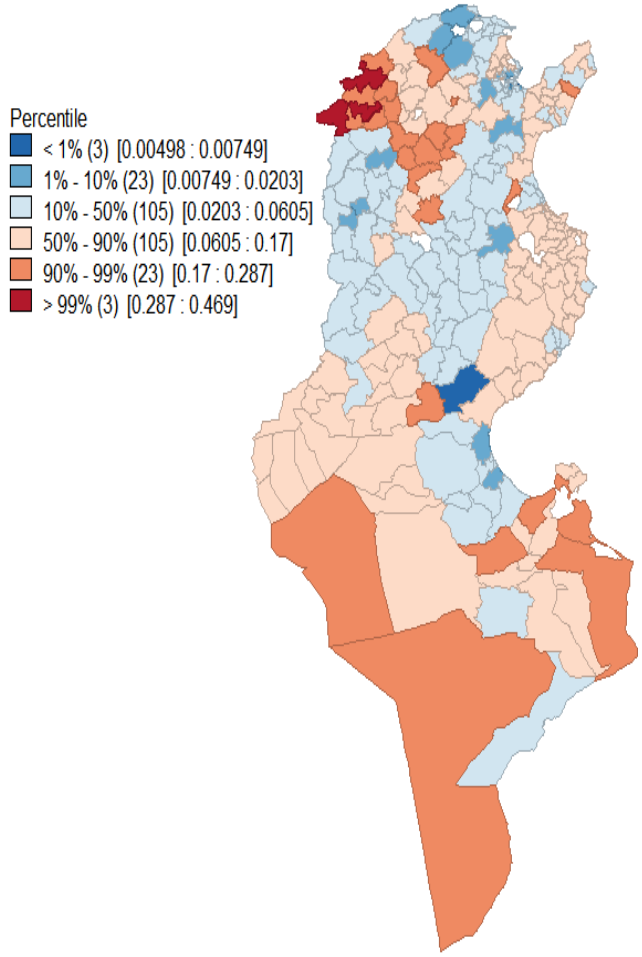

Figure 2: Percentile Map of Relative Risk

Maps of smoothed relative risk ratios by quantile.	Maps of smoothed relative risk ratios by percentile. The delegation of Ezzahra situated in the South of the Capital Tunis has the lowest risk ratio. The delegation of Gar Dima in the North-West has the highest risk rate.

The analysis of this spatial distribution of this relative risk by quantile (Figure 1) shows that the risk of dropping out is relatively very high in the northwest

and southern regions. This risk is lower in the central-eastern delegations. It is too low in the extreme north of the delegation of Bizerte and the delegation of Gabes in the southeast. The presence of a cluster of neighbouring delegations with high relative risk or low relative risk shows that there is a spatial autocorrelation. This spatial correlation means that a high incidence delegation is surrounded by delegations with similar values and conversely a low incidence delegation is surrounded by delegations with similarly low values. This shows that dropping out of school is a phenomenon that depends on individual characteristics and also depends on the characteristics of the area of residence (Paola and Moullet, 2018). Analysis of the percentile map shows that the risk of dropping out is too high in three delegations in the far northwest. The risk in these delegations is 8 times the median risk[vi].

Table 1 reports the results of the mean difference test of the variables between the first quantile, which represents 25% of delegations with the lowest risk, and the fourth quantile, which represents 25% of delegations with the highest risk. The average number of dropouts in high-risk delegations is 374 per delegation and represents 6 times the average number of dropouts in a low-risk delegation which is 74. These results indicate that illiteracy rate, the proportion of individuals with a primary education and the proportion of women with no education are higher in high-risk areas. The risk of dropping out is high in areas known by significant high percentages of university graduates and unemployed individuals with a primary education level. Economic activity plays a significant role in the regional disparity of the risk of dropping out, given that the proportion of individuals working in the agricultural sector is high in areas with a high risk. On the other hand, the proportion of individuals working in the industrial and non-administrative service sectors is significantly higher in areas with a low risk of dropping out. The spatial structure of women's activity significantly affects the spatial structure of the risk of dropping out; given that

this risk is higher where the proportion of women working in the agricultural sector is high and it is the lowest in delegations where the proportion of women working in the industrial and business sectors is low.

