



## Government Educational Expenditure and the Underground Economy in Iran: Application of the MIMIC Method and Quantile Regression Approach

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### Abstract

Government educational expenditures, as one of the most significant determinants of economic welfare, are not only a key instrument in development policymaking but also play a vital role in shaping human capital and strengthening the innovative capacities of society. According to the human capital theory, education enhances the skills and knowledge of the labor force, directly increasing productivity, and by facilitating the absorption of advanced technologies, it provides the necessary foundations for achieving higher levels of economic development. However, despite extensive studies on the effects of educational expenditures on macroeconomic variables such as economic growth, employment rate, and inequality reduction, the role of such expenditures in controlling the underground economy—as an informal sector that negatively affects tax revenues, market transparency, and social justice—has received little attention. To address this gap, the present study first estimated the size of the underground economy using the Multiple Indicators Multiple Causes (MIMIC) model, revealing an average underground economy size of 20.3 percent in Iran's economy. Subsequently, employing the quantile regression method, the impact of government educational expenditures on the underground economy was examined over the period 1986–2023. The results indicate that government educational expenditures have a negative (desirable) effect on the underground economy, with the strongest impact observed in the highest quantile (0.900). Moreover, unemployment and trade openness exert a positive (undesirable) influence on the underground economy, while the size of government has a negative (desirable) effect. The findings of this study provide valuable guidance for policymakers in reducing the size of the underground economy and enhancing economic transparency in the country.

**Keywords:** Underground Economy, Government Educational Expenditures, Quantile Regression, Multiple Indicators-Multiple Causes, Iran.

**JEL Classification:** O17, H52, C21.

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## 1. Introduction

The underground economy exerts strong negative effects on a country's overall health. Politically, it sends misleading signals and undermines the credibility of policymakers. From a macroeconomic perspective, the underground economy reduces tax revenues, thereby affecting the financing of social security systems and the government's ability to provide goods and services. From a microeconomic standpoint, it tends to disrupt fair competition among firms, limits the creation of formal employment, and leads to productive inefficiencies. Given that governments must allocate limited resources across competing priorities (defense, education, infrastructure, etc.), it is important to understand whether the positive relationship between public spending and economic outcomes holds across different components of public expenditure. In particular, it is crucial to examine whether this positive relationship applies to government educational spending, which is considered a key policy instrument. Government spending on education, with its focus on human capital formation, is expected to lead to direct productivity gains, greater innovation, and higher levels of development. Moreover, government expenditures aimed at raising educational attainment should be reinforced for at least two reasons. First, education positively affects income returns and increases the opportunity cost of participating in underground economic activities (the human capital effect). Second, education contributes to the formation of civic values and enhances the perceived importance of tax compliance (the tax morale effect). Recently, a growing body of empirical evidence has emerged on the relationship between education and the underground economy, though these studies report mixed findings. In light of the theoretical framework and the gap in domestic research, the central question of this study is as follows: Does government educational expenditure in Iran have a significant effect on the size of the underground economy? And if so, in what way? This study estimates the relative size of the underground economy using the Multiple Indicators Multiple Causes (MIMIC) method over the period 1986 to 2023. It then investigates the relationship between government educational spending and the size of the underground.

## 2. Theoretical framework

through several key channels. Formal education enhances individuals' skills and employability, increasing their chances of entering the official labor market and reducing participation in informal or illegal activities. Conversely, educational inequality and limited access can push individuals—especially in underserved regions—toward underground employment due to a lack of viable formal job options. Informal learning and adaptive skills also influence this dynamic, as individuals without access to formal education may acquire competencies through unconventional means that align with informal sector opportunities. The expansion of the underground economy can negatively affect the education system itself. Reduced tax revenues limit government budgets, leading to underfunded schools, shortages of qualified teachers, and declining infrastructure quality. Skilled workers participating in informal activities represent a loss of human capital for the formal sector. Additionally, corruption within educational institutions may undermine the credibility of academic credentials. Theoretical frameworks such as human capital theory and institutional theory emphasize that investment in education and strong institutional governance can reduce the scope of the underground economy and support sustainable development.

