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The role of education for alleviating poverty incidence in Egypt: urban-rural analysis

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Abstract

Purpose – This study explores the relevance of education in reducing poverty in Egypt's rural and urban areas.
Design/methodology/approach – The study applies the logistic model to Analyse Household Income Expenditure survey data.
Findings – The results indicate that spending on education in urban regions is higher than in rural areas. Second, the percentage of illiteracy in rural areas is higher than in urban areas. Third, educational spending is significantly inversely related to poverty across various geographical regions of Egypt. Fourthly, the more educated the head of the family is, the less likely the family is to fall into poverty. Finally, the potential for education to alleviate poverty in rural areas is more significant than in urban regions of Egypt.
Research limitations/implications – The suggested approach should be applied on data from different countries.
Practical implications – The paper suggests worthy policy recommendations for policy makers in Egypt.
Social implications – Results of the study worthy as it emphases the role of education in the society.
Originality/value – Based on microdata analysis, the study compares the potential role of education in combating poverty in Egypt's urban and rural areas. Thus, it can be used as a decision-support tool for policymakers.

Keywords Education, Spending on education, Poverty, Human development, Logistic regression
Paper type Research paper

1. Introduction

Poverty is among the most chronic economic, social and political dilemmas facing all developing economies. It threatens peace, security, political and social stability in poor countries (Balvociute, 2020; Bossert *et al.*, 2022).

Poverty refers to an individual's inability to acquire the minimum requirements for surviving in a specific society (Casserly, 2021). It is one of the most important issues occupying decision-makers in developing countries. Therefore, the United Nations made eradicating poverty in all its forms a priority of the seventeen Sustainable Development Goals 2030 (Hickmann *et al.*, 2023).

Education and human capital have assumed priority as prerequisites for pursuing economic growth and alleviating poverty (Moyo *et al.*, 2022). Walker *et al.* (2019) confirmed that providing quality education and ensuring equality in educational opportunities can lower poverty levels. As a result, children from low-income families often receive substandard education, limiting their skills for competitive employment. Moreover, they cannot compete for good quality jobs paying reasonable salaries. Unfortunately, the cycle of poverty is too often repeated, with the children of low-income families also growing up to raise their children in poverty. In conclusion, they find escaping poverty difficult (Zhang, 2014, 2017; Kuka *et al.*, 2020; Liang, 2020; Sugiharti and Primanthi, 2022; Hickmann *et al.*, 2023).

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Education is regarded as the primary tool for supporting human capital and improving people's quality of life, thus stopping the poverty trap dilemma. Education can be defined as the acquisition of skills and knowledge to achieve a better future; therefore, each child should have the right to access an acceptable level of education (Bakhtiari and Meisamy, 2010). This can be justified in many ways: First, education can enhance expected future income, and it has been estimated that spending one additional year in education boosts an individual's future income by at least 10% (World Bank, 2021). Notably, the increase for each additional year spent in education causes an increase in future income by 25% for females (World Bank, 2018). Second, education can help to effectively reduce gender inequality in the community because well-educated women can earn more, whilst well-educated mothers can help to provide better conditions for their families (United Nations Population Fund, 2018). Third, education can improve the health of entire communities, thereby helping to further increase incomes, with educated people typically benefiting from better health and making fewer demands on healthcare services (World Health Organization, 2021). Finally, social cohesion and participation should improve due to education (UNESCO, 2011). Well-educated people are more likely to become involved in social work and the democratic process, thereby helping to improve decision-making processes and support the adoption of pro-poverty policies capable of tackling inequality (UNESCO, 2011).

Rural areas suffer from lower levels of human capital. Therefore, education indicators in these areas are less than in urban areas, which puts constraints on using up-to-date innovations and technology in economic operations (Imai *et al.*, 2015). Moreover, currently, most poor people live in rural areas. Research conducted by the World Bank Group (2016) using data from 89 developing economies revealed that 80% of poor individuals around the globe live in rural areas. Because those living in rural areas often lack access to good quality education, modern technology and well-qualified teachers, there is inequality in terms of the quality of education between urban and rural areas (Xie and Uddin, 2023). Therefore, applied studies have examined education's importance in alleviating poverty in rural areas of developing economies. For example, Phull *et al.* (2022) concluded that education is the key component required to help overcome poverty in rural Pakistan. Similarly, Liu *et al.* (2023) found evidence of the significant positive impact of education, especially compulsory education, in alleviating poverty in rural China.

