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Abstract

This research revisits and extends the literature on the interplay between inequality and education, by accounting for the role of institutions, the latter being a cornerstone of economies and societies. We establish that in the presence of weak tax institutions, the quality of public education is adversely affected by an increase in income inequality. Moreover, the adverse effect of inequality diminishes as the quality of institutions improves, suggesting that for sufficiently high quality of institutions, an increase in inequality would be less harmful for the quality of education. This effect operates via two channels, namely via an effect on the resources allocated to public education and via an effect on the number of individuals participating in the public schooling system.
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1 Introduction

The interaction between inequality and public education has always been central to policy debates. One of the associated aspects is related to the role that education plays on the observed trend of increasing income inequality in developed countries during the last thirty years (see e.g. Atkinson, 2007; Schütz et al., 2008; Goldin and Katz, 2008; OECD, 2008; Chancel et al., 2021). The related literature primarily focuses on the effect of public education on the distribution of earnings and consequently on income inequality (see, e.g., Glomm and Ravikumar 1992; 2003). The reverse question though, i.e., the effect of inequality on the size and the quality of public education, has not attracted adequate attention.

The aim of our paper is to shed light on this reverse relationship. In doing so, however, we introduce into our analysis another critical element, i.e., that of institutional quality. The detrimental effect of weak institutions on a wide range of economic and social aspects of a country has been extensively analyzed.[1] Implicitly in our analysis we refer to tax institutions, as we model tax evasion in our model and weak tax institutions indicate higher levels of tax evasion.[2] Interestingly though, the detrimental effect of evasion may operate via various alternative channels, that have been left relatively unexplored by the relevant literature. In light of the evidence that corruption coexists and interacts with income inequality (Chong and Gradstein, 2007; Roine, 2006), we focus on public education and the potential interaction between corruption and inequality. Whereas it is argued that corruption hurts the quality of public education (Mauro, 1995), the only channel that has been explored by the relevant literature is that of the reduced government spending on education due to corrupt governmental activities.[3]

The present paper seeks to contribute to the discussion about alternative channels that link inequality with public education. Analytically, the paper explores the link from inequality towards the quality of education and suggests that in the presence of weak institutions, inequality exerts a detrimental impact on the quality of public education. This effect operates via two channels. An increase in inequality, on the one hand, affects the revenue allocated to

[1] See e.g., the literature focusing on the direct adverse effects of corruption on government spending and public good provision (Gupta et al., 2001; Mauro, 1998; Hessami, 2014; Hokamp, 2014; Saha and Sen, 2021). More broadly, for a survey of the empirical literature examining the relation between corruption and public finances Hillman (2004). For a general survey on literature of corruption see Aidt (2003).

[2] For the shake of simplicity we will use the terms corruption and tax evasion interchangeably for the rest of the paper.

[3] In particular, Mauro (1995) suggests that since social spending is more transparent compared to other types of spending, public funds are directed towards less transparent activities.

public education and, on the other, the number of people choosing to participate in public schooling. Specifically, in the presence of weak institutions, an increase in inequality will increase the number of children in public schooling (since a larger fraction of households will not be able to afford private education), but this increase will not be accompanied by the corresponding increase in public funds. Consequently, the public spending per student will be reduced, which in turn hurts the quality of education provided. This finding complements previous theoretical studies that do not take into account the impact of institutions (see, e.g., De la Croix and Doepke, 2009). Moreover, in line with the existing empirical literature (Mauro, 1995, 1998; Gupta et al., 2002), we find that corruption has a negative effect on education spending. However, we also argue that, while the sign of the effect of corruption on the quality of education remains negative, its intensity depends on the level of inequality.

To study the question at stake, we build an overlapping generations model with the preferences of individuals being defined over consumption and fertility. Moreover, individuals are faced with the standard quality-quantity trade-off, namely the number of children they wish to have and the quality of education they choose to provide for them (Galor and Moav, 2004; Galor, 2005; 2011). Individuals have the option to tax evade and the probability of being caught depends on the overall quality of institutions. Agents are heterogeneous only with respect to their income, allowing us to capture the element of inequality. Our theoretical results are as follows: a) all three regimes of education (i.e., purely private, mixed and purely public) can arise endogenously under different parameter values, b) in the presence of strong institutions and reduced tax evasion, inequality has a positive effect on the quality of public education, and c) in the presence of weak institutions and high levels of tax evasion, increases in inequality reduce the quality of public education. The intuition behind these results is due to a two-fold effect; first a direct effect of tax evasion on the level of public spending, and second an indirect effect of tax evasion on the number of children participating in public schooling.

