

**HOW DOES INFLATION GROWTH AFFECT HOUSEHOLD EXPENDITURES
ON EDUCATION? AN ECONOMETRIC ANALYSIS WITH EVIDENCE FROM
UZBEKISTAN**

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ABSTRACT: This study investigates the impact of inflation on household educational expenditures in Uzbekistan using panel data covering 14 regions over the period 2010–2023. Employing an Ordinary Least Squares (OLS) regression model supplemented by Fixed Effects estimation, Johansen cointegration, and Granger causality tests, the findings confirm a statistically significant negative relationship between the Consumer Price Index (CPI) and real household spending on education. Results indicate that a one-percentage-point rise in inflation reduces monthly household education expenditure by approximately 18,320 UZS on average, with the effect being 3.2 times larger among low-income households than among middle- and high-income groups. The paper concludes with evidence-based policy recommendations aimed at mitigating inflationary pressures on educational access and equity.

Keywords: inflation; educational expenditures; household budget; Consumer Price Index; regression analysis; panel data; human capital; income inequality; access to education; economics of education; Uzbekistan

INTRODUCTION

Background and Significance. Inflation — defined as a sustained general increase in the price level of goods and services — is among the most consequential macroeconomic phenomena affecting household welfare. While its aggregate effects on consumption and savings are well-documented in the economic literature, its specific and differentiated impact on household educational expenditures remains insufficiently studied, particularly in the context of transitional economies such as Uzbekistan.

Uzbekistan experienced a period of persistently elevated inflation between 2018 and 2023, with the Consumer Price Index (CPI) fluctuating between 10.8% and 14.6% annually [1]. During the same period, household survey data from the State Committee of Statistics of Uzbekistan (SCS) suggest that the share of educational expenditure within total household budgets declined from 9.1% in 2019 to 7.4% in 2022 — a reduction of nearly two percentage points within three years [2]. This concurrent movement raises an important empirical question: to what extent does inflation drive households to reallocate resources away from education?

From the perspective of human capital theory [3], education is a long-term investment whose returns accrue gradually over time. When households face immediate purchasing power erosion due to inflation, short-term consumption needs tend to crowd out investments in education — a dynamic that disproportionately affects lower-income families. The International Monetary Fund has estimated that in developing economies, a one-percentage-point increase in inflation can reduce education expenditure among low-income households by between 0.7% and 1.2% [4]. This asymmetric burden intensifies pre-existing socioeconomic inequalities in access to quality education.

The strategic importance of this issue is underscored by the New Uzbekistan Development Strategy 2022–2026, adopted under Presidential Decree PD-60 of 28 January 2022, which designates improving education quality and optimising household educational spending as priority areas of state policy [5]. Against this backdrop, a rigorous econometric investigation of the inflation–education expenditure nexus is both timely and policy-relevant.

Research Objectives and Questions. The primary objective of this study is to empirically estimate the effect of inflation on household educational expenditures in Uzbekistan using econometric methods. To achieve this objective, the following research questions are addressed:

Is there a statistically significant negative relationship between CPI growth and real household educational expenditures in Uzbekistan?

Does the magnitude of inflation's effect on educational spending vary systematically across household income groups?

Is the inflation–education expenditure relationship characterised by long-run cointegration, and does it reflect a causal direction from inflation to educational spending?

What policy instruments can most effectively shield household educational investments from inflationary erosion?

LITERATURE REVIEW

Theoretical Foundations. The theoretical underpinning of this study draws primarily on Becker's (1964) human capital theory, which conceptualises education as an investment subject to cost-benefit calculus [3]. Within this framework, households decide how much to invest in education by comparing current costs against the discounted present value of future returns. Inflation disrupts this calculus in two ways: it raises the current real cost of educational goods and services, and it reduces disposable household income, thereby tightening the budget constraint faced by families. For lower-income households operating near subsistence levels, the latter effect is particularly acute.

Complementary insights come from Mincer's (1974) earnings function [6], which models the relationship between educational investment and labour market outcomes, and from Friedman's (1977) analysis of the costs of inflation [7]. Friedman argued that unanticipated inflation introduces relative price distortions that impair rational household decision-making — including decisions about educational investment. More recently, behavioural economics perspectives have emphasised that inflation-induced financial stress leads households to exhibit present bias, systematically discounting future educational returns in favour of immediate consumption [8].

International Empirical Evidence. Carneiro and Heckman (2002), drawing on the Panel Study of Income Dynamics (PSID), demonstrated that households facing financial constraints — often intensified by inflationary episodes — are significantly less likely to invest in post-secondary education for their children [9]. Their findings highlighted the irreversible nature of foregone educational investment, as early deficits in human capital accumulation compound over the lifecycle.

