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# Returns to Education in Greece: Causal Evidence from the 1977 Labor Market Survey

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**Abstract**

We estimate the causal effect of schooling on log earnings using instrumental variables (IV), addressing the endogeneity of schooling by using father's education as an instrument. The IV estimate implies a return of approximately 7.7 percent per additional year of schooling. First-stage and endogeneity tests confirm instrument strength and the need for IV.

Keywords: Returns to education; Instrumental Variables; Causal impact

JEL Codes: I2, I26, J24, J31

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# 1. Introduction

Ordinary least squares (OLS) estimates of returns to schooling may be biased due to endogeneity (Card 1999). To address this, we estimate the causal return to schooling using father's education as an instrument. The identifying assumptions are: (1) relevance—parental schooling is strongly correlated with the individual's schooling); and (ii) exclusion—conditional on controls, father's education affects adult earnings only through the individual's schooling. We estimate 2SLS as the main specification Under standard monotonicity, the 2SLS coefficient is a LATE for *compliers* whose schooling is shifted by father's education. We compare OLS and IV estimates to assess the direction of bias (IV often exceeds OLS if ability bias is negative due to measurement error, or if marginal returns are higher for compliers).

There are several attempts to estimate the returns to education in Greece using OLS (Kanellopoulos 1997; Lambropoulos and Psacharopoulos 1992; Leibenstein 1967; Livanos and Pouliakas 2011; Magoula and Psacharopoulos 1999; Prodromidis and Prodromidis 2008; Tsamadias 2001). Psacharopoulos (1982) analyzed the 1977 labor market survey and estimates the rate of return to schooling. He finds a relatively low rate of return at 5.8 percent – the global average rate of return to schooling is 9 to 10 percent (Psacharopoulos and Patrinos 2018). OLS studies broadly confirm modest payoffs, though point estimates vary by cohort, sector, and specification. For example, returns tend to be higher in the private sector than the public sector and are sensitive to controls for experience, region, and occupation; they also shift with macroeconomic conditions, structural changes, and the evolving industrial mix. Methodologically, most Greek estimates rely on standard log-earnings regressions with limited strategies to address endogeneity, leaving them vulnerable to ability bias, measurement error in schooling, and selection into employment. Heterogeneity is another recurring theme: some studies find larger returns for higher education relative to secondary, gender differences in slopes, and nonlinear patterns along the schooling distribution. Overall, the preponderance of OLS evidence suggests that Greece's returns are positive but below international averages. This context underscores the value of causal designs (e.g., IV, policy discontinuities) to reassess returns net of endogeneity.

We begin by replicating Psacharopoulos (1982) on the 1977 labor market survey to recover his baseline OLS return. We match his sample restrictions and covariates to ensure strict

comparability. This replication yields a benchmark against which all subsequent estimates are judged. We then re-estimate the return using the same specification but a causal design to address endogeneity.

In Greece, there have been a few causal estimates. Chletsos and Roupakis (2020) used spouse's education as an instrument and found causal estimate of the returns to education of 3.2 percent, compared to 2.9 using OLS. Patrinos (2022) used the Greek civil war and estimated a causal return of 8.0 percent compare to 5.9 percent OLS. Cholezas and Kanellopoulos (2024) used parental education and the number of siblings as instruments and found IV estimates of 7.2 to 11.5 percent compared to OLS estimates of 3.7 to 6.0 percent.

Causal evidence on the private return to schooling in Greece is limited but growing. Chletsos and Roupakis (2020) instrument spouse's education—exploiting assortative mating—to obtain an IV return of 3.2 percent per year of schooling, only modestly above their OLS estimate of 2.9 percent. While informative, the design hinges on a strong exclusion restriction (spouse's schooling must affect earnings only via own schooling) and is potentially sensitive to assortative mating on unobservables and household labor-supply channels. Patrinos (2022) leverages exogenous variation from the Greek civil war as a schooling shock, reporting a substantially larger IV return of 8.0 percent versus 5.9 percent by OLS—consistent with attenuation from measurement error and/or higher marginal returns among compliers exposed to conflict-induced schooling disruptions. Most recently, Cholezas and Kanellopoulos (2024) use parental education and sibship size as instruments and find IV returns in the 7–11.5 percent range, compared with 3–6 percent by OLS. Taken together, the Greek IV literature generally finds IV estimates greater than OLS estimates, aligning with international evidence that OLS can understate causal returns due to measurement error, selection, and heterogeneous treatment effects, and placing Greece's causal returns closer to (or slightly above) global benchmarks.

