Online Supplement for:

The Mismatch between World Bank Actions and the Decentralization of Educational Systems in LMICs

Table S1. Coding scheme

Who decides [one of the 9 indicators listed in the variable section] at the secondary level?

Subnational	School		Decision-making level
0	0	1	Central government
1	0	2	Combination of subnational entities and the central government
1	0	3	Subnational entities (i.e., region/directorate/district/sub-district)
1	1	4	Combination of schools, subnational entities and/or the central government
0	1	5	Combination of schools and the central government
0	1	6	School actors (i.e., school management committee)

Notes: The codebook for de jure decentralization can be found on pages 33 to 36 in this supplementary file, followed by the codebook for World Bank reforms on pages 37 and 38.

Table S2. Correlation between the indices of de jure decentralization by education level

	School		
	Upper-secondary	Lower-secondary	Primary
Upper-secondary	1		
Lower-secondary	0.94	1	
Primary	0.90	0.95	1

|	**Subnational**		
	Upper-secondary	Lower-secondary	Primary
Upper-secondary	1		
Lower-secondary	0.996	1	
Primary	0.97	0.98	1

Appendix S1: IRT Index

As mentioned in the variable section, the main analysis in the paper uses de jure decentralization, measured by the number of components (out of nine) performed by subnational or school entities. In addition to this simple row sum approach, I also create de jure decentralization indices using the item response theory (IRT) method to examine if the row sum measures align with those generated by IRT. IRT is commonly employed to derive continuous indices of observed outcomes from categorical responses of latent or unobserved characteristics Fraley et al. (2000). However, since the row sum technique requires fewer assumptions while still yielding similar measures to the more complex IRT method (Hambleton & Swaminathan, 2013), I adopt the simpler approach. To explain the IRT method, I specifically use a one-parameter logistic or 1PL regression model to obtain the predicted latent trait scores of decentralization for both levels separately. I estimate Equation A1, where

$$\text{logit}(P(X_i = 1 \mid \theta)) = \alpha_i \qquad \text{[A1]}$$

$P(X_i = 1 \mid \theta)$ denotes the probability of a correct response on the decentralization indicator i given the latent trait θ. α_i signifies the difficulty parameter or intercept specific to each of the nine items or decentralization indicators. Notably, the probability of a correct response on each item X_i only depends on the difficulty parameter α_i, without including a discrimination parameter. Each decentralization indicator possesses its own difficulty parameter. I run this model separately for both the school and subnational levels. I then generate the predicted latent trait scores for both levels. Finally, I standardize the indices with a mean of 0 and a standard deviation of 1, akin to the simple row mean indices, which helps compare the results obtained from both methods. As shown in Figure A1, the measures from both methods are nearly identical.

Figure S1. The comparison between the growth of de jure decentralization indices measured using simple row sum and IRT.
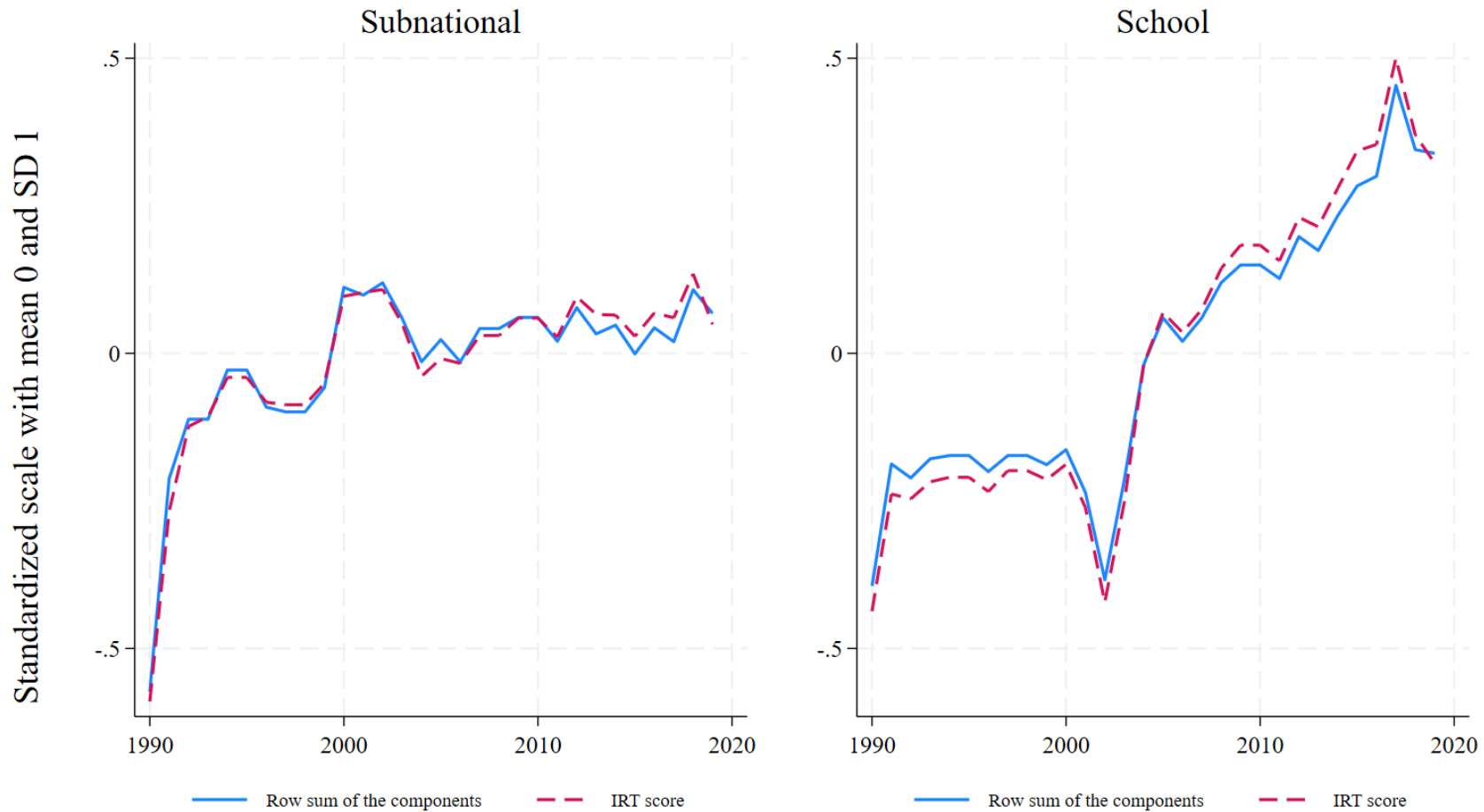
Notes: IRT, item response theory. Simple row sum refers to the total of 9 indicators. Both row sum and IRT indices are standardized with a mean of 0 and a standard deviation of 1.

