Australian National University
Crawford School of Public Policy

CAMA

Centre for Applied Macroeconomic Analysis

Population Growth and Poverty: How Institutions Matter

CAMA Working Paper 44/2026
June 2026

Omer Majeed
Centre for Applied Macroeconomic Analysis, ANU

Abstract

This study examines how institutions condition the impact of population growth on poverty. This question is important given the rapid population growth of recent decades and projections that the global population will increase by two to three billion people by 2100, largely in countries with weak to moderate institutions. The paper shows how institutions determine whether additional population becomes equipped with human capital and avoids poverty, or remains in subsistence, contributing to higher poverty. The paper develops a model of heterogeneous neighborhoods and the public provision of educational services. The model generates predictions that the paper tests in a cross-country setting. Consistent with the framework, the results suggest that institutions condition how population growth impacts poverty. The results are robust across empirical strategies—OLS, GMM, and an IV approach—and across poverty and institution definitions. The analysis shows that investment, education, and healthcare are three possible channels for this mechanism.

Keywords

institutions, population growth, poverty, economic growth

JEL Classification

D02, I32, O11, O43, J11

Address for correspondence:

(E) cama.admin@anu.edu.au

ISSN 2206-0332

Population Growth and Poverty: How Institutions Matter

Omer Majeed*
Centre for Applied Macroeconomic Analysis, ANU

May 2026

Abstract

This study examines how institutions condition the impact of population growth on poverty. This question is important given the rapid population growth of recent decades and projections that the global population will increase by two to three billion people by 2100, largely in countries with weak to moderate institutions. The paper shows how institutions determine whether additional population becomes equipped with human capital and avoids poverty, or remains in subsistence, contributing to higher poverty. The paper develops a model of heterogeneous neighborhoods and the public provision of educational services. The model generates predictions that the paper tests in a cross-country setting. Consistent with the framework, the results suggest that institutions condition how population growth impacts poverty. The results are robust across empirical strategies—OLS, GMM, and an IV approach—and across poverty and institution definitions. The analysis shows that investment, education, and healthcare are three possible channels for this mechanism.

Keywords: *Institutions, population growth, poverty, economic growth.*

JEL Codes: *D02, I32, O11, O43, J11*

*Email: omer.majeed@anu.edu.au. I thank Paul Burke, Robert Breunig, Gabrielle Watson, Prema-Chandra Athukorla, Nabeeh Zakeeriah and participants of various seminars for helpful feedback on this paper.

1 Introduction

While the global average poverty rate has declined over the last few decades, this decline is not represented across all regions. Countries with relatively stronger institutions, notably in East and South-East Asia and especially China, have achieved dramatic reductions in poverty, but in other regions the results are more mixed. Adding pressure to the fight against poverty is population growth. Importantly, countries experiencing the fastest population growth are often those with weak institutions and high levels of poverty. This raises a central question: how do institutions shape the impact of population growth on poverty? The importance and urgency of this question is underscored by unprecedented population growth in recent decades and projections that the global population will increase by two to three billion people by 2100 (United Nations, 2024). Much of this increase is projected to occur in countries with weak to moderate institutions, with some expected to experience population growth of close to 100–200 million people.

A number of developing countries continued to experience rising poverty over the sample period (1996 to 2021), with poverty headcount ratios increasing in 15 and 19 countries under the World Bank's US$3.65 and US$6.85 poverty thresholds, respectively. Without institutional improvements, these and other countries with weak institutional capacity are ill-equipped to absorb large population increases, with potentially significant poverty-related consequences. Moreover, falling poverty rates do not necessarily mean fewer poor people under rapid population growth and weak institutions. In India, poverty headcount ratios at the US$3.65 and US$6.85 thresholds fell from roughly 89 and 98 percent in 1981 to around 49 and 84 percent in 2021, yet the absolute number of poor people increased to roughly 684 million and 1.18 billion, respectively. Despite the importance of this issue, we have a far more limited understanding of how population growth interacts with institutions to shape poverty outcomes.

This paper hypothesizes that the impact of population growth on poverty depends critically on institutions. While prior work recognizes that policy and institutional environments shape the development consequences of demographic change (Das Gupta et al., 2011), there has been limited systematic analysis of how institutional quality interacts with population growth to shape poverty outcomes. This paper fills this gap by developing a microfounded framework and providing novel, detailed empirical evidence consistent with the view that institutions condition the impact of population growth on poverty. In the framework, institutions determine whether population growth is translated into human-capital accumulation and poverty reduction, or instead into congestion pressures and poverty persistence.

The simplest way to illustrate how institutions condition the impact of population growth is to examine how institutions affect the provision of education, and thereby determine the human capital of future cohorts. Human capital formation is well established as essential for development (Mankiw et al., 1992). In a parsimonious fashion, the framework introduces heterogeneous neighborhoods, where public funding determines the quality of education available across neighborhoods, while institutional quality determines how effectively public resources are translated into education provision by limiting corruption and inefficiency in spending. Individuals maximize utility over their lifetime when making schooling decisions based on quality of education offered, and wages are endogenously determined. Weak institutions reduce the effectiveness of public spending, limiting access to quality education and increasing the share of future cohorts trapped in low-human-capital, low-wage states. Population growth further strains effective resources per person, placing upward pressure on poverty. Stronger institutions, by contrast, broaden human-capital accumulation among future cohorts, strengthen tax capacity, and reduce poverty pressures over time.

The framework also formalizes an amplification mechanism. Below a critical institutional threshold, population growth increases poverty not only through congestion in public-resource provision, but also through fiscal erosion, as a larger share of the population remains outside the human-capital sector and contributes little to the tax base. This further reduces the effective public resources available for future cohorts, reinforcing poverty persistence.

For parsimony, the model deliberately focuses on one important channel—the institutional conditioning of human capital formation. Institutional quality plausibly also shapes other channels through which population growth affects poverty, including the investment climate and job creation for future cohorts, the extent to which weak institutions encourage rent-seeking and other unproductive activities in new cohorts as congestion pressures increase and access to healthcare. Suggestive evidence for some of the additional channels is presented in the Mechanism Section. To the extent that these channels operate simultaneously, the framework should be interpreted as capturing one important component of the broader role institutions play in shaping the poverty consequences of population growth. As such, the empirical estimates likely reflect the combined influence of these broader institutional channels.

This contrasts with Dollar and Kraay (2002); Dollar et al. (2016), who argue that economic growth alone drives poverty reduction. In this framework, while growth is correlated with poverty reduction, a deeper mechanism operates that causes both poverty reduction and economic growth. In an economy with population dynamics, institutions determine whether population growth is translated into human capital for a broader set of individuals and neighborhoods. As institutions improve, they enhance human capital formation, increasing wages and economic growth and lowering poverty. This shows that, at least in this framework, both growth and poverty reduction are driven by a deeper mechanism, namely institutions. Consistent with this mechanism, in the empirical framework, the interaction between population growth and institutions remains robust even after conditioning on economic growth.

Empirically, the paper shows that the joint interaction of institutions and population growth is correlated with poverty. Estimating this relationship faces several challenges. First, poverty itself may influence both population growth and institutional quality, and thus their interaction. For example, poorer countries may exhibit higher fertility rates due to income constraints, limited education, or insurance motives. Furthermore, weak fiscal capacity in poor countries may simultaneously limit institutional development. As a result, observed relationships between population growth, institutions, and poverty may reflect feedback effects rather than causal relationships. Second, poverty dynamics are inherently persistent and shaped by initial conditions (Ravallion, 2012; Sampson and Morenoff, 2006). Countries with higher initial poverty may face structural constraints that influence subsequent poverty trajectories, meaning that if initial conditions are not controlled for, they will likely bias the results.

Third, time-varying omitted variables may jointly affect poverty, population growth, and institutional quality, such as exogenous economic growth shocks. Fourth, both poverty and institutional measures are subject to measurement error. This may make it difficult to estimate the relationship between poverty and the interaction between population growth and institutions.

This paper addresses these challenges using a combination of complementary empirical strategies. To address measurement concerns, the analysis uses all three World Bank poverty thresholds ($2.15, $3.65, and $6.85 per day, 2017 PPP). Furthermore, the main regressions focus on the World Governance Indicators (WGI) measures most closely related to state capacity and service delivery (i.e. Government Effectiveness, Control of Corruption, and Rule of Law), while the analysis begins with all six WGI indicators. Population growth is used to measure demographic change, as it captures shocks beyond fertility and mortality, including migration, refugee flows and political unification.

No single empirical strategy fully addresses all identification concerns. Instead, the strategy is to employ multiple approaches that rely on different sources of variation and assumptions and to assess whether they yield consistent results. The empirical analysis begins with ordinary least squares (OLS) specifications that relate poverty to population growth, institutional quality, and their interaction, while controlling for important covariates and initial conditions. These estimates provide informative conditional correlations.

The second approach addresses identification concerns by exploiting within-country variation over time using system generalized methods of moments (GMM) estimation. A common approach in the literature to address omitted variable bias and reverse causality is to employ first-difference and system GMM estimators that instrument endogenous variables using their lagged values (Blundell and Bond, 1998; Berg et al., 2018). First-differencing additionally accounts for country fixed effects. The paper employs a system GMM approach, which builds a system of level and first-difference equations and thereby exploits both within- and cross-country variation, using appropriately lagged variables as instruments from both the level and differenced equations (Blundell and Bond, 1998). By accounting for country fixed effects and exploiting lagged values as internal instruments, this approach mitigates bias arising from omitted variables and reverse causality. In this framework, the paper also controls for initial conditions, which are likely to be important (Ravallion, 2012).

Third, the paper employs a two-pronged instrumental-variable (IV) strategy. To isolate variation in institutional quality, the analysis uses education levels measured roughly fifty years prior to the institutional and poverty variables used in the analysis. Because this historical measure is predetermined and evolves slowly over time, it is unlikely to respond to contemporaneous poverty dynamics or short-run economic shocks. It therefore provides a plausible source of exogenous variation in institutional quality.

Tebaldi and Mohan (2010) and Tabellini (2008) instrument institutions using historical education, emphasizing its role as a deep determinant of institutional development. The mechanism emphasized by Tabellini (2008) is that historical education proxies for long-run differences in societal norms and civic capital that shape institutional evolution. Additionally, legal origins are also used as an instrument, capturing inherited legal and administrative structures that shape institutional performance (Tebaldi and Mohan, 2010). The results are robust to including this additional source of institutional variation.

The IV strategy for population growth exploits the tendency for demographic dynamics to co-move across countries within regions (Bongaarts and Watkins, 1996; Bloom et al., 2003; Casterline, 2001). This co-movement reflects shared demographic forces, including common economic conditions and the diffusion of fertility behavior that generate regional demographic waves. Motivated by this pattern, the paper instruments country-level population growth using a jackknifed regional average that excludes the country itself. This approach builds on Acemoglu et al. (2019) who employ regional averages as instruments in a different context. This approach exploits regional comovement as a source of plausibly exogenous variation. By construction, the jackknifed measure captures common demographic trends while purging country-specific shocks, thereby isolating variation in population growth that is unlikely to be driven by domestic poverty dynamics. Empirically, population growth exhibits positive regional co-movement, supporting the relevance of the instrument.

Importantly, the instruments rely on distinct sources of variation—historical persistence for institutions and regional demographic diffusion for population growth. The identifying assumption is that, conditional on controls, these instruments affect poverty only through institutions, population growth, and their interaction. To probe the exclusion restriction, the analysis incorporates a rich set of controls designed to capture alternative channels through which the instruments may affect poverty.

Despite differences in empirical design (OLS, GMM, and IV) and the definitions used, the results indicate that institutions condition the effect of population growth on poverty, in line with the theoretical framework. In weaker institutional environments, a one-percentage-point increase in population growth is associated with more than a one-percentage-point increase in poverty, while this adverse effect diminishes (and in some cases reverses) as institutional quality improves. Conversely, there is partial evidence that population growth is associated with reductions in poverty in stronger institutional environments, though this positive effect is not always significant.

The interaction between population growth and institutional quality becomes significant at commonly observed levels of institutional quality. For example, based on the baseline GMM estimates, the marginal effect of population growth on poverty becomes positive and statistically significant when the principal component of the core state-capacity variables (Control of Corruption, Rule of Law, and Government Effectiveness) falls below roughly 0.5. In 2021, around 60 percent of countries recorded principal-component values below this threshold, placing them in a range where population growth is associated with upward pressure on poverty. This suggests that the threshold lies within commonly observed institutional levels rather than extreme cases, although the precise cutoff varies across specifications.

Across observations where institutional quality, measured by the principal component of the core WGI state-capacity variables, falls below 0.5, average population growth remains above 1.6 percent, suggesting that demographic expansion places upward pressure on poverty. In 2021, this threshold included several low- and middle-income countries, including Albania, Brazil, Ecuador, Mongolia, Nepal, Lebanon, Nigeria, and Yemen. Several large, rapidly growing economies fall below this threshold. For example, India and Indonesia were at or below it in 2021, while Pakistan and Nigeria have consistently remained below this threshold.

Next, the paper explores the channels through which the interaction of population growth and institutions may affect poverty. While this evidence is suggestive and not as well-identified as the baseline results, it indicates that this interaction may be associated with poverty through education, healthcare, and investment. These findings suggest that strengthening core state-capacity institutions, such as government effectiveness and reducing corruption, is essential for absorbing population growth without increasing poverty, while countries with persistently weak institutions may also need to moderate population growth [1].

The remainder of the paper is organized as follows. Section 2 reviews the literature. Section 3 presents the framework. Section 4 describes the data. Section 5 outlines the empirical strategy. Sections 6 and 7 report the OLS, GMM, and IV results. Section 8 explores mechanisms, and Section 9 concludes.

[1] Appendix Table A1 further highlights this issue.

2 Literature Review

Although global poverty has declined substantially, these reductions have been highly uneven across regions. East and South-East Asia, particularly China, have experienced large declines in poverty, whereas many countries in Asia and Africa have lagged behind (Ravallion, 2012; Perkins et al., 2006; World Bank, 2018). Importantly many high-poverty countries have also experienced rapid population growth.

As discussed earlier, in a prominent part of the literature focusing on poverty, the role of institutions and population growth is missing (Dollar and Kraay, 2002; Dollar et al., 2016). In addition, canonical growth models offer conflicting predictions regarding the direct role of population growth. In the neoclassical framework, higher population growth dilutes capital per worker, lowering steady-state income and potentially increasing poverty (Solow, 1956). In low-income settings, rapid population growth may also exacerbate land scarcity and place pressure on public services such as education and health, further constraining poverty reduction (Ahlburg, 1996).

By contrast, endogenous growth models with scale effects highlight mechanisms through which population growth may raise productivity and reduce poverty. A larger population can expand market size, generate economies of scale, increase incentives for investment and innovation and can increase the number of ideas in an economy (Jones, 2003; Aghion and Howitt, 2008). Similarly, demographic transition theories emphasize the possibility of a demographic dividend, whereby an increase in the working-age population raises productivity, growth, and tax revenues (Bloom et al., 2003; Perkins et al., 2006). Quantitative work further shows that fertility decline can increase output per capita through multiple channels, including lower dependency ratios, greater human capital investment, and capital deepening (Ashraf et al., 2011).

Reflecting these opposing forces, the empirical literature has reached mixed conclusions. Several studies find no robust relationship between population growth and economic outcomes (Perkins et al., 2006), while others suggest that earlier work may suffer from omitted variable bias, including the failure to account for institutional quality (Ahlburg, 1996). Country-level evidence nevertheless indicates that rapid population growth can slow poverty reduction in some contexts, for example by increasing dependency burdens and limiting improvements in living standards (Klasen and Lawson, 2007). Taken together, these findings suggest that the effect of population growth on poverty is unlikely to be uniform across countries.