We use father's education as an instrument (Aakvik et al. 2003; Ashenfelter and Zimmerman 1997; Card 1993; Gong 2019; Ichino and Winter-Ebmer 1999; Levin and Plug 1999). However, to be a valid instrument it needs to be unrelated to wages (Lemke and Rischall 2003; Trostel et al. 2002). In Greece, the return to one additional year of schooling is higher for those whose fathers have more education (Patrinos 1995). The private marginal return to the $S$th year of schooling rises with

father's education, but the overall relationship is weak. Only three broad categories emerge based on father's schooling, and the difference between secondary and tertiary-educated fathers is not statistically significant. The main distinction lies between those with illiterate fathers and everyone else. Surprisingly, workers with fathers who had tertiary education are not significantly better off than those with fathers who completed secondary school. Returns to schooling vary modestly: 5.4 percent for fathers with secondary or higher education, 5.1 percent for primary, and 5.0 percent for illiterate fathers—close to the overall average of 5.6 percent. Hence, the potential bias is minor, and estimates remain consistent with those using strictly exogenous instruments (Hoogerheide et al. 2012; Hou et al. 2020). We therefore use father's education as an instrument, assuming it influences a child's schooling via genetic or environmental factors (relevance) but has little to no direct effect on earnings (exclusion restriction).

## 2. The Greek Labor Market of the 1970s

The late 1970s were a pivotal transition for Greece after the 1974 restoration of democracy. The production structure was anchored in agriculture, tourism, shipping, and small-scale trade, while manufacturing was modest and dominated by small firms. Labor markets were characterized by high self-employment, substantial rural-to-urban migration, and emerging but still centralized wage bargaining; the public sector was expanding in scope and influence. Education policy was in flux: post-1974 reforms broadened access to schooling, standardized curricula and language of instruction, and increased upper-secondary progression, setting the stage for later tertiary expansion. These institutional and sectoral features matter for interpreting returns to schooling circa 1977. Greece's late-1970s political normalization and evolving economic structure provide the backdrop against which both OLS and causal estimates of the private return to schooling should be read (see Alogoskoufis 2024 for an overview).

The labor market during this era exhibited distinct features: the state was a dominant employer, absorbing a high proportion of university graduates—according to an OECD study, higher education holders made up 40 percent of state employees in Greece in the mid-1960s, compared to only 5 percent in France (OECD 1966). Greece's comparatively underdeveloped industrial sector, in contrast to other rapidly industrializing European nations, meant fewer opportunities for skilled private-sector employment. As a result, the public sector, offering more job security and

social benefits, became especially attractive to the educated, fueling rising demand for education (Livanos 2010; Gouvias 1998). Education was widely viewed as the key vehicle for promoting social mobility and equality in Greek public discourse (Tsakloglou and Cholezas 2005). The education system remained highly centralized under the Ministry of Education and Religious Affairs, with the structure largely unchanged after democratization. However, the late 1970s saw a continued expansion of higher education—extending trends from the 1960s—driven by political reforms, public sector incentives, and broader efforts to modernize the educational system in the post-junta era.

# 3. Data and Sample

We draw on the 1977 Special Wages and Salaries Survey—the same microdata analyzed by Psacharopoulos (1982)—conducted by the National Statistical Service of Greece. The survey was expressly designed to measure the structure of pay and employment across urban labor markets and was fielded to a stratified random sample of 8,756 wage-and-salary workers in 12 cities. The questionnaire records earnings, schooling, experience, and father's schooling. Following the original study, we restrict the analysis to male employees to avoid composition and measurement issues linked to gender-specific labor-force participation, discrimination, and the construction of experience measures for women in this period. Table 1 provides variable means and standard deviations.

Table 1. A Summary of Variables

| Variable | Mean | Std |
|---|---|---|
| Log wage | 12.15 | 0.55 |
| Schooling | 12.08 | 4.72 |
| Father's schooling | 7.62 | 4.37 |
| Experience | 20.10 | 11.57 |
| Experience-squared | 537.73 | 536.96 |
| Annual earnings (*drachmas*) | 216,289 | 119,080 |
| N | 6,112 | |

## 4. Identification strategy: Instrumental variables

Given an instrument $Z_i$ , the coefficient $b_i$ in the returns-to-schooling model reflects the individual's private return, with a population average of $b_0$ (Patrinos and Sakellariou 2006). Under homogeneous returns, IV estimation requires the instrument to be uncorrelated with both the error term and unobserved ability. But when returns vary across individuals, this is not enough. In that case, identifying causal effects also requires assuming that the instrument is unrelated to people's individual gains from schooling — a much stronger condition.

This heterogeneity implies that $b_i$ is drawn from a distribution of causal effects, and different estimators will identify different parameters within that distribution. As such, IV estimates depend on the particular relationship between the instrument and treatment assignment. Under specific assumptions, IV recovers a local average treatment effect (LATE) — the average return for those whose schooling decisions are influenced by the instrument. Thus, the IV estimate answers a local, policy-relevant question, rather than a general one.