Despite Egypt's long history of combating poverty through achieving sustainable economic growth and improving income distribution, it still suffers from persistent high poverty rates. It is classified as one of the lower-middle-income countries (AlAzzawi, 2023). The CAPMAS announced that approximately 29.74% of the Egyptian population was living in poverty at the end of the fiscal year 2020. In addition, the poverty rate in rural areas of Upper Egypt stood at 48.15%, compared to 28.96% in urban areas of Upper Egypt. Meanwhile, in rural areas of Lower Egypt, the poverty rate stood at 22.56%, compared to 11.16% in urban areas of Lower Egypt. In effect, such statistics double the challenge facing socio-economic policymakers when attempting to combat the problems of poverty and inequality in urban and rural areas. As a result, the Egyptian government has adopted various strategies and techniques to alleviate poverty. One of these techniques is promoting education as a tool for increasing knowledge and skills whilst also supporting personal capabilities, which can help people get better job opportunities and, thus, alleviate poverty.

The main goal of the current paper is to assess the potential role of education in combating poverty in both urban and rural areas of Egypt. The study also aims to explore the central policies that can be used to reform education in ways that help to alleviate poverty whilst considering rural areas. The paper's main contribution is comparing the role of education in combating poverty in the urban and rural areas of Egypt. This can help policymakers to optimally allocate resources between different regions in Egypt. Rural areas need more education facilities than urban areas in terms of amount or quality. Thus, improving equality between urban and rural areas should help reduce poverty in Egypt. Therefore, the study's

main hypothesis posits that an effective education policy prioritizing rural areas can significantly reduce poverty in Egypt.

The study is organized as follows: section (2) displays the theoretical framework and literature review; Section (3) shows the development of education and poverty indicators in Egypt's rural and urban areas; Section (4) depicts the model; Sections (5) outline discussion of the results; and finally, section (6) is a conclusion and policy recommendations.

2. Theoretical framework and literature review

Education is crucial in enhancing the quality of human capital skills and reducing poverty. The early economists realized the importance of education in the process of economic growth and the reduction of poverty levels. Gregory Mankiw *et al.* (1992) pointed out that education is the most critical element that generates technical progress in national economies. They introduced the aspect of human capital into the production function and confirmed that the high level of human capital leads to higher rates of economic growth and an improvement in the standard of living. Other scholars have recently adopted the idea that Education enhances individual and societal competitiveness, fostering overall community well-being (Antonin Rusek, 2015; Diana and Brînduşa, 2018). Furthermore, other scholars stated that education is a kind of investment with expected returns. Zhang (2017), for instance, pointed out that education can reduce the likelihood of being family poor as it increases family income. Similarly, Sacchidanand and Soma (2017) found that increasing expenditure on education leads to a decrease in the likelihood of poor individuals in Bangladesh. Besides, Wang *et al.* (2019) found that vocational education supports gained income. In addition, Iheonu and Urama (2019) found that increasing expenditures on education enhances individuals' skills and, thus, increases gained incomes and reduces poverty. Above and beyond, other studies concluded similar results, such as Efendi *et al.* (2019) for Indonesia by using Ordinary Least Squares; Marin (2020) for Romania based on the simple correlation method; Oke *et al.* (2020) for Nigeria by using Autoregressive distributed lag model; Xie *et al.* (2023) for 30 developing countries by systematic GMM model.

Some studies highlighted educational institutions, the quality of the educational process, and equal access to education as critical in combating poverty and improving economic growth (Chaudhry and Rahman, 2009; Santos, 2011). Accordingly, education can play a vital role in improving income and wealth distribution in society (Aiston and Walraven, 2024). Moreover, education contributes to reducing crime rates and terrorism and improving economic growth (Fabre and Augersaud-Veron, 2004; Chaudhry and Rahman, 2009; Pervez, 2014). Further, education can combat poverty by raising productivity, expanding opportunities for individuals, building their human capacities and productivity, and supporting the development process and economic growth (Yasir and Bashir, 2024). Also, education supports human competence, expands choices, and increases people's productive capabilities. Education is a prerequisite for adopting new technologies and modern production methods (Kim and Terada, 2013). Furthermore, education is linked to poverty in an inverse relationship because education increases knowledge and skills acquisition and higher productivity and wages (Garza-Rodriguez, 2018; Amaluddin, 2020; Adekeye, 2023; Spada *et al.*, 2023).

Concerning the indirect effects of education on combating poverty, Servas Berg (2008) investigated that the relationship operates through three channels: the ability of educated people to earn higher returns than the uneducated, the ability of educated people to get better wages, and to support economic growth. Similarly, Aisa *et al.* (2019) analyzed the determinants of poverty in Europe based on microdata and found demographic and social variables play a significant role. In addition, Shi and Qamruzzaman (2022) explored the expected impact of education on poverty reduction in 68 low-income and low-middle countries, and they concluded that the development of the financial system and enhancing education could contribute to poverty reduction.

