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The impact of fiscal decentralization on early childhood education in Cameroon.

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Abstract

The objective of this article is to analyze the effect of fiscal decentralization on early childhood education in Cameroon. Using a methodological framework based on econometric modeling by ordinary least squares (OLS), generalized least squares (GLS), and the generalized method of moments (GMM), it emerges that fiscal decentralization positively and significantly affects early childhood education in Cameroon. The results obtained by OLS and GLS reveal that Fiscal decentralization has a significant and positive effect on the number of desks per student. The Global Monitoring Mechanisms (GMM) demonstrate that fiscal decentralization leads to a significant and positive increase in both the number of classrooms per student and the number of desks per student. The investigations revealed that fiscal decentralization has a positive effect on early childhood education in Cameroon.These results suggest implementing financing mechanisms for local authorities to stimulate local development through the provision of sustainable socioeconomic infrastructure that can ensure equal and equitable access to education for children.

Keywords: Cameroon, schooling, early childhood, fiscal decentralization

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Introduction

Since the 1980s, the implementation of decentralization programs in African countries has aimed to amplify the contribution of subnational governments to economic development. This shift was based on the potential effectiveness of local decision-making levels in promoting the supply of public goods, particularly education, health, and public infrastructure (Matete, 2022 ; Dick-Sagoe, 2020; Kigume and Maluka, 2018 ; Channa and Faguet, 2016 ; Ferhat, 2014).It is within this context that the renewed interest in numerous decentralization initiatives has emerged, initiatives that are strengthened in their economic and financial dimensions through fiscal decentralization (Nga, 2022). as a tool for improving access to education and economic well-being (Miranda-Lescano et *al.*, 2023; Hamdi and Azeroual, 2023; Bamba et *al.*, 2021; El Houda Sadi and Rezine, 2021; Dick-Sagoe, 2020; Faguet and Sanchez, 2016).

According to Tanzi (1994), fiscal decentralization refers to " *the devolution of authority for public finances and the provision of government services from the national to the subnational level.*" As Yaw-Nsiah (1997) and Oates (1972) define it, Fiscal decentralization is defined as " *a transfer to subnational administrations of the power to mobilize, allocate and manage financial resources according to locally determined priorities* ". The effectiveness of this transfer has the potential to lead to improved government efficiency and, in turn, to promote economic and human development (Hung and Thanh, 2022; Oates, 1993). Along these lines, Musgrave (1959) posits that the process of decentralizing public finances appears both as a means of improving resource allocation efficiency and as a genuine opportunity to enhance the quality of public services and the living conditions of households at the local level.

With a view to implementing fiscal decentralization, based on decentralization itself, the Cameroonian government has undertaken a series of regulatory reforms since Fundamental Law No. 96/06 of January 18, 1996 and legal framework which has led successively to the adoption of the laws of 2004 [1], Law No. 2009/019 of December 15, 2009 on local taxation, and recently Law No. 2019/024 of December 24, 2019 establishing the General Code of Decentralized Territorial Collectivities (CGCTD). The collective ambition of this legal arsenal enshrines the principle of decentralization in education in favor of local communities. Indeed, the substance of Article 55(1) of the *aforementioned Law of January 18, 1996,* states that *"the Decentralized Territorial Collectivities (CTD) of the Republic are the Regions and the*

[1]These are: Law No. 2004/017 of July 22, 2004, concerning the orientation of decentralization; Law No. 2004/18 of July 22, 2004, establishing the rules applicable to municipalities; and Law No. 2004/019 of July 22, 2004, establishing the rules applicable to regions.

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Municipalities; their mission is to promote economic, social, health, educational, cultural, and sporting development. " The vision of this regulatory framework also formed the basis for the drafting of Law No. 98/004 of April 14, 1998, on Education Policy in Cameroon. Based on this law, the State acknowledges the involvement of local and regional authorities (CTDs) in education management, and therefore the priority is to achieve the Sustainable Development Goals, emphasizing the role of universal primary education: " *Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.*" The strategy within this framework thus involves undertaking actions aimed, among other things, at acquiring infrastructure, constructing new classrooms, providing desks and benches, rehabilitating schools, and providing other amenities.

In this regard, the country has 87,594 primary school classrooms out of the 19,711 schools recorded in 2017. Of these, 73.7% are constructed with permanent materials, 10.2% with semi-permanent materials, and 16.1% with temporary materials (MINEDUB, 2017). Among the classrooms built with permanent materials, 75% are reported to be in good condition, 20% in fairly good condition, and 6% in poor condition. Regarding access to education, the proportion of the school-age population not attending primary school is 8% (MINEPAT, 2020). Substantial variations in percentages between regions highlight the disparities in this area. For example, in the North (25.6%), Adamawa (19.1%), Far North (35%), and East (13.3%) regions, the overall exclusion rate is 32%, and the net preschool enrollment rate is 27% (World Bank, 2018). In preschool, less than 40% of children aged 4 to 5 have access (MINEDUB, 2022). Furthermore, in addition to the sluggish economic growth observed over the last decade, with the country's average annual growth rate below 7% (Fouopi et *al.*, 2024), the resurgence of security and health crises is, in many respects, another clear cause of the school enrollment deficit. Overall, these crises have resulted in more than 6.5 million school-age children being out of school in basic education, as well as the destruction of school infrastructure (MINEDUB, 2023; Republic of Cameroon, 2022).