We estimate the causal effect of schooling ($S$) on log earnings ($lnY$) using IV to address potential endogeneity. We use father's schooling, *sf*, as an instrument for schooling, controlling for experience and its square. The IV estimation is conducted using two-stage least squares (2SLS) with robust standard errors to account for heteroskedasticity.

# 5. Empirical analysis

Our estimate of the returns to schooling in Greece in 1977, using father's education as an instrument, is higher than the existing non-experimental returns to education estimates at the time. We include male workers ages 14-65. The ordinary least squares estimates use the standard Mincerian specification. The results reported in Table 1 show the OLS estimates, followed by the first stage estimates and IV results in the third column. The OLS results are the same as in Psacharopoulos (1982).

Table 2. Returns to education: Greece, 1977

| | OLS | | IV | |
|---|---|---|---|---|
| Variable | 1 | 2 | First stage | Earnings |
| Schooling | 0.054 | 0.058 | | 0.079 |
| | (38.400) | (45.400) | | (25.600) |
| Experience | 0.059 | 0.059 | 0.123 | 0.056 |
| | (34.000) | (33.900) | (8.500) | (28.600) |
| Experience-squared | (0.001) | (0.001) | (0.005) | (0.001) |
| | (25.900) | (25.900) | (16.500) | (19.100) |
| Father's schooling | 0.011 | | 0.426 | |
| | (7.500) | | (41.400) | |
| Constant | 10.757 | 10.787 | 9.074 | 10.530 |
| F-test | | | 1710.2 | 695.18 |
| *p*-value | | | 0.000 | 0.000 |
| Overidentification statistic | | | | Exactly identified |
| Wu-Hausman F-test | | | | 58.75 |
| *p*-value of Wu-Hausman F test | | | | 0.000 |
| *R*-squared | 0.3777 | 0.3720 | 0.2873 | 0.3300 |
| Adjusted *R*-squared | 0.3773 | 0.3717 | | |
| N | | 6,112 | 6,112 | 6,112 |

Source: Labor market survey 1977

Notes: In 1st and 3rd columns the dependent variable is the log of annual earnings; in 2nd column it is years of schooling. Numbers in parentheses are t-scores in the case of OLS and first stage, z-scores for the IV.

The first-stage results indicate that the instrument sf strongly predicts schooling, with an F-statistic of 58.75, well above the conventional threshold of 10, indicating no weak instrument problem. Overall, father's education affects one's schooling significantly. An increase of 1 year in father's education is associated with an increase of 0.4 years in the individual's years of schooling.

The OLS estimates of the returns to schooling in 1977 were estimated as 5.8 percent by Psacharopoulos (1982), which we replicate here. The IV estimate is 7.9 percent, which is 2.1 percentage points higher than the corresponding OLS estimator. Our results are consistent with

others who have used parental education as IV (see, for example (Aryal et al. 2022; Chletsos and Roupakias 2020; Cholezas and Kanellopoulos 2024; Harmon et al. 2003).

These findings align with the idea that returns to education vary across individuals (Card 2001). The LATE framework helps explain this: it captures the return for the group whose schooling choices are influenced by the instrument—in our case, mainly poorer individuals, who likely have higher returns at the margin. OLS tends to underestimate returns because it averages across everyone and is affected by measurement error. IV estimates, by contrast, are not biased by measurement error and reflect the effect for a specific group with above-average returns. As a result, IV estimates are often larger than OLS estimates when returns are heterogeneous.

Using Ishimaru (2024), we decompose the OLS-IV gap into three parts: (1) covariate weighting, which gives different importance to background factors (e.g., experience), or the part of the gap explained by different distributions of covariates in OLS vs IV samples; (2) treatment-level weighting, which handles varying levels of the values of the schooling variable itself; and (3) the marginal effect, or the bias correction since the IV method corrects for hidden confounding factors that OLS misses.

Decomposition results (Table 3) indicate that only 0.06 percentage points of the gap are attributable to differences in the distribution of observed covariates, while treatment-level weighting differences account for 0.04 percentage points. The remaining 1.98 percentage points (96 percent of the gap) reflect differences in marginal returns — suggesting that endogeneity or treatment effect heterogeneity is the main driver of the IV–OLS gap.

Table 3. Decomposition of the IV-OLS Gap in Return to Schooling Estimates

| Coefficients | | | Decomposition | | |
|---|---|---|---|---|---|
| OLS | IV | IV-OLS | ΔCW | ΔTW | ΔME |
| 0.058 | 0.079 | 0.021 | 0.0006 | 0.0004 | 0.0198 |
| (0.001) | (0.003) | (0.003) | (0.0002) | (0.0002) | (0.0028) |

Standard errors are in parentheses. The first three columns report the OLS estimates, the IV estimates, and their gaps. The next three columns report the estimates of the CV (covariate weight) difference, the TW (treatment-level weight) difference, and the ME (marginal effect) difference components. By construction, these three components sum to the IV-OLS gap. Standard errors are robust to heteroskedasticity and correlation across observations.