Box S1. Example of an education project implemented by the World Bank in Honduras from 2008 to 2013

Component 1: Enhancing and Scaling-Up Interventions that Address the Needs of the Poor. This component would support pre-primary and primary school interventions focused on the poorest segments of the population. . . .

Component 2: Community Participation in School Management. This component would foster community participation within an Integrated School Management System. It had three subcomponents: (2.1) Consolidation and Institutionalization of the School Management System: This sub-component would finance analysis of existing school management modalities among traditional, . . . educational networks to develop consolidated policies for community participation, social management, school planning, school systems for information, monitoring and evaluation, and financial administration. (2.2) School Planning and Resources for Quality Education: This sub-component would finance the review and development of instruments to support school and network planning and resource management through cooperative school networks. (2.3) School Management and Education Performance Monitoring and Evaluation: This sub-component would finance the development and implementation of a participatory monitoring and evaluation system for school management.

Component 3: Governance and Institutional Strengthening of the Ministry of Education. The component would finance efforts to strengthen SEDUC [*Ministry of Education*], including improving governance and management capacity. The component was divided into three sub-components: (3.1) Information for improved performance and greater accountability: . . . expanding, strengthening, updating and maintaining the SIARHD [*Integrated System for the Administration of Teachers' Payroll*] at central and Subnational levels to provide reliable information on teachers at all levels . . . ; and strengthening the capacity for educational planning and the use of information for decision-making at the central and departmental levels. (3.2) National System of Assessment of Learning Outcomes: . . . strengthen the institutional capacities of SEDUC to use the information for monitoring of learning outcomes and decision-making, and to increase overall transparency through dissemination of the results . . .

Component 4. Project Administration: This component would finance the cost of technical personnel (local consultants) and operating costs. . . .

Source: World Bank (2013, pp. 3-4).

Table S3. Selected 45 examples of WB's decentralization reforms

No	Country	Project id	Starting year	Closing year	Education level	Decentralization level	Examples of decentralization method
1	Bangladesh	P162619	2018	2023	Primary	Subnational	Administrative and financial powers will be further devolved to divisional, district, and Upazila (sub-district) education offices.
2	Indonesia	P168076	2019	2024	Primary and Secondary	Subnational	Electronic performance-based planning and budgeting, enabling budget management support and monitoring at the provincial and district levels system
3	Chile	P006668	1991	1998	Primary and Secondary	Subnational	Gradually change the managerial and organizational culture in the central and decentralized parts of the Ministry of Education and the municipalities
4	Rwanda	P115816	2009	2010	Primary and Secondary	Subnational and schools	Adoption of a framework and procedures for the implementation of decentralized procurement and school-level selection of textbooks
5	Nepal	P040612	1999	2004	Primary	Schools and communities	Annual school-based in-service teacher training; community mobilization programs through training of Village Development Committees (VDCs) and SMCs
6	Argentina	P064614	2000	2008	Secondary	Schools	Autonomous school management and innovative school projects in the selected junior secondary schools and their districts

7	India	P009955	1993	2000	Primary	Subnational	A strengthened framework for state and district-level planning
8	Cambodia	P070668	2004	2011	Primary and Secondary	Schools and communities	Preparing school development plans, Training school staff and principals, community participation in SMCs
9	Cambodia	P109925	2007	2012	Primary	Educational Administration	Created educational 60 new District Offices of Education buildings; Capacity building was to occur with select province-level staff on accounting, record keeping, and financial monitoring
10	Cambodia	P144715	2013	2017	Primary and Secondary	Educational Administration and schools	Leadership training to principals to direct teachers and plan development program
11	Cambodia	P146160	2014	2019	Primary	Schools and communities	Citizens (men/women) participation in budget decisions
12	Indonesia	P003833	1982	1990	Secondary	Educational Administration and communities	Creating links between units and expanding links to village level
13	Indonesia	P003842	1983	1990	Secondary	Educational Administration and communities	Running examinations at the provincial level
14	Indonesia	P003873	1989	1997	Secondary	Educational Administration	Management training at the central, provincial and district levels
15	Indonesia	P003940	1991	1999	Primary	Educational Administration, schools and communities	Training staff at the regional level and teachers in schools, school guidelines, community participation

	Country						
16	Indonesia	P003987	1995	2004	Secondary	Educational Administration and schools	Train school principals and administrators; develop data analysis skills of district and provincial staff; institutional capacities of project management at the province, district and Directorate of Secondary Education at the national level
17	Kazakhstan	P153496	2016	2022	Primary and Secondary	Schools and communities	School autonomy, participation of stakeholders and leadership building
18	Maldives	P131331	2012	2018	Primary and Secondary	Schools	School-based management, training management teams
19	Bhutan	P078807	2005	2007	Primary	Educational Administration and schools	EMIS to decentralize the data collection system at the subnational and district levels.
20	Uruguay	P070937	2001	2012	Primary	Schools	Strengthening the partnership between schools and parents
21	Azerbaijan	P057959	1998	2004	Primary and Secondary	Schools and communities	strengthening parent and community involvement in school operations
22	Thailand	P004701	1978	1985	Secondary	Communities	Community participation in school construction and rehabilitation
23	Sri Lanka	P010343	1988	1996	Primary and Secondary	Educational Administration, schools and communities	Constructing district-level offices, School management strengthening, school board, community involvement
24	Sri Lanka	P010525	1996	2005	Primary and Secondary	Educational Administration	Strengthening the capacity of provincial education offices, EMIS
25	Chad	P000517	1992	2001	Primary	Schools and communities	Community involvement in school activities; school autonomy
26	Egypt	P005169	1995	2006	Primary	Educational Administration	Capacity building of governorates by funding and staffing

|							
27	Egypt	P050484	1998	2012	Secondary	Schools and communities	Community involvement in school councils, school leadership
28	Georgia	P168481	2018	2026	Primary and Secondary	Educational Administration and schools	Whole school improvement, school-based curriculum, leadership building
29	Burundi	P064557	2006	2012	Primary and Secondary	Educational Administration and schools	Capacity building: 2,200 school directors and 149 inspectors would be trained
30	Burundi	P161600	2017	2023	Primary	Educational Administration, schools and communities	Strengthening School Management Committees (CGEs), strengthening the capacity of principals
31	Afghanistan	P083964	2003	2010	Primary and Secondary	Educational Administration	Providing grants to provincial and district education departments to strengthen school support
32	Benin	P146597	2013	2017	Primary	Schools and communities	Decentralized community-driven development in education
33	Argentina	P005992	1993	2001	Secondary	Educational Administration	Quality improvement at the provincial level included curriculum development, provision of in-service teacher training, provision of textbooks and other learning materials; infrastructure improvement at the provincial level
34	Argentina	P050714	1997	2002	Primary and Secondary	Schools	SBM, institutional development of schools
35	Mexico	P101369	2009	2014	Primary	Schools	Provision of grants to compensatory schools under a Support for School Management

