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María Victoria Anauati (CEDH - Universidad de San Andrés)
Mariano Tommasi (CEDH - Universidad de San Andrés)
Pablo Fernández (CEDH - Universidad de San Andrés)
Cecilia Adrogué (CEDH - Universidad de San Andrés)
Eugenia Orlicki (CEDH - Universidad de San Andrés)

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Departamento de Economía
Universidad de San Andrés

*Vito Dumas 284, B1644BID, Victoria,
San Fernando, Buenos Aires, Argentina
Teléfono 7078-0400
Email: economia@udesa.edu.ar*

Progressivity, Sorting, and the Measurement of In-Kind Public Transfers: The Case of Education

M. Victoria Anauati
Mariano Tommasi
Pablo Fernández
Cecilia Adrogué
Eugenia Orlicki

(Centro de Estudios para el Desarrollo Humano)¹

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Abstract

Conventional benefit-incidence analyses often find public education spending to be progressive, particularly at basic and secondary levels. However, in systems with substantial private provision, measured progressivity may partly reflect income-based sorting between public and private schools rather than redistributive features of public spending itself. This paper refines the interpretation of standard progressivity measures by explicitly accounting for such sorting. Focusing on public secondary education in Argentina, we exploit cross-provincial variation in private school participation to decompose observed progressivity into a mechanical component driven by differential take-up and a structural component reflecting spending design and unit costs. Using a transparent counterfactual reweighting approach, we show that income-based sorting plays a quantitatively important and heterogeneous role across provinces, in some cases inflating and in others attenuating measured progressivity. Once sorting effects are accounted for, cross-provincial differences in progressivity are substantially reduced and provincial rankings change meaningfully. These findings underscore the importance of enrollment patterns for the measurement of the distributive incidence of in-kind public spending and provide a simple adjustment that can be readily incorporated into standard fiscal incidence analyses.

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1. Introduction

Public spending on education is widely regarded as a central instrument for promoting equity and equal opportunities. Accordingly, the distributive incidence of education spending has been extensively studied using redistributive incidence analysis. This literature tends to find that public spending on primary education is strongly progressive, while spending on secondary education is typically less progressive and more heterogeneous across settings, and spending on tertiary education is often weakly progressive or even regressive, particularly in contexts where access is highly stratified by income.² These conclusions are typically based on concentration indices and Kakwani measures that compare the distribution of in-kind education benefits with the distribution of market income.³

However, in education systems where private provision plays a significant role, the interpretation of measured progressivity is not straightforward. When higher-income households are more likely to opt out of public education and enroll their children in private schools, public schools disproportionately serve students from lower-income backgrounds. In such contexts, standard incidence analysis may mechanically attribute greater progressivity to public education spending—not necessarily because public resources are more strongly targeted toward the poor, but because richer households self-select out of the public system. As a result, observed progressivity may conflate genuine redistributive effort with income-based sorting between public and private schools.

² See, among others, Lustig, Pessino and Scott (2014), Lustig (2018) and (2022) for cross-country evidence; and Adrogué and Orlicki (2021) for evidence from Argentina.

³ This approach follows Kakwani (1977) in using progressivity measures based on concentration indices and is applied to in-kind social spending in the health sector by Wagstaff and van Doorslaer (2000).

This issue is particularly noticeable in decentralized education systems, where the size and composition of the private sector vary substantially across subnational jurisdictions. In these settings, cross-regional comparisons of progressivity may reflect differences in private school participation as much as differences in public education policy or spending levels. Despite longstanding recognition in the broader fiscal incidence literature that take-up and selection can affect distributional measures, standard applications of redistributive incidence analysis typically treat enrollment in public education as exogenous and do not attempt to isolate the role of sorting in shaping measured progressivity.⁴

This paper addresses this gap by proposing and implementing a simple adjustment to the standard measure of progressivity of public education spending that explicitly accounts for income-based sorting between public and private secondary schools. Focusing on secondary education, we exploit variation in private school participation across provinces to decompose observed progressivity into two components: (i) a mechanical component driven by differential sorting across income groups, and (ii) a residual component that reflects the distributive profile of spending within the public education system itself. The key idea is to compare the observed concentration of public education benefits with a counterfactual distribution in which provinces share a common income gradient in public school attendance. The difference between these two measures captures the extent to

⁴ The measurement of the distributive incidence and progressivity of public spending has a long tradition in public finance and welfare economics, including benefit-incidence analysis, concentration curves, and progressivity indices. Over the past decade, this literature has been systematized and widely disseminated through the Commitment to Equity (CEQ) framework, which provides a coherent methodology for assessing the distributional impact of taxes and transfers—including in-kind benefits such as education—within a unified fiscal incidence approach (Lustig 2018, ed., *CEQ Handbook*). In this paper, we follow the methodological conventions established in the CEQ Handbook and, for expositional simplicity, refer to the resulting indicators as “CEQ measures,” without implying that these concepts originated with CEQ.

which measured progressivity arises mechanically from private school selection rather than from redistributive targeting.⁵

We apply this approach to provincial data from Argentina, a country characterized by a high degree of decentralization in education financing and a large private secondary school sector. Our results show that income-based sorting plays a quantitatively important role in shaping measured progressivity at the provincial level. In several provinces, standard incidence analysis overstates progressivity because public secondary education primarily serves lower-income households, while in others sorting attenuates progressivity by spreading public benefits more evenly across the income distribution. Once this mechanical component is netted out, differences in progressivity across provinces are substantially reduced, and provincial rankings change in meaningful ways. These findings suggest that conventional “CEQ-based” measures of progressivity may misrepresent the redistributive role of public education spending when private participation varies across jurisdictions.