Our analysis contributes to two different strands of the literature. First, it contributes to the literature that explores the relationship between inequality and education. Glomm and Ravikumar (1992) argue that in societies where the majority of agents have incomes below average, individuals will choose public schooling. Besley and Coate (1991) establish that in the presence of inequality, public provision favors those with low income but involves greater deadweight loss. Epple and Romano (1996) have formulated the "ends against the middle" hypothesis, according to which the coalition of the "ends" in the income distribution (low and high incomes), reduces public school spending. Most of these results have been empirically tested (Poterba, 1997; Harris, Evans and Schwab, 2001) and evidence suggests that support for public education is correlated to the income distribution of the voters.

Second, it contributes to the literature that explores the choice between public and private schooling. As Stiglitz (1974) claimed, the public provision of education was originally desirable for its redistributive effects. Glomm and Ravikumar, in a series of papers (1992; 1998; 2001; 2003), have illustrated that coexistence of public and private education is an equilibrium outcome and that, in the long run, public education works towards closing the income gap between the rich and the poor.[4] Moreover, they argue that public spending on education (as a share of GNP) as well as the quality of education are increasing over time. This paper suggests that private alternatives to the public education can indeed emerge and coexist, but, in the presence of weak institutions, the quality of public education deteriorates, whereas private education remains significantly superior.

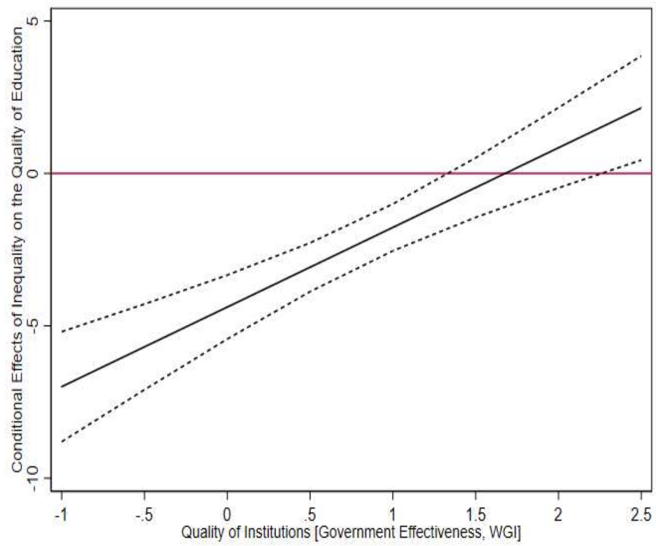
We provide some stylized facts, relying on country level data, to motivate our theoretical analysis and main finding i.e., that in the presence of strong institutions increasing inequality has a positive effect on the quality of public education whereas in the presence of weak institutions this result is reversed. To this end we resort to data obtained from a cross country dataset of 63 –both developed and developing- countries. Analytically, we estimate the marginal effect of income inequality on the quality of education for different levels of institutional quality. [5]

Figures 1 and 2 indicate that the marginal effects are highly conditional on the level of institutional quality.[6] More precisely, income inequality exerts a negative and statistically

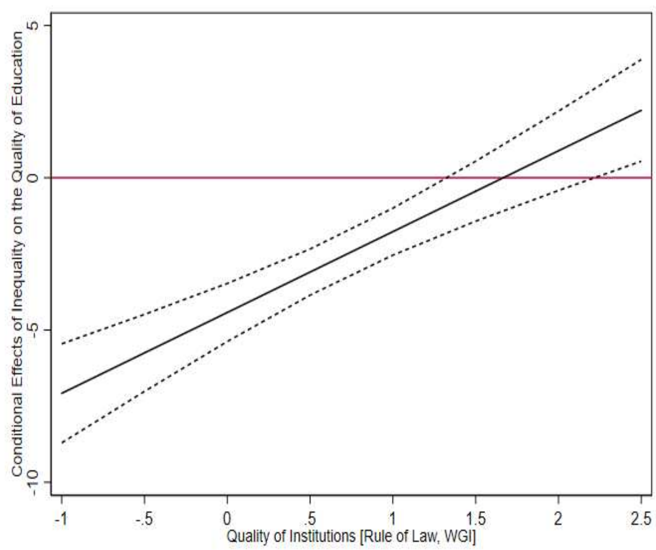
[4]Evidence around the world indicates that public schooling is one of the most prevailing social policies and that especially at early stages (elementary, secondary schooling) the fraction of students participating in public schools is very high, i.e. in the US it is above 85% and in Canada above 95%.Additionally according to the World Bank, most countries spend approximately 9%-15% of total government expenditure on education (Greece- 9.2%, France-10.6%, Germany-9.7%, US-14.1%). Still though, private schooling spending comprises a significant part of GDP, ranging from 0.1-3% of GDP in OECD countries (Busemeyer, 2007).