36	Mexico	P147185	2013	2018	Primary and Secondary	Schools and communities	School autonomy, SBM, parental participation, implementation of School Improvement Plans, capacity-building strategy for school directors and supervisors,
37	Bangladesh	P009555	1992	2001	Secondary	Educational Administration and schools	Thana (Upazila) Project Offices; (e) School Level Coordinators; and (f) a Thana Advisory Committee (TAC)
38	Bangladesh	P009550	1997	2003	Primary	Educational Administration and schools	Support the development of institutional capacity at PMED, DPE (at central, regional, Districts and Upazila levels) and at the school level, to enhance the provision of quality primary education; SMC
39	Bangladesh	P044876	2001	2008	Secondary	Educational Administration and schools	Awareness training for Upazila Program Officers and Assistant Program Officers, field-level officials, educational institutions' School Management Committees and Parent Teachers
40	India	P035821	1995	2003	Primary	Educational Administration, schools and communities	Establish EMIS, strengthening state institutions such as the State Institutes of Educational Management and Training (SIEMT)
41	India	P045050	1998	2005	Primary	Educational Administration, schools and communities	Promoting community awareness and community involvement in school improvement; establishing and strengthening state and district project offices

	Country						
42	India	P050667	1998	2006	Primary	Educational Administration	Strengthening the State Project Office and Divisional Offices; strengthening the capacity of district project management structures
43	Pakistan	P094086	2005	2014	Primary	Schools and communities	Community schools, community mobilization and the selection and registration of Parent Education Committees under Pakistani law; Parent Education Committees, Community Implementation Partners
44	Pakistan	P102608	2008	2012	Primary and Secondary	Schools	School Council capacity building program for effective school management
45	Pakistan	P010394	1991	2000	Primary	Educational Administration	Separating responsibility for the management and administration of elementary and secondary education at provincial, divisional and district level

Table S4. List of countries included in the study.

Country
Afghanistan
Argentina
Armenia
Azerbaijan
Bangladesh
Benin
Bhutan
Burundi
Cambodia
Chad
Chile
Egypt
Georgia
India
Indonesia
Jordan
Kazakhstan
Laos
Malaysia
Maldives
Mexico
Morocco
Nepal
Pakistan
Rwanda
Sri Lanka
Thailand
Tunisia
Uruguay
Vietnam

Figure S2. Percentage of projects focused on decentralizing educational systems.
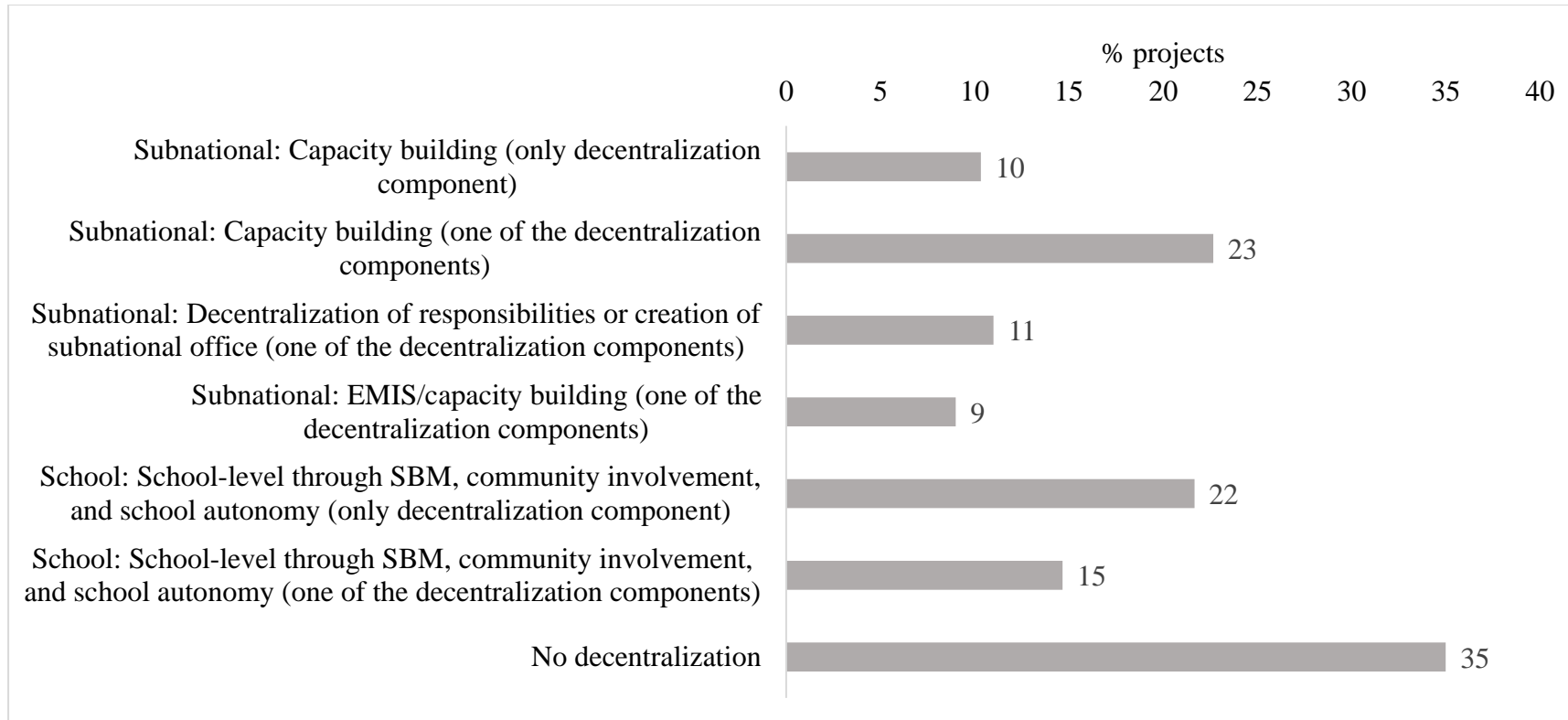
Notes: This is based on 300 projects. The total percentage is over 100 as the decentralization elements overlap in one or more projects. For instance, a single project can include components about SBM and capacity building at the subnational level simultaneously. I illustrate the elements separately for better understanding. Finally, SBM can also be seen as a component of capacity building at the school level.

Appendix S2: Reliability[1]

One may argue that the measures of subnational and school-level decentralization reforms by the WB may be biased due to the coding decision, questioning the reliability of the measurement. Examining inter-rater reliability is challenging in this study since a single researcher coded the data. To address the reliability issue, I use two approaches: (a) computer-assisted text analyses for coding the measures; and (b) re-coding a partial sample of the manually coded measures with a time-lapse.