As for Egypt, research on the relationship between education and poverty has not been given sufficient attention. Mohamed (2015) stated that diminishing education quality is the main cause of poverty in rural areas of Egypt. Further, he concluded that education is the primary determinant of poverty in Egypt. El Laithy and Armanious (2018) stated that poor people prefer to live together in particular places, and the key challenge of the government is reducing geographical distribution in Egypt. Ibrahim (2020) found that investment in education might lead to decreasing poverty under the condition that the government reduce inequality in income distribution. Okasha and Abdelsalam stated that increasing government spending on education helps improve the competitiveness of the economy. Mohamed Mait (2022) concluded that more public spending on social services is required for poverty reduction in Egypt.

The present study is inspired by the previous discussion on the impact of education on poverty, which has been extensively studied in many countries. However, the results of these studies show controversial views and diverse conclusions. This may be due to differences in methodologies and development policies. In Egypt, the research is devoid of tackling the relationship between education and poverty in terms of rural and urban areas.

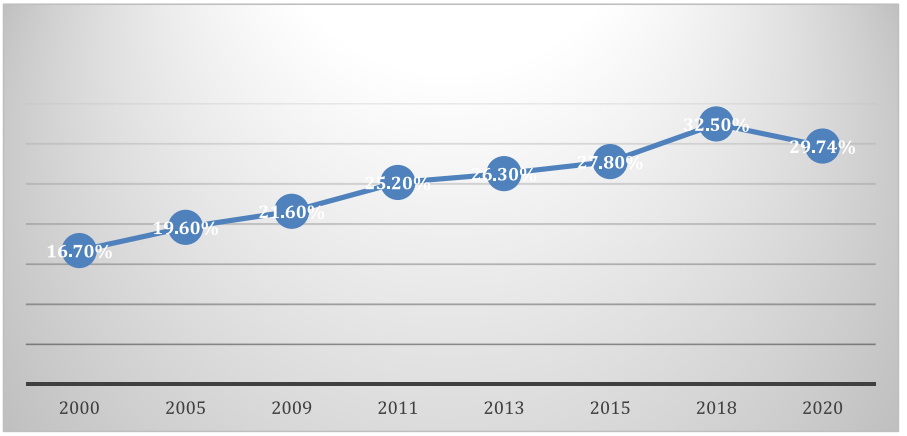
3. Development of poverty and education indicators in Egypt

It is clear from the previous theoretical presentation that poverty is a multidimensional concept. Poverty is not just caused by financial deprivation, either in income or spending, but rather, it is a concept linked to capabilities.

3.1 Development of poverty indicators in rural and urban areas of Egypt

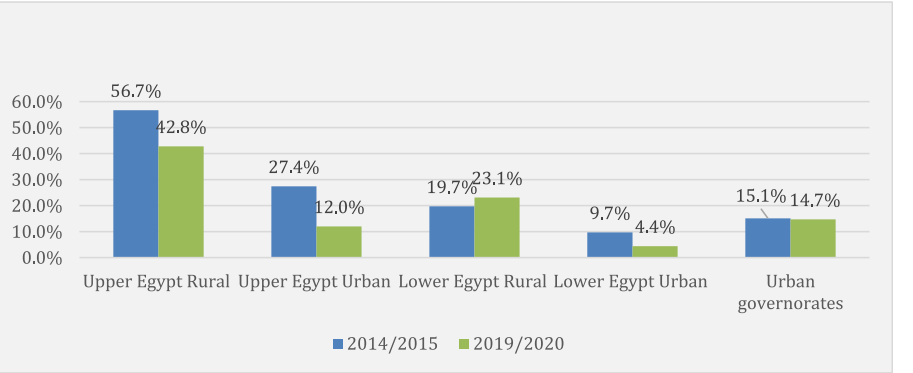
Figure 1 states that the poverty rate in Egypt increased from 16.7% in 2000 to 32.5% in 2018, but it decreased again to reach 29.74% in 2020. The decline might be due to social security programs that the government has adopted in Egypt over the last few years.

Figure 2 states that the poverty rate is high in rural areas relative to urban areas. The study observes that during 2020, the poverty rate was 48.1% in Upper Egypt rural areas compared to 12% in Upper Egypt urban areas and 23.1% in Lower Egypt rural areas compared to 4.4% in Lower Egypt urban areas. The primary reason for higher poverty rates in rural areas is the



Source(s): Central Agency for Public Mobilization and Statistics, Income, Expenditure and Consumption Survey, various issues