By explicitly separating sorting-driven and redistribution-driven components of progressivity, this paper contributes to the literature on benefit incidence analysis and the evaluation of in-kind public spending. Methodologically, the proposed adjustment is transparent and easy to implement using standard household survey data, and can be readily incorporated into CEQ-style analyses. Substantively, the results underscore the importance of accounting for enrollment patterns and institutional context when interpreting distributional indicators in education policy.

⁵ Our counterfactual reweighting approach is in the spirit of the reweighting estimator used to construct counterfactual distributions (DiNardo, Fortin and Lemieux, 1996) and related applications that use reweighting to generate counterfactual income distributions in inequality analysis (e.g., Gradín, 2021).

Beyond its application to education, this paper contributes to the measurement of distributive incidence by showing how standard progressivity indices can be decomposed into structural and mechanical components when participation is endogenous. This insight applies to a wide range of in-kind public services characterized by partial take-up and private alternatives.

The remainder of the paper is organized as follows. Section 2 describes the relevant literature. Section 3 presents the conceptual framework. Section 3 presents the data and the methodology. Section 4 introduces the counterfactual reweighting approach used to isolate the mechanical effect of sorting. Section 5 presents the results, and Section 6 concludes.

2. Measuring the Progressivity of In-Kind Education Spending under Endogenous Participation

This paper relates to three interconnected strands of literature: (i) benefit-incidence analysis of public education spending; (ii) subnational analyses of education spending and fiscal incidence; and (iii) research on public–private sorting in education systems and its implications for the interpretation of progressivity.

A large and influential literature assesses the distributive impact of public education spending using benefit-incidence analysis. Within this approach, education benefits are typically valued as in-kind transfers at public unit costs and assigned to individuals enrolled in public institutions. Progressivity is evaluated by comparing the distribution of these benefits to the distribution of pre-fiscal income, using concentration curves, concentration indices, and summary measures such as the Kakwani index (Lustig et al., 2014). Across countries, this literature finds a consistent pattern: public spending on

primary education is generally progressive and pro-poor; spending on secondary education is typically less progressive and more heterogeneous; and spending on tertiary education is often weakly progressive or regressive. These differences reflect both enrollment gradients across income groups and the relative magnitude of public subsidies at each educational level.

For Argentina, a broad body of research finds that public education spending is progressive at lower educational levels, with later work documenting substantial heterogeneity across provinces. More recent studies using the CEQ framework show that education spending contributes significantly to inequality reduction and poverty alleviation at the initial, primary, and secondary levels, while higher education spending is progressive in relative terms but not pro-poor, reflecting the concentration of access among higher-income households (Lustig and Pessino, 2013; Lustig et al., 2014; Adrogué and Orlicki, 2021; López del Valle et al., 2022).

An important but less systematically explored dimension of the education incidence literature concerns **public–private sorting in education systems**. A substantial body of work shows that differences in quality, peer composition, and institutional characteristics between public and private schools induce higher-income households to opt out of the public system, particularly at the secondary and tertiary levels (Hsieh and Urquiola, 2006; Elacqua, 2012). As a result, participation in public education is strongly income-graded, and the pool of public school beneficiaries differs systematically from the overall population.⁶ This selective participation reshapes the income composition of beneficiaries and, mechanically, the observed distribution of public education benefits.

⁶ De La O, Rossel, and Manzi (2025) document pervasive income-based opting out of public education in Latin America, with higher-income households disproportionately enrolled in private schools. Although not focused on fiscal incidence, their evidence highlights the same compositional mechanism emphasized here: selective participation reshapes the income profile of public school beneficiaries.

Despite longstanding recognition in the broader fiscal incidence literature that take-up and selection can affect distributional measures, most benefit-incidence analyses of education implicitly treat enrollment patterns as exogenous and interpret observed progressivity as reflecting redistributive features of public spending. Consequently, the potential for mechanical progressivity—arising purely from differential participation rather than from spending design or unit costs—remains underexplored. While income-based sorting is often presumed to inflate measured progressivity by concentrating public education benefits among lower-income groups, little is known about how the magnitude and direction of this effect vary across institutional contexts or subnational units, or whether sorting may in some cases attenuate measured redistribution.⁷

These considerations have not been fully incorporated into education-specific incidence analyses, particularly in decentralized settings where participation patterns vary widely across jurisdictions. This gap motivates our focus on explicitly accounting for income-based sorting when measuring the progressivity of public education spending.

Although national-level analyses dominate the literature, fewer studies examine the distributive impact of education spending at the subnational level. For Argentina, existing work documents large disparities in education spending per student across provinces, driven by differences in fiscal capacity and economic development, alongside a redistributive role for national education transfers (Claus and Bucciarelli, 2020). Other contributions highlight inefficiencies in provincial spending and heterogeneity in the effectiveness of education policies (Garriga et al., 2015).