The results of the mean equality test (Table 1) show that accessibility to educational, cultural and sports facilities plays an important role in the disparity of the risk of dropping out across delegations. 25% of the delegations with the lowest rates show higher percentages of a population with access to public infrastructure within a radius of less than 1 kilometre. In Tunisia, access to public infrastructures such as youth centres and sports clubs is free and available to all students. the supervision of the young people who use these facilities is provided by animators and sports instructors paid by the state. these public facilities are more abundant and offer better quality services in large cities and urban areas. in inland cities and rural areas these facilities suffer from a lack of youth coaches.

The higher the proportion of the population that travels more than two kilometres to reach an educational institution, the more likely the risk of dropping out of school.

6. Econometric Model and Estimation Results

Analysis of the spatial distribution of school drop-out risk (Figure 1) shows that this risk is concentrated in clusters of neighbouring delegations. This indicates that this phenomenon also depends on the specific characteristics of these delegations. These clusters show that there is a neighbourhood effect resulting from this spatial interaction which creates a more auspicious climate for dropping out of school.

6.1 Econometric Model

The spatial Durbin model SDM (Anselin, Gallo and Jayet, 2008; Liu, 2018) allows for modelling this spatial interaction since it estimates the direct and indirect effects of residential variables on the risk of dropping out. In addition to exogenous variables, the SDM model integrates a lagged measure of the dependent and independent variables. This specification helps to detect the effects of spatial interaction amongst delegations by weighting the risk of dropping out and the socio-demographic characteristics. It implies, first of all, that the risk of dropping out in one delegation is affected by the levels of risk in neighbouring delegations; the parameter ρ allows for estimating this impact. Then, the risk of dropping out will also be affected by the demographic and economic characteristics of neighbouring delegations through the spatially lagged variables *WX* (Baumont and Legros, 2013).

$$y_i = \delta \sum_{i=1}^{262} w_{ij} y_j + \beta_0 + x_{ij}\beta \quad + \delta \sum_{i=1}^{262} w_{ij} x_{ij}\theta + \varepsilon_i \qquad (1)$$

and

$$\varepsilon_i \rightsquigarrow N(0, \sigma^2)$$

W_{ij} represent the components of a reverse spatial weight matrix of the distance between the delegations defined by:

$$\begin{cases} w_{ij} = \frac{1}{d_{ij}} \quad si\ d_{ij} \leq d_0 \\ w_{ij} = 0 \quad si\ \ d_{ij} > d_0 \end{cases} \qquad (2)$$

This weighting matrix allows for conceptualizing the spatial interaction between delegations that are located in a d0 radius band, while assuming that this

interaction is cancelled out beyond this spatial threshold (Wang et al., 2013). The threshold d_0 considered in this study is the 70-kilometer threshold, which represents the average distance between all the delegations, calculated by the ARCGIS 10 software.

6.2. Results and Interpretations

The estimation results of the equation 1 using the spatial weighted matrix (equation 2) are presented in Table 2.