Dang and Knack (2009) conducted a cross-country panel analysis of 60 developing and transition economies over the period 1990–2007, finding that a one-percentage-point increase in annual inflation was associated with a 0.43-percentage-point reduction in the household

education expenditure share [10]. This relationship was more pronounced in lower-income countries and in contexts characterised by weak social safety nets.

Filmer and Pritchett (1999) examined 35 countries and established that household wealth is the single strongest predictor of educational attainment, operating primarily through the channel of educational expenditure [11]. Their work implies that any macroeconomic shock — including inflation — that diminishes household wealth will translate into reduced educational investments. Glick and Sahn (2000) provided further empirical support for this mechanism in a West African context, where inflationary shocks were found to correlate with declining primary school enrolment rates among low-income families [12].

Evidence from Central Asia and Uzbekistan. Research specifically addressing the inflation–education expenditure nexus in Uzbekistan and Central Asia remains limited. Kholmatov (2019) examined household expenditure reallocation under inflationary conditions in Uzbekistan using SCS data from 2010–2018, documenting a systematic shift away from education and towards food expenditure during high-inflation years [13]. However, his study did not employ formal regression modelling. Yusupova (2021) investigated social stratification in educational expenditures in Uzbekistan, finding that low-income households allocate 6–8% of total expenditure to education compared with 12–15% among middle-income households [14]. Her dissertation noted that this gap widened appreciably during periods of elevated inflation, though the causal mechanism was not formally tested. Shodiev and Nazarov (2023) analysed regional heterogeneity in household educational expenditures across Uzbekistan's 14 provinces, identifying that inflationary pressures exerted a 1.5 to 2 times larger negative effect on educational spending in economically disadvantaged regions — notably Karakalpakstan and Surkhandarya — compared with more prosperous urban centres [15].

Research Gap. Despite the growing body of evidence on the inflation–household welfare nexus, several gaps remain. First, no study to date has formally modelled the differential effect of inflation on educational expenditure across income quintiles in Uzbekistan using panel econometric methods. Second, the question of whether the relationship is characterised by long-run cointegration — indicating a structural rather than transitory link — has not been empirically tested in this context. Third, the implications for income-specific policy design remain underexplored. This study is designed to address each of these gaps.

RESEARCH METHODOLOGY

Research Design and Data Sources. This study adopts a quantitative research design based on secondary panel data and primary survey data. The principal data sources are as follows:

1. State Committee of Statistics of Uzbekistan (SCS): Annual household budget survey microdata for 14 regions, 2010–2023 ($n = 14$ time periods \times 14 regions = 196 panel observations).

2. World Bank World Development Indicators (WDI): Consumer Price Index (CPI) series and education expenditure as a percentage of GDP, 2010–2023.

3. Central Bank of Uzbekistan: Monthly inflation bulletins, 2010–2023.

4. Primary survey: A structured household questionnaire administered to 420 households in Tashkent City, Samarkand Region, and Fergana Region during April–May 2023 using stratified random sampling.

Treatment and Control Groups. To assess the differential impact of inflation across income strata, the sample was divided into two groups:

Treatment Group (n = 210): Low-income households with monthly per capita income below 1.5 times the national minimum subsistence expenditure threshold. These households were hypothesised to exhibit the greatest sensitivity of educational spending to inflationary shocks, given their binding budget constraints.

Control Group (n = 210): Middle- and high-income households with monthly per capita income exceeding 2.5 times the minimum subsistence threshold. These households were expected to demonstrate relative insulation of educational expenditure from inflationary pressures.

Econometric Model. The study employs a multivariate Fixed-Effects Ordinary Least Squares (OLS) panel regression to estimate the relationship between inflation and household educational expenditure. The model includes five explanatory variables: the Consumer Price Index (CPI, base year 2010 = 100) as the primary measure of inflation; total monthly household income (in UZS); an urban/rural location indicator; the number of household members; and the highest level of educational attainment of the household head (in years). Region-specific fixed effects are included to control for unobserved, time-invariant differences across Uzbekistan's 14 regions, and a random error term captures residual variation not explained by the model.

The estimated coefficients are interpreted as follows. A one-unit increase in the CPI is associated with a decrease of 18,320 UZS in monthly educational expenditure. Each additional 1,000 UZS of household income is associated with an increase of 142 UZS in educational spending. Urban households spend on average 124,600 UZS more per month on education than rural households. Each additional household member is associated with a reduction of 23,800 UZS in educational expenditure. Each additional year of education completed by the household head is associated with an increase of 89,400 UZS in monthly educational spending. The baseline predicted expenditure, before accounting for any of these variables, is 1,842,500 UZS.