This article aims to measure the effect of fiscal decentralization on children's schooling in Cameroon. In this paper, fiscal decentralization is captured by the share of municipal spending in total state expenditure (Fouopi et *al.*, 2024). The added value of our research lies, among other things, in measuring school enrollment. Unlike the variables traditionally used to capture children's schooling, such as the average number of years of schooling, gross enrollment rates, and academic achievements like reading and mathematics scores, we will focus on the variables "desks per student" and "classrooms per student," which respectively measure the number of desks and benches and the number of classrooms available for a given number of students in

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the public schools of each municipality. If the option focused on these two variables is appropriately aligned with the limits of available data and the nature of the powers transferred to municipalities, it is more in line with the analysis of the multiplier effects of basic social infrastructures of the Pérez-Montiel type (2020) [2]surrounded by the Keynesian theory of the multiplier (Keynes, 1936) and the accelerator principle highlighted by Samuelson (1939) and Hicks (1950) [3].

also confirm the positive contribution of fiscal decentralization to increasing the supply of schooling, allowing for a more accurate assessment of children's schooling in Cameroon and its potential to project their future productive capacity. Children's schooling influences their subsequent productivity in adulthood. It is therefore a significant factor in development and one of the most important instruments for poverty reduction, improved access to healthcare, peace, and stability. This research is also original in that it incorporates a third variable into the analysis: the primary school enrollment rate (PSER). This indicator reflects access to basic education for a given population and assesses educational progress. It also highlights the demand-side economic approach to education services in order to simultaneously evaluate the effect of fiscal decentralization on children's schooling from both the supply and demand perspectives. Furthermore, the study includes a fairly representative panel of Cameroonian municipalities, namely 107 communes, unlike the work of Fouopi et *al.* (2024) and Onana and Tchitchoua (2020), which was limited to approximately 45 communes. Similarly, the use of linear regression modeling with OLS, CML, and GMM in a dynamic panel is a unique contribution of this article to the analysis of the effectiveness of a municipal budget allocation system on early childhood education [4]in Cameroon.

The general organization of the article is structured around five sections. Apart from this introductory section, the rest of the study will follow the following paths: review of the relevant theoretical and empirical literature (section 2); methodological strategy adopted (section 3); analysis and discussion of the results obtained (section 4); conclusion and economic policy recommendations (section 5).

[2]Infrastructure refers to the facilities, equipment, structures and systems that facilitate economic and social progress in a territory.
[3]The secondary idea behind this theoretical suggestion is that public investment in infrastructure accelerates development
[4]Early childhood education generally refers to the period from birth to the age of eight, but here it is understood as the set of educational arrangements for children over 8 years old, which correspond to primary school.

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2- Fiscal decentralization and children's schooling: A literature review

The theoretical framework for analyzing the effect of fiscal decentralization on the supply of public goods such as education is generally based on the school of thought of fiscal federalism (Oates, 2005; 1972; Musgrave, 1959). This theory addresses the distribution of public sector functions among different levels of government, including the provision of local goods and services. According to Musgrave (1959), the government's responsibility lies in maximizing a social welfare function through fiscal decentralization (Kessing et *al.*, 2020), while the allocation of public goods should be carried out by subnational levels of government. This results in an efficient distribution of public services and goods at the lowest level of government (Ky, 2020; Mwiathi et *al.*, 2018). Two guiding principles underlie the relationship between fiscal decentralization and the provision of public goods such as education: proximity and competition. (Mireim, 2017; Caldeira and Rota-Graziozi, 2014).

First, proximity derives its ideological basis from bringing policymakers and citizens closer together, which leads to an improvement in both the understanding of the needs and preferences of the population (Hayek, 1948) and the accountability and effectiveness of local governments (Seabright, 1996). According to Hayek (1948) and Oates (1972), local governments are expected to possess more information at a lower cost about the members of their community (Caldeira et *al.,* 2014). Indeed, the literature reveals that subnational governments are more effective in providing public goods and services than the central government, as they can better formulate and implement public policies aligned with specific development needs thanks to a better understanding of local preferences (Christl et *al.*, 2020; Hounsounon, 2016; Dafflon and Madiès, 2008; Ebel and Yilmaz, 2001; Oates, 1999, 1972). It goes without saying that fiscal decentralization, viewed through the lens of its key component (proximity), helps local governments obtain more specific information about citizens' needs so they can adjust or implement various policies in line with the interests of people from different social backgrounds (Sisto et *al.*, 2022; Hintea et *al.*, 2019; Ma and Mao, 2018; Jametti and Joanis, 2016; Gadenne and Sin-ghal, 2014). It also operates by reducing supply chains and costs, potentially generating greater economic efficiency (Ezcurra and Pascual, 2008).

Furthermore, the principle of competition rests on inter-jurisdictional competition, which leads to an improved alignment of the supply of public goods and services with residents' preferences (Oates, 1972; Tiebout, 1956) and thus stimulates the pursuit of efficiency by local governments (Besley and Case, 1995; Salmon, 1987). Following the theoretical predictions of the foundational approaches of Tiebout (1956) and Oates (1972), competition between subnational governments should improve the alignment between the supply and demand of public goods

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and services and promote greater efficiency in public policies. Thus, individuals, being well-informed and mobile, can move to the municipalities that best meet their preferences. Competition therefore keeps local authorities on their toes, consequently maintaining a state of distrust regarding the implementation of unorthodox financial practices, which *ultimately* limits the potential for inefficiency, rent-seeking, and corruption. This is because fiscal decentralization can promote competition for financial resources between local authorities and make the delivery of public services more efficient at the local level by reducing income inequality and improving public welfare in regions in the long term (Christl et *al.*, 2020; Jametti and Joanis, 2016; Breton, 1996; Greffe, 1984; Tiebout, 1956).