Table 2: Spatial Durbin Model Estimation Results

Variables	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0,540 0	5,901 1	-0,091 5	0,927 1
activ-indus	-0,0118	0,012 6	-0,935 7	0,349 4
activ-trad	0,044 1	0,017 7	2,484 7	0,013 0
activ-constru	0,0100	0,0052	1,923	0,0273
activ-othserv	-0,0213	0,018 8	-1,132 4	0,257 5
wom_niledu	0,0524	0,0189	2,7773	0,0055
wom_primedu	-0,0286	0,021 7	-1,316 1	0,188 2
wom_work_agr	-0,0192	0,011 9	-1,613 6	0,106 6
wom_work_ind	-0,0100	0,0119	-0,8389	0,4015
wom_work_com	-0,0401	0,0232	-1,7311	0,0834
wom_work_edu	-0,0321	0,0124	-2,5882	0,0096
primunemp_rt	-0,0060	0,0132	-0,4556	0,6486
Sec-school2km	-0,010 7	0,006 1	-1,735 4	0,082 7
Sec-school1km	-0,002 0	0,004 8	-0,410 6	0,681 4
Colleg2km	-0,012 2	0,006 5	-1,880 7	0,060 0
Sport_faci2km	0,0058	0,0067	0,8571	0,3914
Cult_faci2km	0,018 5	0,006 9	2,682 0	0,007 3

logdensit	0,0870	0,0747	1,1649	0,2441
Illitracy_rt	0,0858	0,0202	4,2428	0,0000
unemplhigh_rt	-0,0088	0,0095	-0,9317	0,3515
Indiv_supP	-0,0160	0,0096	-1,6599	0,0969
lag.activ-indus	-0,1408	0,0523	-2,6923	0,0071
lag.activ-trad	0,0181	0,0822	0,2197	0,8261
lag.activ-constru	-0,1351	0,0361	-3,7472	0,0002
lag.activ-othserv	0,160 7	0,060 8	2,641 8	0,008 2
lag.wom_niledu	0,0136	0,065 1	0,209 1	0,834 4
lag. wom_primedu	0,2899	0,099 8	2,906 2	0,003 7
lag.wom_work_agr	-0,0564	0,0484	-1,1666	0,2434
lag.wom_work_ind	-0,0085	0,036 5	-0,233 8	0,815 1
lag.wom_work_com	-0,1706	0,073 1	-2,333 5	0,019 6
lag.wom_work_edu	-0,0854	0,047 6	-1,795 2	0,072 6
lag. primunemp_rt	-0,0954	0,068 7	-1,388 1	0,165 1
lag.sec-school2km	0,194 2	0,046 2	4,208 8	0,000 0
lag.sec-school1km	0,063 9	0,023 4	2,734 6	0,006 2
lag.colleg2km	-0,199 7	0,046 2	-4,320 1	0,000 0
lag.sport_faci2km	-0,054 7	0,029 1	-1,878 9	0,060 3
lag.cult_faci2km	0,1031	0,0365	2,8253	0,0047
lag.logdensit	0,0434	0,1994	0,2178	0,8276
lag. Illitracy_rt	0,0985	0,0826	1,1918	0,2333
lag. unemplhigh_rt	0,1162	0,0448	2,5968	0,0094
lag.indiv_sup	-0,0112	0,0687	-0,1632	0,8704

Table 3: Direct and Indirect Impacts of Neighborhood Variables

	Direct	Pr(>|z|)	Indirect	Pr(>|z|)	Total	Pr(>|z|)
activ-indus	-0,0130	0,306 1	-0,166 9 **	0,010 5	- 0,179 9***	0,004 5
activ-trad	0,0443**	0,0136	0,0290	0,7882	0,0733	0,4946
activ-constru	0,0089**	0,0330	0,1565***	0,0010	0,1475***	0,0020
activ-othserv	-0,0200	0,2885	0,1844**	0,0183	0,1644**	0,0285
wom_niledu	0,0526***	0,0064	0,0253	0,6695	0,0779	0,2518
wom_primedu	-0,0262	0,2482	0,3344***	0,0100	0,3082**	0,0171
wom_work_agr	-0,0196*	0,0982	-0,0695	0,2506	-0,0891	0,1351
wom_work_ind	-0,0101	0,4150	-0,0118	0,7748	-0,0218	0,5921
wom_work_com	-0,0416*	0,0761	-0,2069**	0,0318	-0,2485**	0,0104
wom_work_edu	-0,0328***	0,0080	-0,1057*	0,0859	-0,1385**	0,0236
primunemp_rt	-0,0068	0,6105	-0,1128	0,1662	-0,1196	0,1463
Sec-school2km	-0,009 1	0,170 9	0,225 5***	0,001 6	0,216 5***	0,003 4
Sec-school1km	-0,001 5	0,740 8	-0,074 5**	0,018 5	-0,073 1**	0,028 2
Colleg2km	0,0138**	0,0445	0,2360***	0,0027	0,2498***	0,0025
Sport_faci2km	0,005 3	0,431 9	0,063 0**	0,064 7	0,057 7*	0,093 4
Cult_faci2km	0,019 4***	0,006 1	0,123 9***	0,007 5	0,143 3***	0,003 0
logdensit	0,087 4	0,247 9	0,066 3	0,812 1	0,153 7	0,493 4
Illitracy_rt	0,085 1***	0,000 0	0,100 0	0,329 5	0,014 9	0,889 0
unemplhigh_rt	-0,0079	0,4326	0,1345**	0,0167	0,1266**	0,0259
Indiv_sup	-0,0161*	0,0993	-0,0160	0,9405	-0,0321	0,7966