⁷ Our approach is closely related to Lanjouw and Ravallion (1999), who show that changes in measured benefit incidence may arise from shifts in program participation rather than from changes in program design. While their analysis emphasizes dynamic participation during program expansion, we exploit cross-provincial variation in enrollment patterns to isolate analogous composition effects in the incidence of public education spending.

From a methodological perspective, subnational analysis within Argentina offers an unusually advantageous setting to study how sorting affects measured progressivity. Provinces operate under a common national legal and institutional framework, rely on a single harmonized household survey for income and enrollment measurement, and are analyzed using uniform conventions for valuing in-kind education benefits. At the same time, they exhibit substantial heterogeneity in private school participation—particularly at the secondary level—and in the income gradients of public school attendance. This combination of institutional comparability and enrollment variation provides a clean environment to isolate the role of income-based sorting in shaping measured progressivity.

Building on this setting, our paper integrates the subnational dimension and the role of income-based sorting into the analysis of education spending incidence. By constructing a counterfactual that neutralizes differences in public–private sorting across provinces, we provide new evidence on how measured progressivity reflects both structural redistributive features and mechanical effects driven by participation patterns. In doing so, the paper refines the interpretation of standard progressivity measures and contributes to a more nuanced understanding of the equity properties of in-kind public education spending.

3. Conceptual framework: Sorting and Progressivity in Secondary Education

The redistributive incidence of public education spending is commonly assessed by comparing the distribution of public benefits across the income distribution with the distribution of pre-fiscal income. Let y_i denote pre-fiscal (market) income of individual

i , and let B_i denote the monetary value of public education benefits received by that individual.

The concentration curve of public education spending, $C_B(p)$, ranks individuals by income and plots the cumulative share of total education benefits received by the bottom p proportion of the income distribution. Progressivity is evaluated relative to the Lorenz curve of income, $L_Y(p)$.

The concentration coefficient of education spending is defined as:

$$C_B = 1 - 2 \int_0^1 C_B(p) dp, \quad (1)$$

while the Gini coefficient of income is:

$$G_Y = 1 - 2 \int_0^1 L_Y(p) dp, \quad (2)$$

The Kakwani index of progressivity is given by:

$$K = C_B - G_Y, \quad (3)$$

A negative concentration coefficient and a positive Kakwani index indicate that public education spending is progressive, i.e., disproportionately benefits lower-income individuals.

In the case of education, public benefits are not universally assigned but conditional on enrollment in the public system. Let s_{pq} denote the probability that an individual in income group q and province p attends a public secondary school, conditional on being enrolled at the secondary level.

Observed public education benefits for income group q in province p can be expressed as:

$$B_{pq} = u_p \cdot s_{pq} \cdot N_{pq}, \quad (4)$$

where u_p is public spending per student in province p , and N_{pq} is the number of secondary students in income group q in province p .

Variation in s_{pq} across income groups captures income-based sorting between public and private secondary schools. When higher-income households disproportionately opt out of public education, the composition of public school beneficiaries shifts mechanically toward lower-income groups. As a result, the distribution of public education benefits becomes more concentrated at the bottom of the income distribution, even if public spending rules, eligibility criteria, and unit costs remain unchanged.

Standard fiscal incidence analysis typically interprets differences in progressivity as reflecting redistributive features of public spending. However, in the presence of public–private sorting, part of the measured progressivity may arise mechanically from differential participation across income groups rather than from intentional redistribution embedded in the design or level of public spending. For this reason, it is analytically useful to distinguish between two components of redistribution: (i) structural redistribution, driven by public spending levels, benefit design, and unit costs; and (ii) mechanical redistribution, driven by income-based sorting into and out of the public education system.

Importantly, income-based sorting does not unambiguously increase measured progressivity. Its effect depends on the underlying enrollment structure of the public education system. When public education operates as a residual system that primarily serves lower-income households, sorting by higher-income groups tends to amplify

measured progressivity by further concentrating benefits among the poor. By contrast, when public education functions as a quasi-universal system with high participation across the income distribution, sorting may reduce measured progressivity by spreading public benefits more evenly across income groups.

National-level fiscal incidence analyses implicitly abstract from these differences by assuming homogeneous sorting patterns. This assumption can mask substantial subnational heterogeneity in enrollment structures and private school participation. To account for this variation, we conduct the analysis at the provincial level and construct a counterfactual distribution of public education benefits that neutralizes cross-province differences in income-based sorting. This approach allows us to isolate the mechanical component of redistribution attributable to sorting, while preserving provincial differences in spending levels and demographic composition.

Let s_q^* denote a benchmark probability of attending a public secondary school for income group q , defined as the national average:

$$s_q^* = \sum_p \omega_p s_{pq}, \quad (5)$$

where ω_p are population weights.

In the counterfactual scenario, province-specific attendance probabilities s_{pq} are replaced by the common income profile s_q^* , while provincial unit costs u_p and population structures N_{pq} are held constant. Counterfactual public education benefits are thus given by:

$$B_{pq}^* = u_p \cdot s_q^* \cdot N_{pq}, \quad (6)$$

Progressivity indices computed using B_{pq}^* reflect the redistributive incidence of public secondary education spending net of cross-province differences in sorting patterns.

The mechanical contribution of sorting to measured progressivity in province p is defined as:

$$\Delta K_p = K_p^{\text{obs}} - K_p^{\text{cf}}, \quad (7)$$

where K_p^{obs} is the observed Kakwani index and K_p^{cf} is the counterfactual index obtained under uniform sorting.