Figure 1. Development of poverty rates in Egypt during the period 2000–2020



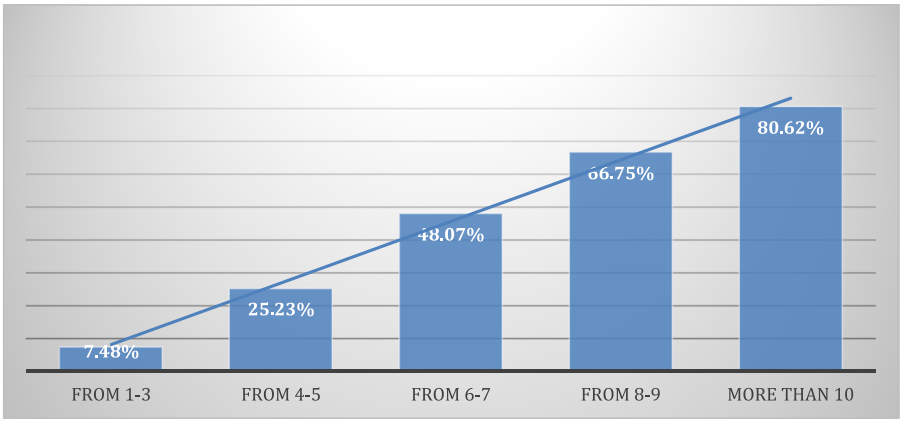
Source(s): Central Agency for Public Mobilization and Statistics, Income, Expenditure and Consumption Survey, various issues

Figure 2. Poverty rates in Egypt by place of residence for the period for years 2015 and 2020

reliance on low-yield small-scale farming, compared to more lucrative urban sectors like services and industry.

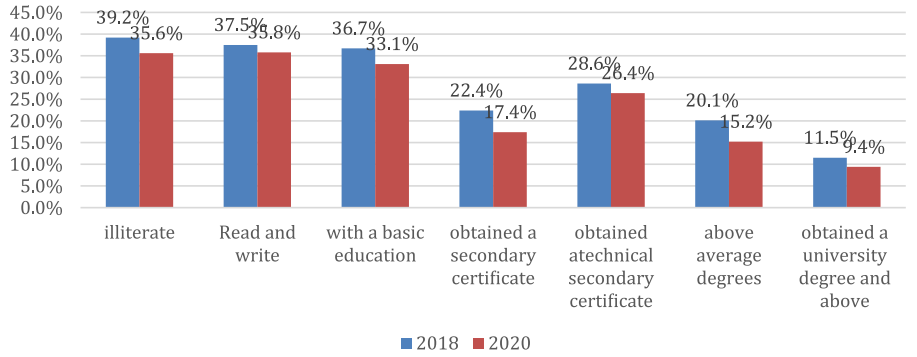
In addition, the CAPMAS data also indicate that the percentage of individuals in poverty increases with family size, as shown in Figure 3. In 2020, only 7.48% of individuals lived in families with less than 4 members, compared to 80.62% for individuals living in families with more than 10 persons. This sheds light on the importance of overcoming the overpopulation problem to solve the poverty dilemma in Egypt.

The outcomes of the family budget research showed that the low level of education is the most closely related factor to the risk of poverty in Egypt, as its indicators decrease as the level of education increases, as indicated in Figure 4. The percentage of people with low incomes among the illiterate reached 35.6% in 2020, compared to 9.4% for those who obtained a university degree in the same year. This calls for prioritizing education as a government strategy.



Source(s): Central Agency for Public Mobilization and Statistics, Income, Expenditure and Consumption Survey, various issues

Figure 3. Poverty rates in Egypt by family size in 2020



Source(s): Central Agency for Public Mobilization and Statistics, Income, Expenditure and Consumption Survey, various issues

Figure 4. Percentage of poverty according to education status in 2018 and 2020

3.2 Development of education indicators in rural and urban areas of Egypt

Table 1 indicates the development of the illiteracy rate of the population according to the place of residence and gender. This table shows that the illiteracy rate decreased from 39.4% in 1996 to 13.3% in 2020. Further, the illiteracy rate among females is higher than among males. This is due to the persistence of the adopted ideology of the importance of educating males, compared to females, and they also suffer from the problem of early marriage. Furthermore, illiteracy rates in rural areas are very high; it reached 16% compared to 9.6% in urban areas in 2020.

Table 2 states the public expenditure on education from 2009 to 2020. This table shows that although the value of expenditure on education increased from 41.6 Egyptian Billion pounds in 2010 to 132 Egyptian billion pounds in 2020, the percentage of public expenditure on education from the state's public expenditure has decreased from 12.9% in 2009/2010 to 8.4% in 2020, as explained in Figure 5.