* p≤ 0,1 ; ** p≤ 0,05 ; *** p≤ 0,01

	Direct	Pr(>|z|)	Indirect	Pr(>|z|)	Total	Pr(>|z|)
activ-indus	-0,0130	0,306 1	-0,166 9 **	0,010 5	- 0,179 9***	0,004 5
activ-trad	0,0443**	0,0136	0,0290	0,7882	0,0733	0,4946
activ-constru	0,0089**	0,0330	0,1565***	0,0010	0,1475***	0,0020
activ-othserv	-0,0200	0,2885	0,1844**	0,0183	0,1644**	0,0285
wom_niledu	0,0526***	0,0064	0,0253	0,6695	0,0779	0,2518
wom_primedu	-0,0262	0,2482	0,3344***	0,0100	0,3082**	0,0171
wom_work_agr	-0,0196*	0,0982	-0,0695	0,2506	-0,0891	0,1351
wom_work_ind	-0,0101	0,4150	-0,0118	0,7748	-0,0218	0,5921
wom_work_com	-0,0416*	0,0761	-0,2069**	0,0318	-0,2485**	0,0104
wom_work_edu	-0,0328***	0,0080	-0,1057*	0,0859	-0,1385**	0,0236
primunemp_rt	-0,0068	0,6105	-0,1128	0,1662	-0,1196	0,1463
Sec-school2km	-0,009 1	0,170 9	0,225 5***	0,001 6	0,216 5***	0,003 4
Sec-school1km	-0,001 5	0,740 8	-0,074 5**	0,018 5	-0,073 1**	0,028 2
Colleg2km	0,0138**	0,0445	0,2360***	0,0027	0,2498***	0,0025
Sport_faci2km	0,005 3	0,431 9	0,063 0**	0,064 7	0,057 7*	0,093 4
Cult_faci2km	0,019 4***	0,006 1	0,123 9***	0,007 5	0,143 3***	0,003 0
logdensit	0,087 4	0,247 9	0,066 3	0,812 1	0,153 7	0,493 4
Illitracy_rt	0,085 1***	0,000 0	0,100 0	0,329 5	0,014 9	0,889 0
unemplhigh_rt	-0,0079	0,4326	0,1345**	0,0167	0,1266**	0,0259
Indiv_sup	-0,0161*	0,0993	-0,0160	0,9405	-0,0321	0,7966

The results of the SDM model show that the ρ value, the coefficient of the lagged endogenous variable, is positive and significant, which indicates that there is a positive spatial autocorrelation in the risk of dropping out. This finding shows that dropping out of school is a phenomenon that does not depend solely on the intrinsic characteristics of isolated individuals or

households, but it is also a phenomenon that spreads spatially and exerts a spillover effect on the neighbouring delegations with the same demographic and economic profiles.