In light of the above, fiscal decentralization possesses considerable scientific credibility. This legitimacy readily justifies the interest in decentralizing budgetary power to the level of peripheral administrations in order to achieve greater efficiency in the public sector, a catalyst for long-term economic development (Hung and Thanh, 2022).

Furthermore, numerous empirical studies have been conducted to establish the links between fiscal decentralization and children's access to education through various channels. This is the case in the study by Fouopi et *al.,* (2024) on the effects of fiscal decentralization on access to health and education services in Cameroon. Their investigations, based on the Driscoll and Kraay estimate, using a sample of 45 rural and urban municipalities for the period 2010-2020, reveal that fiscal decentralization has a positive effect on the number of classrooms per student and the number of desks per student. The findings of Fouopi et *al*., (2024) corroborate these results. The results of empirical work by Bird and Rodriguez (1999); Galiani, Gertler, and Schargrodsky (2008) demonstrate the favorable effect of decentralized spending on access to primary education and student performance in Argentina, respectively. In examining decentralization and human capital development in Argentina, Habibi et *al.,* (2003; 2001) concluded that fiscal decentralization had a positive effect on educational output based on a fixed-effects model from 1970 to 1994. Habibi and colleagues find that their measure of decentralization (own resources/total resources) has a positive and significant association with their measure of educational output, particularly when there is greater fiscal responsibility in a province. Under the same banner, Enikolopov and Zhuravskaya (2007) arrive, from a regression on panel data, at a positive and significant relationship between budgetary decentralization and access to education and health in a study concerning a set of 95 developed and developing countries from 1975 to 2000. The work of Adams, Delis, and Kammas (2014), which analyzes the impact of fiscal decentralization on public sector efficiency in 21 OECD member countries between 1970 and 2000, echoes this finding, revealing that fiscal decentralization has a positive

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impact on access to educational services. In a study of 18 European countries examining the effects of fiscal decentralization on the performance of educational institutions, Jacqmin and Lefebvre (2020) also found a positive relationship.

However, the work of Onana and Tchitchoua (2020), based on modeling using estimates from a dynamic panel of 45 municipalities over the period 2010–2015, demonstrates that the decentralization of spending negatively affects access to classrooms and the supply of desks and benches in Cameroon. Similarly, Salinas and Solé-Ollé (2018) show that fiscal decentralization has a significant negative impact on secondary school dropout rates in Spain. The authors note that this effect is more pronounced in regions that received more revenue. According to Amoussouga and Dedehouanou (2015), budgetary decentralization does not positively affect access to education in Benin. This conclusion aligns with Kiya (2012) finding that decentralizing spending has a non-significant effect on access to education in the United States of America.

Based on the empirical evidence gathered, a quick glance reveals a lack of consensus regarding the effect of fiscal decentralization on access to education. Ky (2020) and Sanogo (2018) aptly provide a compelling demonstration through the premise that all decentralization is the product not only of a specific sociopolitical history, but also of the contextual and institutional *design* unique to the country in question.

3- Methodological approach

This section provides an overview of the nature and source of the data used, a description and justification of the variables used, and a justification of the econometric modeling adopted.

3.1 Data sources and variable descriptions

3.1.1 Data sources

The budget data comes from administrative accounts obtained from the Directorate of Decentralized Territorial Communities of the former Ministry of Territorial Administration and Decentralization (MINATD), the Ministry of Decentralization and Local Development (MINDDEVEL), and the Special Fund for Intercommunal Equipment and Intervention (FEICOM). Information on social infrastructure comes from the Municipal Development Plans of the selected municipalities, available at www.pndp.gov . The study covers a sample of 107 municipalities in the country from 2010 to 2020. The selection of 107 municipalities and the study period is based on data availability during the period under review. Data on school enrollment rates and the number of primary and preschool students are obtained from the statistical yearbooks of the Ministry of Basic Education (Project Planning and Cooperation Division - DPPC). Furthermore, statistical data collected from the aforementioned ministerial

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institutions, compiled from data from national surveys and/or field studies, also served as a basis for our work. These sources of information were prioritized as they were considered closer to reality.

3.1.2 Description of variables

3.1.2.1 Dependent variable

Our dependent variable is access to education. It will be captured using three indicators. First, we will use the variable "desks per student," which measures the number of desks and benches available for a given number of students in the public schools of each municipality (EDUC1). Next, we will use the number of classrooms per student, which refers to the number of classrooms available for a given number of students per municipality (EDUC2). Finally, we will use the primary school enrollment rate, which measures the percentage of students of primary school age (6 and 11 years old) who are actually enrolled in a primary school (TSAP). In general, these indicators provide information on the availability of basic school equipment, which determines the conditions for learning. This measure was used by Onana and Tchitchoua (2020) to measure the effect of fiscal decentralization on access to basic social services in Cameroon.

3.1.2.2 Independent variable

Our independent variable is fiscal decentralization. This variable captures fiscal decentralization as measured by the share of a municipality's expenditures in total municipal expenditures (DécD). This indicator has been used by several authors to assess the effect of fiscal decentralization on access to education (Onana and Tchitchoua, 2020; Gemmell, Kneller and Sanz, 2013; and Caldeira, 2011).

To better explain access to education, the study incorporates a number of control variables clearly identified from certain empirical works.