A positive value of ΔK_p indicates that income-based sorting inflates measured progressivity in the baseline analysis, while a negative value implies that sorting attenuates progressivity relative to a scenario with a common income gradient of public school attendance.

It is important to note that the counterfactual exercise is a partial-equilibrium accounting exercise. It does not rely on behavioral assumptions or structural modeling of school choice, nor does it aim to predict enrollment responses under alternative policy regimes. Instead, it provides a transparent benchmark to assess how much of measured progressivity reflects enrollment composition rather than redistributive design. By exploiting provincial variation, this approach reveals mechanisms that remain hidden in national-level incidence analyses and allows for a more nuanced interpretation of progressivity in decentralized education systems.

4. Data and Methodology

This section describes the data sources and empirical methodology used in the analysis. We first outline the data and the implementation of standard benefit incidence analysis.

We then present the counterfactual reweighting strategy used to isolate the contribution of income-based sorting between public and private secondary schools to measured progressivity.

4.1. Data and Standard Benefit Incidence Analysis

The analysis combines household survey data with administrative information on school enrollment and public education spending for the year 2017. Household income and demographic characteristics are obtained from the Argentine Permanent Household Survey (EPH), which provides representative data at the provincial level. Administrative data on school enrollment by educational level and type of management (public or private) are drawn from official statistics produced by the Ministry of Education. These data provide information on the total number of students enrolled in public and private institutions in each province and are used to characterize enrollment patterns across jurisdictions.

In 2017, the Argentine education system enrolled approximately 13.4 million students, of whom about 64 percent were enrolled in primary and secondary education (Table 1). At the secondary level, roughly 73 percent of students attended public schools and 27 percent private schools, with substantial variation across provinces.

Table 1. Distribution of Students in the Argentine Education System by Type of Management and Educational Level (2017)

Educational Level	Public Education (Students)	Private Education (Students)
Pre-primary	1,197,879	477,011
Primary	3,511,648	1,155,545
Secondary	2,666,611	981,374

Educational Level	Public Education (Students)	Private Education (Students)
Tertiary / Higher Education	2,560,858	853,619
Total	9,936,996	3,467,549

Source: Authors' calculations based on data from the Ministry of Education.

Enrollment is highly concentrated in a small number of provinces. Buenos Aires, the City of Buenos Aires, Córdoba, Santa Fe, and Mendoza account for a large share of total students across all educational levels. At the same time, smaller provinces represent a limited fraction of national enrollment despite often differing markedly in education spending levels and institutional arrangements. This heterogeneity motivates a subnational approach and highlights the relevance of exploiting within-country variation in the analysis of public education incidence.

Public spending on education is obtained from administrative budgetary records and includes recurrent expenditures associated with the provision of public education at the provincial level. Combining spending data with enrollment information allows us to compute province- and level-specific unit costs, defined as total public expenditure divided by total public enrollment. These unit costs are expressed in constant 2017 prices and are used to value in-kind education benefits in the incidence analysis.

Public expenditure per student varies substantially across both educational levels and provinces (Table 2). At the national level, spending per student is highest in secondary and university education. Across provinces, per-student spending differs widely, with jurisdictions such as Tierra del Fuego, Neuquén, Santa Cruz, La Pampa, and Chubut exhibiting particularly high levels of expenditure per student. These differences reflect variation in fiscal capacity, cost structures, and scale, and are central to the valuation of education benefits.

Table 2. Average Annual Public Expenditure per Student by Educational Level and Jurisdiction (2017 constant prices)

Jurisdiction	Total	Pre-primary	Primary	Secondary	Tertiary	University
Argentina	50.453	42.390	45.863	63.277	30.696	57.473
Buenos Aires	46.528	37.413	42.724	53.663	39.838	52.179
Catamarca	65.493	39.188	70.064	75.164	35.539	90.720
Buenos Aires City	61.969	73.567	78.349	106.822	24.443	51.266
Chaco	47.515	36.621	46.286	74.923	20.804	44.099
Chubut	78.567	45.708	88.474	78.894	70.804	93.563
Córdoba	44.777	30.360	35.921	62.711	25.295	55.640
Corrientes	39.768	33.105	31.736	59.195	22.768	47.104
Entre Ríos	53.494	78.863	51.516	48.849	25.477	70.133
Formosa	48.198	36.639	47.082	52.204	39.583	63.610
Jujuy	44.929	46.459	39.918	63.814	12.926	57.893
La Pampa	85.236	83.936	87.670	98.132	30.335	88.627
La Rioja	51.931	27.985	48.683	68.831	53.833	52.690
Mendoza	48.687	31.968	28.445	86.747	27.831	98.407
Misiones	39.422	39.791	32.173	56.826	16.886	55.661
Neuquén	96.039	83.515	90.677	152.120	57.479	63.131
Rio Negro	68.052	56.183	64.651	84.184	38.712	97.499
Salta	39.746	45.105	38.791	49.008	13.112	47.676
San Juan	52.217	43.706	43.019	50.306	24.624	112.391
San Luis	60.756	41.777	39.285	64.108	145.720	96.054
Santa Cruz	94.723	80.119	77.623	131.610	77.028	91.257
Santa Fe	51.283	55.411	50.775	60.107	23.248	52.885
Santiago del Estero	36.535	25.376	26.369	62.748	35.271	50.934
Tierra del Fuego	119.958	105.618	135.812	151.487	80.189	77.362
Tucuman	41.875	17.654	40.285	48.362	15.079	61.912

Source: Authors' calculations based on data from the Ministry of Education (2017), the Permanent Household Survey (EPH), third and fourth quarters of 2017, and PISA 2018.