### 3. Methodology

In statistics and econometric literature, the mean is considered a measure of central tendency, but its value alone cannot fully describe the shape of a distribution. Consequently, conventional regression methods—based on the conditional mean—have limitations and cannot adequately capture the effects of explanatory variables across different levels or quantiles of the dependent variable. To address this, quantiles or percentiles can be used collectively to provide a more comprehensive picture of the distribution and the relationships among variables. Unlike the traditional Ordinary Least Squares (OLS) method, quantile regression is a semi-parametric approach. It represents a fundamental analytical tool in statistics and a key method in applied statistical analysis for studying economic and social phenomena. This technique avoids the use of fixed parameters across the entire distribution (De Silva, 2008) and allows for a more nuanced explanation of the relationship between the dependent variable and the model's explanatory variables. Most domestic studies on the underground economy focus on mean-based regression parameters and fail to examine the asymmetric effects of explanatory variables. Therefore, this study employs the quantile regression model.

The quantile regression model can be expressed as follows:

$$\text{Quant}_{\tau}(UER_t | X_t): UER_t = \delta_t + \beta_{\tau} x_t + u_t$$

Here,  $x_t$  is the vector of explanatory variables, and  $\beta_{\tau}$  is the vector of estimated parameters.  $\text{Quant}_{\tau}(UER_t | X_t)$  represents the  $\tau$  (where  $(0 < \tau < 1)$ ) conditional quantile of the underground economy given the values of the explanatory variables  $x_t$ .

### 4. Discussion

This study investigates the impact of government educational expenditure on the size of the underground economy in Iran. To estimate the effects, quantile regression was employed. Initially, the relative size of the underground economy was calculated using the MIMIC method over the period 1986–2023. The results indicate an upward trend with considerable fluctuations. The highest and lowest estimated shares of the underground economy occurred in 2023 and 1986, at 26.3% and 15.1%, respectively, with an average of 20.3% over the study period. Government educational expenditure also showed a highly volatile pattern across different development plans. The regression results reveal that educational spending by the government has a desirable (negative) effect on the underground economy. This suggests that increased investment in education plays a key role in strengthening economic and social institutions. Such spending typically includes infrastructure development, improved access to educational facilities, and enhanced quality of instruction. These measures help reduce inequality in educational access and promote equal opportunities. Theoretically, when the government allocates more resources to education, more individuals enter the formal labor market, reducing their inclination to participate in informal activities. Additionally, educational investment can boost public trust in government institutions by signaling a commitment to social welfare. Among other explanatory variables in the model, unemployment and trade openness had undesirable (positive) effects on the underground economy, while government size had a desirable (negative) effect. Notably, the absolute coefficient of unemployment was the largest, indicating its strong influence on the underground economy in Iran.

## 5. Conclusion

**Expand Educational Infrastructure:** The government should allocate more budget to building schools and universities, improving educational facilities, and integrating modern technologies. These efforts not only enhance literacy and workforce skills but also create legal and stable job opportunities, reducing incentives for informal employment. Investment in vocational and entrepreneurial education can empower youth to launch formal businesses and reduce reliance on the underground economy.

**Supportive Incentives:** Complementary policies such as scholarships, low-interest student loans, and tax exemptions for private educational institutions can improve access to quality education. Public awareness campaigns about the risks of informal work, combined with life and financial skills training, can promote a culture of legal employment and economic transparency.

**Reduce Unemployment:** To address unemployment—a major driver of informal activity—the government should strengthen skill-based training programs and create sustainable jobs. Investing in large infrastructure projects (e.g., roads, hospitals, power plants) can generate employment and draw individuals away from the informal sector. Incentives like subsidies for SMEs hiring new workers and reducing bureaucracy in business registration can further attract labor into the formal economy.

**Expand Government Size:** Increasing public services and strengthening regulatory institutions can help reduce the underground economy. Allocating more funds to hire personnel in education, healthcare, and security sectors can shift labor toward formal employment. Enhancing the tax system with modern technologies to monitor transactions and reduce evasion enables better resource mobilization and curbs illegal activities.

**Manage Trade Openness:** To control the underground economy linked to external trade, the government can support domestic production and reduce import dependency. Raising tariffs on non-essential imports and subsidizing local industries can strengthen domestic producers and expand formal employment. Promoting economic self-sufficiency through investment in agriculture and industry can reduce incentives for informal cross-border trade and limit illegal international transactions.

## 6. Ethical considerations

### 6.1. Compliance with ethical guidelines

Any violation of the copying of this research will be prosecuted.

### 6.2. Funding

This research does not have the financial support of any organization or person.

### 6.3. Authors' Contribution

The authors have contributed equally in writing the paper.

### 6.4. Conflict of interest

The authors declare that there is no conflict of interest in this research.

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