- **The gender of the municipal executive:** Studies show a difference between female and male elected officials in terms of effectiveness and motivation (Onana et *al.*, 2024; Chattopadhyay et *al.*, 2004; Edlund and Pande, 2002; Dollar et *al.*, 2001; and Lott and Kenny, 1999). Gender is a dichotomous variable that takes the value 1 if the municipal executive is female and 0 otherwise.
- **Urbanization:** The urbanization rate refers to the percentage of the population living in urban areas. Generally, municipalities in urban areas are likely to generate more tax revenue (Catin et *al.*, 2008). Consequently, they generate more resources, enabling them to provide social infrastructure to their population.

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- **Conflict:** This variable identifies municipalities experiencing a socio-political conflict or crisis between 2010 and 2020. During periods of conflict, economic activity is reduced, which limits the mobilization of municipal resources and lowers their revenue. Consequently, municipalities are unable to invest in providing school infrastructure. This variable was used by Sanogo (2018).
- **Density:** Density measures the number of inhabitants per km². This variable was used by Caldeira et *al.,* (2012) in their study analyzing the effect of fiscal decentralization on the supply of social services in Benin.

3.2 Empirical model

To assess the effect of fiscal decentralization on access to education, we will rely on the model developed based on the work of Onana and Tchitchoua (2020) and Caldeira et *al.*, (2012). The compact form of the model is given by equation (1) below:

$$EDuC_{i,t} = \beta_0 + \beta_1 DécD_{i,t} + \beta_2 X_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \qquad (1)$$

Our dependent variables are dynamic processes that can exert strong inertia on their past values. Therefore, it is important to account for this inertia. We introduce the lagged variables of education and access to healthcare into equations (1). They are given by equation (2) below:

$$EDuC_{i,t} = \beta_0 + \beta_1 EDuC_{i,t-1} + \beta_2 DécD_{i,t} + \beta_3 X_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \qquad (2)$$

Where $EDuC_{i,t}$ denotes the matrix of variables that capture access to education. $EDuC_{i,t-1}$ is the lagged variable of a period of access to education. For the set of both equations, $DécD_{i,t}$ denotes fiscal decentralization and $X_{i,t}$ the vector of control variables including gender, urbanization, conflict, and density. μ_i are the specific effects of the unobserved municipalities and ν_t takes into account the specific temporal effect common to all municipalities. $\varepsilon_{i,t}$ is the error term. i represents the number of municipalities (i= 1, 2, 3, ….,107 municipalities); t represents the number of years covered by the study (t= 2010, 2011, 2013……,2020).

3.3 Estimation method

We apply several estimation techniques to estimate equation (1). Referring to contemporary empirical literature, we will use Ordinary Least Squares (OLS) and Generalized Least Squares (GLS) estimation, progressively adding control variables to the regression to arrive at our baseline results. OLS was used by Diaz-Serrano and Meix-Llop (2019) and Faguet and Sanchez (2014) to evaluate, respectively, decentralization and access to social services in Colombia and decentralization and the quality of public services. While the OLS method is interesting and simple to implement, it has limitations: it does not account for heteroscedasticity, autocorrelation of errors, or unobserved heterogeneity, all of which can distort parameter

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estimation. The heteroscedasticity test verifies whether the variances of the residuals of the variables examined in the model are different. The autocorrelation test allows us to check if the measurement of a phenomenon at a time t can be correlated to previous measurements (at time t-1, t-2…) or to subsequent measurements (t+1, t+2…).

To control for this potential unobserved heterogeneity, we estimate the following model using CGM estimators. Our choice of estimation techniques is justified by three main reasons. The first reason relates to the heterogeneity of the municipalities studied. The second reason is due to the specific nature of the data. The third reason relates to the sample size, so its narrowness does not pose major problems in the estimation process. As an advantage, these techniques allow us to take into account unobservable factors that can impact access to education and also allow us to correct for the simultaneity bias between the variables of interest and the control (Wooldridge, 2013).

While these previous methodological approaches are interesting, they do not protect us from the resulting problem of endogeneity, measurement errors, omissions of variables, and reverse causality between our dependent variable and the explanatory variables. Firstly, measurement error stems from the fact that the data collection method itself may have shortcomings. For example, those responsible for data collection may occasionally make mistakes. Furthermore, there are other measures besides the number of desks per student to assess access to education, such as the number of years spent in school (Galiani, 2008), the net enrollment rate (Caldeira et *al.*, 2012; Habibi et *al.,* 2003), and the number of classrooms per student. Secondly, the omission of variables: there are other important explanatory variables (geographic, cultural, or historical factors, etc.) that are omitted but are considered significant determinants of access to education and are correlated with certain explanatory variables. Thirdly, the inverse causality between the dependent variable and the explanatory variables. Just as decentralization affects access to education, it appears that a good level of education promotes greater revenue growth for municipalities, which in turn will increase the level of decentralization. We address this limitation by using a dynamic model specification as described in equation (2).

$$EDuC_{i,t} = \beta_0 + \beta_1 EDuC_{i,t-1} + \beta_2 DécD_{i,t} + \beta_3 X_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \qquad (2)$$

$EDuC_{i,t-1}$ is the lagged variable of a period of access to education. $X_{i,t}$ is the vector of control variables presented above.μ_i are the specific effects of the unobserved municipalities and ν_t takes into account the specific temporal effect common to all municipalities. $\varepsilon_{i,t}$ is the error term.