[5]The marginal effects of income inequality are obtained by the estimation of the following empirical model: $\textit{Quality of Education}_i = \alpha_0 + \alpha_1 \textit{ Income Inequality}_i + \alpha_2 \textit{ Quality of Institutions}_i + \alpha_3 \textit{ Income Inequality}_i * \textit{Quality of Institutions}_i + \beta X_i + \epsilon_i$, where Xi contains a set of major controls such as GDP per capita, public spending on education (% GDP) and a set of continental fixed effects. We approximate the Quality of Education by the international student assessment scores for Mathematics and Science developed by PISA, OECD (2019), the income inequality by the Gini coefficient developed by the Texas University Inequality Project and the quality of institutions by: (i) the Government Effectiveness (Figure 1) and (ii) the Rule of Law indices retrieved from the Worldwide Governance Indicators (2019) (Figure 2). In both cases, higher values indicate better quality of institutions.

[6]Note: The conditional effects are calculated based on the empirical model described in footnote 5. Dashed lines signify 90% confidence interval.



((A)) Government Effectiveness-WGI.



((B)) Rule of Law-WGI

FIGURE 1: Education Regimes: The Effect of Income Inequality on the Quality of Public Education.

significant effect on the quality of education at low levels of institutional quality (i.e., for values of Government Effectiveness and Rule of Law below the cutoff level of 1.6) whereas this effect appears to be reversed and becomes positive at high levels (i.e., above the cutoff level of 1.6). Examples of countries whose institutional quality is beyond the cutoff are e.g., Australia, Iceland, New Zealand, Switzerland.

The remainder of the paper is organized as follows. Section 2 introduces the model and derives the effects of inequality on public education. Section 3 summarizes the main points. There is also an Appendix that provides detailed proofs of the propositions.

2 The Model

We build upon the De la Croix and Doepke (2009), henceforth C-D, model by introducing the option to tax evasion and the presence of weak institutions. Interestingly, this modification yields interesting implications that highlight the role of institutions. For ease of comparison and for brevity, we use the same notation and omit some of the details.

2.1 Demographics, Preferences and Budget Sets

Consider an economy consisting of a continuum of agents whose total mass is equal to 1. All agents are endowed with one unit of time and care about their own consumption, c, and the quantity and quality of their children, n and h, respectively:

$$\ln(c) + \gamma(\ln(n) + \eta \ln(h)), \quad \gamma > 0, \quad \eta \in (0, 1). \tag{1}$$

Each individual has a level of human capital, x, which is also equal to the wage that this individual can obtain in the labor market, i.e., the wage rate per unit of human capital is normalized to unity. We assume that x is uniformly distributed over the interval $[1-\sigma, 1+\sigma]$.

Human capital is obtained via formal education provided by teachers, whose wage is assumed equal to unity and equal to the average wage in the population. Parents can enroll their children either to a public education system or to a private one. The public education system provides the same level of education s to all students. It is financed through an income tax at the rate v, imposed on all adult agents in the economy independently of their preferred mode of education for their children. For those parents that choose the public education scheme no additional cost is applicable. The educational quality, s, and the tax rate, v, are determined endogenously, via a voting procedure that will be described below.

The private education system provides children with an education quality e. Parents pay for it out of their income at the expense of their own consumption. Education is measured in units of time of the average teacher and hence the cost of educating each child in the private system is also e. This cost is assumed to be tax deductible. Besides the education expenditure, raising a child requires a fraction ϕ of a parent's time. Hence, a parent's taxable income is $x(1-\phi n)-ne$.

Crucially, individuals have the option to evade taxes. They decide what fraction μ to *declare* knowing that the detection probability is $\theta(1-\mu)$; $\theta>0$ is an institutional parameter that captures the effectiveness of the auditing mechanism. Delinquent tax payers are charged a penalty rate $\zeta>1$ on evaded tax payments, which are $v(1-\mu)(x(1-\phi n)-ne)$.[7] In sum, the budget constraint of an agent with human capital x is

$$c=(1-v\mu-\pi v(1-\mu)^2)(x(1-\phi n)-ne), \tag{2}$$

where $\pi\equiv\zeta\theta$. The term $v\mu+\pi v(1-\mu)^2$ is the effective tax rate; recall that taxes at a rate v are paid on a fraction μ of taxable income and the *expected* penalty rate $\zeta\theta(1-\mu)=\pi(1-\mu)$ applies on evaded taxes. Given μ, an improvement in tax institutions, i.e., an increase in θ, or an increase in the penalty rate ζ lead to an increase in the expected penalty rate.