4. The model

The study relies on the logistic regression model, which is the process of modeling the estimated probability of a discrete outcome given the existing data. This model depends on a specific algorithm for data classification (Edgar and Manz, 2017). Logistic regression is a statistical method that is used if the objective is to study the effect of number of independent variables on a binary qualitative variable (Tolles and Meurer, 2016). Therefore, the study depends on Binary logistic, a regression model with binary dependent variable; that is, it might only take two values, 0 or 1, or attempt to estimate the probability of an event arising or not arising. We can express the relationship as follows:

Table 1. The illiteracy rate of the population in urban and rural of Egypt (by %)

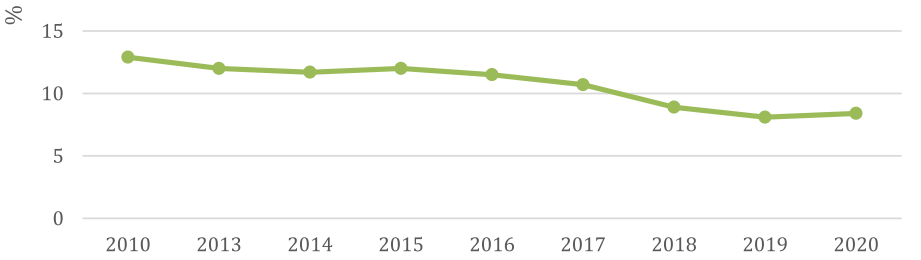
	Urban			Rural			All		
	Male	Female	All	Male	Female	All	Male	Female	All
1996	19.9	33.9	26.7	36.4	63.3	49.6	29.0	50.2	39.4
2020	6.9	12.3	9.6	10.2	21.9	16.0	8.8	17.8	13.3

Source(s): Central agency for public mobilization and statistics, population census

Table 2. State public expenditure on education (2010–2020)

	2010	2013	2014	2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
The state public expenditure	323.9	533.78	689.3	789.4	864.5	974.79	1,207	1,424	1574.5
Public expenditure on education	41.68	640	808.6	943.5	992.6	103.96	107	115.6	132

Source(s): Statistical yearbook, CAPMAS. Unit: Billion. L.E



Source(s): Statistical Yearbook, CAPMAS. Unit: Billion. L.E

Figure 5. Percentage of Public Expenditure on education in Egypt

$$Pov_i = \alpha + \beta EXP\_edu_i + \zeta EXPER_i + \eta FS_i + \theta MS_i + \vartheta Gen_i + \varrho Edu_i + u_i \quad (1)$$

Whereas:

(1) Pov_i: a dummy variable that expresses poverty; this variable is taken one if the family is poor and zero if the family is not poor. The family is defined as poor if their income is under a specific poverty line which is updated every year by CAPMAS.

(2) EXP_edu_i: family spending on education; this variable refers to the total annual value of expenses incurred by the family for education.

(3) $EXPER_i$: the experience variable expresses the knowledge or skill that an individual acquires from a specific job or activity for a certain period, and it is calculated by subtracting the years of age before school and the years of study from the total age of the head of the family.

(4) FS_i: the family size variable refers to the number of people who live in one house so that the family bears the responsibility for them.

(5) MS_i: the marital status variable indicates whether the person is still single or married or others.

(6) Gen_i: gender indicates whether a household is female or male, taking one in the case of male and zero in the other case.

(7) Edu_i: it refers to the level of education of the head of the family.

The logistic regression model is based on a primary hypothesis; the dependent variable under study (y) is a two-valued variable that follows the Bernolli distribution with probability (p) to

take the value (1) and the probability ($q = 1-p$) to take the value (0), which means the likelihood of an event occurring or not. The logistic model can be expressed as follows:

$$y = \alpha_0 + \alpha_1 x + \varepsilon \tag{2}$$

Since it is the calculated value of the dependent variable under study, the model can be written as follows:

$$E(y/X) = \widehat{y} = \widehat{\alpha}_0 + \widehat{\alpha}_1 X \tag{3}$$

As it is known in the traditional regression that the right-hand side of these models takes values from $(+\infty)$ to $(-\infty)$, but when there are two variables, one of them is binary (y), then simple linear regression is not appropriate because:

$$E(y/X) = P(y = 1) = P' \tag{4}$$

Thus, the value of the right-hand side is restricted between the two numbers (0,1) and therefore, the model is not mathematically applicable (Kibet *et al.*, 2019), and a mathematical transformation must be performed on the dependent variable, and the natural logarithm of the probabilities of the dependent variable can be taken or equal to $\frac{p}{q}$, and therefore the regression can be written as Kutner *et al.* (2004):

$$\log_e\left(\frac{p}{q}\right) = \widehat{\alpha}_0 + \sum_{i=1}^{k} \widehat{\alpha}_j X_{ij} \tag{5}$$

Where $i = 1, 2, \ldots, n$; $j = 1, 2, \ldots, k$

Thus, the previous equation can be reformulated as follows:

$$P = \frac{1}{1 + \exp\left[-\left(\widehat{\alpha}_0 + \sum_{i=1}^{k} \widehat{\alpha}_j X_{ij}\right)\right]} \tag{6}$$

Where: exp is the inverse of the natural logarithm. This model is called the Logistic Regression Model.