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Introducing the lag variable $EDuC$ as an explanatory variable invalidates standard static panel regression due to "dynamic panel bias" (Nickell, 1981). After removing country-specific fixed effects by first difference, the first-difference lagged dependent variable is still correlated with the first-difference idiosyncratic error term, since $EDuC_{it-1}$it is correlated with μ_{it-1}. This raises the endogeneity problem, and estimation using standard methods (OLS, CGM) produces biased and inconsistent results. The common approach in the literature to address this endogeneity problem is to use either an instrumental variable approach or a generalized method of moments (GMM) approach. In this research, the system GMM is preferred to the instrumental variable 2SLS approach. In the literature, the instrumental variable method using external instruments has been used to effectively address the reverse causality problem (Farhadi et *al.*, 2015). However, one limitation of this approach is the difficulty of finding a purely exogenous external instrument that varies across countries and over time, and this method therefore tends to ignore the endogeneity of other corrective factors. The MMG has the advantage of addressing the endogeneity of all explanatory variables using internal instruments. Furthermore, the G MM addresses endogeneity that would arise from reverse causality and produces valid instruments.

To efficiently estimate the dynamic model formulated above, we use the GMM initially proposed by Arellano and Bond (1991), and improved by Arellano and Bover (1995), and Blundell and Bond (1998). The GMM technique is available in two versions: difference GMM, where the lagged levels of the explanatory variables are used as instruments, and system GMM, which combines difference regression and level regression. Using Monte Carlo simulations, Blundell and Bond (1998) and Bond (2002) show that the GMM system estimator is more efficient than the GMM difference estimator, as it greatly improves efficiency and avoids the problem of weak instruments in regression models.

Although System-GMM resolves endogeneity issues, it has two shortcomings. Windmeijer (2005) showed that the estimated asymptotic standard deviations of the two-step GMM estimator can be biased downwards at a finite distance. To guard against this bias, we use the second-step covariance matrix correction method proposed by Windmeijer (2005). The second weakness is related to the proliferation of instruments. To address this, we limit the number of variables to be instrumented as well as the number of lags, as suggested by Roodman (2009). In what follows, the regressions use the "Collapse" option.

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4 Analysis and discussion of econometric results

This section is dedicated to the analysis and discussion of the study's results. The discussion focuses on the main descriptive statistics and econometric analyses.

4.1 Descriptive analyses

Table **1** below presents the main descriptive statistics of the variables selected.

Table 1: Descriptive statistics

Variable	Obs	Average	Standard deviation	Min	Max
Education	1177	29.185	14,277	0	74.2
Decentralization	1177	.004	.006	0	.139
Urbanization	1177	.639	.647	.021	2,846
Density	1177	438.873	1496.625	.882	18007.352
Average income	1177	13180224	69582965	189,873	625000010
Public Spending	1177	280081323	208392415	239016	2217000000

Source : Authors

Analyses reveal that there are an average of 29 desks and benches per student in classrooms. This ratio varies across municipalities. Some municipalities have no desks or benches per student, while others have approximately 74. The degree of decentralization also varies between municipalities. In some municipalities, the ratio of municipal spending to total municipal spending is 0.002, compared to 0.139 in others. This demonstrates that some municipalities are more financially stable than others and therefore enjoy a greater degree of autonomy. This difference in municipal financial resources can affect the provision of educational services. The average urbanization rate is 0.639. Some municipalities have a minimum urbanization rate of 0.021, while others have a maximum of 2.846. The urbanization rate also has a significant impact on access to education. A high rate of urbanization means that populations tend to migrate to these municipalities, leading to an increased demand for education. The average income is 13,180,224 FCFA. Municipalities invest an average of 280,081,323 FCFA. These investments vary from one municipality to another, with some investing a minimum of 239,016 FCFA and others a maximum of 2,217,000,000 FCFA. It should be noted that municipal expenditures vary according to available resources. A municipality with limited financial resources will spend less than one with greater financial stability. Table **2** presents the correlation matrix.

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Table 2 Correlation matrix

1	Variables	2	(1)	3	(2)	4	(3)	5	(4)	6	(5)	7	(6)
8	**(1) Education**	9	1,000	10		11		12		13		14	
15	**(2) Decentralization**	16	0.068	17	1,000	18		19		20		21	
22	**(3) Urbanization**	23	0.113	24	0.059	25	1,000	26		27		28	
29	**(4) Density**	30	0.021	31	0.101	32	0.350	33	1,000	34		35	
36	**(5) Average income**	37	-0.083	38	-0.020	39	-0.041	40	-0.035	41	1,000	42	
43	**(6) Public spending**	44	-0.004	45	0.204	46	-0.089	47	0.024	48	-0.009	49	1,000

Source : Authors

This table shows that decentralization, gender, urbanization, population density, and corruption are positively correlated with education. Conversely, conflict, average income, and expenditures are negatively correlated with education. The correlation matrix already provides a clear indication of the nature of the relationship between fiscal decentralization and education. However, econometric analysis will confirm the nature of this relationship.

4.2 Presentation and discussion of the results

The presentation of the results is done in two stages: the first sets out the results obtained after empirical analysis of the basic model and the second presents the results after robustness analysis.

4.2.1 Basic results

Tables **3** and **4** present the results after estimating equation (1). Table **3** shows the results for OLS and Table **4** those for CGS.