A large literature identifies human capital as a central driver of economic growth and poverty reduction (Perkins et al., 2006; Mankiw et al., 1992). Early contributions emphasize the role of education as an investment that raises productivity and earnings (Schultz, 1961), while subsequent work shows that increases in schooling can translate into higher wages (Duflo, 2001) and improved life outcomes (Duflo et al., 2024).

Importantly, this paper argues that institutions likely determine how effectively education expenditures reduce poverty. In weak institutional settings, public spending on education may be subject to inefficiencies, corruption, or poor governance (Rajkumar and Swaroop, 2008), limiting its impact on human capital accumulation. This suggests that population growth may place additional strain on human capital formation in environments where institutional quality is low.

Recent work has also examined the role of demographic dynamics in shaping poverty outcomes. Wietzke (2020) shows that differential fertility patterns across socioeconomic groups can slow poverty reduction by increasing dependency ratios among poorer households and limiting human capital investment. Similarly, Ahmed et al. (2016) find that increases in the working-age share of the population are associated with higher income growth and reductions in poverty, highlighting the importance of demographic structure. Relatedly, Ravallion (2012) emphasizes the role of initial poverty conditions, showing that high initial poverty can weaken both growth and the responsiveness of poverty to growth. These findings underscore that structural conditions play an important role in shaping poverty dynamics.

More broadly, demographic transition theories suggest that declines in fertility can generate a demographic dividend through lower dependency ratios, increased savings, and greater investment in human capital (Bloom et al., 2003). Related surveys emphasize that while population dynamics matter for development outcomes, their effects depend on broader policy and institutional environments (Das Gupta et al., 2011; Sinding, 2009). In particular, fertility decline alone may not be sufficient for poverty reduction if accompanied by weak policies or limited human capital formation. However, these papers do not examine how population growth interacts with institutions to impact poverty.

This paper builds on these insights by focusing on the role of institutions in shaping the relationship between population growth and poverty. A large literature documents the importance of institutions for economic development (Acemoglu et al., 2001), with evidence that institutional quality is strongly associated with poverty outcomes (Tebaldi and Mohan, 2010). Moreover, institutions are not necessarily fixed; policy- and leadership-driven reforms can substantially alter development trajectories over relatively short horizons (Lin, 2009), and recent work highlights conditions under which institutional change can occur (Acemoglu and Robinson, 2025; Majeed, 2025).

Despite this, the role of institutions in mediating the poverty effects of population growth remains under explored. Much of the existing literature examines population dynamics and institutional quality largely in isolation—either focusing on the average effects of demographic change or on the independent role of institutions in development. There is limited systematic evidence on how institutional quality conditions the extent to which population growth translates into human capital accumulation and, ultimately, poverty reduction.

This paper contributes to this literature by examining the interaction between population growth and institutions in determining poverty outcomes. In particular, it asks when population growth acts as a demographic dividend and when it becomes a demographic burden. By focusing on this interaction, the analysis helps reconcile competing theoretical predictions and provides new evidence on how institutions condition the impact of population growth on poverty.

3 Framework

This section introduces the basic economic environment and outlines the main assumptions of the model. In the framework, population growth increases congestion pressures on public resources, while the availability and quality of education across locations depend on public provision. Institutional quality determines how effectively tax revenue is translated into public provision, and individuals decide whether to acquire human capital to maximize lifetime utility.

Environment Consider an economy consisting of individuals distributed across N neighborhoods. Neighborhoods are indexed by $j = 1, \ldots, N$, and differ in their initial wealth $(\tilde{w}_1, \tilde{w}_2 \ldots, \tilde{w}_N)$. Pre-tax output by each person is produced using human capital:

$$y_i = Ah_{it}^{\beta}l, \qquad \beta \in (0, 1), \tag{1}$$

where h_{it} denotes human capital of person i at time t. The concavity parameter β captures diminishing returns: increases in human capital raise income, but at a decreasing rate. A denotes productivity and l_i is labour supplied by individual i and is supplied inelastically, so $l_i = 1$. The marginal product of labour equals the wage:

$$MPL_i = \frac{\partial y_i}{\partial l_i} = A\, h_{it}^{\beta} = w_{hi}. \tag{2}$$

Wages, including subsistence wages, are endogenously determined by the quality of education funded and individuals' schooling decisions based on lifetime income considerations. For individuals without education, human capital remains at the baseline level, $h_{it} = h$, implying low productivity and correspondingly low wages. In the framework, subsistence wages therefore emerge from low human capital:

$$w_i = Ah^{\beta} \equiv w_s,$$

where w_s denotes the subsistence wage, and $h_i > h$ implies $w_{hi} > w_s$. To clear the markets, assume that all individuals are employed. Given the above, total pre-tax output is just the sum of individual outputs:

$$Y_t = A \sum_{j=1}^{N} \sum_{i=1}^{m_t} h_{ijt}^{\beta}, \tag{3}$$

Population Individuals in each of the N neighborhoods live for two periods: young and old. The young in period $t-1$ become old in period t, after which they die, while a new young cohort is born each period. Population evolves according to $m_{t+1} = (1+n_t)m_t$, where m_t is the neighborhood population and n_t is the population growth rate, implying total population Nm_t. For simplicity, population growth is initially assumed to be uniform across neighborhoods. The paper later relaxes this assumption and shows that if population growth is concentrated among poorer locations, as observed empirically (Eswaran, 2006; Vandenbroucke, 2016), the main results are amplified.

Taxation and Public Resources Education funding per person determines the quality of education provided across locations. The government finances education through taxation, with total tax revenue given by:

$$T_t = \tau Y_t.$$

Weak institutions reduce the effectiveness of public spending through leakage:

$$\tilde{G}_t = [1 - \ell(I_t)]T_t,$$

where better institutions reduce $\ell(I_t)$ and increase the share of resources reaching households. The assumption that corruption reduces effectiveness of public provision comes from a well-established literature Banerjee (1997); Mauro (1995, 2004); Gupta et al. (2002).

Under imperfect institutions, public resources are allocated unevenly across neighborhoods. Wealthier neighborhoods receive a larger share (denoted s) of effective education spending:

$$s_j = s(\tilde{w}_j), \qquad s'(\tilde{w}_j) > 0, \qquad \sum_{j=1}^{N} s_j = \tilde{G}_t.$$

This allocation rule captures the idea that initial conditions and lower agency among poor individuals matter for economic outcomes and government allocations and is grounded in established literature Rajkumar and Swaroop (2008); Sampson and Morenoff (2006); Banerjee (1997); Galor and Zeira (1993). In weak institutional environments, poorer neighborhoods receive a disproportionately smaller share of public resources due to differences in political influence, access, and leakage, consistent with Banerjee (1997).

Human capital Human capital is formed through access to effective public investment in education. Let g_{it} denote effective public investment in education received by individual i. Higher g_{it} indicates higher quality of education.

Individual human capital is then given by $h_{it} = \underline{h} + \mathbf{1}\{i \in \mathcal{E}_t\}\, \phi(g_{it})$, where $\phi(\cdot)$ captures the transformation of public investment into human capital. Assume $\phi'(g) > 0$ and $\phi''(g) \leq 0$, so public investment increases human capital, but at a diminishing rate. $\mathcal{E}$ is the set of people receiving education.

Poverty Definition Individual income is given by $y_{it} = w_{it} = Ah_{it}^{\beta}$. An individual is poor if their income lies below a threshold $\bar{y}$, that is, if $w_{it} < \bar{y}$.

Key assumptions and motivations The first assumption follows an established literature (Banerjee and Duflo, 2007; Kraay and McKenzie, 2014), where poverty is concentrated in households with low human capital and adverse initial conditions.

ASSUMPTION 1 (SUBSISTENCE WAGE AND POVERTY). Individuals without human capital earn a subsistence wage below the poverty line, that is,

$$w_s < \bar{y}.$$

In addition, individuals in the initial cohort who do not obtain education have income below the poverty line in the first period.

ASSUMPTION 2 (EDUCATION PROVISION).

For simplicity, the framework assumes that human capital formation occurs through public provision alone. Relaxing this assumption to allow private education financed through a fraction of parental income would not alter the core mechanism. If anything, it would likely reinforce inequality in education quality, since poorer households would face greater constraints in financing high-quality education.

Similarly, for expositional clarity, the framework abstracts from credit constraints and capital asset accumulation. Incorporating these features would amplify the core mechanisms of the paper.

ASSUMPTION 3 (COST OF EDUCATION AND TAX).

Minimum cost to get educated is such that $\tau w_{hi}^{*} > c_h$. This states that the tax revenue generated by an individual earning the threshold educated wage is sufficient to cover the cost of providing education.

The affordability assumption is empirically motivated [2]. In practice, weak education outcomes often reflect leakage and inefficiencies in delivery rather than the absence of public resources (Rajkumar and Swaroop, 2008).

[2] In countries with strong institutions, for example Australia and Belgium, government tax revenue per year is much lager than what they need to cover in education costs.

ASSUMPTION 4 (INITIAL SET). The initial education set is non-empty and represents a positive fraction of the population $\mathcal{E}_0 > 0$. This assumption is imposed to avoid corner solutions in which no individuals are educated.

3.1 Characterization of the Core Mechanisms and Thresholds

The structure of equilibrium depends on how many neighborhoods (and hence individuals) gain access to decent quality education funding. This determines M_{t+1}, the measure of neighborhoods (and hence the incoming cohort) that can be equipped with human capital. To provide the sharpest intuition, the analysis focuses on how institutional quality $\ell(I_t)$, total output and population growth n_t shape outcomes.

The key tension arises because population growth increases the size of the incoming cohort that must be equipped with human capital. At the same time, institutional quality determines how much of public expenditure is effectively used to equip this cohort, rather than being lost to corruption or inefficiency.

Given the above setup, the number of neighborhoods (and hence the new population cohort) that can be equipped with human capital is:

$$M_{t+1} = \frac{[1 - \ell(I_t)]\tau Y_t}{c_h m_t \,(1 + n_t)}.$$

Here c_h denotes the cost of providing the minimum level of education necessary for individuals to find schooling worthwhile (defined below).

This expression defines the threshold and makes the central trade-off transparent: an increase in population growth raises the denominator by enlarging the cohort that must be funded, while an improvement in institutional quality raises the numerator by increasing the effective resources available. As a result, M_{t+1} summarizes how institutions and population growth jointly determine the share of the new cohort that acquires human capital.

Schooling Decision Utility for person i in period t is given by:

$$U = \frac{c_t^{1-\sigma} - 1}{1 - \sigma}. \tag{4}$$

Given education funding for their neighborhoods, individuals choose education by comparing the lifetime payoff from acquiring human capital to remaining at subsistence. The education decision is given by:

$$\frac{(1-\tau)w_{hi}}{1+r} \;\geq\; (1-\tau)w_s + \frac{(1-\tau)w_s}{1+r}. \tag{5}$$

Investing time in education requires the individual to forgo the subsistence wage w_s in the first period. In return, the individual earns a higher, skilled wage in the second period, given by $w_{it}(h_{it})$, which is discounted by $1 + r$. By contrast, if the individual does not acquire education, they earn the subsistence wage w_s in both periods. The education decision therefore compares the discounted gain from higher future earnings to the opportunity cost of forgone subsistence income.

Solving equation (5) yields the threshold condition:

$$w^*_{hi} = (2 + r)\, w_s. \tag{6}$$

An individual invests time in education only if education quality is sufficiently high to cross the human-capital threshold.

Using (2), $w_{hi} = Ah^{\beta}_{it}$ and $w_s = Ah^{\beta}$. Substituting into $w^*_{hi} = (2 + r)w_s$ yields

$$h_{it} \geq \bar{h} \equiv (2 + r)^{1/\beta} h. \tag{7}$$

Let c_h denote the public resource cost of attaining the minimum human-capital threshold $\bar{h}$. Moreover, the education set then becomes:

$$\mathcal{E}_t := \{\, i \mid h_{it} \geq \bar{h} \,\}$$

3.2 Main Result

Proposition 1 *Better institutional quality raises the share of the new population that accumulates human capital and earns above subsistence wages, as public resources are more efficiently translated into human-capital formation.*

Proofs of the propositions and Corollary 1 are in the appendix. Proposition 1 is intuitive. Institutional quality determines the extent to which public spending is lost through leakage. By reducing leakage, stronger institutions increase the share of public resources that reach various neighborhoods, thereby enabling a larger share of the incoming population cohort to accumulate human capital. As more individuals acquire human capital, they earn above subsistence wages and are not likely to fall into poverty. Furthermore, in this setting, educated cohorts do not generate the same congestion pressures, since their per capita tax contributions remain sufficiently high to sustain public spending at levels comparable to previous educated cohorts. As a larger share of the population accumulates human capital, output and the tax base also increase, further reinforcing effective public spending and poverty reduction across the economy.

By contrast, when institutions are weak, a significant share of tax revenue is lost through leakage arising from inefficiencies and corruption, limiting the extent to which public resources are translated into effective educational provision across locations. As a result, fewer individuals in the new cohorts accumulate human capital and a larger share of the population remains at subsistence wages.

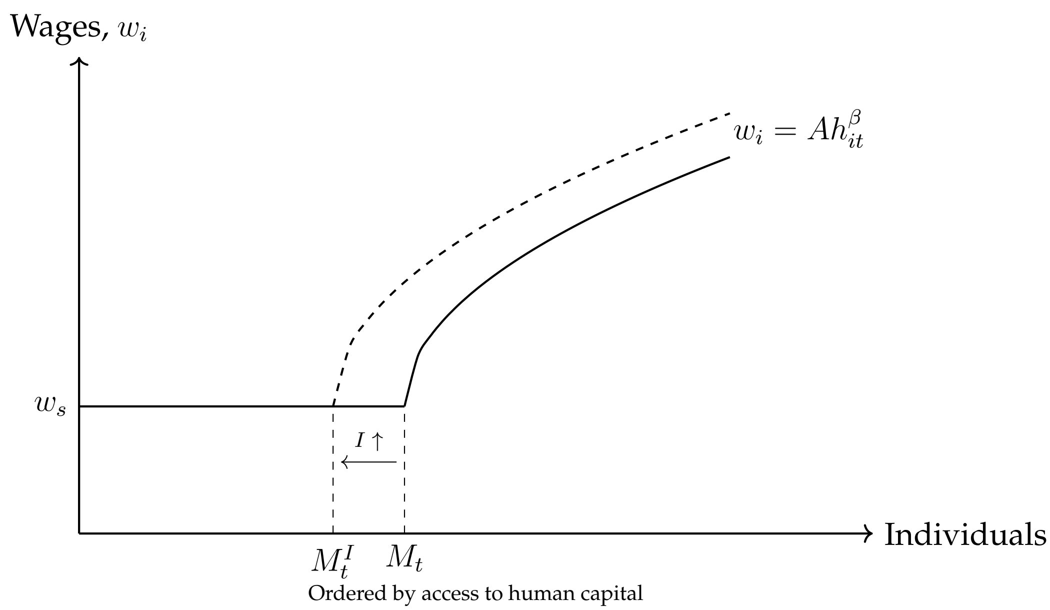


Figure 1: Wages and access to human capital. Individuals are ordered by access to human capital across locations. Stronger institutions shift the cutoff from M_t to M_t^I, increasing the share of individuals earning above subsistence.

Proposition 2 (Threshold Effect) *There exists a critical level of institutional quality, I^*, such that for $I_t < I^*$, an increase in population growth raises poverty, and this effect is amplified beyond the direct congestion effect through fiscal erosion.*

Proposition 2 highlights a crucial two-layer mechanism. The first layer is direct congestion: population growth enlarges the incoming cohort that must be equipped with human capital, while available public resources remain limited. When institutions are sufficiently weak — below I^* — effective public resources per member of the incoming cohort fall short of the minimum level required for human-capital accumulation. As a result, a positive share of the new cohort remains outside $\mathcal{E}_t$, earns subsistence wages, and remains poor.