Agents can offer to their children either public, s, or private, e, education, but not both. Therefore parents choosing public education choose also $e=0$. Effective education is expressed as the maximum of the two, i.e., $h=\max\{e,s\}$. Substituting the budget constraint (2) into an agent's utility function (1) yields

$$u[x,v,\mu,n,e,s]=\ln\{(1-v\mu-\pi v(1-\mu)^2)(x(1-\phi n)-ne)\}+\gamma\ln n+\gamma\eta\ln\max\{e,s\}.$$

The sequence of events is the following. First, individuals make their decision over the optimal number of children, n, educational quality e, and the fraction of their taxable income that they will declare to the tax authorities, μ. Second, all adults vote on the tax rate v, and, hence, through the government budget constraint (specified below), the public education level, s. Individuals have perfect foresight regarding the outcome of the voting process.

[7] This assumption, besides the fact that it allows for analytical tractability, is a plausible one, since most countries follow this practice (see Yitzhaki (1974) for a more extensive discussion on this assumption).

2.2 Individual Choices and the Distribution of Income

For parents that provide public education to their offsprings, the optimization problem is $\max u[x, v, \mu, n, 0, s]$ with respect to μ and n. For these individuals the optimal fraction of their income that will be reported to the tax authorities is

$$\mu^s = 1 - \frac{1}{2\pi}. \tag{3}$$

Equation (3) implies that the rate of tax evasion, $1 - \mu^s$, is constant and unaffected by the tax rate, v,[8] or the income of the individual, x. Thus, all individuals, irrespectively of their income, evade at the same rate. Instead, the evasion rate is adversely affected by π, implying that improvement in the institutional quality, θ, or increases in the penalty rate imposed on evaded tax, ζ, lead to a decrease in the tax evasion rate. The condition $\pi = \zeta\theta \geq 1/2$ must be imposed, to ensure that $\mu^s \geq 0$.

Also, as in C-D, the number of children chosen by individuals who provide public education to their offsprings is

$$n^s = \frac{\gamma}{\phi(1+\gamma)}. \tag{4}$$

Individuals have the option to choose a private education scheme for their offsprings if they are not satisfied with the quality of public education s. For parents planning to provide private education, the optimization problem reduces to $\max u[x, v, \mu, n, e, 0]$ with respect to μ, n and e. The optimal fraction of income that will be reported to the tax authorities by these individuals is also

$$\mu^e = 1 - \frac{1}{2\pi}. \tag{5}$$

Similarly to the public education regime, the rate of tax evasion, $1 - \mu^e$, is independent of the tax rate, v, and the income of the individuals, x. As it will become clear later, this result, along with the other assumptions in C-D maintains the analysis tractable by keeping the tax base constant (see C-D for details). In fact, from now on we write $\mu^s = \mu^e = \mu$.

The number of children and the level of education chosen by an individual who prefers private education is

$$n^e = \frac{\gamma(1-\eta)}{\phi(1+\gamma)} \tag{6}$$

[8] Clearly, this simplified formula is, among others, the outcome of the assumption that the fine is imposed on evaded tax and not, for example, on evaded income. As already argued, this assumption is not only plausible but also renders the model tractable.

and

$$e = \frac{\eta\phi x}{1-\eta}. \tag{7}$$

Interestingly, spending on private education is not directly affected by π, i.e., the quality of tax institutions θ and the penalty rate ζ.[9]

The parental cost of an individual that provides public education is $\phi n^s x$, which after substituting from equation (4) is equal to $\gamma x/1+\gamma$. Similarly, the parental spending of an individual that chooses the private education scheme is given by $\phi n^e x + ne$, which after using equations (7) and (6) reduces also to $\gamma x/1+\gamma$, i.e., as in C-D (2009), overall parental spending remains unaffected by the choice of the educational regime. This in turn implies the constancy of the tax base, an outcome that allows us to explore the underlying mechanism behind the effect of inequality on the quality of education. A direct implication of this outcome, is that the taxable income of each individual remains unaffected by the choice between private or public schooling, since richer parents will have fewer children to offset the increased spending on their education. In other words, the taxable income of those who send their children to a public school is equal to $x(1-\phi n^s) = x/1+\gamma$, and is equal to that of individuals who select a private school $x(1-\phi n^e) - n^e e) = x/1+\gamma$.