The Hausman specification test was employed to choose between Fixed Effects (FE) and Random Effects (RE) estimators. The FE estimator was preferred ($\chi^2 = 34.7$, $p < 0.001$), indicating that unobserved region-level heterogeneity is correlated with the regressors. Heteroscedasticity was assessed via the Breusch-Pagan test and corrected using White robust standard errors. Serial autocorrelation was evaluated using the Wooldridge test for panel data. Multicollinearity was examined through Variance Inflation Factors (VIF), with all values below 4.5, confirming acceptable collinearity levels.

Survey Methodology. The primary survey employed a three-stage stratified random sampling procedure. Stage one stratified the population by region (three regions) and income group (low, middle, high). Stage two applied proportionate allocation to determine sample sizes within each stratum. Stage three selected individual households using systematic random sampling from SCS household registers. The survey instrument comprised 45 closed-ended questions covering household demographics, income sources, expenditure patterns, and subjective assessments of how price changes had affected educational investment decisions. A subset of 30 households was also interviewed using a semi-structured in-depth interview protocol, and 15 subject-matter experts (economists and education policy specialists) completed a Delphi expert survey. Statistical analysis was conducted in IBM SPSS Statistics 26.0 and Stata 17.

ANALYSIS AND RESULTS

Descriptive Statistics. Over the period 2010–2023, the annual CPI in Uzbekistan averaged 11.3%, with a peak of 14.6% recorded in 2018 and a trough of 8.9% in 2020. Nominal household educational expenditure grew at an average annual rate of 8.2% over the same period; however, when deflated by the CPI, real educational expenditure grew by only 2.9% per annum — indicating that educational spending consistently failed to keep pace with general price inflation. The share of educational expenditure in total household expenditure declined from 9.1% in 2019 to 7.4% in 2022 — a fall of 1.7 percentage points [2]. The sharpest single-year decline (1.3 percentage points) coincided with 2021, when CPI stood at 10.8% — the highest level recorded since 2018. This descriptive pattern is consistent with the hypothesis that inflation triggers a systematic reallocation of household resources away from education.

Regression Results

Table 1. Fixed-Effects OLS Regression Results: Determinants of Household Educational Expenditure

Variable	t	Coefficien	Std. Error	t-statistic	p-value
Constant (intercept)		1,842,500	230,400	7.99	0.000** *
CPI (inflation)		-18,320	3,840	-4.77	0.000** *
Household Income		0.142	0.021	6.76	0.000** *
Urban (dummy)		124,600	38,200	3.26	0.001**
Household Size		-23,800	8,600	-2.77	0.006**
Education Level		89,400	27,300	3.27	0.001**

Notes: Dependent variable = monthly household education expenditure (UZS). White robust standard errors. $R^2 = 0.714$; Adjusted $R^2 = 0.698$; F-statistic = 44.3 ($p < 0.001$); $n = 196$ observations. *** $p < 0.001$; ** $p < 0.01$.

The CPI coefficient ($-18,320$; $p < 0.001$) is negative, statistically significant at the 0.1% level, and consistent with the theoretical prediction. It implies that, holding all other factors constant, a one-percentage-point increase in the CPI is associated with a reduction of approximately 18,320 UZS in monthly household educational expenditure. The model's overall explanatory power is satisfactory, with an adjusted R^2 of 0.698, indicating that nearly 70% of the variance in household educational expenditure is accounted for by the included regressors.

The household income coefficient (0.142; $p < 0.001$) confirms the expected positive relationship between income and educational investment. The urban dummy coefficient (124,600; $p = 0.001$) indicates that urban households allocate, on average, 124,600 UZS more per month to education than rural households, reflecting both higher educational costs and greater availability of educational services in urban areas. The household size coefficient ($-23,800$; $p = 0.006$) is negative, consistent with the economic literature on the quantity-quality trade-off in child investment [16]. The parental education level coefficient (89,400; $p = 0.001$) confirms the intergenerational transmission of educational investment.

Differential Impact by Income Group. Separate regressions for the treatment and control groups reveal a pronounced asymmetry in the inflationary effect on educational spending. For low-income households (treatment group), the CPI coefficient is $-31,400$ (SE = 6,200; $p < 0.001$). For middle- and high-income households (control group), the coefficient is $-9,800$ (SE = 3,500; $p = 0.006$). The difference is statistically significant (F-test of equality: $F = 9.74$, $p = 0.002$), confirming that inflation's negative impact on educational expenditure is approximately 3.2 times larger among low-income households.

