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Do dropout and environmental factors matter? A directional distance function assessment of tunisian education efficiency

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ABSTRACT

The purpose of this paper is to investigate the education efficiency in Tunisia based on a sample of secondary schools. We place some special focus on schools resources and corresponding dropout levels. We use the Directional Distance Function (DDF) methodology to simultaneously deal with bad outputs and non-discretionary inputs. Our assessment is based on Data Envelopment Analysis (DEA) method. The data is extracted from the Program for International Student Assessment (PISA) 2012 survey. We generate four models through various inputs and outputs specifications while considering dropout levels and education environment. Our empirical study reveals strong influence between education performance and both school infrastructure and educational resources. In particular, the financial constraints seem to have real effect on the dropout levels.

1. Introduction

The Tunisian Ministry of Education affirms that every year more than 100,000 children and teenagers up to the age of 16 drop out schools in Tunisia. More specifically, during the 2014/2015 school year, records show that 157,000 repeaters and 106,917 children left school before the age of 16 leading to a loss of 36.7% of the budget of the Ministry of Education. This loss is estimated to 1474 million Tunisian dinars. School dropout has become a worldwide problem threatening the education system in many countries (UNESCO, 2015). However, its rapid evolution these last years makes this phenomenon seriously worrying in Tunisia (see Appendix A).

In order to combat this alarming phenomenon, the Tunisian Education Ministry carries out a National Campaign baptized "*the school recovers its children*". Moreover, the Ministry believes that one of the foremost reasons of this problem is the poor quality of school infrastructure. That is why, as a part of this national campaign on September 8, 2016 the Ministry of Education signed with the Italian Cooperation, the UNICEF and the UNOPS (United Nations Office for Project Services) a renovation partnership program concerning 34 facilities (28 elementary schools and 6 preparatory schools) across the country.[2] Clearly, good and safe school buildings and surrounding neighborhoods can sustain children interest in school and hence might decrease dropout school rate. Nevertheless, we should note that dropout phenomenon is much more complex than just a simple consequence of few factors. Indeed, we conjecture that each child's abandonment is the outcome of many complicated and interrelated troubles confronted by the child at many levels. For instance, while discussing relevant factors, Hunt (2008) and De Witte et al. (2013) focus on the dropout phenomenon in all its complexity. They discuss dropout not as a separate event, but rather as a process where a range of factors, related to students, families, schools and community, interact to influence schooling access.

In addition to the bad school environment, over the last few years the Tunisian education system has witnessed a decrease in its quality. This is also true for many other countries. Indeed, the World Bank (2013) in its report about the Middle East and North Africa (MENA) states that "*The low quality and relevance of education are widely seen as the most important reason for the failure of MENA's educational and training systems to produce employable graduates*". Moreover, the 2003, 2009 and 2012 Program for International Student Assessment (PISA) reports support this assertion. Indeed, the 2003 PISA identifies Tunisian-15-year-old children as having bad cognitive skills in mathematics, science and reading. This situation perseveres according to the 2009

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and 2012 PISA survey with a mean performance of Tunisian schools below the OECD average score. In fact, Tunisia is ranked 61 out of 65 countries in science skills in 2012.

The above discussion raises concerns about the quality of the Tunisian education system and its inefficiency. As a result, it becomes urgent to identify the main factors behind this low quality as well as the reasons yielding the high rate of school dropout. In particular, it is legitimate to question the validity of the Tunisian authorities' approach to handle the education quality through the renovation partnership program seeking to improve the school environment. Actually, some more general questions need to be addressed to identify from various angles the main factors that explain the low quality of the education system in Tunisia and its relation with the excessive dropout rate. This suggests among other things conducting more investigations to understand the causality between dropout rate and education quality. In other words, it is important to explore whether a high rate of dropout reveals a bad quality of education reflecting less confidence in the education system or whether both bad quality of education and high dropout rates are simultaneously generated from some other sources. Furthermore, empirical studies are required to approve or disapprove the conjectured conviction of the Ministry of Education about the causality of the school environment on the high dropout rates. Undeniably, in order to undertake a successful reform, more investigations assessing school performance and serving to understand the relationship between school inefficiency and its factors are needed.

The aims of this paper are two-fold. The first objective is to evaluate the efficiency of education in the Tunisian secondary schools taking into account the dropouts' number and the quality of school infrastructure and its material resources. The second objective is to investigate elements susceptible of assessing the validity of the Tunisian Education Ministry's approach. To achieve those goals, we use Directional Distance Functions (DDF) approach developed by Chambers et al. (1998). One of the main advantages of this approach is to bring together several specifications of inputs and outputs: discretionary and non-discretionary inputs, desirable (good) and undesirable (bad) outputs.

We believe that this current study will contribute to the existing body of knowledge in the Tunisian public education literature and offer valuable related information to policymakers.