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Table 3: Fiscal decentralization and access to education with fixed-effect MCO

	Dependent variable: EDUC1				
VARIABLES	(1)	(2)	(3)	(4)	(5)
Decentralization	0.161**	0.177**	0.156**	0.157**	0.162**
	(0.070)	(0.070)	(0.070)	(0.069)	(0.069)
Sex		0.006***	0.006***	0.006***	0.006***
		(0.002)	(0.002)	(0.002)	(0.002)
Urbanization			0.002***	0.003***	0.003***
			(0.001)	(0.001)	(0.001)
Conflict				-0.008***	-0.008***
				(0.001)	(0.001)
Density					-0.002
					(0.003)
Common fixed effect	Yes	Yes	Yes	Yes	Yes
Fixed time effect	Yes	Yes	Yes	Yes	Yes
Constant	0.029***	0.023***	0.021***	0.022***	0.022***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	1,177	1,177	1,177	1,177	1,177
R-squared	0.046	0.052	0.062	0.095	0.096

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

The trend emerging from this table reveals that Fiscal decentralization has a significant and positive effect on the number of desks per student. As mentioned above, while OLS offers advantages, this technique does not address the problem of heteroscedasticity, autocorrelation of errors, and unobserved heterogeneity, all of which can skew parameter estimation. It is because of this limitation that CGS is applied to improve estimators and results.

The results of the MCG are presented in Table **4** below.

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Table 4: Fiscal decentralization and access to education with MCG

	Dependent variable: EDUC1				
VARIABLES	(1)	(2)	(3)	(4)	(5)
Decentralization	0.161**	0.177**	0.156**	0.157**	0.162**
	(0.070)	(0.070)	(0.070)	(0.068)	(0.069)
Sex		0.006***	0.006***	0.006***	0.006***
		(0.002)	(0.002)	(0.002)	(0.002)
Urbanization			0.002***	0.003***	0.003***
			(0.001)	(0.001)	(0.001)
Conflict				-0.008***	-0.008***
				(0.001)	(0.001)
Density					-0.002
					(0.003)
Common fixed effects	Yes	Yes	Yes	Yes	Yes
Fixed time effect	Yes	Yes	Yes	Yes	Yes
Constant	0.029***	0.023***	0.021***	0.022***	0.022***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	1,177	1,177	1,177	1,177	1,177
Number of municipalities	107	107	107	107	107
chi 2	56.71	64.58	78.14	123.6	124.3

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

Column 1 of Table **4** shows a bivariate relationship between fiscal decentralization and access to schooling, measured by the number of desks per student. It reveals that fiscal decentralization has a significant positive effect at the 5% level on the number of desks per student. More specifically, a one-point increase in decentralization leads to a 0.161-point increase in the number of desks per student. This implies that fiscal decentralization positively affects access to education in Cameroon. This may be due to the transfer of responsibilities for equipping classrooms in preschools and primary schools initiated by the Government in 2010.

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These results are consistent with some theoretical literature that posits that fiscal decentralization is beneficial for the efficient delivery of social services such as education (Oates, 1972; Tiebout, 1956). According to these authors, proximity between local decision-makers and the population ensures adequate access to education services. These results are similar to those obtained by Fouopi et *al.,* (2024) in their analysis of the effects of fiscal decentralization on access to health and education services in Cameroon. Likewise, these results are consistent with previous work, notably Bird and Rodriguez (1999), who concluded that decentralized spending has a positive effect on access to primary education in Argentina. Similar results have been corroborated in the Philippines and in some developed and developing countries by Habibi et *al.* (2003), Enikolopov et *al,* (2007), and Galiani et *al.,* (2008). The work of Adams, Delis and Kammas (2014) echoes this finding that fiscal decentralization has a positive impact on access to educational services in their analysis of the impact of fiscal decentralization on the efficiency of the public sector in 21 OECD member countries between 1970 and 2000. Jacqmin and Lefebvre (2020) do not depart from previous conclusions by indicating that fiscal decentralization increases the performance of educational institutions in a study of 18 European countries.

However, these results stand in stark contrast to those of Onana and Tchitchoua (2020), who showed that the decentralization of spending has negative effects on the supply of school desks and benches in Cameroon. The latter's divergent findings can be explained by their five-year study period. Similarly, fiscal decentralization has a significant negative impact on secondary school dropout rates in Spain, and this effect is more pronounced in regions that received higher revenues (Salinas and Solé-Ollé, 2018). The work of Amoussouga and Dedehouanou (2015) and Kiyia (2012) found that decentralization has a non-significant effect on access to education in Benin and the United States.

All control variables are significant at the 1% level and positive, with the exception of conflict, which is negative. Gender has a positive effect on access to education. These results show that populations in municipalities with female municipal executives have greater access to educational services compared to populations with male municipal executives. Several studies have revealed that women elected to office have a strong sense of public service and are more motivated in their work (Onana et *al.*, 2024; Edlund and Pande, 2002; and Dollar et *al.*, 2001). A one-point increase in the urbanization rate leads to a 0.003-point increase in access to education (4). Urban population growth implies an increased demand for education. To address this, municipal executives will make additional efforts to meet the needs of the population. It should also be noted that municipalities in urban areas are likely to generate more tax revenue

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(Catin et *al.*, 2008). Consequently, the revenue generated can be invested in equipping classrooms. Conflict negatively impacts access to education services. The results demonstrate that municipalities that have experienced conflict offer limited access to education services compared to municipalities that have not. This finding echoes Sanogo (2018), who demonstrated that in times of crisis, populations benefit less from social services due to the destruction of school buildings and equipment. Based on these descriptive predictions, the Northwest, Southwest, and Far North regions have recorded substantial losses in schools in some municipalities.