By setting $u[x, v, \mu, n^s, 0, s] = u[x, v, \mu, n^e, e, 0]$, we can find the income level $\tilde{x}$ of the marginal household that is indifferent between choosing private or public education. This is

$$\tilde{x} = \frac{1-\eta}{\delta\phi\eta} E[s], \tag{8}$$

where $\delta \equiv (1-\eta)^{1/\eta}$ and $E[s]$ denotes the expected quality of public schooling.[10] For given $E[s]$, all agents with income above $\tilde{x}$ choose private education whereas those with income below $\tilde{x}$ choose public education.

Recall our assumption that human capital follows a uniform distribution over the interval $[1-\sigma, 1+\sigma]$. Thus, the density function is $g(x) = 0$ for $x < 1-\sigma$ and $x > 1+\sigma$, whereas $g(x) = 1/2\sigma$ for $1-\sigma \leq x \leq 1+\sigma$. Therefore the fraction of households whose children attend public schools (Ψ) is

[9] However, as will become clear below, these parameters affect the quality of public education, s and, hence, indirectly the decision regarding the education system, i.e., whether $e = 0$ or $e > 0$.

[10] As mentioned above, agents have perfect foresight regarding the outcome of the voting process. Thus, in equilibrium, $E[s] = s$.

$$\Psi = \int_0^{\tilde{x}} g(x)dx = \begin{cases} 0 & if \quad \tilde{x} < 1-\sigma, \\ \frac{\tilde{x}-(1-\sigma)}{2\sigma} & if \quad 1-\sigma \leq \tilde{x} \leq 1+\sigma, \\ 1 & if \quad \tilde{x} > 1+\sigma. \end{cases} \tag{9}$$

2.3 Voting

The government provides public education under a balanced-budget rule:

$$\int_0^{\tilde{x}} n^s s g[x]dx = \int_0^{\tilde{x}} v\mu(x(1-\phi n^s))g[x]dx + \int_{\tilde{x}}^{\infty} v\mu(x(1-\phi n^e) - n^e e[x])g[x]dx, \tag{10}$$

where the LHS of (10) is the total spending on public education and the RHS equals tax revenues collected by all agents, regardless of the education system that they choose.[11]

Employing equations (3)-(7), i.e., the individually optimal choices of the rate of declared income, the amount of private education and the fertility rates, the government budget constraint reduces to the following equation

$$v = \frac{\Psi\gamma}{\phi\mu} s. \tag{11}$$

Given v, the level of education s follows from (11) and vice versa. Naturally, the higher the fraction of households whose children participate in the public schooling system, Ψ, and the higher the quality of public education, s, the higher the tax rate. Moreover, the higher the fraction of income that individuals declare to the tax authorities, μ, the lower the tax rate.

As in C-D (2009), the level of public spending and thus implicitly of taxes is determined via a probabilistic voting model, which allows for the smooth aggregation of all voters' preferences. The voting outcome follows from the maximization of the following objective function

$$\Omega(s) = \int_0^{\tilde{x}} u[x, v, \mu^s, 0, s]g[x]dx + \int_{\tilde{x}}^{\infty} u[x, v, \mu^p, e[x], 0]g[x]dy \tag{12}$$

subject to the government budget constraint (11).

Solving the above optimization problem and using equations (3) and (5) yields the quality of public education

[11] For analytical convenience we adopt the simplifying assumption that the fines from the tax revenue do not return to the economy, found in among others Allingham and Sandmo (1972).

$$s = \frac{2(2\pi - 1)}{4\pi - 1} \frac{\eta\phi}{(1 + \eta\gamma\Psi)}. \tag{13}$$

Next, using equations (11) and (13), we have that the corresponding tax rate is

$$v = \frac{4\pi}{4\pi - 1} \frac{\eta\gamma\Psi}{1 + \eta\gamma\Psi}. \tag{14}$$

2.4 Education Regimes

Three alternative education regimes can emerge: i) a fully private education regime ($\Psi = 0$), where all children attend private schools; ii) a fully public education regime ($\Psi = 1$), in which case all individuals send their offsprings to public schools and iii) segregation ($\Psi \in (0, 1)$), where there are private and public schools and the richer individuals provide private education to their children while the rest use public schools.[12]

The following proposition gives the conditions under which each education regime arises.

Proposition 1.

i) If $\pi < \pi_1 \equiv \frac{2(1-\eta)-\delta(1-\sigma)}{4[1-\eta-\delta(1-\sigma)]}$, then the fully private regime arises, $\Psi = 0$.

ii) If $\pi > \pi_2 \equiv \frac{2(1-\eta)-\delta(1+\eta\gamma)(1+\sigma)}{4[1-\eta-\delta(1+\eta\gamma)(1+\sigma)]}$, then the fully public regime arises, $\Psi = 1$.

iii) If $\pi \in (\pi_1, \pi_2)$, then there is segregation; the richest individuals send their children to private schools, while the rest attend public schools. In particular, if $\pi \gtreqless \tilde{\pi} \in (\pi_1, \pi_2)$, then $\Psi \gtreqless 1/2$, where $\tilde{\pi} \equiv \frac{4(1-\eta)-\delta(2+\eta\gamma)}{4[2(1-\eta)-\delta(2+\eta\gamma)]}$.