First, I use computer-assisted automated text analysis techniques to analyze WB project documents that are included in the study. It examines whether analyses derived from manually coded measures of Subnational and school-level decentralization can be approximately replicated by the measures constructed by text analysis.

For coding by computer-assisted text analysis, I first process 19,633 project documents[2] on all study countries using natural language processing (NLP) techniques. Precisely, I lowercase, tokenize and remove all stop words and words containing less than three characters. Next, to code Subnational decentralization, I create a dictionary using the following keywords listed in the upper panel of Table S5 with both American and British spellings. I construct the lists based on the literature used in the study that suggests the types of decentralization reforms that took place in developing countries over the past few decades and the words used to define them (e.g., Ball & Youdell, 2009; Florestal & Cooper, 1997; Galiani et al., 2008; Ganimian, 2016; Gershberg & Winkler, 2004; Gertler et al., 2006). I create the variable by counting the frequency of occurrences of the listed words in every 1,000 words as the size of documents widely varies. I follow the same strategies to code school-level decentralization but with a different set of words, as shown in the lower panel of Table S5.

As demonstrated in Figure S3, the distribution of subnational and school-level decentralization over the years is approximately similar when manually coded measures are compared with the ones coded using automated text analysis.

Table S5. List of keywords about Subnational and school-level decentralization

Decentralization channels	List of keywords
Subnational	'decentralization', 'decentralize', 'decentralizing', 'decentralized', 'decentralisation', 'decentralise', 'decentralising', 'decentralised', 'devolution', 'devolved', 'devolving', 'devolve', 'devolves', 'delegation', 'delegate'
School	'school management committee', 'smc', 'school management committees', 'school autonomy', 'school-based management', 'school based management', 'sbm', 'parent-teacher association', 'parent teacher association'

Note: The lists are constructed based on the literature as suggested.

My analyses using manual and automated coding separately also suggest similar growth trajectories of subnational and school-level decentralization. As Table S6 illustrates, Models 1 and 2 for manual coding and Models 5 and 6 for automated coding suggest that there is a downward curvature after an initial instantaneous growth in subnational decentralization

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[1] The dataset on WB reforms was originally prepared on 99 LMICs. Hence, the robustness checks are shown for these 99 countries including the 30 countries included in this study.
[2] Each single project has multiple documents produced throughout its lifespan. This leads to having more documents than the number of total documents read for manual coding, around 2,500. I use fewer documents for manual coding because, for hand coding, I go through only key documents such as project appraisal and evaluation documents that usually contain most of the project information, including the keywords used in the text analysis. However, to account for any potential bias large documents may cause, I use relative frequency of keywords to the document size. In addition, I present results for textual coding in Figure S6 weighted by the number of documents.

reforms. This holds similar in both types of coding and approximates the scenario in Figure 4 in the main analyses.

Figure S3. The cumulative distribution of Subnational- and school-level decentralization using manual and computer-assisted coding techniques.
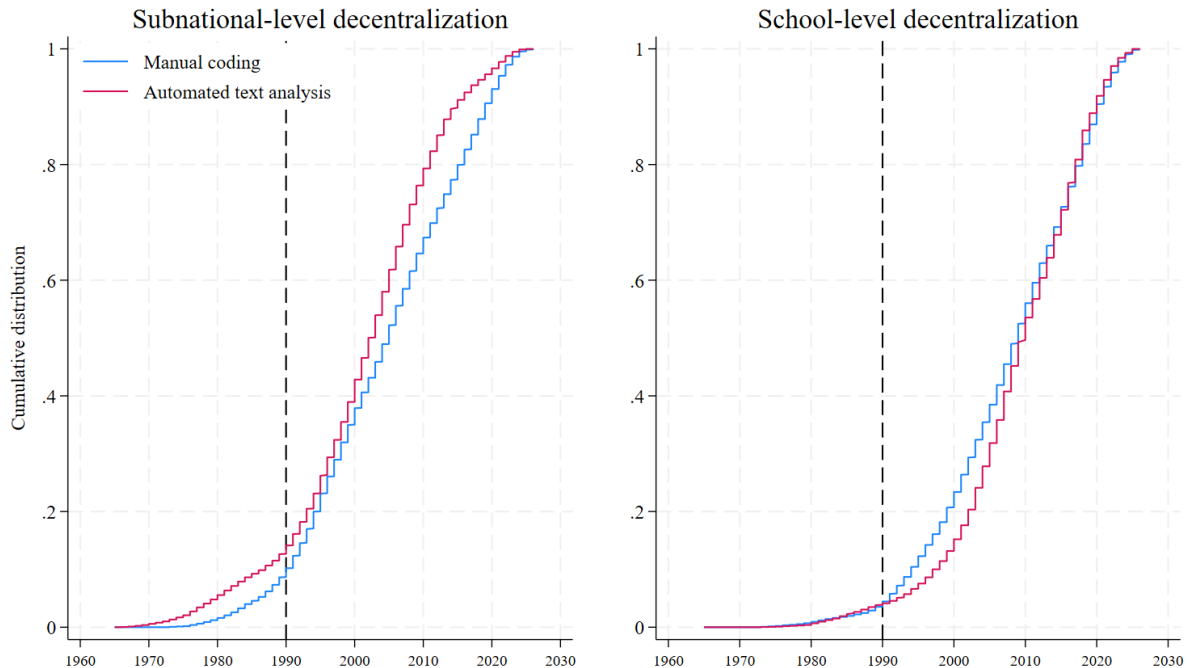
Notes: The vertical dash lines signify the initial stage of the neoliberal era after the Washington Consensus in 1989.
Source. Own data.

      To calculate Models 1, 2, 5 and 6, I use generalized linear mixed models (GLMM) to be consistent with my main analyses. Besides, in both measures, a significant number of observations have 0 value, making the distribution skewed and likely heteroscedastic. I use the linear link function for Models 1, 2, 5 and 6. This is because the automated measure is a continuous variable ranging between 0 and 9, for which the linear function is more appropriate. To make the regression outputs from manually coded measures comparable to those from automated coding, I also apply a linear function to the manually coded measure, a proportion measure ranging from 0 to 1. However, when I use the logit link function in Models 3 and 4, similar to the main analyses, the results still suggest a similar trajectory: after instantaneous growth, subnational decentralization reforms take a negative curvature.

      We plot the estimated slope for each country over time in Figure S4. The upper and lower panels on the left side of the figure show similar growth trajectories in both manual and automated subnational decentralization measures.

Table S6. Comparison between the growth trajectories of Subnational decentralization reforms when coded manually and using automated text analysis.