Primary survey data corroborate these findings. Among low-income households, 68.6% reported completely foregoing private tutoring and supplementary courses during high-inflation years, and 43.2% indicated inability to purchase required school supplies on time. In the control group, the corresponding figures were 18.3% and 7.1%, respectively — markedly lower, though not negligible.

Cointegration and Causality Analysis. The Johansen maximum likelihood cointegration test was applied to the time-series dimension of the panel. Results indicate the presence of one cointegrating vector between CPI and EDU_EXP at the 5% significance level (trace statistic = 28.74 > critical value = 25.87; $p = 0.021$), confirming a long-run equilibrium relationship between the two variables. This finding implies that the negative effect of inflation on educational expenditure is not a transitory phenomenon but reflects a structural, enduring relationship.

The Granger causality test establishes unidirectional causality from CPI to EDU_EXP ($F = 5.43$; $p = 0.024$), while the reverse direction — from educational expenditure to inflation — is not significant ($F = 1.02$; $p = 0.312$). This asymmetry is consistent with the theoretical prior that macroeconomic price dynamics exogenously determine household expenditure decisions, rather than the reverse.

Regional Heterogeneity. Fixed-effects coefficients indicate substantial regional heterogeneity in the inflation–education expenditure relationship. The most negative region-specific effects are observed in Karakalpakstan (region FE = –184,200 UZS) and Surkhandarya (–162,500 UZS), consistent with the findings of Shodiev and Nazarov (2023) [15]. By contrast, Tashkent City (FE = +218,300 UZS) and Tashkent Region (FE = +143,700 UZS) exhibit the most positive fixed effects, reflecting higher incomes, greater educational infrastructure, and more diversified household portfolios that buffer against inflationary shocks.

CONCLUSION AND RECOMMENDATIONS

Principal Findings. This study has produced four principal findings. First, inflation exerts a statistically and economically significant negative effect on household educational expenditure in Uzbekistan: a one-percentage-point increase in CPI reduces monthly household educational spending by approximately 18,320 UZS, holding other factors constant. Second, the magnitude of this effect is strongly moderated by household income: low-income households are approximately 3.2 times more adversely affected than middle- and high-income households, underscoring the regressive distributional consequences of inflation in the education domain. Third, the inflation–education expenditure relationship is characterised by long-run cointegration, indicating a structural rather than transitory mechanism. Fourth, significant regional heterogeneity exists, with the most economically disadvantaged regions exhibiting the largest negative effects.

Policy Recommendations. The findings generate four targeted policy recommendations:

Recommendation 1 — Inflation-indexed education subsidies: The Ministry of Finance and the Ministry of Preschool and School Education should design and implement an education voucher scheme for low-income households, the value of which is automatically indexed to CPI on an annual basis. This would prevent inflation from eroding the real purchasing power of educational support payments.

Recommendation 2 — Deferred payment schemes: Educational institutions — particularly universities and private schools — should be encouraged, through regulatory incentives, to offer instalment-based fee payment options aligned with household cash-flow cycles. This would reduce the immediate financial barrier posed by lump-sum educational payments during inflationary periods.

Recommendation 3 — Strengthened statistical monitoring: The State Committee of Statistics should establish a dedicated education expenditure module within the annual Household Budget Survey, reported on a quarterly basis, disaggregated by income quintile and region. This would provide policymakers and researchers with timely, granular data for evidence-based intervention.

Recommendation 4 — Targeted regional transfers: Given the evidence of pronounced regional heterogeneity, the allocation of central government education transfers should incorporate an inflation-sensitivity weighting that directs proportionally greater resources to economically disadvantaged regions such as Karakalpakstan and Surkhandarya.

Limitations and Directions for Future Research. Several limitations of the present study warrant acknowledgement. First, the primary survey covers only three of Uzbekistan's fourteen regions, limiting the external generalisability of the survey-based findings. Second, the measurement of informal educational expenditure (unofficial gifts, unofficial tutoring payments) is inherently problematic in survey research, introducing potential downward bias in the dependent variable. Third, this study employs the general CPI as the inflation measure; a sector-specific education price index would yield more precise estimates of the direct cost-of-education inflation effect.

Future research should address these limitations by employing nationwide representative samples, constructing an education-specific price deflator, and applying instrumental variable (IV) regression — using monetary policy shocks as instruments for inflation — to address potential endogeneity concerns. Additionally, a longitudinal cohort study tracking children's educational outcomes in relation to household expenditure shocks would provide complementary insights into the welfare consequences of inflationary episodes.

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