Proof. All proofs are presented in Appendix.

Proposition 1 suggests that tax institutions play a critical role in the emergence of the equilibrium outcome. If the quality of tax institutions is very low, implying a very high tax evasion rate, the public revenue and hence the quality of public education is so low that all individuals send their children to private schools, i.e., a fully private education regime emerges. We note that in the C-D (2009) setting, where tax institutional quality is not considered, the fully private is not an equilibrium. There, if the number of students is low, then the quality public education (measured as spending per student) is sufficiently high, which induces the poorest parents to send their children to public schools.

For high-enough quality of tax institutions, the tax evasion rate is low and hence public revenue and spending per student are high. This makes even the richest individual to prefer

[12] The existence of an equilibrium with $\Psi \in [0, 1]$ is essentially the same as that in C-D (2009) and thus omitted.

public to private schools.[13] Finally, for an intermediate level of institutional quality, which is perhaps the case for most countries, the two regime co-exist. The richer individuals send their children to private schools and the poorer to public schools. Figure 3 depicts the relation between π_1, π_2, and $\tilde{\pi}$ and indicates the education regime that emerges depending on the level of institutional quality.

The following proposition establishes the effect of inequality on segregation, the quality of the public schools and the tax rate.

Proposition 2. Whenever there is segregation, i.e., $\Psi \in (0, 1)$,

$$\text{If } \pi \lesseqgtr \tilde{\pi}, \text{ then } \frac{\partial \Psi}{\partial \sigma} \gtreqless 0, \ \frac{\partial s}{\partial \sigma} \lesseqgtr 0, \text{ and } \frac{\partial v}{\partial \sigma} \gtreqless 0.$$

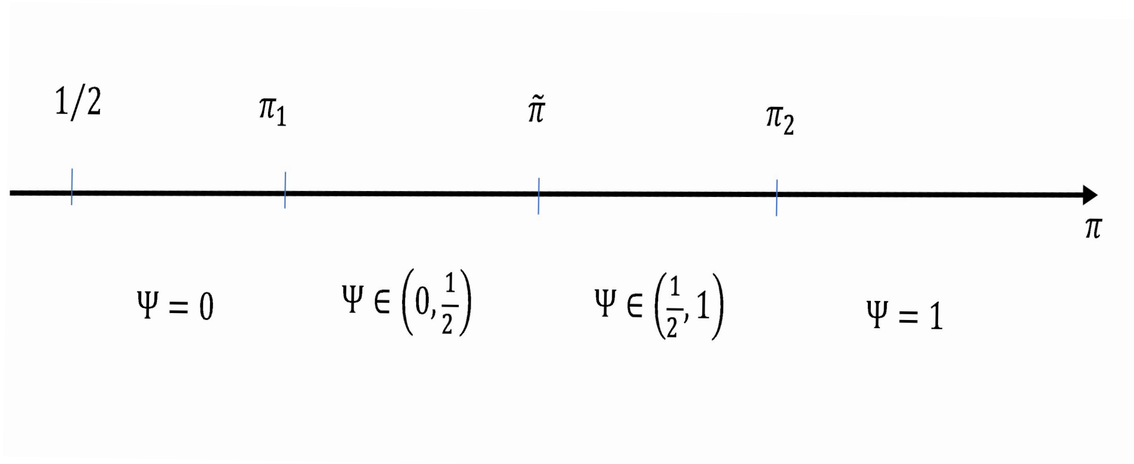
According to Proposition 2, in the presence of weak tax institutions, i.e., $\pi < \tilde{\pi}$, an increase in inequality (an increase in σ) leads to a higher share of public schooling (Ψ), lower quality of public schooling (s) and a higher tax rate. When institutions are weak and there is a lot of tax evasion, the fraction of the population that prefers public schooling is small because the quality of public schooling is low. As inequality increases and total income is redistributed, the income of the marginal person, who was indifferent between private and public schooling before the change in σ, decreases and this person prefers now public schooling. This raises the number of students in the public school system. Despite the fact that the tax rate increases, the change in the participation rate is higher and hence the spending per student (quality of public education) decreases. The opposite results apply when the quality of tax institutions is sufficiently high, namely, $\pi > \tilde{\pi}$.