The unit of analysis is the individual student enrolled at each educational level, linked to household income information from the EPH. Provinces constitute the relevant jurisdiction for policy variation, reflecting the decentralized nature of education financing and provision in Argentina. All calculations account for survey weights and population scaling factors to ensure representativeness at both national and provincial levels.

Standard benefit incidence analysis is implemented for all educational levels following the CEQ methodology (Lustig 2018 and 2022). Public education spending is treated as an in-kind transfer valued at average unit cost. Individuals enrolled in public institutions are assigned the corresponding unit value, while individuals attending private institutions are assigned zero public education benefits. Using this assignment, we compute concentration coefficients of education benefits by level and province, ranking individuals according to pre-fiscal household income. Progressivity is summarized using the Kakwani index, defined as the difference between the concentration coefficient of education benefits and the Gini coefficient of market income. These measures constitute the benchmark against which counterfactual analysis is evaluated.

4.2. Counterfactual Adjustment for Income-Based Sorting

The counterfactual adjustment proposed in this paper focuses on secondary education, where private sector participation is substantial and income-based sorting between public and private schools is most relevant for measured progressivity. All simulation exercises and adjusted progressivity measures therefore pertain to public secondary education spending.

To isolate the mechanical component of progressivity arising from income-based sorting, we implement a counterfactual reweighting strategy that equalizes sorting patterns across

provinces. The objective is to construct a counterfactual distribution of public education benefits in which the income gradient of public school attendance is held constant across provinces, while preserving differences in provincial spending levels, population size, and demographic composition.

Formally, the reweighting procedure leaves provincial unit costs and household income distributions unchanged. What is altered is the probability of attending a public secondary school conditional on income. In the observed data, this probability varies across provinces due to differences in private school participation. In the counterfactual scenario, public school attendance probabilities by income group are fixed at a common benchmark shared by all provinces.

Specifically, we replace province-specific public enrollment shares by income group with a common profile defined as the national average public enrollment share by income group. Intuitively, if high-income students are underrepresented in public secondary schools in a given province relative to the national benchmark, the reweighting increases the weight assigned to observed public-school students in that income group so that their aggregate share matches the benchmark. Conversely, if low-income students are overrepresented, their weights are adjusted downward accordingly.

The difference between observed progressivity and counterfactual progressivity captures the mechanical component of redistribution attributable to income-based sorting. This component reflects the extent to which measured progressivity arises from differential participation in public education rather than from redistributive features of spending design or unit costs.

Importantly, this approach does not rely on behavioral assumptions or structural models of school choice. It is a partial-equilibrium exercise that exploits observed enrollment

patterns to construct a transparent counterfactual. The purpose is not to predict enrollment responses under alternative policy regimes, but to provide a clean benchmark against which the contribution of sorting to measured progressivity can be assessed.

5. Results

5.1. Benchmark Incidence and Progressivity Measures

This section presents benchmark results from a standard benefit incidence analysis of public education spending. Following conventional redistributive incidence methodology, each student observed in the household survey is assigned the average unit cost of public education provision corresponding to their educational level and province of residence. These in-kind transfers are incorporated into household income to assess the distributive impact of public education spending using standard progressivity measures.

We first examine the effect of public education spending on overall income inequality and then analyze its progressivity using concentration coefficients and Kakwani indices. Throughout this section, individuals are ranked according to pre-transfer household income.

Aggregate redistributive effects

At the national level, incorporating public education transfers reduces the Gini coefficient of household per capita income from 0.420 to 0.368, corresponding to a decline of 12.4 percent (Table 3). A reduction in inequality is observed in all provinces, although the magnitude of the effect varies substantially. Provinces such as Tierra del Fuego, Neuquén, Catamarca, La Pampa, and La Rioja exhibit the largest relative reductions, while the City of Buenos Aires, Córdoba, and the Province of Buenos Aires show more modest effects,

reflecting heterogeneity in spending levels, enrollment patterns, and underlying income distributions.

Table 3. Gini Coefficient Before and After Education Transfers, by Jurisdiction

Jurisdiction	Pre-transfer income Gini coefficient	Post-transfer income Gini coefficient	Percentage change in the Gini coefficient
National average	0.42	0.368	-12.38%
Buenos Aires	0.408	0.357	-12.50%
Catamarca	0.422	0.325	-22.99%
Buenos Aires City	0.387	0.348	-10.08%
Chaco	0.385	0.31	-19.48%
Chubut	0.372	0.305	-18.01%
Córdoba	0.447	0.398	-10.96%
Corrientes	0.394	0.323	-18.02%
Entre Ríos	0.397	0.336	-15.37%
Formosa	0.357	0.284	-20.45%
Jujuy	0.397	0.316	-20.40%
La Pampa	0.45	0.348	-22.67%
La Rioja	0.331	0.259	-21.75%
Mendoza	0.396	0.338	-14.65%
Misiones	0.389	0.326	-16.20%
Neuquén	0.387	0.297	-23.26%
Río Negro	0.361	0.282	-21.88%
Salta	0.427	0.367	-14.05%
San Juan	0.395	0.335	-15.19%
San Luis	0.361	0.297	-17.73%
Santa Cruz	0.375	0.302	-19.47%
Santa Fe	0.385	0.335	-12.99%
Sgo del Estero	0.419	0.348	-16.95%
T. del Fuego	0.376	0.287	-23.67%