The analysis of the direct effect, which gives the effect of the delegation-specific socio-economic characteristics on the risk of dropping out at, indicates that the higher the proportion of a population working in the construction and business sectors, the higher the risk of dropping out of school. These sectors are known to attract more unskilled workers. Moreover, controlling the age and qualification of workers in these sectors, particularly in the interior regions, is difficult. The risk of dropping out is higher in delegations where the proportion of illiterate women is high. Women's participation in economic activities and in the agriculture, industry and services sectors has a negative impact on the phenomenon of school dropout. This result can be explained by two reasons. The first assumes that the regions that tolerate women's participation in social and economic life tend to tolerate women attending middle school and high school and do not impose constraints on the pursuit of their studies. The second reason inferred from this finding is that women's participation in economic activities improves household income and consequently helps to cover the cost of schooling for children, thus reducing the risk of dropping out. Women's participation in the more regulated and formal sectors such as industry, education and trade, reduces the risk of dropping out of school compared to their participation in the informal and less regulated agricultural sector (Table 1). Women in these formal sectors are better paid and can benefit from several leaves.

Accessibility to secondary school at the delegation level has a direct impact on school dropout behaviour. The risk of dropping out is more likely among individuals who commute more than two kilometres to reach a college. The

inaccessibility to a cultural infrastructure such as a youth centre plays an important role in the decision to drop out. Illiteracy concentration in a delegation increases the risk of dropping out, and it becomes lower in delegations with a high concentration of individuals with higher education levels. The indirect effects are estimated by means of spatially lagged exogenous variables. They help to quantify the effect of the socio-economic structure of neighbouring delegations, assess the risk of dropping out and determine the value and significance of the total impact.

The analysis of these effects shows that employment concentration in the industrial sector in neighbouring delegations reduces the risk of dropping out. This finding shows that the creation of non-fragile jobs that are more stable and require a skilled workforce, in an economic area with neighbouring delegations, encourages young people to continue their studies in order to obtain diplomas and certificates that will enable them to secure more remunerated and stable employment in the industrial sector.

Employment concentration in the construction and non-public services sectors in neighbouring delegations increases the risk of school dropouts among young people who would look for precarious employment which does not require a specific qualification or certificate. The existence of a regional economic area that offers jobs in fragile and uncontrolled sectors favours the decision to leave school early. The existence of a significant proportion of women working in the business and public service sectors in the region has a negative effect on the likelihood of dropping out. All else being equal, in a delegation located in an area with a high concentration of women working in the service sectors, the probability of dropping out is lower.

Accessibility to schools in neighbouring delegations plays an important role in the decision to drop out. The higher the proportion of a population with an access to a high school within a radius of 1 kilometre in neighbouring delegations, the higher the proportion of individuals who benefit from this access in the said delegation, and consequently the risk of dropping out due to the distance of the schools is low. The more difficult the access to a sports or cultural infrastructure in the neighbouring delegations, the higher the risk of dropping out.

The unemployment rate of university graduates in an area with neighbouring delegations has a significant impact on the risk of dropping out. If the economic fabric made up by the labour market in neighbouring delegations does not allow the demand for employment of university graduates to be absorbed, then the willingness to acquire a diploma or a higher technician's certificate decreases in favour of an access to a fragile job that does not require additional studies.

7. Policy Implication

Since the alarm bell was rung in 2014, favorized by the results of the OOSCi (Out-of-School Initiative) Study conducted by the UNICEF[vii] in Tunisia in 2013 and published in 2014, which stated that about 12% of children aged between 5 and 14 did not attend school or were at risk of being expelled from school. Successive governments have become aware of the consequences of this phenomenon on the problem of unemployment, the qualification of the workforce and the increase of delinquency and terrorism. Some have deployed measures and initiatives to contain it. Most of the solutions have taken the form of international agreements aimed at providing financial support for the efforts of local authorities and at enabling the most disadvantaged areas to dispose of a financial package to improve the state of school equipment and infrastructure. The most important reforms were based on a single approach, namely the