We also conclude that father's schooling is a valid instrument, even if it has a direct effect on earnings, because that effect appears to be small. To examine this, we compare an earnings regressions that includes father's schooling (1) to equation (2). The inclusion of father's schooling increased the *R*-squared from 0.3720 to 0.3777, a gain of 0.0057 (or approximately 0.57 percentage points). The adjusted *R*-squared rose from 0.3714 to 0.3770, or 0.56 percentage points. This modest improvement in model fit suggests that while father's schooling contributes some predictive value to individual schooling outcomes, its incremental effect is limited—consistent with standard interpretations of *R*-squared changes (Wooldridge 2010; Gujarati and Porter 2009).

The period under study was one of profound transformation for Greece. The restoration of democracy in 1974 ushered in political stability, and education became a central pillar of modernization and social mobility. Labor markets remained segmented, with high levels of self-employment and an expanding public sector that disproportionately absorbed educated workers. In this institutional setting, education functioned not only as a signal of productivity but also as a ticket to stable and relatively prestigious public-sector jobs. That the causal return is higher than the OLS estimate suggests that, even in a labor market where credentials carried strong signaling value, genuine productivity-enhancing aspects of education were substantial.

Several caveats should be borne in mind. First, the validity of father's education as an instrument depends on the exclusion restriction, which, while plausible, cannot be tested directly. Although robustness checks suggest that any direct effect of father's schooling on earnings is minor, we cannot rule it out entirely. Second, the LATE interpretation reminds us that IV estimates are not universal: they apply to the subgroup of individuals whose schooling is affected by the instrument. In our case, these are likely to be individuals from lower socioeconomic backgrounds who were on the margin of continuing their studies. Thus, while the 7.9 percent figure is policy-relevant, it should not be generalized to all workers in the 1970s.

## 6. Concluding remarks

This paper has revisited the returns to education in Greece by re-analyzing the 1977 Special Wages and Salaries Survey with a causal identification strategy. The use of father's education as an instrument provides a credible way to address endogeneity and recover a local average treatment

effect (LATE) of schooling on earnings. The results suggest a private return to education of approximately 7.9 percent per additional year of schooling, which is substantially higher than the OLS benchmark of 5.8 percent reported in Psacharopoulos (1982). This finding is consistent with international evidence that IV estimates often exceed OLS, reflecting both attenuation bias from measurement error and heterogeneity in returns, whereby individuals at the margin of schooling—those whose decisions are most influenced by their father's education—experience above-average payoffs.

This study also illustrates the value of re-examining historical data with modern econometric techniques. The 1977 survey remains one of the most comprehensive early datasets on Greek labor markets. By applying an IV strategy, we are able to extract new insights from old data, contributing both to the historical record and to methodological debates. The decomposition of the OLS–IV gap shows that endogeneity and treatment-effect heterogeneity are the primary drivers of differences, rather than differences in observed covariates. This aligns with recent work highlighting how IV can capture higher marginal returns for groups with stronger responses to the instrument.

The implications of these findings are far-reaching. For policymakers in Greece during the 1970s, the evidence would have supported continued investment in expanding access to education, as private returns were high and likely correlated with broader social benefits. More generally, our results reinforce the enduring message that education is a sound economic investment. The historical evidence that causal returns were robustly positive provides an important reminder of education's long-run payoff.

Moreover, by identifying that causal returns exceed OLS estimates, our study implies that conventional methods may understate the benefits of education. This matters for cost–benefit analyses of educational policy, international comparisons, and the design of interventions aimed at reducing inequality. In particular, individuals at the margin of schooling—those most influenced by parental background—appear to reap the largest gains. This provides an equity argument for policies targeting disadvantaged groups, as they may experience disproportionately high returns when educational barriers are lowered.

This study demonstrates the potential of combining historical data with modern causal inference, and several avenues for extension remain open. One natural step would be to broaden the scope beyond male wage earners by incorporating women and the self-employed, which would provide a more comprehensive picture of Greece's human capital payoff. Another direction is to examine dynamic returns over time by linking evidence across decades to see how payoffs evolved with economic modernization, EU accession, and structural reforms.

The evidence presented here reaffirms that education in Greece during the late 1970s yielded high and economically significant private returns. By applying instrumental variables to the 1977 survey, we move beyond the limitations of OLS and provide a causal estimate that is both larger and more credible. The results are consistent with international patterns and resonate with broader theories of human capital. Most importantly, they remind everyone that investing in education—especially for those from disadvantaged backgrounds—not only fosters social mobility but also delivers strong economic dividends. Education was, and remains, one of the most powerful levers for individual and national development.

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