Tucumán	0.372	0.321	-13.71%
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Source: Own calculations

Education benefits are assigned based on students' province of residence rather than the location of the school attended. While most students attend school in their province of residence, some cross-jurisdictional attendance—particularly between the City of Buenos Aires and the Province of Buenos Aires—may lead part of the redistributive effect of education spending in one jurisdiction to be reflected in the income distribution of another. This does not affect the internal consistency of the analysis but is relevant for interpreting provincial comparisons.

Distribution of education benefits by level

Table 4 reports concentration coefficients of public education spending by educational level and province. Consistent with the international and Argentine literature, public spending at the initial, primary, and secondary levels is generally pro-poor in absolute terms, while spending at the tertiary and university levels tends to be pro-rich.

Table 4. Concentration Coefficient by Level of Education and Province

Jurisdicción	Total	Pre- primary	Primary	Secondary	Terciary
National average	-0.228	-0.318	-0.386	-0.301	0.126
Buenos Aires	-0.253	-0.415	-0.429	-0.309	0.163
Catamarca	-0.225	-0.284	-0.396	-0.281	0.152
Buenos Aires City	-0.33	-0.25	-0.52	-0.51	0.06
Chaco	-0.167	-0.284	-0.329	-0.145	0.182
Chubut	-0.216	-0.326	-0.31	-0.24	0.086
Córdoba	-0.194	-0.412	-0.45	-0.343	0.209
Corrientes	-0.195	-0.01	-0.268	-0.324	0.056
Entre Ríos	-0.221	-0.368	-0.354	-0.334	0.106

Formosa	-0.189	-0.143	-0.291	-0.291	0.103
Jujuy	-0.263	-0.306	-0.335	-0.314	-0.005
La Pampa	-0.233	-0.35	-0.341	-0.256	0.16
La Rioja	-0.174	-0.254	-0.223	-0.244	-0.021
Mendoza	-0.26	-0.354	-0.385	-0.351	-0.012
Misiones	-0.349	-0.337	-0.475	-0.406	n.a.
Neuquén	-0.275	-0.272	-0.37	-0.299	0.168
Río Negro	-0.199	-0.268	-0.28	-0.221	-0.005
Salta	-0.277	-0.385	-0.294	-0.329	-0.039
San Juan	-0.216	-0.375	-0.442	-0.295	0.114
San Luis	-0.198	-0.324	-0.421	-0.305	0.139
Santa Cruz	-0.228	-0.466	-0.331	-0.179	0.009
Santa Fe	-0.254	-0.346	-0.461	-0.283	0.079
Santiago del Estero	-0.231	-0.379	-0.433	-0.307	0.125
Tierra del Fuego	-0.291	-0.346	-0.373	-0.284	0.036
Tucumán	-0.149	-0.367	-0.343	-0.311	0.153

Source: Own elaboration

There is substantial heterogeneity across provinces, particularly at the secondary level, where concentration coefficients range from strongly pro-poor to mildly pro-rich. This dispersion highlights secondary education as a critical margin where enrollment patterns and institutional context may play a larger role in shaping the observed distribution of public education benefits. At the tertiary level, concentration coefficients are predominantly positive, reflecting the concentration of access among middle- and high-income households, although a small number of provinces display near-neutral patterns. These patterns are consistent with the descriptive evidence reported in prior work on Argentina (Adrogué and Orlicki, 2021).

Relative progressivity

Table 4 reports Kakwani indices by educational level and province. Across all provinces and levels, public education spending is progressive relative to market income, with progressivity strongest at the initial, primary, and secondary levels and markedly weaker at the tertiary level.

Table 5. Kakwani Progressivity Index by Level of Education and Province

Jurisdicción	Total	Pre-primary	Primary	Secondary	Tertiary
National average	0.648	0.738	0.806	0.721	0.294
Buenos Aires	0.661	0.823	0.837	0.717	0.245
Catamarca	0.647	0.706	0.818	0.703	0.27
Buenos Aires City	0.717	0.637	0.907	0.897	0.327
Chaco	0.552	0.669	0.714	0.53	0.203
Chubut	0.588	0.698	0.682	0.612	0.286
Córdoba	0.641	0.859	0.897	0.79	0.238
Corrientes	0.588	0.403	0.661	0.717	0.337
Entre Ríos	0.617	0.764	0.75	0.73	0.29
Formosa	0.546	0.5	0.648	0.648	0.254
Jujuy	0.66	0.703	0.732	0.711	0.402
La Pampa	0.683	0.8	0.791	0.706	0.29
La Rioja	0.505	0.585	0.554	0.575	0.352
Mendoza	0.656	0.75	0.781	0.747	0.408
Misiones	0.738	0.726	0.864	0.795	0.389
Neuquén	0.662	0.659	0.757	0.686	0.219
Río Negro	0.56	0.629	0.641	0.582	0.366
Salta	0.704	0.812	0.721	0.756	0.466
San Juan	0.611	0.77	0.837	0.69	0.281
San Luis	0.559	0.685	0.782	0.666	0.222
Santa Cruz	0.603	0.841	0.706	0.554	0.366
Santa Fe	0.639	0.731	0.846	0.668	0.306