The second layer is fiscal erosion, here those who fail to accumulate human capital earn subsistence wages and contribute little to the tax base, eroding the public resources available to subsequent cohorts. This fiscal erosion compounds the initial congestion: weak institutions and population growth interact to produce a deteriorating cycle in which the resources available to equip each successive cohort decline further.

By contrast, when institutional quality exceeds I^*, the incoming cohort is absorbed into $\mathcal{E}_t$, earns above subsistence wages, contributes positively to the tax base, and sustains future public investment. Importantly, in this case, the fiscal erosion mechanism does not operate.

Uneven population growth Moreover, Proposition 2 highlights that population growth can generate a disproportional rise in poverty. Relaxing the assumption of uniform population growth, and allowing it to be higher among poorer households—as is empirically observed (Eswaran, 2006; Vandenbroucke, 2016)—further amplifies the core mechanism. When population growth becomes more concentrated in areas where there is not sufficient funding for education, it further reduces the share of the new cohort that can be equipped with human capital.

Corollary 1 (Uneven Population Growth and Poverty Amplification) *Suppose $I_t < I^*$, so that institutional quality is below the threshold required to absorb population growth without increasing poverty. Let $\lambda_t \in (0, 1]$ denote the share of the incoming cohort concentrated in low-human-capital neighborhoods. If population growth is disproportionately concentrated in these neighborhoods, then population growth further amplifies poverty through fiscal erosion.*

Building on the mechanisms in Proposition 2, an increase in λ_t strengthens the fiscal-erosion channel by concentrating population growth among neighborhoods that remain outside the human-capital sector. As a larger share of the incoming cohort earns subsistence wages and contributes little to the tax base, effective public resources available for future cohorts decline further. Uneven demographic pressure therefore amplifies the interaction between weak institutions and population growth, reinforcing poverty persistence.

In the framework, for reasons of parsimony, credit constraints and capital asset accumulation are not incorporated into the model. Adding these two features in the framework would only strengthen the core results.

While how institutions affect government spending is stylized for parsimony, Propositions 1 and 2 emerge from a broader and well-established literature highlighting the role of corruption in effectively using public expenditure Banerjee (1997); Mauro (1995, 2004); Gupta et al. (2002) and constraints faced by poorer households (Banerjee and Duflo, 2007; Kraay and McKenzie, 2014). The framework isolates a core mechanism through which institutions shape how economies absorb population growth. Next, the paper turns to Proposition 1 to empirically examine whether institutions condition the impact of population growth on poverty.

4 Data

The data are drawn from the World Development Indicators (WDI), the World Governance Indicators (WGI), and the V-Dem dataset. The pooled OLS sample covers 166 countries (Table A2), declining to 109 under GMM estimation, requiring at least two consecutive observations for all core variables. The analysis uses five-year averages over the period 1996-2021 and draws on 1991 data to construct lagged values for the 1996 observations. Using five-year averages is standard in the growth and poverty literature to reduce noise from annual fluctuations and business-cycle volatility (Barro, 1996; Cingano, 2014). Institutional variables from the WGI are only available from 1996 onward, which determines the starting date of the analysis. For some countries, we observe data for all six time periods; for GMM estimation, we have as few as two observations.

Within the WGI measures used in the analysis, all governance dimensions may matter, but the prior is that Government Effectiveness, Control of Corruption, and Rule of Law are especially relevant because they map most directly into state capacity, service delivery and policy implementation, all of which are closely linked to the framework of this paper and hence poverty outcomes. Within the WGI framework, Government Effectiveness captures the quality of public services, the civil service, and policy implementation, while Control of Corruption captures the extent to which public power is used for private gain, including petty corruption, grand corruption, and state capture. Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, including the quality of contract enforcement, property rights, the police, and the courts.

Regulatory Quality captures the ability of governments to formulate and implement policies and regulations that promote private sector development, including elements such as price controls, market regulation, labour market regulation, and licensing requirements. Voice and Accountability reflects political participation and civil liberties, including electoral competitiveness and media freedom, while Political Stability and Absence of Violence captures political violence, terrorism, armed conflict,the ability to hold clean elections and ensure orderly transfers. While many of these individual measures are interesting, several of the dimensions used in these indices likely capture broader aspects of governance that extend beyond the administrative capacity and service-delivery channels emphasized in this paper. Nevertheless, the paper uses all of these in the OLS regressions, before narrowing down to the core governance variables.

Poverty is measured using the World Bank's standardized poverty headcount ratio. We separately analyze three poverty thresholds: US$2.15, US$3.65, and US$6.85 per day (PPP). These standardized poverty lines allow for consistent cross-country comparisons, unlike national poverty lines, which vary due to differing definitions of poverty and country-specific economic and political contexts (Perkins et al., 2006; Breunig and Majeed, 2020; Cingano, 2014). Moreover, many country-specific poverty lines are based on relative measures and therefore capture inequality rather than absolute poverty.

Population growth is used to measure demographic changes. Population shocks extend well beyond fertility and mortality rates in a modern, globalized world. For instance, these shocks include migration, refugee flows (such as Syrian displacement into Europe and parts of the Middle East), and large discrete events such as political unification (e.g., East and West Germany). As fertility and mortality rates do not capture these population shocks, the analysis instead relies on population growth.

Table 1 reports summary statistics for the variables used in the analysis. Key covariates include investment, education, inflation, population growth, trade openness, financial development, and government expenditure. Specifically, investment is measured as gross fixed capital formation as a percentage of GDP; education is measured by secondary school attainment among the population aged 25 and over; inflation is measured as $\ln(1 + \text{inflation})$; population growth is measured as the total population growth rate; trade openness is measured as trade as a percentage of GDP; financial development is proxied by domestic credit to the private sector by banks as a percentage of GDP; and government expenditure is measured as general government final consumption expenditure as a percentage of GDP.

Table 1: Descriptive Statistics (All Countries; 1996–2021)

Variable	Definition and source	*N*	Mean	SD	Min–Max
Poverty headcount (US$2.15)	Headcount ratio, PPP; WDI	741	16.02	22.14	0–91.5
Poverty headcount (US$3.65)	Headcount ratio, PPP; WDI	741	29.05	30.59	0–97.6
Poverty headcount (US$6.85)	Headcount ratio, PPP; WDI	740	46.40	36.28	0–100
Population growth	Total population growth rate; WDI	1,519	1.48	1.53	-6.48–12.36
Investment	Gross fixed capital formation (% GDP); WDI	1,147	22.49	7.28	0–60.50
Education	Lower secondary completion, age 25+; WDI	517	61.31	26.92	2.04–100
$\ln(1 + \text{inflation})$	Consumer price index; WDI	1,199	1.82	1.14	-1.70–8.73
GDP per capita growth	Five-year compound growth rate; WDI	1,094	1.84	3.57	-20.69–43.49
Financial development	Domestic credit to private sector (% GDP); WDI	1,176	43.36	44.90	0.00–493.49
Trade	Trade openness (% GDP); WDI	1,233	85.98	55.04	0.52–639.52
Government expenditure	Final consumption (% GDP); WDI	1,177	16.99	8.99	1.39–134.81
Institutions					
Control of corruption	Public-sector corruption; WGI	1,211	0.00	0.99	-1.80–2.40
Government effectiveness	Bureaucratic and service quality; WGI	1,203	0.00	0.99	-2.37–2.29
Political stability	Absence of violence and terrorism; WGI	1,222	0.00	0.99	-3.21–1.94
Regulatory quality	Quality of regulation; WGI	1,204	0.00	0.99	-2.42–2.18
Rule of law	Judicial quality and property rights; WGI	1,245	0.00	0.99	-2.44–2.06
Voice and accountability	Democratic accountability and freedoms; WGI	1,244	0.00	0.99	-2.24–1.70

Notes: WDI denotes World Development Indicators; WGI denotes Worldwide Governance Indicators. The sample includes all countries for which data are available over the period 1996–2021. Typical range of WGI variables is -2.5 to 2.5, however, for some countries like Afghanistan and Somalia, the values can be lower than -2.5.

The next section sets out the empirical model and estimation strategy and describes the choice of control variables.

5 Model and Estimation

The paper now turns to testing the main hypothesis of the model. The analysis begins by providing correlational evidence, examining the relationship between population growth, institutions, and poverty.

Estimating this relationship presents several challenges. First, reverse causality is a central concern. Poverty itself may influence both institutional quality and population growth. For instance, poorer countries may exhibit weaker institutions due to limited fiscal capacity and governance constraints, while poverty may also affect demographic behaviour, including fertility behvaiour. Second, time-varying variables may jointly affect poverty, population growth, and institutions.

Third, measurement error is a concern. Both poverty and institutional quality are measured with error. Finally, poverty dynamics are likely to be persistent and shaped by initial conditions (Ravallion, 2012; Sampson and Morenoff, 2006). Countries with higher initial poverty may face structural constraints that influence subsequent poverty trajectories.

To address these concerns, the empirical strategy proceeds in three steps. First, OLS specifications control for observable covariates and initial conditions that may jointly determine poverty and the variables of interest. Second, the analysis employs system GMM, which accounts for country fixed effects, captures persistence in poverty, and uses internal instruments based on lagged values of endogenous variables to mitigate reverse causality and omitted variable bias.

Finally, the paper implements an instrumental variables (IV) strategy. Population growth is instrumented using regional jackknifed population growth, while institutional quality is instrumented using historical education, following strategies in Acemoglu et al. (2019); Tebaldi and Mohan (2010); Tabellini (2008). The IV estimates are particularly important as they provide plausibly exogenous variation in the key regressors, helping to address concerns about reverse causality and omitted variables. Below, the section expands upon the empirical strategy and discusses each approach in detail.

Empirical Design. This paper estimates the impact of population growth and institutional quality on poverty using a series of specifications based on Equation (8). Three World Bank poverty headcount ratios (defined in the data section) are used as the primary outcome variables.

$$\begin{aligned}\mathrm{Pov}^{\xi}_{it} = \beta_0 + \beta_1 I^{\Omega}_{it} + \beta_2 \,\mathrm{PG}_{it} + \beta_3 \Big(I^{\Omega}_{it} \times \mathrm{PG}_{it}\Big) + \beta_4 \,\mathrm{Initial\_pov}^{\xi}_{i} + \beta_5 \,\mathrm{Initial\_I}^{\Omega}_{i} \\ + \mathbf{B}'\mathbf{X}_{it} + \psi_t + \mu_i + \varepsilon_{it},\end{aligned} \tag{8}$$

where i indexes countries and t indexes five-year periods. Pov_{it}^{ξ} is the poverty head-count ratio, with

$$\xi \in \{\text{US\$2.15/day},\ \text{US\$3.65/day},\ \text{US\$6.85/day}\},$$

and I_{it}^{Ω} denotes institutional quality measured by the Worldwide Governance Indicators (WGI), with

$$\Omega \in \begin{array}{l}\{\text{Control of Corruption},\ \text{Government Effectiveness},\ \text{Political Stability},\\ \qquad\qquad \text{Regulatory Quality},\ \text{Rule of Law},\ \text{Voice and Accountability}\}\end{array}$$

The poverty and institutional measures are alternated across specifications using the definitions above. Population growth is denoted by PG_{it}. Time and country fixed effects are captured by ψ_t and μ_i, respectively. The vector $\mathbf{X}_{it}$ contains control variables as described in Table 2.

Empirical design. For each of the three poverty measures (ξ), equations are estimated using the relevant WGI institutional indicators (Ω). To conserve space, the paper reports the key results, while full output from all specifications is available upon request.

Table 2: Sets of covariates ($\mathbf{X}$) used in the empirical specification

Variable	**Set 1**	**Set 2**	**Set 3**
Gross fixed investment (% of GDP)	X	X	X
Proportion of population with secondary education	X	X	X
$\ln(1 + \text{inflation})$	X	X	X
Initial institutions	X	X	X
Initial poverty rate	X	X	X
Economic growth (five-year compound growth of GDP per capita)		X	X
Trade openness (trade as a proportion of GDP)			X
Government expenditure (% of GDP)			X
Domestic credit to private sector by banks (% of GDP)			X

Control Variables and Covariate Sets The choice of control-variable sets is motivated by the economic growth, poverty and population literature. The empirical analysis employs all three alternative control sets described in Table 2, however, for parsimony only key results are shown.

Set 1 includes investment, education, and $\ln(1 + \text{inflation})$. Prior work on disadvantage and distributional outcomes commonly controls for education and investment (e.g., Breunig and Majeed (2020); Cingano (2014)). Inflation is included because it can disproportionately affect poor households (Gill and Nagle, 2022; Easterly and Fischer, 2001) . Initial poverty and institutions are included to address concerns about persistence and initial conditions (Ravallion, 2012; Sampson and Morenoff, 2006).

Set 2 augments Set 1 with economic growth, which is argued to be a key determinant of poverty rates (Dollar and Kraay, 2002). Even after controlling for economic growth, the estimated association between population growth, institutions, and poverty remains statistically significant in the main specifications.

Set 3 further adds trade openness (trade as a share of GDP) as a proxy for economic openness, as it may influence poverty, institutions, and population growth. In larger economies, greater openness may also attract foreign investment, which can affect poverty and institutional outcomes. Government expenditure and domestic credit (both as shares of GDP) are added to proxy fiscal capacity and financial development that may mitigate poverty. Set 2 is preferred based on standard specification tests (described below). Sets 1 and 3 are employed as sensitivity tests.

Methodology: System GMM Estimation Estimating poverty equations shares common challenges with estimating growth equations. Poverty dynamics may be persistent, some regressors may be endogenous or predetermined (correlated with past and current unobservables), and country-specific fixed effects must be controlled for (Roodman, 2009; Arellano and Bond, 1991).

First-difference and system GMM estimators provide a solution. First-difference GMM differences Equation (8) to remove fixed effects and uses appropriately lagged levels of endogenous variables as internal instruments. However, if regressors are highly persistent, the resulting instruments can be weak—a concern for poverty, inequality, education, and institutions (Halter et al., 2014).

System GMM addresses weak-instrument concerns by estimating a system of equations in levels and first differences, using lagged differences as instruments for the level equation and lagged levels as instruments for the differenced equation (Blundell and Bond, 1998; Arellano and Bond, 1991). To reduce data loss and mitigate issues associated with unbalanced panels, orthogonal deviations are used (Roodman, 2009). System GMM can exploit cross-country variation more effectively than first-difference GMM, in which time-invariant components are swept out (Halter et al., 2014).

All reported estimates use the two-step system GMM estimator, which is asymptotically more efficient than the one-step estimator (Bond et al., 2001). Standard errors are computed using the Windmeijer (2005) finite-sample correction, and the small-sample correction discussed in Roodman (2009).

Internal instruments are restricted to two lags in the baseline specifications, and this choice does not lead to instrument proliferation, a common concern with internal instruments (Roodman, 2009). As a robustness check, restricting the instrument set to one lag does not materially affect the substantive results.

Instrument Validation and the Hansen Test GMM estimates can suffer from instrument proliferation Roodman (2009). The Hansen (1982) test of overidentifying restrictions is used to assess the joint validity (exogeneity) of the instrument set. Under the null hypothesis, the instruments are valid. A small p-value suggests rejection of instrument exogeneity. Conversely, high p-values—particularly when the number of instruments is large—may indicate instrument proliferation (Roodman, 2009). Accordingly, for each model, the tables report the Hansen p-value, and the results section discusses Hansen tests further. The next section presents the empirical results.

6 Results

6.1 Correlational Evidence - Ordinary Least Squares

This section begins by examining how poverty is correlated with institutions, population growth, and their interaction. Using each of the WGI institutional variables, it examines how their interaction with population growth is associated with poverty at the US$2.15 threshold. Table 3 reports estimates of this relationship. In the odd-numbered columns, the table reports the baseline relationship between population growth, the institutional measure, and their interaction, including only time fixed effects. Across these specifications, the interaction term is consistently negative and statistically significant for most institutional measures[3], indicating that the association between population growth and poverty becomes more adverse as institutional quality weakens.