4.2.2 Robustness analysis

The robustness analysis of the results is carried out in three phases: the first uses an alternative measure of access to education and deals with endogeneity (Table **5)**, the second proceeds by adding additional control variables (Table **6)** and the third phase which deserves to be highlighted is the introduction into the basic model of the education demand variable (Tables **7** and **8)**.

4.2.2.1 Alternative measure of access to education.

As an alternative measure of access to education, the analysis uses the number of classrooms per student. This measure was used by Fouopi et *al.,* (2024) and Onana and Tchitchoua (2020). Comprehensive methodological control (CMC) allows us to obtain, on the one hand, relatively unbiased, consistent, and efficient estimators in the presence of lagged variables, and on the other hand, it allows us to correct for simultaneity bias between the variables of interest and the control. However, this estimation technique does not correct for endogeneity. To address this endogeneity issue, we use system-level general methodological control (GMM).

Table 5: Fiscal decentralization and access to education with GMM as a system

	Dependent variable: EDUC2				
VARIABLES	(1)	(2)	(3)	(4)	(5)
L.Educ1	1.064***	1.061***	1.041***	1.084***	1,100***
	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)
Decentralization	0.001***	0.001***	0.082***	0.012**	0.025***
	(0.002)	(0.001)	(0.019)	(0.005)	(0.004)
Sex		-0.002***	-0.002***	-0.001***	-0.003***
		(0.001)	(0.001)	(0.001)	(0.001)
Urbanization			-0.001**	-0.002***	-0.001***
			(0.002)	(0.001)	(0.002)
Conflict				0.005***	0.003***

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				(0.001)	(0.001)
Density					-0.019***
					(0.003)
Constant	-0.002***	-0.012*	0.001	-0.002***	-0.001***
	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)
Observations	1.070	1.070	1.070	1.070	1.070
Number of ID	107	107	107	107	107
No. Instrument	27	31	26	26	27
AR (1)	0.0066	0.0073	0.0594	0.00312	0.0419
AR (2)	0.0869	0.0979	0.878	0.410	0.951

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

The results obtained from these estimations (Table **5)** reveal that fiscal decentralization has a positive effect on the number of classrooms per student. The significance level is 1%, with the exception of model (4), which shows a significance level of 5%. A one-point increase in fiscal decentralization leads to a 0.082 increase in the number of classrooms per student (3). The variable lagged by one period of education is statistically significant at the 1% level across all specifications.

4.2.2.2 Adding additional variables

Table **6** presents the results after adding additional control variables to the base model.

Table 6: MCG with Additional Variable

	Dependent variable: EDUC1		
VARIABLES	(1)	(2)	(3)
Decentralization	0.195***	0.187***	0.165**
	(0.0690)	(0.0688)	(0.0699)
Sexes	0.00734***	0.00622***	0.00646***
	(0.00200)	(0.00199)	(0.00200)
Urbanization	0.00291***	0.00281***	0.00284***
	(0.000674)	(0.000675)	(0.000680)
Conflict	-0.00792***	-0.00803***	-0.00783***
	(0.00120)	(0.00120)	(0.00120)
Density	-0.00210	-0.00183	-0.00216
	(0.00283)	(0.00283)	(0.00284)
Average income	-0.000513***		
	(0.000151)		
Corruption		0.00373***	

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		(0.00120)	
Spending invested			-0.000115
			(0.000449)
Common fixed effect	Yes	Yes	Yes
Fixed time effect	Yes	Yes	Yes
Constant	0.0263***	0.0187***	0.0241***
	(0.00246)	(0.00231)	(0.00881)
Observations	1,177	1,177	1,177
Number of municipalities	107	107	107
chi 2	137.1	135.0	124.4

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Authors

The finding that emerges from the addition of the supplementary variables is that fiscal decentralization always has a positive and significant effect on the number of desks per student. As additional control variables, average income, corruption, and investment spending were used. Average income is likely to influence access to education. The results suggest that average income has a significant negative effect at the 1% level on the number of desks per student. A one-point increase in average income leads to a reduction in the number of desks per student. This result can be explained by the fact that the construction or provision of desks in schools is not financed by households. Average income may instead influence student enrollment in schools.

Corruption has a positive and significant effect at the 1% level on the number of desks per student. It is measured by the conviction of municipal executives by the Court of Auditors for administrative corruption (Blundo and Olivier de Sardan, 2001; Olivier de Sardan, 2009). This measure was used by Onana et *al.* (2024), Onana and Tchitchoua (2020), and Fisman and Gatti (2000). It is a dichotomous variable that equals **1** if the municipal executive has been convicted and **0 if it has not.** Otherwise, the results reveal that corruption positively affects the number of desks and benches per student in public schools. This may reflect the phenomenon of benefit capture in terms of local power brokers retaining projects in their locality to the detriment of other jurisdictions, which constitutes a risk to decentralization identified by Reinikka and Svensson (2004). Thus, municipal executives, in order to gain the trust of the population in upcoming elections, may be incentivized to draw on public funds to make donations to schools in their municipality.