Where, some tests might be utilized to judge the quality of the logistic regression and the ability of this model to predict the relationship in the future. Those tests such as: Wald test, Omnibus Tests of Model Coefficients, Explained variance ratio test, percentage of correct classification of the logistic regression model, and Exponential regression coefficient Odds Ratio test (Hosmar and Lemeshow, 2000).

5. Empirical results

The study utilizes HIECS data provided by CAPMAS for the years 2005 and 2020. The total sample size in 2005 was about 21,465 subjects, divided into 12,429 subjects for rural areas and 9,036 subjects for urban areas. The total sample size for 2020 is 10,653 subjects, divided into 5,858 subjects for rural areas and 4,795 for urban ones.

We can distinguish between two types of statistics. The first type is qualitative statistics, which relate to the educational status of the head of the family. The second type is quantitative statistics, which relates to the statistics of the average annual income of the head of the family, total expenditure on education, the number of years of experience, the age of the head of the family, and the size of the family.

Table A1 presents the descriptive statistics for the quantitative variables in the sample under study, and this table indicates that the average income in urban areas for 2005 amounted to about 16,023 Egyptian pounds annually, compared to about 11,087 Egyptian pounds annually in the countryside. The average spending on education in 2005 was about 622 pounds annually in urban areas, compared to about 618 EGP annually in the rural, while the average family size in 2005 was approximately 4.03 people per household in urban areas, compared to about 4.68 members per household in rural areas.

Additionally, the same table indicates that the average income in urban areas for 2020 amounted to about 78431.86 pounds annually, compared to about 58435.7 pounds annually in the rural. Thus, the average income in urban areas is higher than in rural areas. The average expenditure on education in 2020 amounted to about 4,795 pounds per year in urban areas, compared to about 3,218 pounds per year in the countryside. Thus, the average expenditure on education in urban areas is higher than in rural areas. Moreover, the average family size for the year 2020 in urban areas was about 3.81 individuals per household, compared to about 4.24 individuals per household in rural areas, as shown in Table A1.

Table A2 indicates that the in 2005, the proportion of males in rural areas was approximately 45.6%, compared to about 38.8% in urban areas, and the Proportion of males in the rural areas in the sample was about 45%, compared to about 36% in the urban areas in 2020.

Table A3 indicates that the rate of illiteracy in rural areas was about 27.93% in 2020, compared to 17.91% in urban areas. The percentage of those who hold a high qualification, whether a bachelor's or above bachelor's degree, was about 10.08% in rural areas, compared to 21.77% in urban areas. Therefore, the education level in urban areas is better than in rural areas.

Tables A4–A6 refer to the results of diagnostics tests for the logistic regression model. The significant results, which are less than 0.05 for omnibus Tests of the Model, acceptable Explained variance ratio, and Corrected Rating percentages, which are higher than 80% of overall cases, confirm the validation of the adopted model.

Tables A7 and A8 review the logistic regression results for the effect of the explanatory variables and poverty in both rural and urban areas of Egypt and all over Egypt for the 2005 and 2020 surveys, respectively. Family size has a significant positive effect on the probability of falling below the poverty line, i.e. the greater the number of family members, the greater the probability of the family falling below the poverty line. The coefficient's value in 2020 is 0.7677 for urban areas and 0.827 for rural areas. The relationship between spending on education and poverty is negative in different geographical areas. An increase in education spending decreases the probability of a family falling below the income line. The coefficient's value in 2020 was −0.671 for urban areas and −0.654 for rural ones. The effect of the number of years of experience on poverty is negative. The coefficient's value in 2020 is −0.0399 for urban areas and −0.671 for rural areas. This indicates that the increase in experience decreases the probability of the family falling below the poverty line. Appendix depicts tables from 3 to 10 which indicate descriptive statistics and estimates of different models while Table A9 depicts different abbreviations which were used in the study.

6. Conclusion and recommendations

The study traces the impact of education in terms of its ability to alleviate poverty in urban and rural areas of Egypt. It tackles the theoretical framework mechanisms regarding the role of education in alleviating poverty. The study also presents the development of indicators for education and poverty in Egypt from 2009 to 2020. It conducts econometric analysis by applying HIECS data prepared by CAPMAS in a logistic model.