In the even-numbered columns, the table examines the same relationship conditioning on Control Set 2 from Table 2, including investment, educational attainment, inflation, GDP per capita growth, and initial conditions. The results remain robust to conditioning on covariates: the interaction between population growth and institutional quality continues to be negative and statistically significant. Importantly, this is true for the core governance dimensions that the framework section argued are likely to be important for poverty, i.e. control of corruption, government effectiveness, and rule of law[4].

Figure 2 and 3 shows the corresponding marginal effects of these institutions. Moving from the upper to the lower end of the institutional distribution, we can see that institutions strongly condition the association between population growth and poverty, which is associated with substantial change in the marginal effect of population growth on poverty.

[3]Except for Political Stability, where it is not statistically significant

[4]To get an idea of the countries included in the regression see Table A2.

The results are robust to using different Control Sets from Table 2, and to removing initial conditions. Results are also robust to using broader poverty headcount measures of US$3.65 per day and US$6.85 per day [5]. This suggests that the relationship is not driven by omitted macroeconomic factors, measurement error, and remains robust to the inclusion of standard controls and initial conditions.

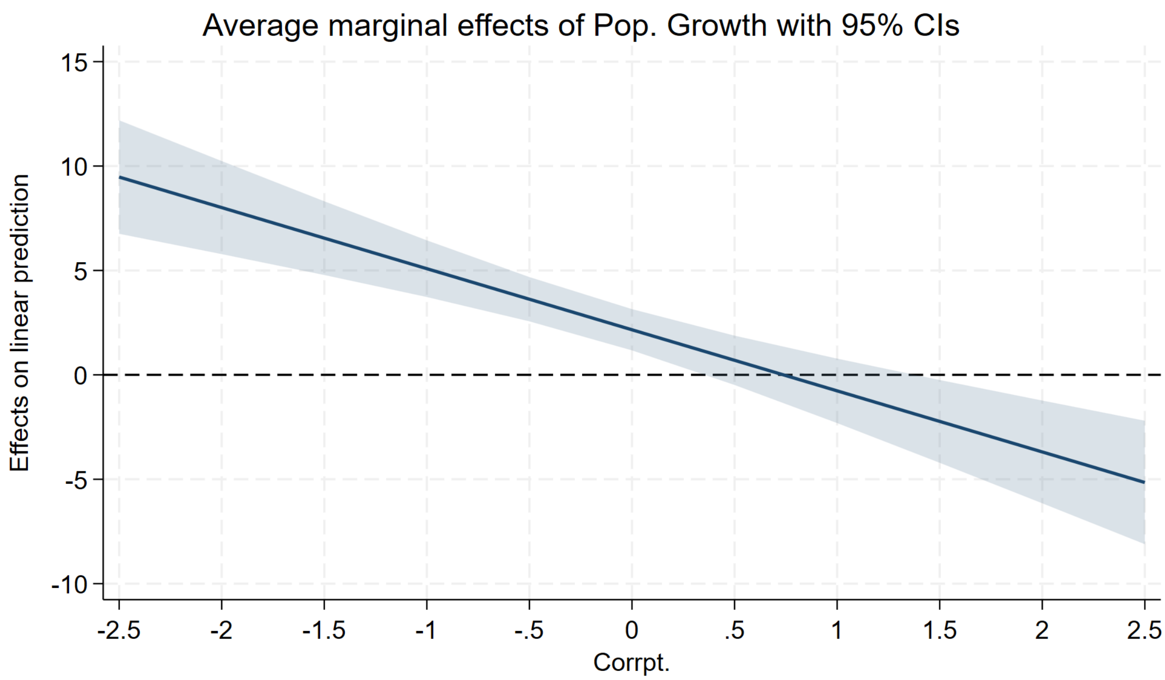
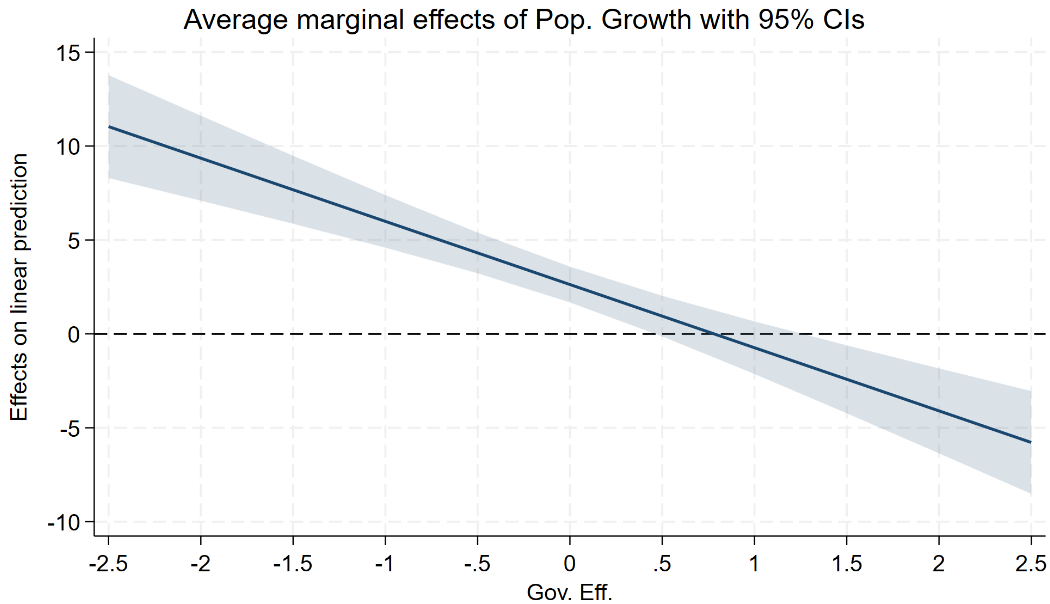
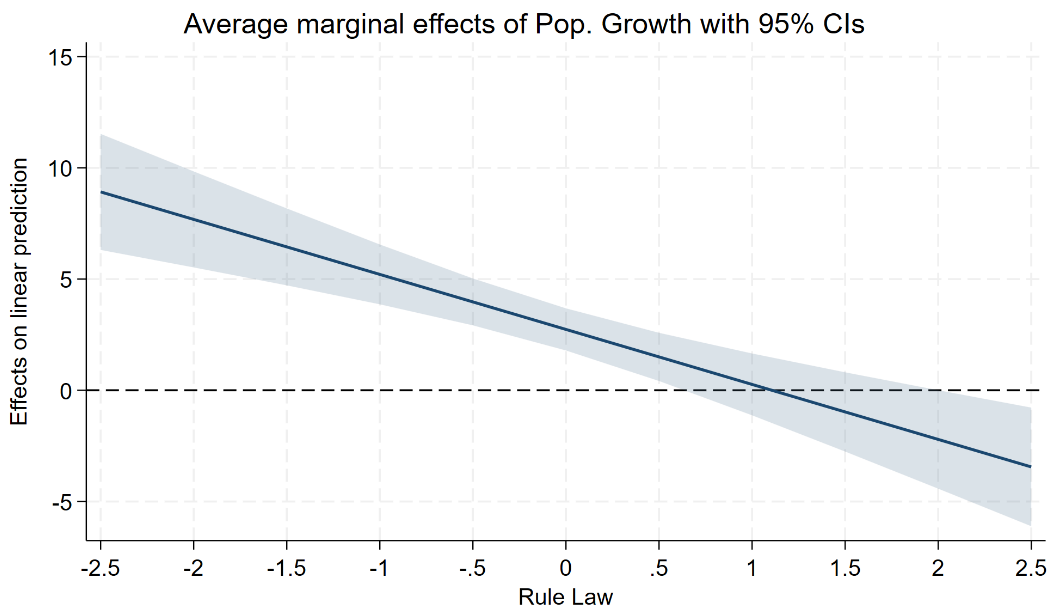


Figure 2: **Marginal effect of population growth on poverty across institutional quality (OLS): Control of corruption.** The figure plots the marginal effect of population growth on the poverty headcount ratio at the US$2.15 threshold. Shaded areas represent 95% confidence intervals.

[5] Results available on request



(a) Government effectiveness



(b) Rule of law

Figure 3: **Marginal effect of population growth on poverty across institutional quality (OLS, continued).** The figure reports the corresponding estimates for government effectiveness and rule of law. Shaded areas represent 95% confidence intervals.

Table 3: **Poverty headcount ratio (US$2.15 per day): OLS estimates**

VARIABLES	**(1) No CS**	**(2) Set 2**	**(3) No CS**	**(4) Set 2**	**(5) No CS**	**(6) Set 2**	**(7) No CS**	**(8) Set 2**	**(9) No CS**	**(10) Set 2**	**(11) No CS**	**(12) Set 2**
Population growth × institutions (interaction terms)												
PG × Control of corruption	**-3.11*****	**-2.93*****										
	(0.76)	(0.65)										
PG × Government effectiveness			**-4.68*****	**-3.36*****								
			(0.68)	(0.62)								
PG × Political stability					**-0.04**	**-1.47*****						
					(0.68)	(0.55)						
PG × Regulatory quality							**-4.16*****	**-3.39*****				
							(0.71)	(0.65)				
PG × Rule of law									**-3.35*****	**-2.47*****		
									(0.71)	(0.60)		
PG × Voice and accountability											**-1.98*****	**-2.08*****
											(0.72)	(0.62)
Population growth and Institutions												
Population growth (PG)	7.20***	2.16***	5.60***	2.63***	8.86***	2.66***	6.56***	3.27***	6.86***	2.74***	7.95***	2.74***
	(0.64)	(0.60)	(0.60)	(0.58)	(0.61)	(0.60)	(0.60)	(0.59)	(0.62)	(0.57)	(0.60)	(0.59)
Institution	-2.62**	2.17	-3.17***	1.17	-4.41***	6.37***	-3.16***	6.31***	-3.06***	7.74***	-3.75***	5.77***
	(1.02)	(1.52)	(1.00)	(1.61)	(1.26)	(1.32)	(1.08)	(1.61)	(1.02)	(1.52)	(1.13)	(1.51)
Constant	-1.21	-0.90	0.37	-2.48	-2.47	2.71	-0.30	-1.21	-0.81	0.34	-1.17	-0.12
	(1.69)	(3.43)	(1.60)	(3.38)	(1.75)	(3.38)	(1.66)	(3.36)	(1.67)	(3.36)	(1.73)	(3.48)
Controls and specification												
Initial poverty	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Initial institution	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Investment (GFCF % of GDP)	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Education (lower secondary attainment)	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Inflation	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
GDP per capita growth	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	679	302	678	302	680	302	678	302	682	302	682	302
R^2	0.450	0.728	0.516	0.738	0.404	0.731	0.486	0.739	0.466	0.742	0.436	0.727

Notes: The dependent variable is the poverty headcount ratio at US$2.15 per day (PPP). Each pair of columns reports a separate OLS specification using one numbered columns include time fixed effects only. Even-numbered columns additionally include the initial poverty rate, the corresponding initial (lagged) valu column, and the control variables. PG denotes the population growth rate. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.2 Generalized Method of Moments Estimates

To address concerns that the OLS estimates may be biased by unobserved country characteristics and reverse causality, this section turns to using system GMM. By exploiting within-country variation over time and using lagged values of the endogenous variables as instruments, this approach helps mitigate biases arising from time-invariant unobservables and potential feedback effects. This, together with the inclusion of relevant covariates and initial conditions, shows that the results remain robust.

For parsimony and consistency with the framework, the analysis focuses on the core institutional dimensions most closely linked to state capacity—control of corruption, government effectiveness, and rule of law—along with their principal component. The results are also robust to using the principal component constructed from all institutional variables.

Table 4 reports the estimates for the US$2.15 poverty threshold, while the corresponding results for US$3.65 and US$6.85 are reported in Appendix Tables A3-A4, respectively. To provide a more compact summary of the results across poverty thresholds, the figures focus on the principal component of the above-mentioned institutional variables, plotting the marginal effects of population growth across the distribution of institutional quality (Figures 4 and 5).

The bottom rows of Table 4 and Appendix Tables A3-A4 report p-values for tests of second-order serial correlation (AR(2)) in the first-differenced residuals. The absence of AR(2) correlation is required for the validity of the moment conditions, since the estimator relies on lagged levels of the endogenous variables as instruments. Across all specifications, the null hypothesis of no second-order serial correlation cannot be rejected. This supports the validity of the internal instruments used in the GMM framework.

GMM estimates can suffer from instrument proliferation problems, as discussed by Roodman (2009). The Hansen (1982) test can be used to check for the exogeneity of instruments and also for the problem of too many instruments, or instrument proliferation. The null hypothesis of the test is that instruments are exogenous. When the p-value is small, we reject the null hypothesis and conclude that the instruments are invalid, as exogeneity does not hold. On the other hand, Roodman (2009) shows that as the number of instruments becomes too large, the p-value of the Hansen test converges to one. For each model we estimate, we report the number of instruments. A rule of thumb is that when the p-value of the Hansen test is above 0.8, there may be a problem of instrument proliferation.

In particular, the Hansen p-values for both Set 1 and Set 2 fall within a reasonable range, providing reassurance regarding instrument validity. While Set 2 is preferred, as it includes a richer set of controls capturing key economic channels, the results remain consistent across specifications. Results based on Control Set 3 also provide consistent results relative to Control Sets 1 and 2, although there is indication of instrument proliferation, as the Hansen test p-value exceeds 0.8.

The GMM estimates confirm the patterns documented in the OLS results. Across specifications, the interaction between population growth and institutional quality remains negative and statistically significant, indicating that the effect of population growth on poverty depends systematically on institutional quality. Importantly, these results are identified from within-country changes over time, suggesting that the relationship is not driven by cross-country differences alone. The magnitudes remain economically meaningful and consistent with the framework.

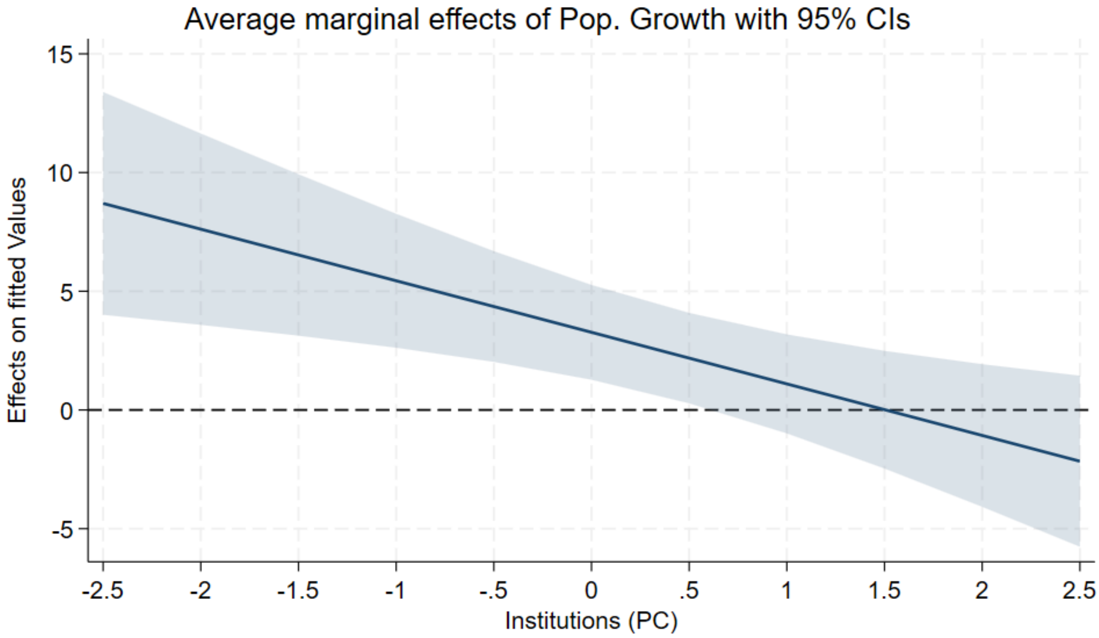
Examining Figures 4 and 5 gives evidence consistent with the OLS results, where the marginal effect of population growth becomes increasingly adverse as institutional quality declines. Conversely, at higher levels of institutional quality, population growth is associated with reductions in poverty, though the results are not statistically significant. This pattern is consistent with institutions playing an important role in mediating the economic consequences of demographic change and provides a transparent summary of the interaction effect.