educational and pedagogical approach, that considers school drop-out as a phenomenon that only relates to the characteristics of the students, without taking into account the social and economic fabrics and the inequalities in accessing basic cultural and economic infrastructure in disadvantaged areas. Dropping out of school is a multidimensional phenomenon (Robertson and Collerette, 2006), and any effective strategy aimed at circumventing it should consider all of its dimensions, primarily inequalities in accessing schools and other institutions that can contribute to the student's cultural and social environment. The fight against dropping out of school should be the objective of an entire strategy that needs the commitment of several stakeholders. These latter should support the actions of the Ministry of Education, such as the Ministry of Culture; the Ministry of Youth and Sport, the Ministry of Labour and local authorities. Among others, promoting the role of women in economic life and in stable, non-marginal jobs reduces the likelihood of dropping out of school.

8. Conclusion

Over the last two decades, the school dropout problem has preoccupied all developed and developing countries, and the galloping numbers of dropouts have worried decision-makers in the educational and social fields. A review of the literature on the dropout issue leads to the conclusion that this phenomenon is multidimensional and that studying this phenomenon should take into account the spatial heterogeneity of the dropouts' social and economic environment. The results of this study have shown that concentration of marginal and temporary jobs in the service and construction sectors in the vicinity of students' homes increases the probability of dropping out. Meanwhile, promoting women's participation in economic activities and developing qualified industry-oriented jobs in neighbouring delegations reduces the risk of dropping out. High unemployment rates among university graduates may be a factor affecting

young people's motivation to continue their studies in order to obtain more diplomas that will enable them to secure better-paid and more stable employment.

The availability of cultural and sporting facilities in the neighbourhood reduces the risk of dropping out and helps break the spill-over effects exerted by a high dropout risk into a neighbouring area. This finding should encourage political decision-makers to consider putting accessibility to these facilities and to schools into a more coherent strategy that involves all the stakeholders in the supervision of young people in a well-defined area. The results of this study can be improved by mixing individual geo-referenced surveys that integrate residential data to calculate accessibility indices for other cultural and transportation facilities and further dividing employment structure into spatial units that are smaller than the delegation.

Notes

[i] Tunisia - Country Report on Out-of-School Children (UNICEF 2015)
[ii] African Development Bank Report 2009
[iii] https://open.unicef.org/sites/transparency/files/2020-06/Tunisia-TP6-2018.pdf
[iv] http://www.ins.tn/sites/default/files/publication/pdf/rapport%20national%20genre%20Site%20_0.pdf
[v] The delegation is an administrative unit with a population between 20 000 and 100 000.
[vi] (0,47 / 0,060 8) =7,73
[vii] https://www.unicef.org/mena/media/6646/file/MENA%20OOSCI%20Tunisia%20Fact%20Sheet_EN.pdf%20

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Table 1 T-test for equality of means between delegations with a lower risk of dropping out and delegations with a higher risk of dropping out.

Variable		Mean	Sig.	Variable		Mean	Sig.
Illitracy_rt	1st quantile	19,3	0	**cult_faci1-2km**	1st quantile	38,7	0,138
	4th quantile	25,9			4th quantile	31,9	
unemplhigh_rt	1st quantile	22,9	0	**cult_faci1km**	1st quantile	31,1	0,009
	4th quantile	31,4			4th quantile	22,2	
primunemp_rt	1st quantile	20,4	0,002	**sport_faci1-2km**	1st quantile	37,1	0,132
	4th quantile	24,7			4th quantile	30,4	
secondunemp_rt	1st quantile	41,5	0,025	**sport_faci2km**	1st quantile	33,7	0,003
	4th quantile	38,5			4th quantile	50,5	
unemplnil_rt	1st quantile	7,2	0,071	**colleg1km**	1st quantile	39,8	0
	4th quantile	9,1			4th quantile	21,5	
wom_work_edu	1st quantile	39,1	0,004	**colleg1-2km2**	1st quantile	33,9	0,462
	4th quantile	36,6			4th quantile	33,4	
wom_work_com	1st quantile	10,4	0,053	**colleg2km**	1st quantile	26,3	0,001
	4th quantile	8,1			4th quantile	45,1	
wom_work_agr	1st quantile	10	0,027	**sec-school1km**	1st quantile	28,6	0,001
	4th quantile	18,3			4th quantile	18,3	
wom_work_ind	1st quantile	25,6	0,002	**sec-school1km2**	1st quantile	39	0,065
	4th quantile	22,7			4th quantile	31,1	
indiv_prim	1st quantile	28,4	0	**sec-school2km**	1st quantile	32,4	0,002
	4th quantile	34,5			4th quantile	50,7	