Santiago del Estero	0.65	0.798	0.852	0.726	0.294
Tierra del Fuego	0.667	0.722	0.749	0.660	0.34
Tucumán	0.521	0.739	0.715	0.683	0.219

Source: Own calculations

As with concentration coefficients, there is substantial cross-provincial heterogeneity in Kakwani indices, particularly at the secondary level. Importantly, these indices do not distinguish between progressivity arising from redistributive features of public education spending and progressivity generated mechanically by differential participation in public versus private schools. In provinces where higher-income students disproportionately opt out of public secondary education, measured progressivity may partly reflect income-based sorting rather than redistributive design.

A simple descriptive relationship illustrates this point: across provinces, the Kakwani index for secondary education is negatively correlated with the share of students enrolled in public secondary schools. Provinces with near-universal public enrollment tend to display lower measured progressivity, while provinces with substantial private participation exhibit higher Kakwani indices. These patterns motivate the counterfactual analysis presented next, which explicitly adjusts for income-based sorting between public and private secondary schools.

5.2. Counterfactual Progressivity and the Role of Income-Based Sorting

This section presents the results of the counterfactual reweighting exercise introduced in Section 4.2, which isolates the mechanical contribution of income-based sorting between public and private secondary schools to measured progressivity. By equalizing the income gradient of public secondary school attendance across provinces while preserving

provincial unit costs and population structures, the counterfactual provides a benchmark against which observed progressivity can be evaluated.

Table 6 reports the Gini coefficient, concentration index, and Kakwani index under observed and counterfactual allocations for public secondary education. In all provinces, public secondary education spending remains progressive in relative terms under both scenarios. What changes is the magnitude of progressivity, underscoring the importance of enrollment composition in shaping distributional outcomes.

Table 6. Observed vs. Counterfactual Progressivity Measures (Secondary Education)

Jurisdiction	Concentration Coefficient (baseline)	Concentration Coefficient (counterfactual)	Kakwani Index (baseline)	Kakwani Index (counterfactual)	Δ Kakwani Index	Sorting share
Buenos Aires	-0.309	-0.294	0.717	0.703	0.01	2%
Catamarca	-0.281	-0.489	0.703	0.875	0.02	2%
CABA	-0.51	-0.276	0.897	0.699	0.01	1%
Chaco	-0.145	-0.193	0.53	0.580	-0.05	-9%
Chubut	-0.24	-0.352	0.612	0.727	-0.11	-18%
Córdoba	-0.343	-0.302	0.79	0.748	0.04	5%
Corrientes	-0.324	-0.344	0.717	0.738	-0.02	-3%
Entre Ríos	-0.334	-0.359	0.73	0.756	-0.02	-3%
Formosa	-0.291	-0.352	0.648	0.710	-0.06	-9%
Jujuy	-0.314	-0.335	0.711	0.732	-0.02	-3%
La Pampa	-0.256	-0.334	0.706	0.787	-0.08	-11%
La Rioja	-0.244	-0.312	0.575	0.644	-0.07	-12%
Mendoza	-0.351	-0.332	0.747	0.728	0.02	3%
Misiones	-0.406	-0.375	0.795	0.764	0.03	4%
Neuquén	-0.299	-0.351	0.686	0.740	-0.05	-8%
Río Negro	-0.221	-0.307	0.582	0.670	-0.09	-15%
Salta	-0.329	-0.306	0.756	0.733	0.02	3%

San Juan	-0.295	-0.309	0.69	0.704	-0.01	-2%
San Luis	-0.305	-0.336	0.666	0.697	-0.03	-5%
Santa Cruz	-0.179	-0.291	0.554	0.669	-0.11	-20%
Santa Fe	-0.283	-0.329	0.668	0.714	-0.05	-7%
Sgo del Estero	-0.307	-0.270	0.726	0.688	0.04	5%
T. del Fuego	-0.284	-0.361	0.660	0.738	-0.08	-12%
Tucumán	-0.311	-0.263	0.683	0.635	0.05	7%

Note: The difference between observed and counterfactual Kakwani indices captures the mechanical component of progressivity driven by income-based sorting into public and private schools. The relative measure expresses this difference as a share of the observed Kakwani index and indicates the proportion of measured progressivity attributable to sorting.