For context, the interaction effect is statistically significant at the 5 percent level at a principal component index value of 0. In 2021, countries such as Azerbaijan, Bangladesh, Egypt, the Philippines, and Papua New Guinea recorded institutional scores at or below this threshold.

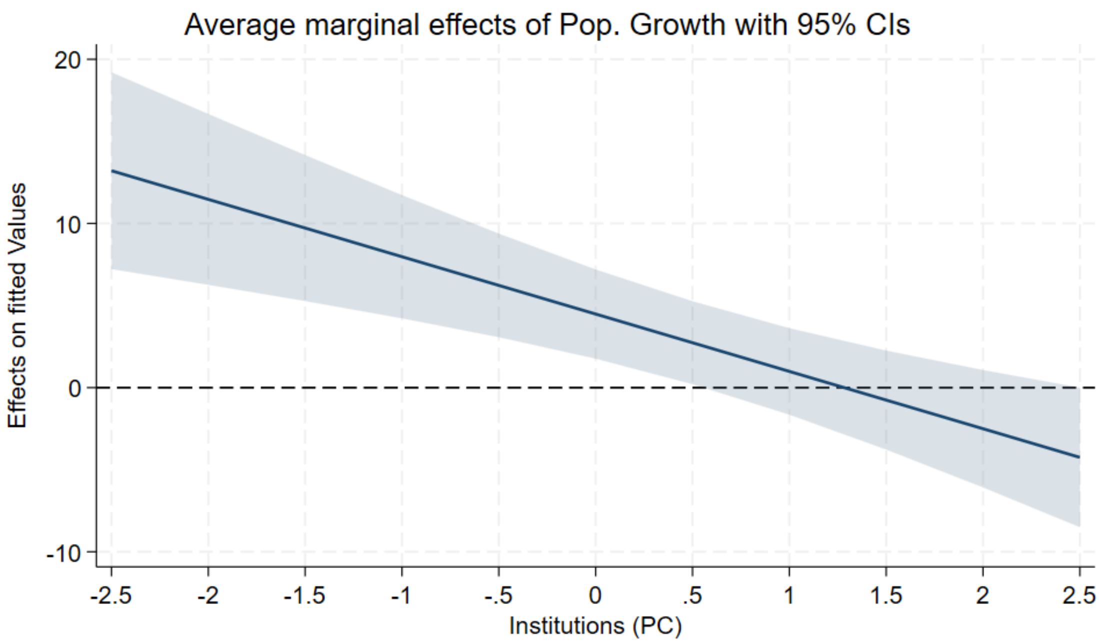
For these countries, a one percentage point increase in population growth is often associated with an increase in poverty rates exceeding one percentage point, indicating that population growth in weak institutional environments places substantial additional pressure on poverty outcomes. This result is particularly concerning for low- and middle-income countries, where average annual population growth has remained around 2 percent since the mid-1990s.

A key difference relative to the OLS results is that the positive effect of population growth at higher levels of institutional quality is not statistically significant when using the principal component measure. However, when institutions are considered separately—particularly Control of Corruption and Government Effectiveness—the effect remains positive and statistically significant, suggesting that for the institutional dimensions most closely aligned with the underlying mechanisms, there is evidence suggestive of beneficial effects of population growth. To conserve space, only figures for Government Effectiveness are presented in Appendix Figure A1.

Separately, the interaction effects involving political stability and voice and accountability are not statistically significant at the 95 percent level. This suggests that the poverty-reducing potential of population growth depends more strongly on institutions related to state capacity and enforcement than on broader political or participatory dimensions, consistent with the framework of this paper.



(a) US$2.15 per day



(b) US$3.65 per day

Figure 4: **Marginal effect of population growth on poverty across institutional quality.** Panels (a) and (b) plot the marginal effect of population growth on the poverty headcount ratio at the US$2.15 and US$3.65 thresholds, respectively, evaluated over the principal component of core institutional quality. Shaded bands indicate 95% confidence intervals.

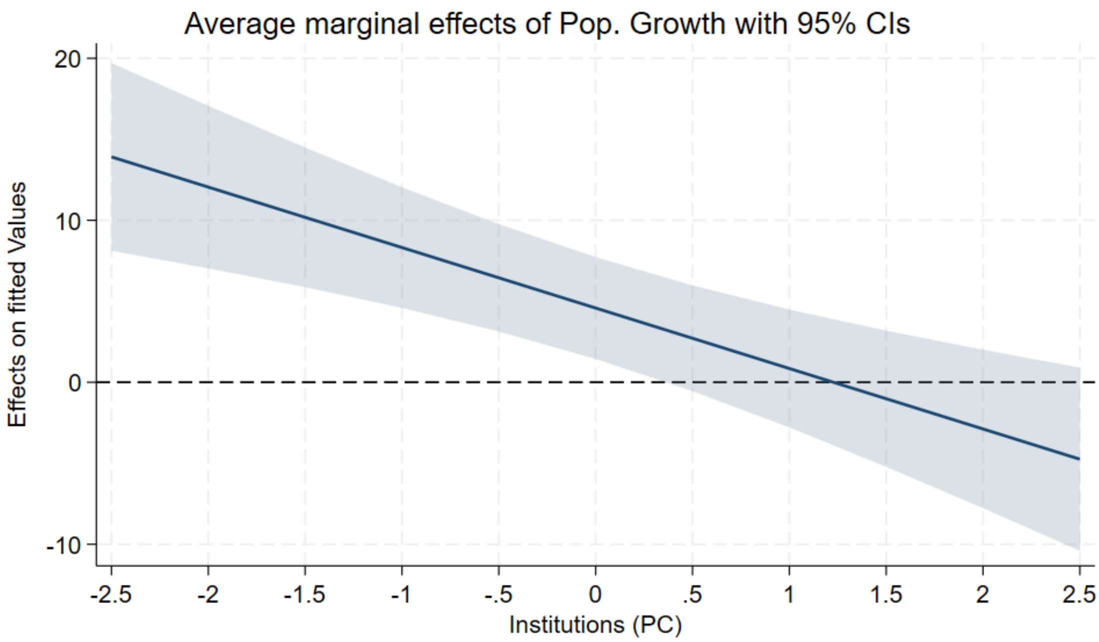


Figure 5: **Marginal effect of population growth on poverty across institutional quality (US$6.85 per day).** The figure plots the marginal effect of population growth on the poverty headcount ratio at the US$6.85 threshold, evaluated over the principal component of core institutional quality. Shaded bands indicate 95% confidence intervals.

Table 4: **Poverty headcount ratio (US$2.15 per day): estimates (Set 2)**

VARIABLES	**(1)** **Con. Corr.**	**(2)** **Gov. Eff.**	**(3)** **Rule Law**	**(4)** **Inst. PC**
Population growth $\times$ institutions				
PG $\times$ Con. Corr.	-3.003**			
PG $\times$ Gov. Eff.		-3.722***		
PG $\times$ Rule Law			-3.348**	
PG $\times$ Inst. PC				-2.172**
Population growth and institutions				
Population growth (PG)	2.821**	3.048***	3.284***	3.271***
Institution	2.533	0.004	8.755***	2.778*
Initial conditions				
Initial poverty	0.347***	0.329***	0.328***	0.328***
Initial institution	0.339	2.331	-6.203***	-0.972
Controls				
Investment	-0.302*	-0.307*	-0.406**	-0.367**
Education	-0.00120	0.0230	0.000522	0.0114
GDP per capita growth	0.523	0.212	0.381	0.457
Log inflation	-0.136	-0.461	-0.522	-0.231
Constant	4.446	4.401	7.734	5.216
Observations	302	302	302	302
Countries	109	109	109	109
Time effects	Yes	Yes	Yes	Yes
AR(2) p-value	0.382	0.306	0.160	0.351
Hansen p-value	0.665	0.581	0.453	0.663

Notes: The dependent variable is the poverty headcount ratio at US$2.15 per day. Each column reports a separate specification using one institutional measure. PG denotes population growth. Inst. PC is the principal component of control of corruption, government effectiveness, and rule of law. Initial poverty denotes the lagged dependent variable. AR(2) reports the Arellano?Bond test for second-order serial correlation in first differences. Hansen reports the test of overidentifying restrictions. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.3 Robustness

This section examines the robustness of the GMM estimates along two dimensions.

First, the analysis considers alternative control sets. The preferred specification uses Control Set 2, which augments the baseline controls with economic growth. Control Set 1 includes investment, education, inflation, and initial conditions, while Control Set 3 further incorporates trade openness, government expenditure, and domestic credit as proxies for openness, fiscal capacity, and financial development. Across these specifications, the results remain qualitatively consistent. Although Control Set 3 includes a richer set of covariates, it is more susceptible to instrument proliferation, as reflected in the Hansen test statistics.

Second, the robustness of the results to the lag structure of the GMM estimator is examined. The baseline specification uses two lags of the endogenous variables as instruments. As a robustness check, the model is re-estimated using a more parsimonious specification with a single lag. The results remain consistent across lag structures and control sets, indicating that the findings are not driven by the choice of instrument lag length. The results are also robust to the exclusion of initial conditions. Together, these findings indicate that the relationship between population growth and poverty is systematically conditioned by institutional quality.

7 Instrumental Variable Estimates

The OLS and GMM estimates presented in the previous sections condition on a rich set of controls, including initial conditions. GMM strategy further exploited within-country variation over time, and instrumented endogenous variables using internal lags.

No single strategy fully resolves the endogeneity concerns described earlier. This section therefore develops an IV strategy. The OLS, GMM and IV estimates help triangulate the evidence on the relationship between population growth, institutions, and poverty. Furthermore, a key benefit of the IV strategy is that it alleviates concerns regarding reverse causality and time varying omitted variables that may simultaneously affect population growth, institutions and poverty. Reassuringly, the IV estimates are also consistent with the theoretical framework and qualitatively similar with the results reported in the OLS and GMM sections.

Instrumental Variable Strategy

Historical education has been employed in the literature as an instrument for institutions, based on the premise that early human capital accumulation shapes the emergence and persistence of effective governance structures. The relevance of the instrument follows from substantial evidence that institutions are highly persistent and closely linked to historical factors, including early investments in human capital Tebaldi and Mohan (2010). Additionally, Tabellini (2008) argues that early human capital is directly linked to cooperation, norms, and hence institutions. This is consistent with the recent literature arguing that norms likely shape institutions (Acemoglu and Robinson, 2025). As such, this paper uses historical education (from 1950) as an instrument for institutions. Additionally, legal origins, also used in Tebaldi and Mohan (2010), are employed as a robustness check and do not change the results. However, once historical education is included, legal origins are only weakly associated with institutions; as such, they are excluded from the baseline IV specification.

The identifying assumption is that historical education influences contemporary poverty primarily through its effect on institutional quality. A potential concern is that historical education may affect current outcomes through alternative channels; to address this, the IV results control for a rich set of covariates (discussed below). A key benefit of using historical education is that it helps removed reverse causality. This approach therefore isolates variation in institutions that is plausibly exogenous to contemporaneous poverty dynamics.

The second approach exploits the fact that demographic dynamics tend to co-move across countries within regions (Bongaarts and Watkins, 1996; Bloom et al., 2003; Casterline, 2001). This co-movement can reflect shared demographic forces (such as common economic conditions, migration patterns, and the diffusion of fertility and household behaviour, including practices such as contraceptive use) that generate regional demographic waves. Motivated by this, the paper instruments country-level population growth using a jackknifed regional average, excluding the country itself.

This approach follows Acemoglu et al. (2019), who exploit regional co-movement as a source of exogenous variation in a different context. By construction, the jackknifed measure captures common demographic trends while purging country-specific shocks, thereby isolating variation in population growth that is unlikely to be driven by domestic poverty dynamics. Empirically, population growth exhibits substantial regional co-movement (with correlations around 0.6), supporting the plausible use of this instrument.

Motivated by the above observations, this section exploits regional population growth trends as a source of exogenous variation in a country's own population growth. The instrumental variable for population growth is thus given by:

$$Z_{it}^{pop} = \frac{1}{|\mathcal{R}_i| - 1} \sum_{\substack{i' \in \mathcal{R}_i \\ i' \neq i}} \mathrm{PG}_{i't}$$

Here, Z_{it}^{pop} denotes the instrument for population growth for country i at time t, $\mathcal{R}_i$ is the set of countries in the same region as country i, and $\mathrm{PG}_{i't}$ represents population growth in country i' at time t. The instrument is the average population growth of other countries in the same region-year, excluding country i.

The identifying variation comes from regional co-movement (in this case demographic dynamics) rather than country-specific shocks. A key concern is that regional population growth may reflect common economic shocks that directly affect poverty, potentially violating the exclusion restriction. To address this, the specification controls for a large set of covariates (discussed below), including time effects and region-specific factors, helping to isolate the component of regional demographic variation driven by diffusion rather than shared shocks.

As such, the empirical specification instruments population growth, institutional quality, and their interaction using the corresponding exogenous components derived from the instruments described above. Formally, the endogenous variables PG_{it}, I_{it}^{Ω}, and $I_{it}^{\Omega} \times \mathrm{PG}_{it}$ are instrumented with Z_{it}^{pop}, Educ_i, and $Z_{it}^{pop} \times \mathrm{Educ}_i^{hist}$.

$$P_{it} = \beta_1 PG_{it} + \beta_2 I_{it} + \beta_3 \left(PG_{it} \times I_{it}\right) + \mathbf{X}_{it}'\gamma + \delta_t + \varepsilon_{it}, \tag{9}$$

$$\left(PG_{it},\ I_{it},\ PG_{it} \times I_{it}\right) \quad \text{are instrumented by} \quad \left(Z_{it}^{pop},\ Educ_i^{hist},\ Z_{it}^{pop} \times Educ_i^{hist}\right) \tag{10}$$

As before, P_{it} denotes the poverty headcount in country i and year t, PG_{it} is population growth, and I_{it} is institutional quality. $\mathbf{X}_{it}$ is a vector of control variables, and δ_t denotes year fixed effects.

Exclusion Restrictions

The identifying assumptions for the IV strategy require that, conditional on controls, the instruments affect poverty only through their impact on institutional quality, population growth, and their interaction. Hence, the exclusion restriction requires that these instruments do not have independent direct effects on poverty once relevant covariates are accounted for.

These assumptions highlight the main threats to identification. Historical education may affect contemporary poverty through channels other than institutions, for example via persistent differences in economic growth and the investment environment. Similarly, regional population growth may affect poverty through shared regional shocks, including the diffusion of institutional dynamics, which could directly influence poverty. To verify that the IV results are not driven by other factors, the specifications control for a host of variables discussed below.

As discussed earlier, there is a large and well-established literature that highlights economic growth as a central driver of poverty reduction Dollar and Kraay (2002); Dollar et al. (2016). A key concern is that historical education may be correlated with current economic growth and investment. Given this, the regressions control for these variables. Controlling for investment is additionally important, as rising population growth in the region may attract more investment and reflect underlying scale effects.

A second concern is that regional population growth may reflect the diffusion of institutional ideas across countries. For example, regional waves of democracy have been shown to influence individual countries' democratic performance Acemoglu et al. (2019). Controlling for jackknifed regional institutional averages therefore helps isolate variation in population growth that is not driven by shared governance dynamics.