The results of the study confirm the following: First, the average income and spending on education are higher in urban areas of Egypt than in rural areas of the country. Second, families are smaller in urban regions than in rural areas. Third, the percentage of illiterate people in urban areas is lower than in rural areas. Fourth, spending on education is significantly

negatively related to poverty across various geographical areas of Egypt, thereby indicating that an increase in spending on education reduces the probability of families living in poverty. Moreover, the more highly educated the head of a family, the less likely it is that the family will experience poverty in both urban and rural areas. Furthermore, when measuring the correlation between poverty and education, the exponential regression coefficient is higher for rural areas than for urban areas. This indicates that the potential impact of education on rural poverty is more significant than it is in urban areas of Egypt, given the favorable effects of educating children in rural areas in terms of their standard of living, the income of their family, their health and habits.

From an economic policy perspective, the following recommendations can be emphasized: Firstly, providing illiteracy support programs in rural areas can help reduce illiteracy rates. Secondly, increasing the proportion of the state budget allocated to education could enhance access to high-quality education, thereby benefiting all individuals but disproportionately assisting those living in poverty. Thirdly, government programs intended to combat poverty should seek to increase community awareness about education's critical role in helping people break free from the poverty trap. Fourthly, the government should prioritize rural areas when considering education policies. Finally, the ratio of education allocations should be increased to support low-income families, especially those living in rural areas, and to encourage them to enroll their children in school.

The study's main limitation is that a more detailed study is required for the various governorates of Egypt. In addition, certain macroeconomic variables were omitted from the estimated model. Future research should, therefore, explore the effects in different governorates and incorporate additional explanatory variables, such as economic growth and government education spending, to provide a more comprehensive analysis of poverty alleviation strategies.

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Appendix

Table A1. Descriptive statistics for quantitative study variables (mean and standard deviation)

		Descriptive statistics for quantitative variables (mean and standard deviation)				
Year	Residence	Total income	Spending on education	Years of experience	Family size	Age
2005	Rural	11087.84 (7683.67)	618.34 (1648.83)	32.77 (15.37)	4.68 (2.12)	45.41 (14)
	Urban	16023.84 (15639.04)	622.89 (1650.72)	33.32 (14.79)	4.09 (1.79)	47.91 (13.50)
	All Egypt	13366.72 (12278.11)	620.45 (1649.67)	33.02 (15.11)	4.40 (1.99)	46.56 (13.83)
2020	Rural	58910 (32363)	3,218 (7,037)	36.9 (15)	5,858 (4.11)	47.23 (14.3)
	Urban	78431.86 (75939)	4,795 (6,471)	40 (15.16)	3.81 (1.5)	50.8536 (14.6)
	All Egypt	71003.21 (43352.76)	4478.48 (11,253)	35.48 (13.5)	4.75463 (1.8)	46.16 (12.9)

Source(s): Prepared by the researcher based on collected data

Table A2. Descriptive statistics for the gender

		Type of gender			
		Male		Female	
Year	Residence	Frequency	Ratio%	Frequency	Ratio %
2005	Rural	21,463	45.6	3,889	8.2
	Urban	18,267	38.8	3,476	7.4
	All Egypt	39,730	84.4	7,365	15.6
2020	Rural	4,861	45.6	997	9.3
	Urban	3,864	36.3	931	8.7
	All Egypt	8,725	81.9	1,928	18.1

Source(s): Prepared by the researcher based on collected data

Table A3. Descriptive statistics of the educational status

		Residence			
		Rural		Urban	
Year	Category	Frequency	Ratio %	Frequency	Ratio %
2005	Illiterate	2,338	19.5	969	8.1
	Reads and writes	864	7.2	575	4.8
	Obtaining a literacy certificate	171	1.4	112	0.9
	Certificate below average (Primary/Prep)	887	7.4	782	6.5
	Certificate medium	1,763	14.7	1,547	12.9
	Above average and below university degree	231	1.9	289	2.4
	Certificate at the bachelor's level and above	513	4.3	947	7.9
2020	Illiterate	1,636	27.93	859	17.91
	Reads and writes	661	11.28	451	9.41
	Obtaining a literacy certificate	122	2.08	79	1.65
	Certificate below average (Primary/Prep)	797	7.6	687	14.33
	Certificate medium	1,879	32.08	1,431	29.85
	Above average and below university degree	172	2.94	244	5.09
	Certificate at the bachelor's level and above	591	10.08	1,044	21.77

Source(s): Prepared by the researcher based on collected data

Table A4. Test the significance of the proposed model

The year	Residence	Maximum possible ratio −2 log likelihood	The fully adapted form morale test Omnibus tests of model coefficients Square chi-square	Calculated moral
2005	Rural	7835.109	5266.869	0.000 ***
	Urban	2320.351	2439.803	0.000 ***
	All Egypt	10261.915	8508.633	0.000 ***
2020	Rural	2138.50	1192.91	0.000***
	Urban	1271.59	712.39	0.000***
	All Egypt	1875.48	2040.77	0.000***

Note(s): ***Significant at 1% level
Source(s): Prepared by the researcher based on collected data