indiv_second	1st quantile	35,8	0	**high_sch_umrt**	1st quantile	30,8	0,082
	4th quantile	35,4			4th quantile	27,8	
indiv_sup	1st quantile	23,6	0,005	**wom_secondedu**	1st quantile	35,3	0
	4th quantile	14			4th quantile	29,4	
sport_faci1km	1st quantile	29,1	0,004	**Indiv_primf**	1st quantile	29,3	0,003
	4th quantile	19,1			4th quantile	31,1	
cult_faci2km	1st quantile	30,2	0	**Nantf**	1st quantile	22,2	0
	4th quantile	45,9			4th quantile	31,4	
pop_dens	1st quantile	1863,5	0,004	**drop_out2018**	1st quantile	74,1	0
	4th quantile	114,1			4th quantile	357	
Active-agri	1st quantile	11 ,585	0,091	**activ-trad**	1st quantile	12 ,356	0,725
	4th quantile	17 ,136			4th quantile	11 ,823	
activ-indus	1st quantile	17 ,570	0	**activ-othserv**	1st quantile	10, 496	0,002
	4th quantile	10 ,678			4th quantile	6 ,854	

Table 4: Variables definitions

Illitracy_rt	illiteracy rate
activ-indus	percentage of active population in industry
activ-trad	percentage of active population in Trade
activ-constru	percentage of active population in construction
activ-othserv	percentage of active population in non-public services
Active-agri	percentage of active population in Agriculture
unemplhigh_rt	unemployment rate of higher education graduates
primunemp_rt	the rate of unemployed people who have a primary school education
secondunemp_rt	the rate of unemployed people with secondary school education
unemplnil_rt	the rate of unemployed with a nil level
wom_work_edu	percentage of women working in education and public administration
wom_work_com	percentage of women working in trade
wom_work_agr	percentage of women working in agriculture
wom_work_ind	percentage of women working in the industry
indiv_prim	percentage of individuals with primary education
indiv_second	percentage of individuals with secondary education
indiv_sup	percentage of individuals who have a higher level
sport_faci1km	Percentage of population within one kilometer far from sports' facilities
cult_faci2km	Percentage of population within 2 kilometers far from cultures' facilities
pop_dens	Population Density

cult_faci1-2km	percentage of the population between 1 and 2 kilometers far from cultures' facilities
cult_faci1km	Percentage of population within one kilometer far from cultures' facilities
sport_faci1-2km	percentage of the population between 1 and 2 kilometers from sports' facilities
sport_faci2km	Percentage of population within 2 kilometers far from sports' facilities
colleg1km	percentage of the population within one kilometer far from a college
colleg1-2km	Percentage of the population between 1 and 2 kilometers far from a college
colleg2km	percentage of population within 2 kilometers far from a college
sec-school1km	percentage of the population within one kilometer far from a secondary school
sec-school1-2km	percentage of the population between 1 and 2 kilometers far from a secondary school
sec-school2km	percentage of the population within 2 kilometers far from a secondary school
high_sch_umrt	the rate of unemployed people with a high school education
wom_secondedu	Percentage of women with high secondary education
wom_primedu	percentage of women with primary education
wom_niledu	percentage of women with a nil level
drop_out2018	number of students dropping out in 2018.

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