Similarly, the diffusion of ideas may affect poverty through channels such as practices and norms on fertility behavior, and changes in social norms, which may exhibit regional patterns. As such, the regressions control for trade openness, measured as the share of trade in GDP, which captures the extent of exposure to external ideas and diffusion.

Finally, the specification controls for freedom of expression using the V-Dem dataset. This variable captures broader information and idea diffusion that may simultaneously influence institutional quality and demographic behavior. Furthermore, historical education may be associated with greater access to information and political openness, which can shape institutional outcomes by strengthening accountability, civic participation, and governance quality. Freedom of expression may also influence fertility decisions through knowledge of contraceptive methods, female empowerment, and evolving social norms. Controlling for this variable therefore helps ensure that the identifying variation in institutions, such as control of corruption, rule of law, and government effectiveness, is not driven by shared informational or political environments.

In addition, time fixed effects capture global shocks. Together, these controls help absorb alternative pathways through which historical education and regional population growth may affect poverty, thereby helping to isolate variation that operates through institutions and population growth.

The confidence in the IV results is bolstered as the results remain robust to the inclusion of these variables. This IV strategy is particularly valuable because it provides plausibly exogenous sources of variation in both institutional quality and population growth, addressing reverse causality and time varying omitted variables more directly. It therefore complements the earlier OLS and GMM estimates, which are already robust to extensive controls, alternative specifications, and lag structures.

For parsimony, the analysis focuses on a principal component of institutional quality. It is constructed from Control of Corruption, Government Effectiveness, and Rule of Law, the measures most strongly associated with poverty in the previous empirical section. The results remain robust when each of these measures is used individually. Again, for brevity, the results presented here focus on the PHC $2.15 measure [6].

[6] Results are similar for other PHC measures and available on request

First Stage and Reduced Form Estimates

The first-stage and reduced-form relationships that underlie the 2SLS estimates are shown in Tables 6 and Panel B of 5, respectively. To save space, Table 6 only reports the first stage using the most extensive set of covariates; results are qualitatively similar for other control sets. As discussed earlier, to address natural concerns over the validity of the results, the regressions control for a large set of covariates in the baseline specification. The first-stage regressions indicate that historical education and regional population growth are strongly correlated with institutional quality and population growth.

The Kleibergen-Paap F-statistics indicate that the instruments are relevant, although, as a result of the interaction, the corresponding statistics are modest. The Kleibergen-Paap F-statistic is more challenging to interpret in this setting because the paper has two endogenous variables and their interaction being instrumented. It is reassuring, however, that when estimated in separate poverty regressions—instrumenting population growth with the regional (jackknifed) population growth measure and institutions with historical education, one at a time—the Kleibergen-Paap F-statistics exceed 20, indicating strong first-stage relevance [7]. This suggests that each instrument is individually strong in predicting its corresponding endogenous variable, and that the lower Kleibergen-Paap F-statistics in the full specification primarily reflect the additional complexity introduced by jointly instrumenting multiple endogenous variables and their interaction.

Regardless, to address potential weak-instrument concerns in the interaction specification, the analysis relies on Limited Information Maximum Likelihood (LIML) IV estimation, which is more robust in such settings. The results remain robust when using the standard two-stage least squares estimator.

Next, the reduced-form relationship between the interaction of the two instruments shows a negative impact on poverty, and the results are statistically significant. While regional population growth (jackknifed) is seen to be exerting upwards pressure on poverty, institutions on their own seem insignificant once population growth and the interaction term are controlled for.

2SLS Estimates

Panel C of Table 5 reports the 2SLS (LIML) results. Column 1 2SLS LIML estimate with a parsimonious control set, where the results show that the interaction term between population growth and institutions is negative and statistically significant at -2.11, while the coefficient on institution is also negative and statistically significant, and population growth itself is seen to put upward pressure on poverty. Columns 2-4 probe the robustness of the results by including additional time-varying covariates that may threaten the validity of the exclusion restriction. The central concern is that other

[7] Results available on request

economic or political shocks that are correlated with regional population growth and historical education might simultaneously have an impact on poverty. These columns progressively expand the control set. Column 2 adds investment (as a share of GDP) and trade (as a share of GDP). Column 3 further includes economic growth and the regional (jackknifed) average of institutional quality. Column 4 additionally incorporates freedom of expression. Figure 6 presents the margins plot for Column 4. The results are qualitatively similar across all columns.[8]

For ease of interpretation, this section focuses on the margins plot. In weak institutional environments, population growth is associated with higher poverty, with effects statistically significant at the 90 and 95 per cent levels. In stronger institutional settings, the estimated effect of population growth is positive, although generally insignificant except at very high levels of institutional quality. The lack of statistical significance at higher levels of institutional quality may reflect a smaller postive impact and wider confidence intervals, which likely arise from the reduced precision associated with instrumenting multiple endogenous variables and their interaction. The 2SLS estimates in this section are less precisely estimated than the OLS and GMM results. This is not surprising given the challenge of instrumenting three endogenous variables with three external instruments.

The estimated marginal effects are economically large. In weak institutional environments, where the median principal component of institutional quality is around -0.3[9], a one-percentage-point increase in population growth is associated with an increase in poverty of more than one-percentage-point. In 2016, countries such as Ghana, Belize, and the Philippines exhibited principal component scores of the relevant institutional measures below -0.3.

The IV estimates provide additional support for the baseline findings. By exploiting plausibly exogenous variation, the results suggest that the interaction between population growth and institutional quality is unlikely to be driven solely by reverse causality or omitted variables. While the IV estimates are less precisely estimated, they are consistent with the earlier results, indicating that the observed relationship may reflect an underlying structural interaction. The similarity of IV, GMM, and OLS estimates suggests that the results are unlikely to be driven by any single identification strategy.

The findings are also robust when the analysis is restricted to the most recent cross-section. Estimating the specification using only the 2021 sample, rather than the full panel, produces qualitatively similar results.

Summary

Despite differences in empirical design, the evidence across strategies points to the same conclusion: institutions strongly condition the impact of population growth

[8]Results available upon request.

[9]The median value of the Control of Corruption index is -0.23.

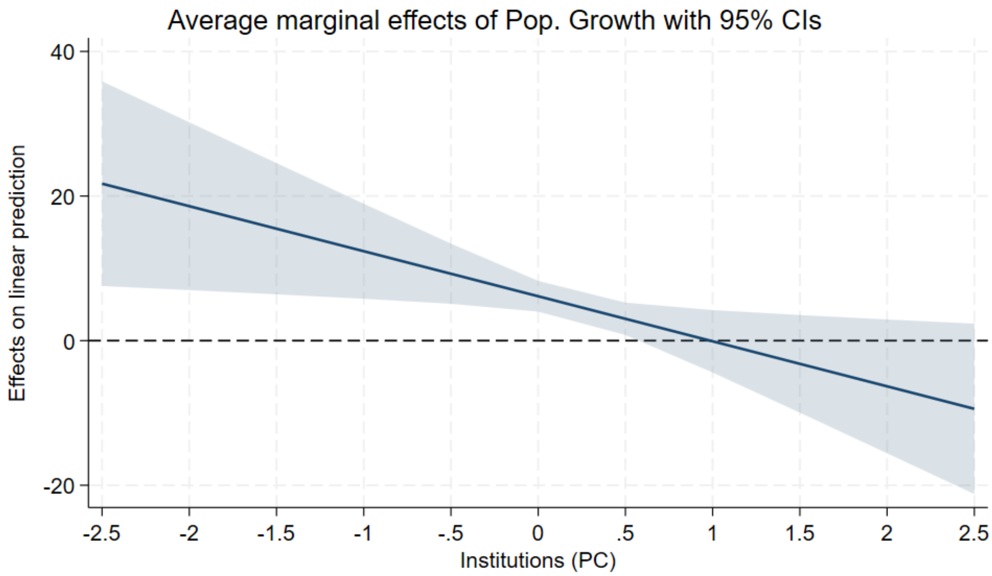


Figure 6: **Marginal effect of population growth on poverty across institutional quality (US$2.15 per day).** The figure plots the marginal effect of population growth on the poverty headcount ratio at the US$2.15 threshold. Grey area indicates 95% confidence intervals.

on poverty, consistent with the theoretical framework. Population growth is associated with higher poverty in weak institutional environments. This effect diminishes as institutional quality improves. There is also partial evidence that population growth reduces poverty in strong institutional settings, although these effects are statistically significant in OLS and GMM estimates but not in the IV specifications. Regardless, to be conservative, the evidence that population growth reduces poverty in high-institutional-quality environments should be interpreted as suggestive.

8 Mechanisms

This section uses correlational evidence to explore the potential mechanisms through which population growth may affect poverty outcomes. While the evidence presented here is illustrative and does not permit definitive conclusions as in the previous sections, or a separation of individual mechanisms, it remains informative and consistent with the framework. Additionally, there may be multiple channels through which population growth interacts with institutions to affect poverty, and this section highlights three of the main channels.

To this end, this section estimates models in which the dependent variable is a po-

Table 5: Population Growth, Institutions, and Poverty: OLS, Reduced Form, and IV Estimates

	(1)	(2)	(3)	(4)
Panel A. OLS				
Institutions (PC)	-1.647***	-1.370**	-0.412	-0.203
	(0.590)	(0.605)	(0.688)	(0.797)
Pop. growth	6.380***	6.833***	6.957***	7.300***
	(1.007)	(1.027)	(0.998)	(1.024)
Institutions $\times$ Pop. growth	-2.111***	-2.287***	-2.596***	-2.547***
	(0.584)	(0.599)	(0.595)	(0.598)
Panel B. Reduced Form				
Regional pop. growth	8.289**	9.669**	9.492**	9.478**
	(3.530)	(4.039)	(4.076)	(4.233)
Log population (1950)	-0.156	-0.123	-0.131	-0.129
	(0.110)	(0.114)	(0.110)	(0.115)
Log population (1950) $\times$ Regional pop. growth	-0.272***	-0.295***	-0.313***	-0.328***
	(0.101)	(0.109)	(0.117)	(0.124)
Panel C. IV (LIML)				
Institutions (PC)	-0.878	1.145	1.580	1.389
	(3.233)	(3.672)	(5.434)	(5.713)
Pop. growth	4.445**	5.923***	5.823***	6.140***
	(1.799)	(2.155)	(1.807)	(1.683)
Institutions $\times$ Pop. growth	-4.177	-5.432*	-5.965	-6.228
	(2.741)	(3.051)	(3.745)	(3.829)
Time fixed effects	Yes	Yes	Yes	Yes
Investment, share of GDP	Yes	Yes	Yes	Yes
Trade, share of GDP	Yes	Yes	Yes	Yes
GDPpc growth	No	Yes	Yes	Yes
Regional institutions avg (minus own)	No	No	Yes	Yes
Free expression	No	No	No	Yes
Kleibergen–Paap rk Wald F statistic	5.198	4.415	3.268	3.312
Observations	540	532	461	453

Notes: Robust standard errors clustered at the country level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: First-Stage Estimates

	(1)	(2)	(3)
	Panel A. First-stage estimates for Column (3) of Table 6		
Dependent variable	Pop. growth	Institutions (PC)	Institutions $\times$ Pop. growth
Regional pop. growth	0.985***	-0.001	-0.115
	(0.161)	(0.165)	(0.581)
Log population (1950)	-0.013**	0.033***	0.035*
	(0.006)	(0.007)	(0.020)
IV: Inst. $\times$ Pop. growth	-0.008	0.017**	0.033*
	(0.006)	(0.008)	(0.019)
Observations	614	614	614
R-squared	0.467	0.601	0.341
Time fixed effects	Yes	Yes	Yes
Investment (share of GDP)	Yes	Yes	Yes
Trade (share of GDP)	Yes	Yes	Yes
GDPpc growth	Yes	Yes	Yes
Regional institutions avg. (minus own)	Yes	Yes	Yes
Free expression	No	No	No
	Panel B. First-stage estimates for Column (3) of Table 6		
Dependent variable	Pop. growth	Institutions (PC)	Institutions $\times$ Pop. growth
Regional pop. growth	1.022***	0.155	0.060
	(0.161)	(0.166)	(0.594)
Log population (1950)	-0.014**	0.031***	0.034*
	(0.006)	(0.007)	(0.020)
IV: Inst. $\times$ Pop. growth	-0.014**	0.017**	0.032
	(0.006)	(0.008)	(0.020)
Observations	590	590	590
R-squared	0.490	0.663	0.362
Time fixed effects	Yes	Yes	Yes
Investment (share of GDP)	Yes	Yes	Yes
Trade (share of GDP)	Yes	Yes	Yes
GDPpc growth	Yes	Yes	Yes
Regional institutions avg. (minus own)	Yes	Yes	Yes
Free expression	Yes	Yes	Yes

Notes: The table reports first-stage estimates for the preferred specifications. Robust standard errors clustered at the country level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

tential channel through which the interaction of population growth and institutions may influence poverty. Following Acemoglu et al. (2019), this approach examines mechanisms by estimating analogous specifications with potential intermediate outcomes as dependent variables.

Specifically, the analysis considers outcomes capturing investment (share of investment in GDP), human capital formation (secondary school attainment), and health conditions (proxied by life expectancy). The specifications mirror the baseline framework and allow for interactions between population growth and institutional quality. The estimates are based on OLS. Robustness using System GMM specifications provide qualitatively similar results [10]

$$M_{it}^{k} = \alpha + \beta_1 \, \text{PopGrowth}_{it} + \beta_2 \, \text{Inst}_{it} + \beta_3 \left(\text{PopGrowth}_{it} \times \text{Inst}_{it} \right) + \Gamma' X_{it} + \delta_t + \varepsilon_{it}, \quad (11)$$

$$M_{it}^{k} \in \{ \text{Investment share of GDP}, \ \text{Secondary school attainment}, \ \text{Life expectancy} \} .$$

where M_{it}^{k} denotes mechanism k in country i and year t.

Appendix Table A5 reports the corresponding estimates, while Figure A2 plots the marginal effects of population growth across the distribution of institutional quality for each mechanism. Across specifications, population growth is associated with higher investment and life expectancy in stronger institutional environments, while the effects are negative or weaker in weaker institutional settings. The positive effect on investment appears at relatively lower levels of institutional quality.

Importantly, despite being strongly conditioned by institutions, the effect on education remains negative across all levels, though it attenuates as institutional quality improves. These patterns suggest that the effect of population growth on key economic channels becomes more favorable as institutional quality improves.

Of course, the above specifications do not fully account for reverse causality and other endogeneity concerns; the estimates provide informative and consistent evidence with the framework and priors. Across both OLS and System GMM specifications, the interaction between population growth and institutional quality is positively associated with investment, education, and health outcomes. Overall, the evidence suggests that the interaction of population growth and institutions may operate through multiple channels.

These results are consistent with the mechanisms outlined in Section 3. In environments with stronger institutions, additional population appears more likely to be

[10] Results available on request.

absorbed productively through increased investment, improved human capital accumulation, and better health outcomes. In these settings, the positive impact of scale is also likely. By contrast, in weaker institutional settings, population growth may strain existing capacity, limiting improvements in the underlying outcomes and channels.

This empirical strategy for mechanisms does not allow the paper to conclusively establish that these are the primary mechanisms. However, the fact that the estimated marginal effects of population growth on these outcomes become more positive in higher-quality institutional environments—even after controlling for several relevant covariates—suggests that they are plausible channels through which population growth interacts with institutions to shape poverty outcomes.

9 Conclusion

This paper was motivated by an important and unanswered question: how does the interaction between population growth and institutions affect poverty? Understanding the role of population growth and institutions is important not only because the world has experienced substantial demographic expansion in recent decades, but also because the global population is projected to increase by two to three billion people by 2100, largely in low- and lower-middle-income countries.

To underpin the mechanisms at play, the analysis microfounds the model with heterogeneous neighborhoods and allowing weak institutions to generate leakage through corruption and ineffective governance. The framework suggests that in countries with stronger institutions, additional population is more likely to escape poverty because public resources are translated into human capital through better provision of educational services. In contrast, weak institutions limit this process, increasing the likelihood that additional population remains trapped in poverty and places greater pressure on existing households.