Table A5. Explained variance ratio

	Residence	Explained variance in the model Cox and Snell *R* square	Nagelkerke *R* square
2005	Rural	0.345	0.530
	Urban	0.237	0.578
	All Egypt	0.327	0.561
2020	Rural	0.591	0.838
	Urban	0.419	0.873
	All Egypt	0.518	0.849

Source(s): Prepared by the researcher based on collected data

Table A6. Corrected rating percentages (%)

Year	Residence	Views	Corrected rating ratio
2005	Rural	12,429	87.1
	Urban	9,036	95.2
	All Egypt	21,465	90.5
2020	Rural	5,858	94.4
	Urban	4,759	98.4
	All Egypt	10,617	96.6

Source(s): Prepared by the researcher based on collected data

Table A7. Estimates of logistic regression model for 2005

		Estimated parameters		Wald test			Exponential regression coefficient exp.(B)
	Explanatory variable	Regression coefficient	Standard error	Wald statistic	Degrees of freedom	Calculated significance	
Urban	Constant	−3.6	0.334	508.8	1	0.000***	0.025
	Experience	0.002	0.003	0.396	1	0.529	1.002
	Spending on education	0.001	0.000	0.039	1	0.843	1.000
	Family size	0.590	0.022	717.7	1	0.000***	1.804
	Marital status	−0.08	0.094	0.71	1	0.4	0.924
	Gender	0.168	0.192	0.760	1	0.383	1.182
	Education level	−0.452	0.029	235.4	1	0.000***	0.636
Rural	Constant	−2.299	0.207	123.5	1	0.000***	0.100
	Experience	−0.005	0.020	6.86	1	0.000***	0.995
	Spending on education	0.001	0.000	2.439	1	0.118	1.000
	Family size	0.462	0.120	1381.6	1	0.000***	1.587
	Marital status	0.006	0.540	0.011	1	0.918	1.006
	Gender	−0.135	0.101	1.788	1	0.181	0.874
	Education level	−0.348	0.019	323.8	1	0.000***	0.706
All Egypt	Constant	−2.4	0.171	201.2	1	0.000***	0.992
	Experience	−0.008	0.002	20.067	1	0.000***	1.000
	Spending on education	0.001	0.000	1.918	1	0.166	1.669
	Family size	0.512	0.011	2231.7	1	0.000***	0.986
	Marital status	−0.014	0.046	0.088	1	0.767	0.923
	Gender	−0.08	0.089	0.803	1	0.370	0.641
	Education level	−0.444	0.016	807.33	1	0.000***	0.088

Source(s): Prepared by the researcher based on collected data

Table A8. Estimates of logistic regression model for 2020

		Estimated parameters		Wald test			Exponential regression coefficient exp.(B)
	Explanatory variables	Regression coefficient	Standard error	Wald statistic	Degrees of freedom	Calculated significance	
Urban	Constant	1.66	1.663	1.159	1	0.09*	5.27
	Experience	−0.0399	0.022	0.55	1	0.07*	0.94
	Spending on education	−0.671	0.08	52.2	1	0.000***	0.511
	Family size	0.7677	0.099	61	1	0.000***	2.15
	Marital status	−0.655	0.5	7.2	1	0.248	1.3
	Gender	0.0566	0.3	4.4	1	0.950	1.02
	Education level	−0.0767	0.073	34	1	0.000***	0.926
Rural	Constant	1.86	0.92	1.485	1	0.04**	6.46
	Experience	−0.06	0.008	3.325	1	0.000*	0.941
	Spending on education	−0.654	0.033	384.69	1	0.000***	0.56
	Family size	0.8271	0.076	572.6	1	0.000***	2.28
	Marital status	0.154	0.208	4.9	1	0.4	1.16
	Gender	−0.24	0.357	12.9	1	0.41	0.781
	Education level	−0.574	0.061	36.5	1	0.00***	0.932
All Egypt	Constant	0.33	0.4	7.04	1	0.95	2
	Experience	−0.05	0.03	1.82	1	0.000***	0.97
	Spending on education	−1.214	0.4	10.3	1	0.000***	0.5
	Family size	1.27	0.39	0.105	1	0.000***	3.57
	Marital status	−13.52	2.5	2.6	1	0.8	0.02
	Gender	25.1	5	2.2	1	0.99	0.01
	Education level	−0.407	0.2	56.672	1	0.06*	0.66

Source(s): Prepared by the researcher based on collected data

Table A9. Abbreviations

CAPMAS	Central Agency for Public Mobilization and Statistics
UN	United Nations
Logit	Logistic regression
HIECS	Household Income Expenditure and Consumption Survey
WB	World Bank
UNFPA	United Nations Population Fund
WHO	World Health Organization

Source(s): Prepared by the researcher

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