3 Concluding Remarks

This research establishes that in the presence of weak institutions, the quality of public education is adversely affected by an increase in inequality. Moreover, the adverse effect of inequality diminishes as the quality of institutions improves. This effect operates via two channels, namely via an effect on the resources allocated to public education and via an effect on the number of individuals participating in the public schooling scheme. These findings suggest that the relation between education and income inequality is more complicated than prevously thought: they can feed on each other. Moreover, the quality of tax institutions can play a crucial role in breaking the vicious cycle.

[13] Note that for π_2 to be positive and greater than $1/2$, it is required that the income inequality be sufficiently compressed. More specifically, $\sigma < [(1-\eta)/(1+\gamma\eta)\delta] - 1$. If this condition does not hold we have either segmentation or the private education regime.

Figure 2: Education Regimes



Note: π denotes the quality of tax institutions and Ψ the fraction of households whose children attend public schools.

Appendix

Proof of Proposition 1: (i) Recall that $\tilde{x}$ denotes the income level of the marginal individuals that is indifferent between choosing private or public education. Individuals with income higher than $\tilde{x}$ prefer private education, while those with income lower than $\tilde{x}$ prefer public education. It follows from equations (8) and (13) that in equilibrium

$$\tilde{x}[\Psi] = \frac{2(2\pi-1)}{4\pi-1}\frac{1-\eta}{\delta}\frac{1}{1+\eta\gamma\Psi}.$$

Let $\tilde{x}_\psi$ denote the value of $\tilde{x}$ when $\Psi = \psi$. Note that $\tilde{x}$ is decreasing in Ψ and hence $\tilde{x}_{\psi_1} > \tilde{x}_{\psi_2}$, for $\psi_2 > \psi_1$. The private regime is then the equilibrium outcome if $\tilde{x}_0 < 1-\sigma$, that is, as Ψ tends to zero the threshold level at which one is indifferent between public and private schools is below the income of the poorest person.[14] Hence, even the poorest person prefers private to public education. Solving this inequality yields $\pi < \pi_1$ presented in the proposition.

(ii) A public education regime ($\Psi = 1$) is an equilibrium if even the richest person prefers public over private schools, i.e., $\tilde{x}_1 > 1+\sigma$. Solving this inequality yields $\pi > \pi_2$ presented in the proposition.

(iii) If $\tilde{x}_0 > 1-\sigma$ and $\tilde{x}_1 < 1+\sigma$, then there is segregation, i.e., the equality

$$\Psi = \frac{\tilde{x} - (1-\sigma)}{2\sigma} = \frac{\frac{2(2\pi-1)}{4\pi-1}\frac{1-\eta}{\delta}\frac{1}{1+\eta\gamma\Psi} - (1-\sigma)}{2\sigma} \quad \text{(A1)}$$

[14] Alternatively, it suffices to show that the public education regime or any segregation are not equilibrium outcomes. The inequality $\tilde{x}_0 < 1-\sigma$ implies that $\tilde{x}_1 < 1+\sigma$ (because $\tilde{x}_1 < \tilde{x}_0$) and hence public education is not an equilibrium; when $\Psi = 1$, the richest person prefers private education. Also, $\tilde{x}_\psi < 1-\sigma$ for any $\psi > 0$ and hence segregation is not an equilibrium; when $\Psi = \psi$, even the poorest person has income above the threshold level $\tilde{x}_\psi$.

is satisfied for a value of $\Psi = \psi \in (0,1)$. In such a regime, individuals with income greater than $\tilde{x}_\psi$ prefer private education while those with income below $\tilde{x}_\psi$ prefer public education. Solving the two inequalities we get $\pi \in (\pi_1, \pi_2)$. Next, we set $\Psi = 1/2$ in (A1) and solve for π to get $\tilde{\pi}$. Solving (A1) with respect to Ψ gives two functions of $\Psi[\pi]$, only one of which takes positive values. This function is continuous and increasing in π. It follows then that if $\pi \gtrless \tilde{\pi}$, then $\Psi \gtrless 1/2$. ■

Proof of Proposition 2: The proof is similar to that of Proposition 3 in C-D (2009). From equations (8) and (9) we obtain:

$$\Psi = \frac{\frac{1-\eta}{\phi\delta\eta}s - (1-\sigma)}{2\sigma}.$$

Taking the derivative with respect to σ we obtain:

$$\frac{\partial\Psi}{\partial\sigma} = \frac{1}{\sigma}(\frac{1}{2} - \Psi).$$

Thus, $\frac{\partial\Psi}{\partial\sigma} \gtreqless 0 \Leftrightarrow \frac{1}{2} \gtreqless \Psi$. It follows then from Proposition 2 that if $\pi \lesseqgtr \tilde{\pi}$, then $\frac{\partial\Psi}{\partial\sigma} \gtreqless 0$. The other results follow from equations (13) and (14). ■

References

[1] Aidt, T. S. (2003). Economic analysis of corruption: A Survey. Economic Journal 113, F632–F652.

