

Education Expansion, Institutional Environment and Income Inequality: A Comparative Study Between China and Portugal

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Abstract. This paper examines the impact of educational expansion on income inequality in different institutional settings. Based on a comparison of 2024 Chinese and Portuguese data from 1995 to 2010, the study finds that the effect of education on income inequality is highly dependent on the institutional environment. In China, due to the urban-rural household registration system and the uneven distribution of educational resources, the initial expansion of education has exacerbated income inequality; while in Portugal, thanks to a sound social security system and a fair distribution mechanism of educational resources, educational expansion has effectively promoted social mobility and reduced the income gap. This study uses Gini coefficient as inequality index, combined with generalized linear regression model analysis, to reveal the moderating effect of institutional environment on the effect of educational equalization. This paper emphasizes that simply expanding the scale of education is not enough to reduce inequality, and institutional measures such as redistribution of resources and coordination of labor market should be implemented. All country-level comparisons are based on publicly available data and do not represent value judgments on any national system or policy.

Keywords: education expansion, income inequality, institutional environment, Sino-portuguese comparison, generalized linear regression model

1. Introduction

How much does education affect income inequality under different institutions? This paper explores this important issue. Education is generally recognized as one of the most important sources of improvement in individual production efficiency and social mobility. But it has heterogeneity effects on different groups. Although universal education can help reduce wealth gaps, if there is no supporting institutional arrangement, the expansion of education scale may further strengthen the advantages that existing powers enjoy.

Based on the analysis of China and Portugal from 1995 to 2024 as two examples [1], we analyze how this situation has changed over time. The choice of this couple of countries provides three analytical benefits:

2. Theoretical framework and review of literature

There are mainly two schools of research on education and income inequality: one is based on human capital theory, paying attention to how education promotes fairness; the second adopts an institution-based approach that explores instead how contexts and structures shape such associations. From both perspectives, scholars have studied the association between education and inequalities, but they differ sharply in terms of the expected timing and channels through which education might reduce (or fail to reduce) inequalities.

According to human capital theory [2], education can promote economic growth and reduce disparities in income through increasing people's productive capacity and improving their chances of success in the labor market. Based on this argument, if there are enough increases in enrollment rates, the expansion of education will lead to lower levels of inequality [3]. In short, based on this argument, it is expected that universal access to education would decrease inequality.

However, research on the system has complicated this perspective. According to Piketty et al. [4], if there are differences in access to education or if the market overcompensates those with high skills, education could even intensify rather than reduce class divisions. This is consistent with the "inverted-U" hypothesis proposed by Kuznets [5]: during the initial phase of development, inequality tends to increase; afterwards, it will decrease gradually along with improvements in the redistribution system and social security capacity. The above research shows that the distributive effect of education does not exist independently, but is conditional: it can only mitigate inequality when institutions are able to offset the resultant unequal returns from markets. Research based on China and Portugal respectively illustrates the difference of institutions.

Since the late nineties, China's education has developed rapidly, but it mainly benefited those who lived in cities because the division of household registration system and differences of access to good-quality schools produced this gap [6]. The related studies point out many institutional barriers, particularly the separation between city and countryside and the duality of the labor market, and therefore, how difficult it is to promote justice in education. But in Portugal, studies highlight the importance of social policies in line with European Union norms, need-based grants, regulation of the labor market, and so on, that contributed to a fairer share-out of educational gains [7]. In both debates, such institutions do not only increase people's level of schooling; they also shape its distribution path by making sure that new chances of entering school result in mobility instead of stratification.

In sum, instead of being a general rule, how the relationship between education and inequality looks like is conditioned on whether there are enough institutional capabilities, redistribution measures, and equal opportunity for everyone. But we still do not have a comparative analytical framework to synthesize the above results. Most researchers study China and Portuguese-speaking countries independently, using the unique theoretical perspective of each country to explain similar problems.

Why did the two countries display such different evolutions of inequality after increasing the level of education at similar times, but with very different institutional settings?

In this way, we have enriched the academic discussion by synthesizing many studies in one comparative study: not only does it investigate how education and inequality are related, but also what difference the institutional context makes to this relation. Comparing market-oriented vs. coordinated institutional contexts shows that rather than being something inherent and fixed, education's power to make society more equal depends on institutions: education can be designed either to reproduce or reduce inequalities.

3. Data and methodology

We obtained from the World Development Indicators database [1], and have taken out the value of the Gini coefficient as the explained variable. The main explanatory variables are: total population; GDP per capita (PPP constant); degree of urbanization; proportion of rural population; net enrollment rate in elementary school; gross enrollment rates in secondary and tertiary institutions, respectively. All analyses were conducted using R (4.3). First, we ran Pearson's correlations (directional associations; significance level $p < 0.05$); then, we employed a Generalised Linear Regression model to explain how much each education variable predicts academic achievement when removing the effects of socioeconomic and demographic control variables. The latter provides causal estimators, which have more policy relevance than simple correlations. Finally, all graphs were built with ggplot2 and modified so they are also accessible to color-blind readers.

4. Reason for choosing variables

The variables are measures that display change in education over time, as well as the influence of broader demographic and economic drivers of inequality: enrolment indicators indicate how many people can access different services; and urbanisation and GDP show changes in the economy.

5. Why not a model with fixed effects

A fixed effects model would wipe out much of the significant cross-temporal structure because it only looks at long-term national trends instead of intrawindow changes. We want to explain overall institutions rather than pick up short-lived shocks.