	Subnational decentralization					
	Manual-linear (1)	Manual-linear (2)	Manual-logit (3)	Manual-logit (4)	Automated-linear (5)	Automated-linear (6)
Year	0.66***	0.42**	16.4***	11.0***	2.92***	2.61***
	(0.12)	(0.16)	(2.39)	(3.24)	(0.42)	(0.56)
Year quadratic	-0.00016***	-0.00010**	-0.0041***	-0.0027***	-0.00073***	-0.00065***
	(0.000030)	(0.000040)	(0.00060)	(0.00081)	(0.00011)	(0.00014)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Starting time		Yes		Yes		Yes
Project cost (log)		Yes		Yes		Yes
Education levels		Yes		Yes		Yes
Constant	-662.2***	-420.3**	-16402.5***	-11009.7***	-2916.6***	-2602.9***
	(120.6)	(161.7)	(2390.2)	(3242.8)	(421.2)	(566.2)
Σu (Country)	0.0062***	0.0063***	1.45***	1.52***	0.11**	0.11**
	(0.0010)	(0.0010)	(0.39)	(0.37)	(0.035)	(0.035)
Σe (Country-project year)	0.022***	0.021***			0.28***	0.28***
	(0.0018)	(0.0018)			(0.064)	(0.064)
N	3312	3312	3312	3312	3313	3313

Robust standard errors in parentheses. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Notes: (a) 'Manual' denotes manual coding of the Subnational decentralization variable by WB projects, while 'automated' means coding Subnational using text analysis. (b) 'Linear' indicates that I use generalized linear mixed models (GLMM) with linear (identity) link function, whereas 'logit' suggests the use of logit link function. (c) Coefficients from the linear models for the manually coded measure can be interpreted as the proportion of WB project components focusing on subnational decentralization. For instance, the instantaneous growth of subnational decentralization reforms (as suggested by the year coefficients in Model 2) is 66 percentage points each year. However, it then decreases by 0.016 percentage points (as the year quadratic coefficient suggests) after a certain time, indicating a downward curvature. For automated coding, coefficients can be interpreted as changes in the frequency of Subnational decentralization-related words in every 1,000 words in WB project documents. Conversely, manual logit coefficients can be interpreted as the log odds of Subnational components in WB projects.
Source: Own data.

Here, I also use country fixed effects in the lower and upper panels in the middle of the figure. After accounting for time-invariant country-specific unobservable factors, the variation across countries shrunk. Importantly, both manual and automated measures of subnational-level reforms as the outcome variables provide a very similar growth trend. The panel on the furthest right is similar to the plot on the left panel of Figure 4 in the main analyses, which uses the logit link function. It also closely resembles the overall trend in all panels using any type of coded measure.

Like subnational decentralization, I also conduct comparative analyses using the manual and automated coded measures of school-level decentralization reforms, as shown in Table S5. The only difference in this table is that I do not find growth curvature statistically significant when I use a linear link function in GLMM regressions for both types of the school-

level decentralization measure as suggested in Models 1, 2, 6 and 7. However, when I do not use the year quadratic function, the growth seems to be significant in both manual and automated coding, as presented in Models 3 and 8. This suggests that decentralization growth at the school level is linear compared to the subnational level. Although the quadratic year is significant when the logit link function is used (as shown in Models 4 and 5 in Table S7), the curvature is not as downward as for subnational decentralization, as presented on the furthest right panel in Figure S5. Additionally, as the lower and upper panels on the left and middle of Figure S5 suggest, the estimated growth is very similar in both manual and automated measures of school-level decentralization when I use country random effects/mixed effects and country fixed effects.

Figure S4. Growth trajectories of Subnational decentralization reforms using both manual and automated coding
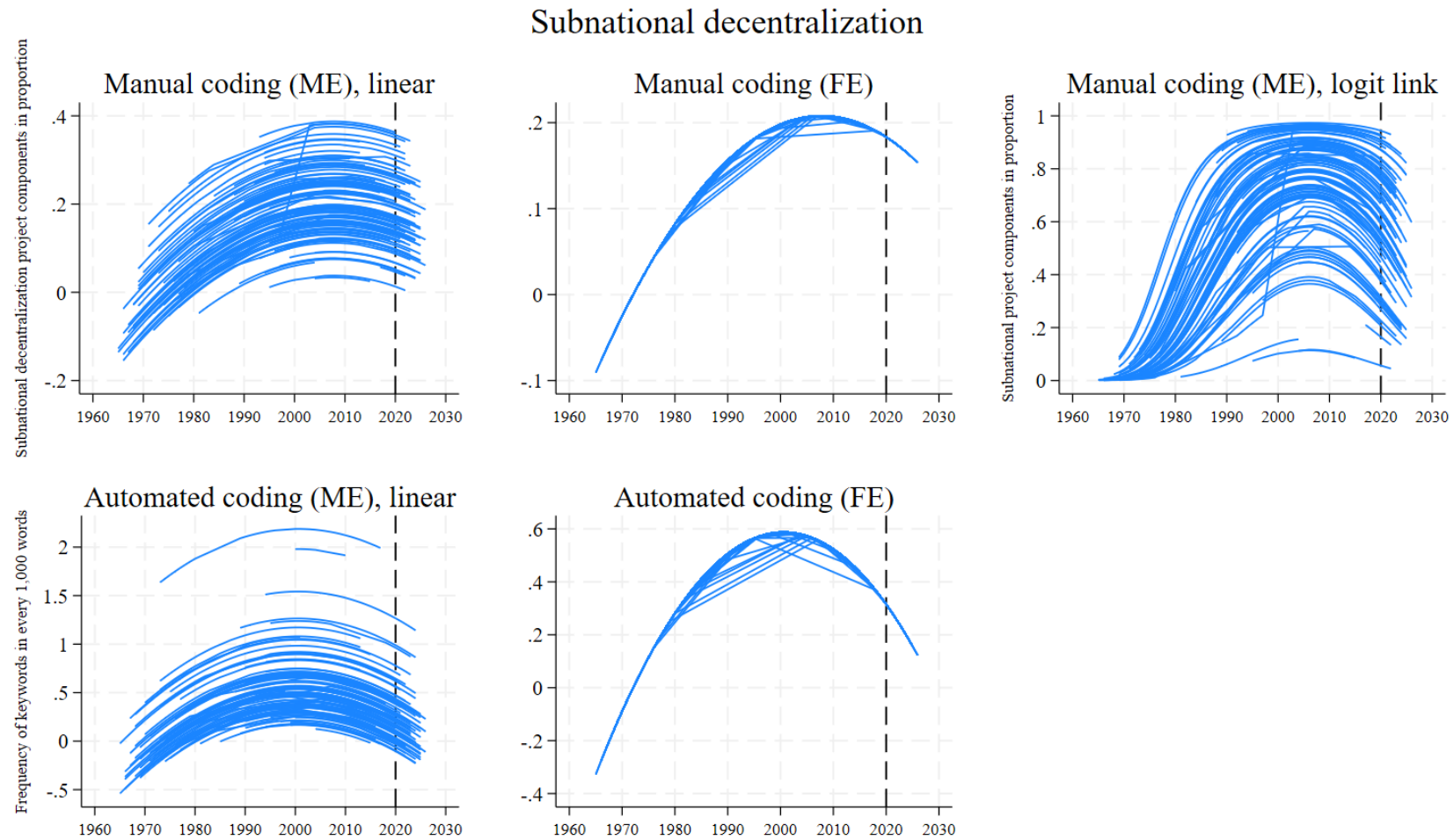