The paper tests this hypothesis using multiple empirical strategies. The results provide strong evidence that institutions condition the impact of population growth on poverty. The empirical results show that in weak institutional environments, a one-percentage-point increase in population growth is associated with an increase in poverty exceeding one percentage point. The triangulation of this pattern across OLS, GMM, and IV specifications bolsters confidence in the empirical results. In addition, the findings also shed light on the role of population in canonical growth models, showing that its effects should be studied alongside its interaction with institutions.

While the analysis focuses on natural population growth, the mechanism generalizes to large migration and refugee inflows. The extent to which economies absorb demographic shocks — such as the Syrian refugee influx into Germany or Afghan refugee inflows into Pakistan and Iran — likewise depends on institutional capacity.

These findings highlight the importance of strengthening institutional frameworks as a strategic priority for poverty alleviation, particularly in rapidly growing developing economies. As policymakers seek durable solutions for poverty reduction, improving institutional quality appears central to translating demographic change into positive economic outcomes. This analysis also underscores the urgency of moderating population growth in countries with very weak institutions.

Declaration of AI-assisted technologies in the manuscript preparation process

AI was used to help improve the clarity of the document, shorten certain sections, and undertake copy edits. AI was further used to convert Stata tables into LaTeX format and to assist in checking proofs and formatting equations.

References

Acemoglu, D., Egorov, G., and Sonin, K. (2021). Institutional change and institutional persistence. In *The handbook of historical economics*, pages 365–389. Elsevier.

Acemoglu, D. and Jackson, M. O. (2015). History, expectations, and leadership in the evolution of social norms. *The Review of Economic Studies*, 82:423–456.

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5):1369–1401.

Acemoglu, D., Naidu, S., Restrepo, P., and Robinson, J. A. (2019). Democracy does cause growth. *Journal of political economy*, 127(1):47–100.

Acemoglu, D. and Robinson, J. A. (2025). Culture, institutions, and social equilibria: A framework. *Journal of Economic Literature*, 63(2):637–692.

Aghion, P. and Howitt, P. W. (2008). *The economics of growth*. MIT press.

Ahlburg, D. A. (1996). Population growth and poverty. In *The impact of population growth on well-being in developing countries*, pages 219–258. Springer.

Ahmed, S., Cruz, M., Quillin, B., and Schellekens, P. (2016). Demographic change and development: a global typology. *World Bank Policy Research Working Paper*, (7893).

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297.

Ashraf, Q. H., Weil, D. N., and Wilde, J. (2011). The effect of interventions to reduce fertility on economic growth. Technical report, National Bureau of Economic Research.

Banerjee, A. and Duflo, E. (2007). The economic lives of the poor. *Journal of Economic Perspectives*, 21(1):141–168.

Banerjee, A. V. (1997). A theory of misgovernance. *The Quarterly journal of economics*, 112(4):1289–1332.

Barro, R. J. (1996). Democracy and growth. *Journal of economic growth*, 1(1):1–27.

Berg, A., Ostry, J. D., Tsangarides, C. G., and Yakhshilikov, Y. (2018). Redistribution, inequality, and growth: new evidence. *Journal of economic growth*, 23(3):259–305.

Bloom, D., Canning, D., and Sevilla, J. (2003). *The demographic dividend: A new perspective on the economic consequences of population change*. Rand Corporation.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1):115–143.

Bond, S., Hoeffler, A., and Temple, J. (2001). Gmm estimation of empirical growth models.

Bongaarts, J. and Watkins, S. C. (1996). Social interactions and contemporary fertility transitions. *Population and development review*, pages 639–682.

Breunig, R. and Majeed, O. (2020). Inequality, poverty and economic growth. *International Economics*, 161:83–99.

Casterline, J. B. (2001). Diffusion processes and fertility transition: Selected perspectives.

Cingano, F. (2014). Trends in income inequality and its impact on economic growth. *OECD Social, Employment and Migration Working Papers*, (163).

Das Gupta, M., Bongaarts, J., and Cleland, J. (2011). Population, poverty, and sustainable development: A review of the evidence. *World Bank Policy Research Working Paper*, (5719).

Dollar, D., Kleineberg, T., and Kraay, A. (2016). Growth still is good for the poor. *European Economic Review*, 81:68–85.

Dollar, D. and Kraay, A. (2002). Growth is good for the poor. *Journal of economic growth*, 7(3):195–225.

Duflo, E. (2001). Schooling and labor market consequences of school construction in indonesia: Evidence from an unusual policy experiment. *American economic review*, 91(4):795–813.

Duflo, E., Dupas, P., Spelke, E., and Walsh, M. P. (2024). Intergenerational impacts of secondary education: Experimental evidence from ghana. Technical report, National Bureau of Economic Research.

Easterly, W. and Fischer, S. (2001). Inflation and the poor. *Journal of money, credit and banking*, pages 160–178.

Eswaran, M. (2006). Fertility in developing countries. *Understanding poverty*, (Part 1):143–60.

Galor, O. and Zeira, J. (1993). Income distribution and macroeconomics. *The review of economic studies*, 60(1):35–52.

Gill, I. and Nagle, P. (2022). Inflation could wreak vengeance on the worlds poor.

Gupta, S., Davoodi, H., and Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? *Economics of governance*, 3(1):23–45.

Halter, D., Oechslin, M., and ZweimÃ¼ller, J. (2014). Inequality and growth: The neglected time dimension. *Journal of Economic Growth*, 19:81–104.

Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica: Journal of the econometric society*, pages 1029–1054.

Jones, C. I. (2003). Population and ideas: A theory of endogenous growth. *Knowledge, information, and expectations in modern macroeconomics: in honor of Edmund S. Phelps*, pages 498–521.

Klasen, S. and Lawson, D. (2007). The impact of population growth on economic growth and poverty reduction in uganda. Technical report, Diskussionsbeiträge.

Kraay, A. and McKenzie, D. (2014). Do poverty traps exist? assessing the evidence. *Journal of Economic Perspectives*, 28(3):127–148.

Lin, J. Y. (2009). *Economic development and transition: thought, strategy, and viability*. Cambridge university press.

Majeed, O. (2025). Why institutions endure: Norms, leadership, and the difficulty of reform. *CAMA Working Paper 36/2025 June 2025*, 2025.

Mankiw, N. G., Romer, D., and Weil, D. N. (1992). A contribution to the empirics of economic growth. *The quarterly journal of economics*, 107(2):407–437.

Mauro, P. (1995). Corruption and growth. *The quarterly journal of economics*, 110(3):681–712.

Mauro, P. (2004). The persistence of corruption and slow economic growth. *IMF Staff Papers*, 51(1):1–18.

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press.

Perkins, D. H., Radelet, S., and Lindauer, D. L. (2006). *Economics of Development*, chapter 8, page 314. W. W. Norton & Company, New York, 6 edition.

Rajkumar, A. S. and Swaroop, V. (2008). Public spending and outcomes: Does governance matter? *Journal of Development Economics*, 86(1):96–111.

Ravallion, M. (2012). Why don't we see poverty convergence? *American Economic Review*, 102(1):504–523.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system gmm in stata. *The stata journal*, 9(1):86–136.

Sampson, R. J. and Morenoff, J. D. (2006). Durable inequality: Spatial dynamics, social processes, and the persistence of poverty in chicago neighborhoods. In *Poverty Traps Conference, Jul, 2001, Santa Fe Institute, Santa Fe, NM, US; Revision of paper presented at the aforementioned conference.* Princeton University Press.

Schultz, T. W. (1961). Investment in human capital. *The American economic review*, 51(1):1–17.

Shleifer, A. and Vishny, R. W. (1993). Corruption. *The quarterly journal of economics*, 108(3):599–617.

Sinding, S. W. (2009). Population, poverty and economic development. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1532):3023–3030.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics*, 70(1):65–94.

Tabellini, G. (2008). Institutions and culture. *Journal of the European Economic association*, 6(2-3):255–294.

Tebaldi, E. and Mohan, R. (2010). Institutions and poverty. *The journal of development studies*, 46(6):1047–1066.

United Nations (2024). World population prospects 2024: Summary of results. Accessed: 2026-03-11.

Vandenbroucke, G. (2016). The link between fertility and income. *St. Louis Fed On the Economy*. Accessed: 2026-04-27.

Wietzke, F.-B. (2020). Poverty, inequality, and fertility: the contribution of demographic change to global poverty reduction. *Population and Development Review*, 46(1):65–99.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step gmm estimators. *Journal of Econometrics*, 126:25–51.

World Bank (2018). *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*. World Bank, Washington, DC.

Appendix

A Proofs

Proof of Proposition 1

Proof.

An individual is poor if income lies below the poverty threshold $\bar{y}$. By Assumption 1, individuals without human-capital accumulation earn the subsistence wage w_s, where $w_s < \bar{y}$. Hence, individuals who remain outside the human-capital sector remain poor.

Recall that the number of neighborhoods that can be equipped with human capital is given by:

$$M_{t+1} = \frac{[1 - \ell(I_t)]\tau Y_t}{c_h\, m_t(1 + n_t)}.$$

The comparative static with respect to institutional quality is:

$$\frac{\partial M_{t+1}}{\partial I_t} = \frac{\tau}{c_h\, m_t(1 + n_t)} \left[-\ell'(I_t) Y_t + (1 - \ell(I_t)) \frac{\partial Y_t}{\partial I_t} \right].$$

The first term captures the direct effect: since $\ell'(I_t) < 0$, improvements in institutional quality reduce leakage and increase the effective public resources available for human-capital investment.

The second term captures an indirect effect: stronger institutions increase human-capital accumulation, which raises wages, output, and the tax base available to support future cohorts.

Together, these effects imply that improvements in institutional quality increase M_{t+1}, both directly by reducing leakage and indirectly by raising output. A higher M_{t+1} means that a larger share of neighborhoods receives sufficient education funding to cross the human-capital threshold.

For individuals in these neighborhoods, human capital rises above the threshold required to earn above subsistence wages. Since individuals outside the education set earn $w_s < \bar{y}$, expanding the education set reduces the mass of individuals below the poverty threshold.

Therefore, better institutional quality raises the share of the new population that accumulates human capital, earns above subsistence wages, and avoids poverty. This reduces the likelihood that population growth translates into higher poverty. ■

Proof of Proposition 2.

Proof.

Since each neighborhood has population m_t, and total population is Nm_t, the poverty headcount is

$$P_t = \frac{Nm_t - M_t m_t}{Nm_t} = 1 - \frac{M_t}{N}.$$

This highlights that poverty is inversely related to the share of neighborhoods equipped with human capital, summarized by M_t. From the main text, the number of neighborhoods that can be equipped with human capital in period $t+1$ is

$$M_{t+1} = \frac{[1 - \ell(I_t)]\tau Y_t}{c_h m_t (1 + n_t)}.$$

Since $\ell'(I_t) < 0$, better institutions increase M_{t+1}, while higher population growth reduces it:

$$\frac{\partial M_{t+1}}{\partial I_t} > 0, \qquad \frac{\partial M_{t+1}}{\partial n_t} < 0.$$

Define the critical institutional threshold I^* as the level of institutional quality at which effective public resources are exactly sufficient to equip all neighborhoods with human capital:

$$M_{t+1} = N.$$

Substituting for M_{t+1}, the threshold condition is

$$[1 - \ell(I^*)]\tau Y_t = c_h N m_t (1 + n_t).$$

Since $\ell'(I_t) < 0$, a unique threshold I^* exists.

If $I_t < I^*$, then

$$[1 - \ell(I_t)]\tau Y_t < c_h N m_t (1 + n_t),$$

implying

$$M_{t+1} < N.$$

Hence, not all neighborhoods can be equipped with human capital. A positive share of the incoming cohort remains outside $\mathcal{E}_t$, earns subsistence wages $w_s < \bar{y}$, and remains poor. Since $P_{t+1} = 1 - M_{t+1}/N$, poverty is higher than in the case where the incoming cohort is fully equipped with human capital.

Population growth further amplifies this effect through fiscal erosion. As a larger share of the population remains outside $\mathcal{E}_t$, aggregate output and tax revenue decline, reducing the effective public resources available for future cohorts. Population growth therefore generates both a direct congestion effect and an indirect fiscal erosion effect, which reinforce one another.

By contrast, if $I_t > I^*$, then

$$M_{t+1} \geq N,$$

so the incoming cohort is absorbed into human-capital formation, earns above subsistence wages, contributes positively to the tax base, and sustains future public investment. In this case, the fiscal erosion mechanism does not operate. ■

Proof of Corollary 1.

Proof.

Suppose institutional quality is below the threshold, $I_t < I^*$, so that the economy cannot fully absorb population growth through human-capital formation. Let $\lambda_t \in (0, 1]$ denote the share of the incoming cohort concentrated in low-human-capital neighborhoods. Individuals in these neighborhoods earn the subsistence wage w_s, while individuals with human capital earn the average wage $\bar{w}_h$.

Average income in the economy is therefore

$$\bar{Y}_t = (1 - \lambda_t)\bar{w}_h + \lambda_t w_s.$$

Using $Y_t = N_t \bar{Y}_t$ and $N_t = N m_t$, the number of neighborhoods, and hence the incoming cohort, that can be equipped with human capital is

$$M_{t+1} = \frac{[1 - \ell(I_t)]\tau N \bar{Y}_t}{c_h(1 + n_t)}.$$

Differentiating with respect to population growth gives

$$\frac{\partial M_{t+1}}{\partial n_t} = -\frac{[1 - \ell(I_t)]\tau N \bar{Y}_t}{c_h(1 + n_t)^2} + \frac{[1 - \ell(I_t)]\tau N}{c_h(1 + n_t)} \frac{\partial \bar{Y}_t}{\partial n_t}.$$

Since a higher λ_t shifts population mass from the high-human-capital sector toward the subsistence sector, average income falls as λ_t rises. Formally,

$$\bar{Y}_t = (1 - \lambda_t)\bar{w}_h + \lambda_t w_s,$$

we get:

$$\frac{\partial \bar{Y}_t}{\partial n_t} = (w_s - \bar{w}_h)\frac{\partial \lambda_t}{\partial n_t},$$

population growth concentrated among poorer neighborhoods implies

$$\frac{\partial \lambda_t}{\partial n_t} > 0.$$

Because $w_s < \bar{w}_h$, it follows that

$$\frac{\partial \bar{Y}_t}{\partial n_t} < 0.$$

Hence,

$$\frac{\partial M_{t+1}}{\partial n_t} < 0.$$

Population growth therefore lowers M_{t+1} through two reinforcing channels. First, it directly enlarges the incoming cohort that must be funded, generating congestion in effective public-resource provision. Second, when population growth is concentrated among poorer neighborhoods, a larger share of the population remains at subsistence wages, weakening the tax base and reducing the resources available for future cohorts.