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4.2.2.3 Demand-driven approach to education

The economic approach, focusing on the supply of education services, has allowed us to establish the relationship between fiscal decentralization and access to education. In this context, although underutilized in the literature, the variables of student-to-teacher ratio (STR) and number of desks per student in public primary and preschool education were introduced into the basic model to capture access to education at the local level. However, given the conflicting opinions surrounding the effect of fiscal decentralization on the supply of education, it seems prudent to also consider it through an economic lens based on the demand for education services in order to improve the quality of the results. Hence the existence of other indicators to further refine the interpretation of the basic model's results. One such indicator is the primary school enrollment rate (PSER). This variable was chosen solely based on data availability. Moreover, this latter method was used in the study by Caldeira et *al.,* (2012) in Benin. Therefore, the analysis of the results obtained from Table **7** The analysis *below* reveals that fiscal decentralization positively and significantly affects primary school enrollment rates at the 1% threshold. More specifically, a one-point increase in fiscal decentralization leads to a 0.007-point improvement in primary school enrollment. These results are consistent with previous work (Caldeira et *al.*, 2012) and also congruent with our baseline findings. In any case, a quick glance is enough to see that, by adopting both a supply-side and demand-side approach to education, fiscal decentralization positively affects access to education services for the population.

The control variables represent a set of characteristics of the municipality, namely the gender of the elected official, conflicts, and population density. Gender has a negative effect on the school enrollment rate. The results indicate that the primary school enrollment rate is low in municipalities headed by male elected officials, unlike those headed by female officials. Conflict negatively affects the number of students enrolled in primary school. Conversely, population density contributes positively and significantly to the development of the primary school enrollment rate. Specifically, a one-point increase in population density raises the primary school enrollment rate by 0.003 points.

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Table 7: Fiscal decentralization and school enrollment rates

	Independent variable: TSAP				
VARIABLES	(1)	(2)	(3)	(4)	(5)
Decentralization	0.007***	0.007***	0.007***	0.006***	0.006***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Sex		-0.070**	-0.068**	-0.070**	-0.069**
		(0.032)	(0.032)	(0.032)	(0.032)
Urbanization			0.007	0.009	-0.003
			(0.011)	(0.011)	(0.011)
Conflict				-0.026	-0.074***
				(0.020)	(0.022)
Density					0.003***
					(0.000)
Constant	4.434***	4.504***	4.498***	4.504***	4.489***
	(0.009)	(0.033)	(0.034)	(0.034)	(0.034)
Observations	859	616	616	616	616
Municipalities	299	56	56	56	56
Standard errors in parentheses			***p<0.01, **p<0.05, *p<0.1		

Source: Authors

4.2.2.3.1 Demand-driven approach with added variables

The presentation of the results after the addition of the supplementary control variables is shown in Table **8.** As in the supply-side approach, these variables are corruption, average income, and investment spending. The key finding from the information in this table is that fiscal decentralization has a positive and significant impact on the primary school enrollment rate at the 5% threshold. *Conversely,* corruption and investment spending have a negative impact on the primary school enrollment rate. However, average household income does have a positive influence on the enrollment rate. Specifically, an additional unit of average income leads to a 0.013 percentage point increase in the enrollment rate. This implies that the higher the household income, the more educational services they demand for their children.

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Table 8: Fiscal decentralization and school enrollment rates with added variables

	Independent variable: TSAP							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Decentralization	0.007***	0.007***	0.007***	0.006***	0.006***	0.006***	0.005***	0.005***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Sex		-0.070**	-0.068**	-0.070**	-0.069**	-0.071**	-0.100***	-0.099***
		(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.031)	(0.031)
Urbanization			0.007	0.009	-0.003	0.001	-0.004	-0.006
			(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Conflict				-0.026	-0.074***	-0.070***	-0.069***	-0.076***
				(0.020)	(0.022)	(0.022)	(0.022)	(0.022)
Density					0.000***	0.000***	0.000***	0.000***
					(0.000)	(0.000)	(0.000)	(0.000)
Corruption						-0.035*	-0.033*	-0.028
						(0.018)	(0.018)	(0.018)
Average income							0.013***	0.013***
							(0.002)	(0.002)
Investment expenditure								-0.020***
								(0.007)
Constant	4.434***	4.504***	4.498***	4.504***	4.489***	4.494***	4.397***	4.771***
	(0.009)	(0.033)	(0.034)	(0.034)	(0.034)	(0.033)	(0.037)	(0.137)
Observations	859	616	616	616	616	616	616	616
Municipalities	299	56	56	56	56	56	56	56
Standard errors in parenthes		*** p<0.01, ** *p<0.1		p<0.05,				

Source: Authors

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Conclusion and recommendations

The objective of this article was to analyze the effect of fiscal decentralization on early childhood education enrollment in Cameroon. To achieve this, we specified our model based on the work of Onana et Tchitchoua (2020) and Caldeira et *al*., (2012). This model was modified to incorporate variables likely to influence access to education. Estimating this model required the use of several estimation techniques, including time-fixed and common-fixed least squares, the CGM estimation method, and GMMs. Overall, the results obtained reveal that fiscal decentralization has a positive and significant effect on the number of classrooms per student, the number of desks per student, and the primary school enrollment rate. Overall, the results lead to the conclusion that, regardless of the approach taken (supply or demand for education), fiscal decentralization promotes access to early childhood education in Cameroon. It is clear that decentralization is an evolving and gradual process within Cameroonian political and administrative practices. However, the preceding findings suggest that the Government should increase the prerogatives of local authorities, particularly in the area of education. The reopening of the issue of school management under the auspices of local power structures suggests implementing financing mechanisms for local communities. All of these factors argue in favor of accelerating and intensifying decentralization in its various forms, both fiscal and financial, in order to stimulate local development through the provision of sustainable socioeconomic infrastructure capable of ensuring equal and equitable access to education for children. Therefore, it can be recommended that public investment in early childhood education be politically supported, but that its management be the prerogative of municipalities to allow for appropriate targeting.

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