Subnational decentralization

Table S7. Comparison between the growth trajectories of school-level decentralization reforms when coded manually and using automated text analysis

	School-level decentralization							
	Manual-linear (1)	Manual-linear (2)	Manual-linear (3)	Manual-logit (4)	Manual-logit (5)	Automated-linear (6)	Automated-linear (7)	Automated-linear (8)
Year	0.20	0.22	0.0034***	17.6***	13.6**	0.11	0.57	0.0052**
	(0.11)	(0.15)	(0.00077)	(3.43)	(4.77)	(0.23)	(0.30)	(0.0017)
Year quadratic	-0.000048	-0.000055		-0.0044***	-0.0034**	-0.000025	-0.00014	
	(0.000027)	(0.000037)		(0.00086)	(0.0012)	(0.000058)	(0.000076)	
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Starting time		Yes	Yes		Yes		Yes	Yes
Project cost (log)		Yes	Yes		Yes		Yes	Yes
Education levels		Yes	Yes		Yes		Yes	Yes
Constant	-200.3	-227.6	-6.70***	-17713.0***	-13739.1**	-112.6	-579.9	-10.5**
	(106.2)	(147.8)	(1.53)	(3436.4)	(4783.9)	(229.3)	(303.0)	(3.36)
Σu (Country)	0.0061***	0.0063***	0.0063***	3.35***	3.41***	0.021**	0.021**	0.021**
	(0.0013)	(0.0014)	(0.0013)	(0.81)	(0.87)	(0.0066)	(0.0066)	(0.0065)
Σe (Country-project year)	0.018***	0.017***	0.017***			0.064***	0.064***	0.064***
	(0.0015)	(0.0014)	(0.0015)			(0.015)	(0.015)	(0.015)
N	3312	3312	3312	3312	3312	3313	3313	3313

Robust standard errors in parentheses. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Notes: (a) 'Manual' denotes manual coding of the Subnational decentralization variable by WB projects, while 'automated' means coding school-level decentralization using text analysis. (b) 'Linear' indicates that I use generalized linear mixed models (GLMM) with a linear (identity) link function, whereas 'logit' suggests the use of a logit link function. (c) Coefficients from the linear models for the manually coded measure can be interpreted as the proportion of WB project components focusing on the subnational level. For instance, as suggested by the year coefficient in Model 3, school-level decentralization reforms increase by 0.34 percentage points each year. For automated coding, the linear automated coding coefficients can be interpreted as the changes in the frequency of Subnational decentralization-related words relative to every 1,000 words in WB project documents. Conversely, manual logit coefficients can be interpreted as the log odds of school-level decentralization components in WB projects.

Source: Own data.

School-level decentralization
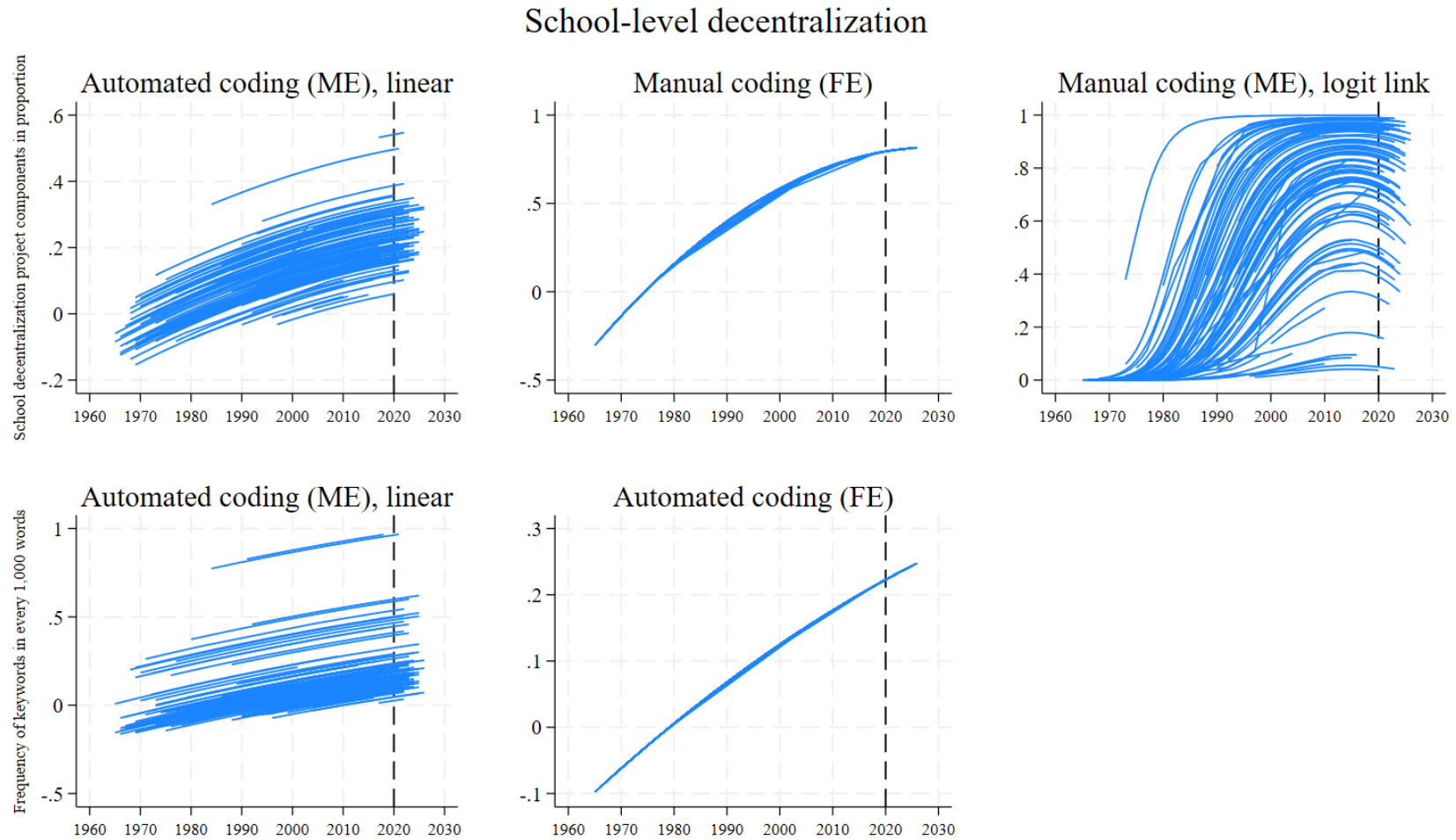
Additionally, to account for any potential bias that the variation in the number of documents within each project may cause, I run OLS regression with country fixed effects for automated coded measures. As presented in Figure S6, even after considering the number of project documents in the analyses, the results remain similar, suggesting the robustness of the measures.