Thus, when population growth is concentrated among poorer neighborhoods, weak institutions amplify poverty persistence through both congestion and fiscal erosion. ■

Table A1: **Table A.1. Five year population growth for countries with weak institutions (control of corruption), as at 2021**

Country	Avg. pop. growth rate	Country	Avg. pop. growth rate
Below P25 (institutions)	2.05	Kyrgyz Republic	1.94
Below P50 (institutions)	1.77	Lao PDR	1.50
Below P75 (institutions)	1.59	Lebanon	-2.22
Afghanistan	2.97	Liberia	1.99
Albania	-0.45	Libya	1.40
Algeria	1.83	Madagascar	2.54
Angola	3.43	Malawi	2.70
Azerbaijan	0.77	Mali	3.21
Bangladesh	1.17	Mauritania	2.64
Benin	2.91	Mexico	0.84
Bolivia	1.41	Moldova	-1.38
Bosnia and Herzegovina	-1.24	Mongolia	2.02
Brazil	0.71	Morocco	1.10
Burundi	2.86	Mozambique	2.98
Cambodia	1.21	Myanmar	0.72
Cameroon	2.78	Nepal	1.52
Central African Republic	2.16	Nicaragua	1.40
Chad	3.32	Niger	3.83
Colombia	1.58	Nigeria	2.49
Comoros	1.94	Pakistan	1.62
Congo, Dem. Rep.	3.32	Panama	1.56
Congo, Rep.	2.39	Papua New Guinea	2.26
Cote d'Ivoire	2.56	Paraguay	1.36
Djibouti	1.56	Peru	1.61
Dominican Republic	1.10	Philippines	1.66
Ecuador	1.60	Russian Federation	-0.12
Egypt, Arab Rep.	1.83	Somalia	3.61
El Salvador	0.20	South Sudan	-0.56
Equatorial Guinea	3.16	Sudan	3.00
Eritrea	1.47	Syrian Arab Republic	2.38
Ethiopia	2.70	Tajikistan	2.25
Gabon	2.33	Tanzania	3.17
Gambia, The	2.64	Togo	2.44
Guatemala	1.57	Turkmenistan	1.56
Guinea	2.55	Uganda	3.42
Guinea-Bissau	2.35	Ukraine	-0.54
Haiti	1.33	Uzbekistan	1.86
Honduras	1.67	Venezuela, RB	-1.71
India	1.01	Vietnam	0.92
Indonesia	0.89	West Bank and Gaza	2.42
Iran, Islamic Rep.	1.09	Yemen, Rep.	2.41
Iraq	2.38	Zambia	3.04
Kenya	2.05	Zimbabwe	2.05

Notes: "Avg. pop. growth rate" refers to population growth in 2021. Institutional quality is used based on the control of corruption indicator. Below P25", Below P50", and "Below P75" denote country groups below the 25th, 50th, and 75th percentiles of control of corruption.

Table A2: **Countries included in OLS sample (Control of Corruption specification)**

Country	**Country**	**Country**	**Country**
Albania	Canada	Ghana	Lithuania
Algeria	Central African Republic	Greece	Luxembourg
Angola	Chad	Guatemala	Madagascar
Argentina	Chile	Guinea	Malawi
Armenia	China	Guinea-Bissau	Malaysia
Australia	Colombia	Guyana	Maldives
Austria	Comoros	Haiti	Mali
Azerbaijan	Congo, Dem. Rep.	Honduras	Malta
Bangladesh	Congo, Rep.	Hungary	Marshall Islands
Belarus	Costa Rica	Iceland	Mauritania
Belgium	Cote d'Ivoire	India	Mauritius
Belize	Croatia	Indonesia	Mexico
Benin	Cyprus	Iran, Islamic Rep.	Micronesia, Fed. Sts.
Bhutan	Denmark	Iraq	Moldova
Bolivia	Djibouti	Ireland	Mongolia
Bosnia and Herzegovina	Dominican Republic	Israel	Montenegro
Botswana	Ecuador	Italy	Morocco
Brazil	Egypt, Arab Rep.	Jamaica	Mozambique
Bulgaria	El Salvador	Japan	Myanmar
Burkina Faso	Estonia	Jordan	Namibia
Burundi	Eswatini	Kazakhstan	Nauru
Cabo Verde	Ethiopia	Kenya	Nepal
Netherlands	Poland	Spain	Uzbekistan
Nicaragua	Portugal	Sri Lanka	Vanuatu
Niger	Romania	St. Lucia	Venezuela, RB
Nigeria	Russian Federation	Sudan	Vietnam
North Macedonia	Rwanda	Suriname	West Bank and Gaza
Norway	Samoa	Sweden	Yemen, Rep.
Pakistan	Sao Tome and Principe	Switzerland	Zambia
Panama	Senegal	Syrian Arab Republic	Zimbabwe
Papua New Guinea	Serbia	Tajikistan	
Paraguay	Seychelles	Tanzania	
Peru	Sierra Leone	Thailand	
Philippines	Slovak Republic	Timor-Leste	
Poland	Slovenia	Togo	
Portugal	Solomon Islands	Tonga	
Romania	South Africa	Trinidad and Tobago	
Russian Federation	South Sudan	Tunisia	
Rwanda	Turkey	Turkmenistan	

Notes: This table reports the set of countries included in the OLS estimation using the control of corruption specification.

Table A3: **Poverty headcount ratio (US$3.65 per day): estimates (Set 2)**

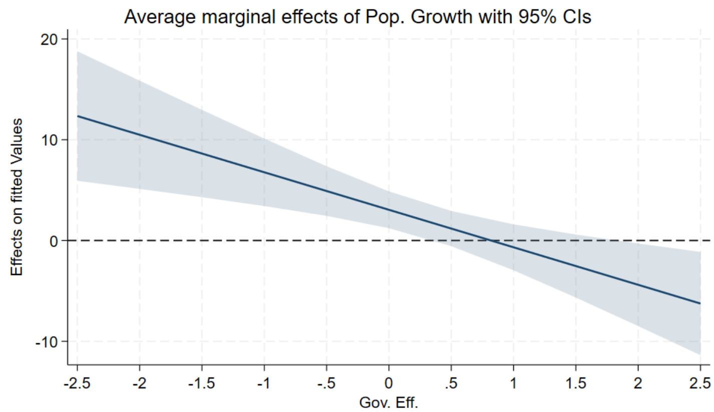
VARIABLES	(1) Con. Corr.	(2) Gov. Eff.	(3) Rule Law	(4) Inst. PC
Population growth × institutions				
PG × Con. Corr.	-5.372***			
PG × Gov. Eff.		-6.255***		
PG × Rule Law			-4.749**	
PG × Inst. PC				-3.493***
Population growth and institutions				
Population growth (PG)	3.762**	4.268***	5.129***	4.482***
Institution	5.864	2.316	13.53***	5.240**
Initial conditions				
Initial poverty	0.490***	0.469***	0.492***	0.487***
Initial institution	-0.444	2.859	-8.467***	-1.711
Controls				
Investment	-0.579***	-0.551***	-0.769***	-0.679***
Education	-0.0832	-0.0567	-0.0589	-0.0566
GDP per capita growth	1.277*	0.957*	1.299**	1.329**
Log inflation	-0.777	-0.406	-0.998	-0.406
Trade (% of GDP)	0.000792	0.00517	-0.0198	0.000153
Constant	15.21**	12.48*	19.15**	14.30*
Observations	302	302	302	302
Countries	109	109	109	109
Time effects	Yes	Yes	Yes	Yes
AR(2) p-value	0.734	0.900	0.338	0.812
Hansen p-value	0.767	0.604	0.717	0.730

Notes: The dependent variable is the poverty headcount ratio at US$3.65 per day. Each column reports a separate specification using one institutional measure. PG denotes population growth. Inst. PC is the principal component of control of corruption, government effectiveness, and rule of law. Initial poverty denotes the lagged dependent variable. AR(2) reports the Arellano-Bond test for second-order serial correlation in first differences. Hansen reports the test of overidentifying restrictions. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

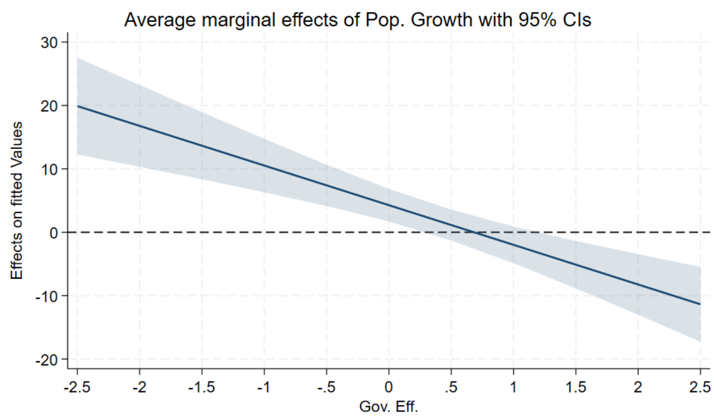
Table A4: **Poverty headcount ratio (US$6.85 per day): estimates (Set 2)**

VARIABLES	(1) Con. Corr.	(2) Gov. Eff.	(3) Rule Law	(4) Inst. PC
Population growth × institutions				
PG × Con. Corr.	-5.820***			
PG × Gov. Eff.		-6.426***		
PG × Rule Law			-4.002**	
PG × Inst. PC				-3.733***
Population growth and institutions				
Population growth (PG)	4.119**	4.483**	5.557***	4.583**
Institution	6.630	1.355	10.27**	4.836
Initial conditions				
Initial poverty	0.649***	0.627***	0.658***	0.656***
Initial institution	-2.184	1.831	-6.850	-1.911
Controls				
Investment	-0.660***	-0.692***	-0.903***	-0.785***
Education	-0.0776	-0.0471	-0.0612	-0.0501
GDP per capita growth	1.675***	1.263**	1.716***	1.637**
Log inflation	-0.792	-0.363	-0.884	-0.478
Trade (% of GDP)	-0.000678	0.00968	-0.0213	0.00146
Constant	17.04*	15.95*	22.27**	16.74*
Observations	302	302	302	302
Countries	109	109	109	109
Time effects	Yes	Yes	Yes	Yes
AR(2) p-value	0.831	0.867	0.668	0.943
Hansen p-value	0.777	0.831	0.709	0.787

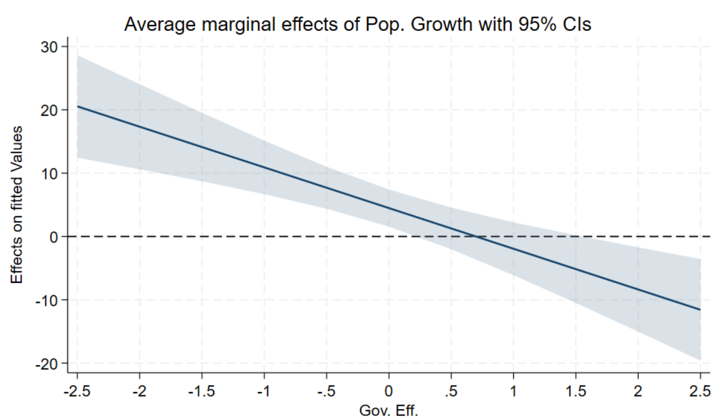
Notes: The dependent variable is the poverty headcount ratio at US$6.85 per day. Each column reports a separate specification using one institutional measure. PG denotes population growth. Inst. PC is the principal component of control of corruption, government effectiveness, and rule of law. Initial poverty denotes the lagged dependent variable. AR(2) reports the Arellano-Bond test for second-order serial correlation in first differences. Hansen reports the test of overidentifying restrictions. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.



(a) US$2.15 per day

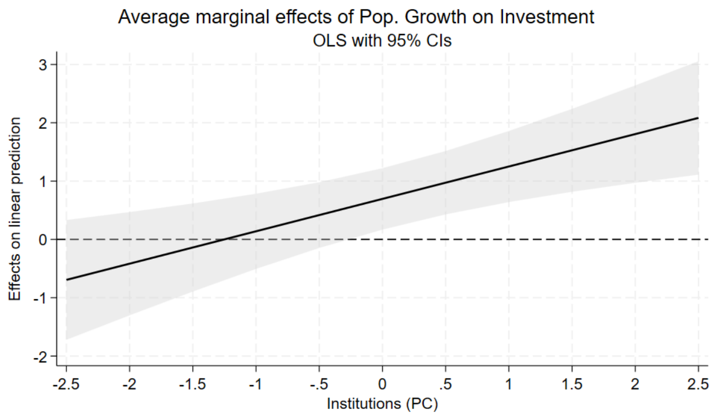


(b) US$3.65 per day

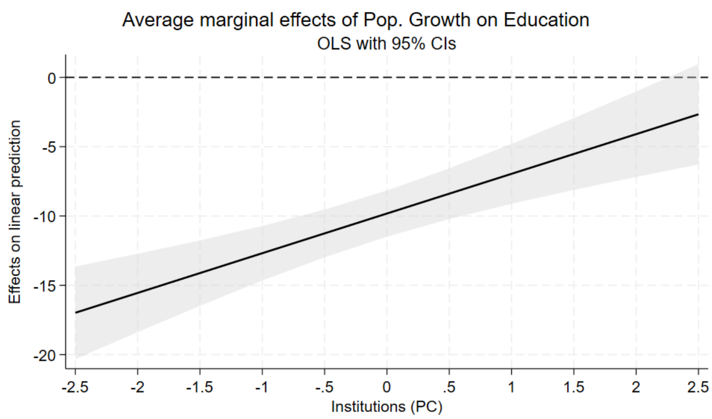


(c) US$6.85 per day

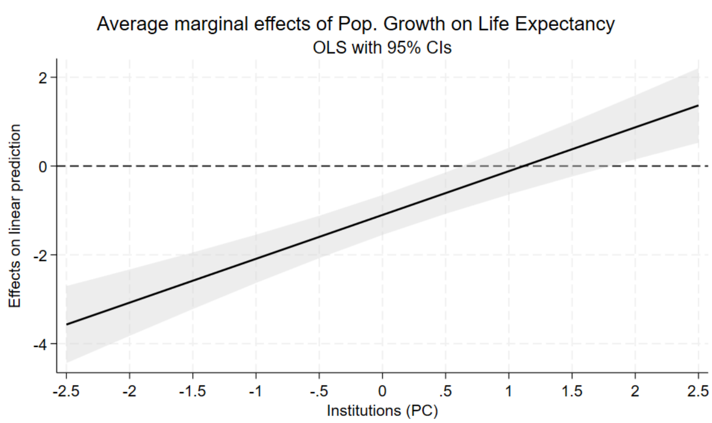
Figure A1: **Marginal effect of population growth on poverty across government effectiveness.** The figure plots the marginal effect of population growth on the poverty headcount ratio at the US$2.15, US$3.65, and US$6.85 thresholds, evaluated across the distribution of government effectiveness. Shaded areas represent 95% confidence intervals. The estimates suggest that the adverse effect of population growth weakens as government effectiveness improves and, at high levels, may become statistically indistinguishable from zero or suggestive of a reversal.



(a) Investment



(b) Education



(c) Life Expectancy

Figure A2: **Mechanisms: Marginal effect of population growth across institutional quality (OLS).** The figure plots the marginal effect of population growth on key economic mechanisms—investment, education, and life expectancy—evaluated across the distribution of institutional quality (principal component index). Shaded areas represent 95% confidence intervals.

Table A5: Mechanisms: Population Growth, Institutions, and Economic Channels

	(1)	(2)	(3)
	Dependent Variable		
	Investment	Education	Life Expectancy
Panel A. OLS			
Population Growth	0.695***	-9.821***	-1.102***
	(0.267)	(0.845)	(0.227)
Institutions (PC)	0.459	2.329	1.286***
	(0.555)	(2.019)	(0.468)
Population Growth × Institutions	0.556***	2.864***	0.987***
	(0.173)	(0.622)	(0.148)
Observations	397	397	397
Time Effects	Yes	Yes	Yes
Panel B. System GMM			
Population Growth	0.829	-10.345***	-1.217***
	(0.575)	(1.486)	(0.436)
Institutions (PC)	0.420	3.005	1.595
	(0.838)	(3.320)	(0.998)
Population Growth × Institutions	0.453	4.200***	1.097***
	(0.335)	(1.413)	(0.409)
Observations	397	397	397
Countries	135	135	135
Time Effects	Yes	Yes	Yes

Notes: The dependent variables are investment (gross fixed capital formation), education (secondary attainment), and life expectancy. All specifications include year fixed effects. Control variables differ by outcome to avoid mechanical inclusion of the dependent variable: investment regressions exclude investment controls, education regressions exclude education controls, and life expectancy regressions include both. The baseline controls include education, investment, inflation, GDP per capita growth, and trade openness as appropriate. Robust standard errors are reported in parentheses for OLS and System GMM estimates.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.