6. Selection of GLM

The generalized linear model is a flexible family of models that can be used to model the Gini coefficient, whilst making distributional assumptions, giving policy-relevant estimates of how much each determinant explains the Gini coefficient. Analyses were conducted using R (4.3). Pearson's correlations showed significant directionally associated ones ($p < 0.05$). GLM regression analysis was conducted to examine the effect of education after taking into account significant economic and demographic determinants. We created the chart with the package "ggplot2" in consideration of colorblindness.

7. Results and visualization

The relationship between the growth rate of education and economic inequality is quite different for China and Portugal, which shows that there is no fixed relationship between them. The above results only show the statistical correlation between variables, rather than causal relationships, which illustrate the interaction between education and wider institutions.

After some time has passed, there is a high positive correlation between wealth inequality and the number of secondary school students in China ($r = 0.93$). That is, the level of wealth concentration at the beginning of economic development is relatively high. This is mainly because residents of cities with better conditions have priority access to educational resources. But we cannot say that it's education that causes the gap to widen; instead, in an environment where there is no effective wealth redistribution and social institutions remain underdeveloped, both the development of education and the increase in differences happen at the same time. In Portugal, as education opportunities increase,

the level of inequality decreases, which is compatible with the strengthening of the welfare system in the country and the improvement of socialization of education. This pattern also reflects synchronized changes instead of a simple one-way causal relationship.

The urbanization process shows different trends: in China, the increase in urban population is positively correlated with higher inequality ($r = 0.66$), suggesting an ongoing urban-rural divide; while in Portugal there is even a negative relationship between the two ($r = -0.81$), which corresponds to its relatively even regional development. Such relationships imply that how changes in demographics and geography affect inequality differ according to institutions. No multicollinearity problem was found ($VIF < 2$), ruling out the possibility that the difference in coefficients results from differences in predictor overlap.

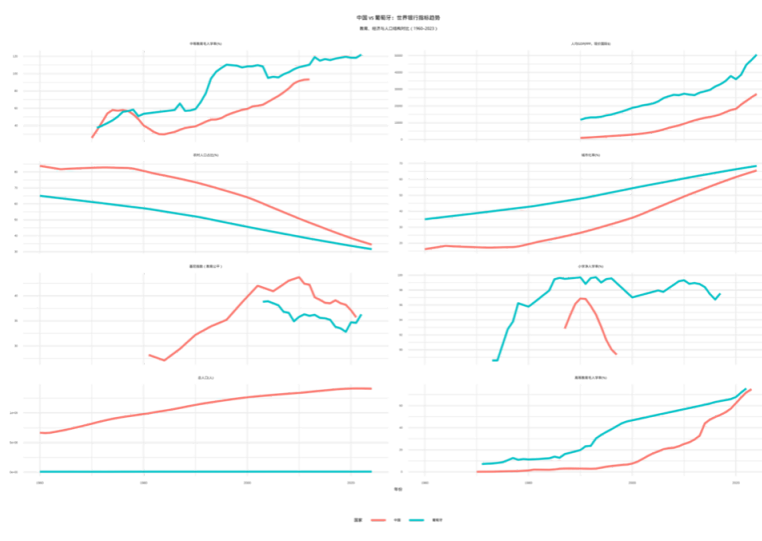


Figure 1. This caption has one line so it is centered

8. Clarifying contradictory trends

The institutions create two totally different development paths: in China, the uneven allocation of educational resources, the problem of the hukou system, the relatively limited redistributive capacity during the early period increase the level of inequality at the initial stage of education; but in Portugal, an inclusive social security network, need-based scholarships, equal starting line for receiving education, and so on ensure that the development of education promotes social mobility instead of strengthening class divide.

And the smoothed curve (see Figure 1) shows this pattern more clearly: with the increase of education level, the income disparity of Portuguese society has further narrowed; while the later turning point of China shows that such change comes from institutional change, instead of pure economic reasons.

9. Discussion

The result supports human capital theory and the Kuznets curve, showing the importance of institutions' capacity. The reason why there is a lag effect of equalization in China is that there are structural problems like the urban-rural divide and uneven distribution of college entrance opportunities before 2010; in contrast, what we learn from Portugal is that education really matters

if policymakers pay attention to the coordination between tax systems, social welfare systems, and labor markets, etc.

10. Examples of institutions in concrete

After entering the EU, Portugal has increased social security expenditures, distributed needs-based scholarships, set up employment aid projects, etc., which have alleviated the situation of social disparity in the country.

China: Since 1999, the development of higher education has been in stages; policies to help the children of farmers enter university have only been introduced since the 2010s.

In these two cases, we see that equity will not be realized simply through expanding access to students; without redistribution of resources, alignment with labour markets, and strong institution-building measures in place, schooling has the potential to increase, rather than decrease, social distance.

11. Conclusion and future policy

The comparison shows that education expansion alone will not reduce inequality unless it takes place under a well-developed institution. Inequality first rose then fell in China because more people got access to resources at a later stage; it was such institutions that allowed Portugal to solve problems of social protection and the labor market before and in a sustainable way.

12. Suggestions for policy

1.Promote the popularization and development of secondary and higher education in rural and poor regions.

2.Reform education in advance, so it is consistent with redistribution measures, such as means-tested grants and taxes on income that are progressive (increasing as income rises).

3.Coordinate education planning and employment promotion policies in a complementary way to avoid skills mismatch.

4.Evaluate the effectiveness of policies, at the same time, check the trend of change in the Gini coefficient and the change in education indicator values.

In future researches, it is possible that panel or multilevel model will be adopted for further exploration of causes and effect relationships, examination of mediating effects, etc.

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