Figure S6. Growth trajectories of Subnational and school-level decentralization reforms by automated measures weighted by the number of documents in each WB project

Decentralization
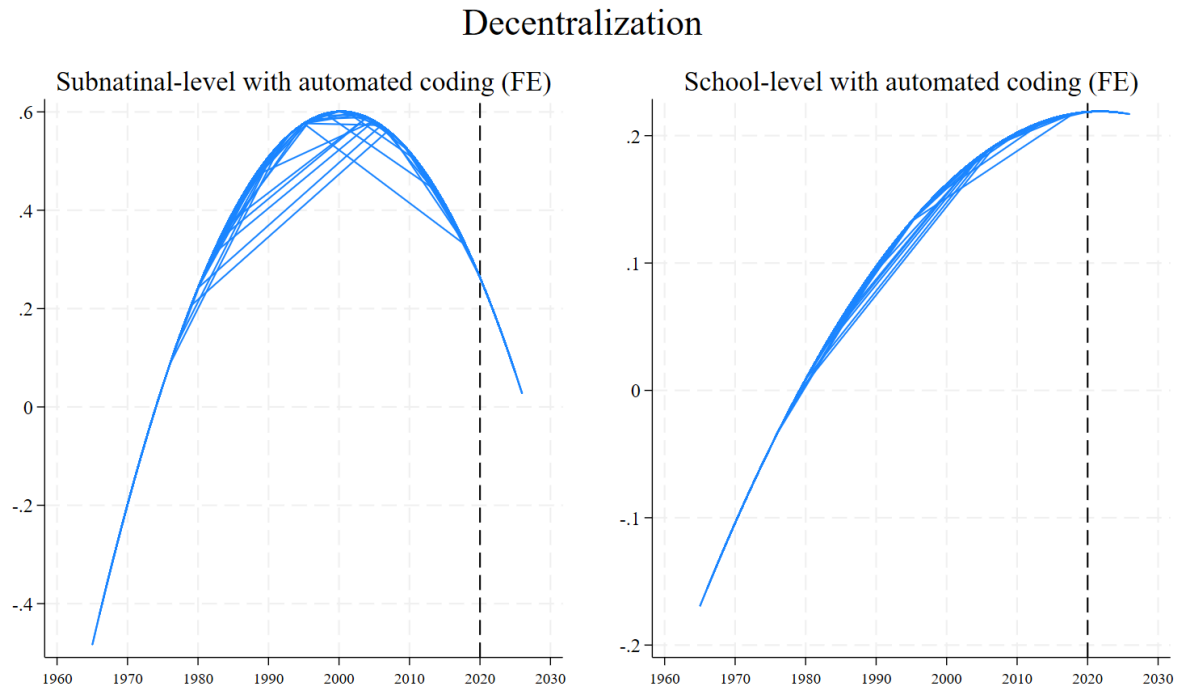
Notes: (a) FE, fixed effects. (b) The results are from OLS regression with country fixed effects as it allows weighting by analytical weights even when weights are not constant within the group, i.e., country.

Finally, I check the relationship between the predicted probability of manual and automated measures of subnational and school-level decentralization reforms using both GLMM (country random effects/mixed-effects) and country fixed effects models. I find a high correlation between the predicted probability of both decentralization channels, as shown in Figure S7. In mixed-effects or GLMM models, the correlation is around 0.78 for Subnational and around 0.8 for school-level, as demonstrated on the left panels in Figure S5. It is worth noting that I only use predicted probability from the fixed portion of the mixed models, unlike the growth slopes used in Figures S5 and S6, which use predicted probability from both fixed and random portions of the models. This is to keep the correlation comparable with the country fixed effects on the right panels of the figure. When I account for country-specific time-invariant and unobservable factors, the correlation becomes stronger, that is, 0.86 and 0.99 for Subnational and school-level decentralization, respectively.

All these analyses suggest that the measures are reliable, and coding decisions do not drive the findings.

Figure S7. The correlation between the predicted probability of Subnational and school-level decentralization from GLMM and country fixed effects models
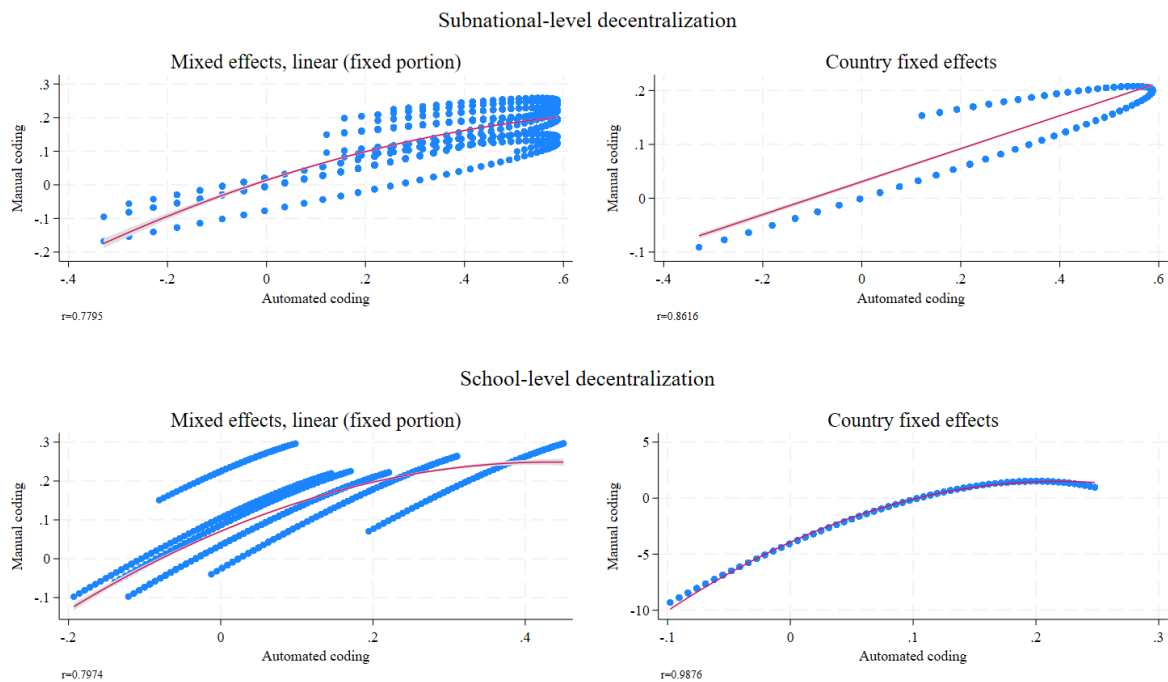
As the second step for examining reliability, I re-coded around 5 percent of the data, or 50 projects, after more than 6 months of the original coding using the same guidelines and see whether the results are similar. That is, the association between the first and re-coded variables is identical or nearly identical. Since a single coder coded the two measures, an inter-rater reliability check is not feasible. In such circumstances, re-coding with a lapse of time is suggested by Mackey and Gass (2015). This first coding was completed between June 2020 and October 2020, while the re-coding was carried out in May 2021. I find a high correlation between the first coded and re-coded measures of Subnational and school-level decentralization (manual), which stands over 0.95 for both measures[3].