We believe that this current study will contribute to the existing body of knowledge in the Tunisian public education literature and offer valuable related information to policymakers. Additionally, it may help answer the question about the validity of the adopted strategy by the Tunisian Ministry of Education concerning its launched campaign "*the school recovers its children*".

The remainder of this paper is organized as follows. Section 2 provides a brief literature review. Section 3 explains the methodology. Section 4, describes the data and variables used in the analysis. Section 5 presents the empirical results and discusses the main finding. Finally, section 6 concludes.

2. Literature review

Over the last years, an increasing number of studies examine the efficiency of educational institutions. Among these, some review the state-of-the-art. De Witte and López-Torres (2015) provide a broad overview of the education efficiency literature by covering all articles up to 2015 using frontier efficiency techniques. Johnes (2015) offers an extensive survey of the diverse education topics where Operations Research tools have been applied in order to provide improved solutions to problems considered by government, managers and users of education. An earlier study, Worthington (2001) discusses a survey on frontier efficiency measurement techniques in education up to 1998.

Various approaches have been adopted and developed to evaluate education efficiency. At the beginning, only factors that are under managerial control (discretionary) have been considered. Having noticed the importance of taking into account certain non-discretionary variables (factors out of the control of the manager) in the efficiency assessment, many studies start to consider them in their appraisal process. Initially, some researchers have treated non-discretionary inputs as standard discretionary ones, which certainly led to biased results. More discussion is given in Mirjaberi and Matin (2015). Subsequently, two major streams of studies dealing with non-discretionary inputs are identified. The first category of studies uses single stage models (such as Ruggiero, 1996). However, the second one adopts multiple stage approaches (see for example, Mancebón et al., 2012 and Dufrechou, 2016). De Witte and López-Torres (2015) summarize previous studies according to four identified levels of non-discretionary variables; namely, student, family, education institution, and community.

Recently, considering undesirable outputs in the assessment of efficiency begins to be discussed and pointed out as a hot topic. These last years, school dropout problem (undesirable factor) has attracted considerable attention and debate. However, very few studies deal with it in the efficiency assessment. In fact, the main outputs that have been used in the literature to assess education efficiency are desirable ones. According to De Witte and López-Torres (2015), among 221 reviewed papers only 5 papers until 2015 consider dropout in their efficiency evaluation and discussion; namely, Ruggiero (1996), Ruggiero and Vitaliano (1999), Alexander et al. (2010), Conroy and Arguea (2008), and Mancebón et al. (2012). To the best of our knowledge, four additional studies consider the dropout problem in their investigations. Agasisti and Salerno (2007) use dropout rate as a measure for education quality while assessing the cost efficiency of Italian universities. Zoghbi et al. (2013) include the dropout ratio for Brazilian universities in the production function, in order to appraise their efficiency. Barra and Zotti (2016) consider the dropout number of some Italian universities in the estimation of their technical efficiency. Sagarra et al. (2017) concentrate on the efficiency of the teaching and research at Mexico's universities. All these studies either consider dropout/relative proxy variables as inputs or outputs using parametric or non-parametric methods, or use dropout as an explicative variable in a second stage.

The above brief literature review advocates the need for more studies to better assess education efficiency taking into account not only desirable outputs but also undesirable ones such as school dropouts phenomenon that has been given little attention. Furthermore, to the best of our knowledge, no study has examined the efficiency of schools by incorporating simultaneously both non-discretionary inputs and undesirable outputs.

In the Tunisian context, few studies have been dedicated to the assessment of the performance of education. However, none of these studies has taken into consideration bad outputs (in particular school dropout). Indeed, Essid et al. (2010) use a DEA-bootstrap approach with non-discretionary inputs to estimate the efficiency of high schools in Tunisia. Essid et al. (2013) shed lights on the significant effect and impact of school resources and environmental variables on educational outcomes. Essid et al. (2014) apply a Malmquist index to examine efficiency changes over time. Ramzi et al. (2016) evaluate the efficiency of basic and secondary education in the 24 governorates of Tunisia and show, contrary to Essid et al. (2013), the absence of significant relationships between school resources and student performance.

To include undesirable factors in the efficiency analysis, especially in DEA framework, the most commonly used approach is the DDF methodology. According to Chambers et al. (1998), it is an approach that allows simultaneously handling undesirable with desirable inputs/outputs according to the chosen direction vectors. Ramli and Munisamy (2013) believe that the DDF is a popular approach among researchers owing to its simplicity and its intuitiveness. Nevertheless, its application in the field of education remains limited in number. According to De Witte and López-Torres (2015), only 11 papers among 221 reviewed ones utilize DDF to evaluate efficiency. Barra and Zotti (2016) also use the DDF to assess the efficiency of Italian universities while considering