[2] Atkinson, A , 2007. The distribution of earnings in OECD countries, International Labour Review, 146, No. 1–2

[3] Allingham and, M.G., Sandmo, A., 1972. Income tax evasion: A theoretical analysis. Journal of Public Economics, 1, 323-338.

[4] Besley, T. and Coate, S., 1991. Public provision of private goods and the redistribution of income. American Economic Review, 81, 979-984.

[5] Busemeyer, M., 2007. Determinants of public education spending in 21 OECD democracies, 1980-2001. Journal of European Public Policy, 14, 582-610.

[6] Chancel, L., T. Piketty, E. Saez, and G. Zucman. 2021. "World inequality report 2022." World Inequality Lab.

[7] Chong, A., Gradstein, M., 2007. Inequality and informality. Journal of Public Economics 91, 159-179.

[8] De La Croix, D. and Doepke, M., 2009. To segregate or to integrate: Education politics and Democracy. Review of Economic Studies, 76, 597-628.

[9] Epple, D. and Romano, R., 1996. Ends against the middle: Determining public service provision when there are private alternatives. Journal of Public Economics, 62, 297-325.

[10] Galor, O., 2005. From stagnation to growth: Unified growth Theory. Handbook of Economic Growth. In: Philippe Aghion & Steven Durlauf (ed.), Handbook of Economic Growth, Elsevier, 1, 171-293.

[11] Galor, O., 2011. Unified growth theory. Princeton University Press.

[12] Galor, O. & Moav, O., 2006.Das human-kapital: A theory of the demise of the class structure. Review of Economic Studies, 73, 85-117.

[13] Glomm, G., and Ravikumar, B., 1992. Public versus private investment in human capital endogenous growth and income inequality. Journal of Political Economy, 100, 813-34.

[14] Glomm, G., and Ravikumar, B., 1998. Opting out of publicly provided services: A majority voting result. Social Choice and Welfare, 15, 187-199.

[15] Glomm, G., and Ravikumar, B., 2001. Human capital accumulation and endogenous public expenditures. Canadian Journal of Economics, 34, 807-826.

[16] Glomm, G., and Ravikumar, B., 2003. Public education and income inequality. European Journal of Political Economy, 19, 289-300.

[17] Goldin, C., Katz, L., 2008. The race between education and technology. Harvard University Press.

[18] Gupta, S., Davoodi, H. and Alonso-Terme R., 2002. Does corruption affect income inequality and poverty?. Economics of Governance 3, 23-45

[19] Gupta, S., de Mello, L., Sharan, R., 2001. Corruption and military spending. European Journal of Political Economy 4, 749-777.

[20] Hessami, Z. (2014). Political corruption, public procurement, and budget composition: Theory and evidence from OECD countries. European Journal of Political Economy 34, 372-389.

[21] Hillman, A., 2004. Corruption and public finance: an IMF perspective. European Journal of Political Economy 20, 1067-1077.

[22] Hokamp, S., 2014. Dynamics of tax evasion with back auditing, Social norm updating and public goods provision - An agent-based simulation. *Journal of Economic Psychology* 40, 187 – 199.

[23] Kaufmann, D., Kray, A., Mastruzzi, M., 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues.

[24] Lindert, P., 1994. The rise of social spending, 1880-1930. Explorations in Economic History 31, 1-36.

[25] Mauro, P., 1995. Corruption and growth. Quarterly Journal of Economics, 2, 681-711.

[26] Mauro, P., 1998. Corruption and the composition of government expenditure. Journal of Public Economics, 69, 263-279.

[27] Moav, O., 2005. Cheap children and the persistence of poverty. Economic Journal, 115, 88-110.

[28] Roine, J. 2006. The political economics of not paying taxes. Public Choice 126, 107-134.

[29] Saha, S.and Sen, K. (2021). The Corruption–growth relationship: Does the political regime matter? *Journal of Institutional Economics*, 17(2), 243-266.

[30] Schütz, G., Ursprung, H. W. and Wöessmann, L. (2008), Education Policy and Equality of Opportunity. Kyklos, 61: 279–308

[31] Stiglitz, J. E., 1974. The demand for education in public and private school systems. Journal of Public Economics, 3, 349-385.

[32] Yitzhaki, S., 1974. A note on income tax evasion: A theoretical analysis. Journal of Public Economics, 3, 201-202.