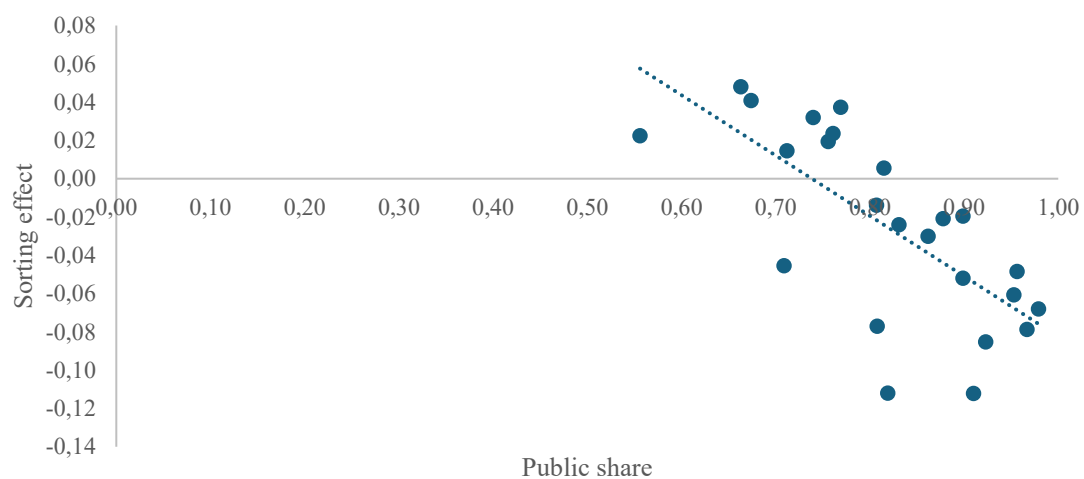
Income-based sorting has a quantitatively meaningful but heterogeneous effect across provinces. In several jurisdictions, equalizing sorting patterns leads to a lower Kakwani index relative to the observed allocation, indicating that part of the progressivity identified in standard incidence analysis is mechanically generated by differential private school participation. In other provinces, however, the counterfactual allocation exhibits higher progressivity, suggesting that observed sorting attenuates redistribution by spreading public education benefits more evenly across the income distribution.

In provinces where higher-income households disproportionately opt out of public secondary education, the counterfactual reweighting produces a sizable reduction in progressivity. In these cases, a non-trivial share of the observed Kakwani index reflects differential exit to private schools rather than redistributive design within the public sector. By contrast, in provinces where public secondary education is nearly universal across income groups, imposing the national income gradient increases the concentration of public education benefits among lower-income households, resulting in a higher

counterfactual Kakwani index. In these cases, sorting reduces, rather than amplifies, measured progressivity.

Figure 1 plots the estimated sorting effect against the share of students enrolled in public secondary schools across provinces. A clear negative relationship emerges: provinces with higher public enrollment rates tend to display negative sorting effects, while provinces with lower public enrollment—reflecting greater private school participation—exhibit positive sorting effects. This relationship highlights that income-based sorting does not uniformly inflate progressivity measures; its effect depends systematically on the underlying enrollment structure.

Figure 1. Income-Based Sorting and Measured Progressivity across Provinces



Note: Each point represents a province. The sorting effect is defined as the difference between the observed and counterfactual Kakwani indices for public secondary education.

Source: Author's calculations.

Taken together, the counterfactual results underscore the importance of accounting explicitly for enrollment composition when interpreting progressivity measures. Cross-province comparisons based solely on observed incidence may be misleading if differences in public–private participation are not taken into account. By exploiting subnational variation in sorting patterns, the analysis reveals a mechanical component of redistribution that is obscured in national-level analyses but central to understanding the equity properties of public education spending.

6. Conclusions

This paper revisits the interpretation of standard benefit-incidence measures of public education spending in contexts where private schooling plays a significant role. While conventional redistributive incidence analyses typically interpret measured progressivity as evidence of redistributive design, we show that part of this progressivity may arise mechanically from income-based sorting between public and private schools rather than from the structure of public spending itself.

Focusing on secondary education in Argentina, we exploit cross-provincial variation in enrollment patterns to distinguish between two components of redistribution: structural redistribution, driven by public spending levels and unit costs, and mechanical redistribution, driven by differential take-up across income groups. Our results indicate that sorting effects are quantitatively important and heterogeneous. In provinces where higher-income households disproportionately opt out of public secondary education, standard incidence measures tend to overstate progressivity, whereas in provinces with near-universal public enrollment, sorting can attenuate measured redistribution. Once sorting is accounted for, cross-provincial differences in progressivity are substantially

reduced, suggesting that much of the observed heterogeneity reflects participation patterns rather than differences in redistributive effort.

Although our analysis is conducted at the provincial level, it has implications for the interpretation of national-level incidence results. To the extent that provincial patterns generalize, standard CEQ-based estimates of the progressivity of public education spending in Argentina are likely to incorporate a non-trivial mechanical component associated with income-based sorting. At the same time, the results confirm that public education spending remains genuinely redistributive at lower educational levels, highlighting the importance of distinguishing between structural and mechanical components when assessing the equity effects of education policy in Argentina as a whole.

Methodologically, the paper contributes a simple and transparent adjustment that refines standard progressivity measures without relying on behavioral assumptions or structural models of school choice. By exploiting subnational variation within a common institutional framework, the approach provides a diagnostic tool for identifying biases arising from endogenous participation in in-kind public services. Substantively, the findings caution against interpreting cross-jurisdictional differences in education incidence as reflecting policy effort alone and underscore the importance of accounting for institutional context and enrollment composition.

More broadly, the analysis has implications for cross-country comparisons of fiscal redistribution. In the CEQ tradition, such comparisons are widely used to assess the redistributive capacity of national fiscal systems. Our results suggest that when redistribution relies heavily on in-kind spending—such as education—differences in

participation regimes and public–private sorting can affect the comparability of standard incidence measures across countries. To the extent that the mechanisms identified here extend beyond Argentina, cross-country comparisons based on conventional methods should therefore be interpreted with caution, particularly when contrasting fiscal systems that differ in the relative importance of in-kind versus cash-based redistribution.

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