I took the same approach to validate the reliability of de jure decentralization data by re-coding 10 percent of the data, or for 3 countries and found that the indices remain very similar.

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[3] The results are not presented here to avoid repetitions but are available upon request.

Table S8. Descriptive statistics.

Variable	Observations	Mean	St Dev	Min	Max
Subnational-level actual decentralization	677	0	1	-1.37	2.05
School-level actual decentralization	677	0	1	-0.83	3.57
Subnational -level WB decentralization reforms	974	0	1	-0.88	4.25
School-level WB decentralization reforms	974	0	1	-0.89	4.59
GDP per capita (log)	677	23.98	2.03	19.19	28.63
Share of ethnic groups	677	0.55	0.39	0.01	1
Population size (in number)	677	88019091	224500000	223158	1353000000
Clientelism index	677	0.54	0.22	0.03	0.94
Public sector corruption index	677	-0.75	1.31	-3.07	2.19
Decentralization of local government index	677	0.5	0.27	0.05	0.98
Global goals	723			0	2
UN goals until MDGs in 2000	205				
MDGs in 2020 until 2015	372				
SDGs in 2015	100				

Notes: Observations are expressed in country-year terms. St Dev, standard deviation; Min, Minimum; Max, maximum. The 'Global goals' variable is categorical; hence, a breakdown of observations by its categories is provided. The variable includes only three breakthroughs of UN goals since the number of observations is limited. For WB reforms, summary statistics for all available country-years are presented as I use the lag of these variables in different analyses for robustness checks.

Figure S8. Decentralization components over time at the subnational level.
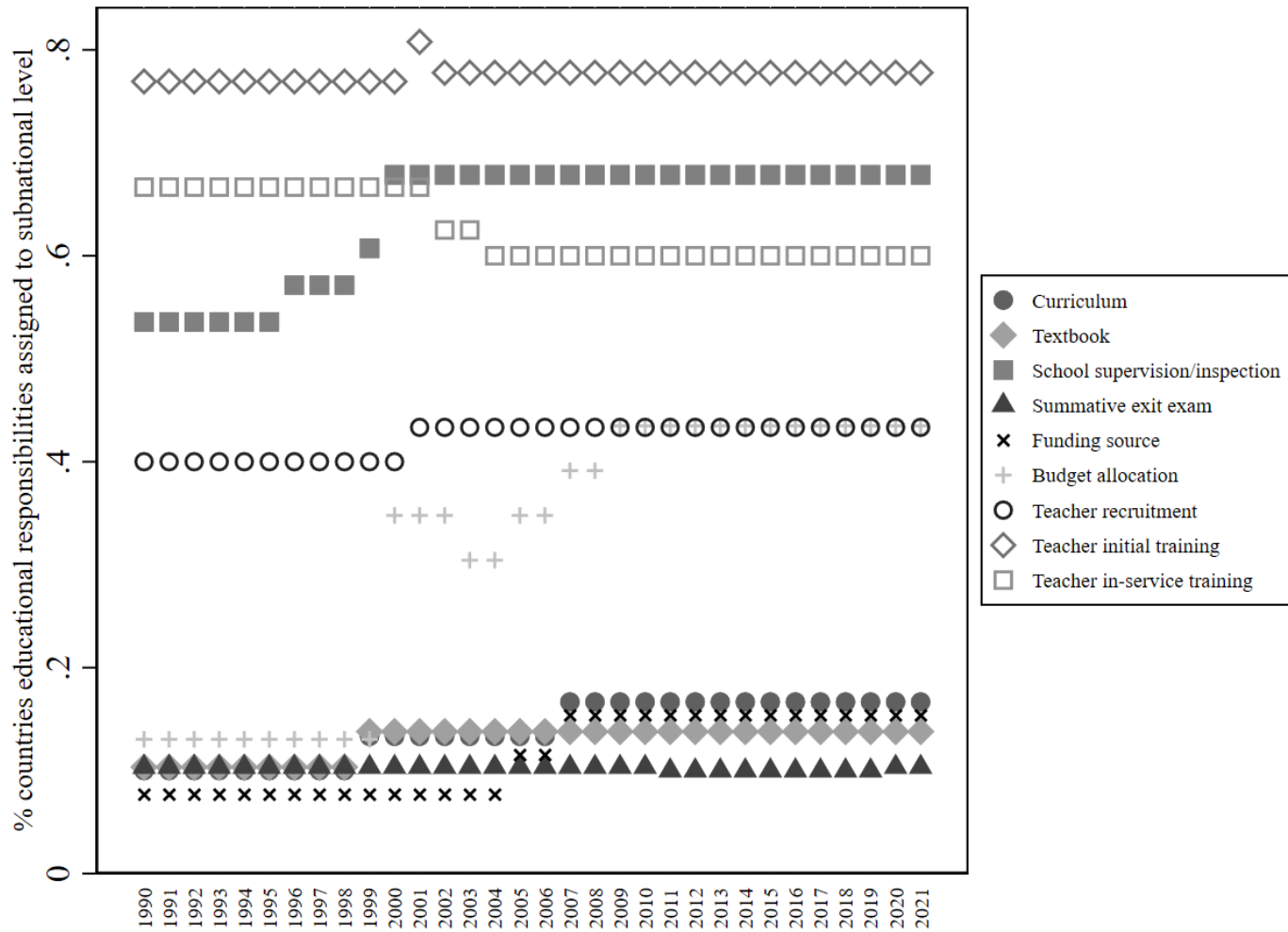
Notes: Since there is a very high correlation between de jure decentralization by education levels (Table S2), here I present indicators from upper secondary education.

Figure S9. Decentralization components over time at the school level.
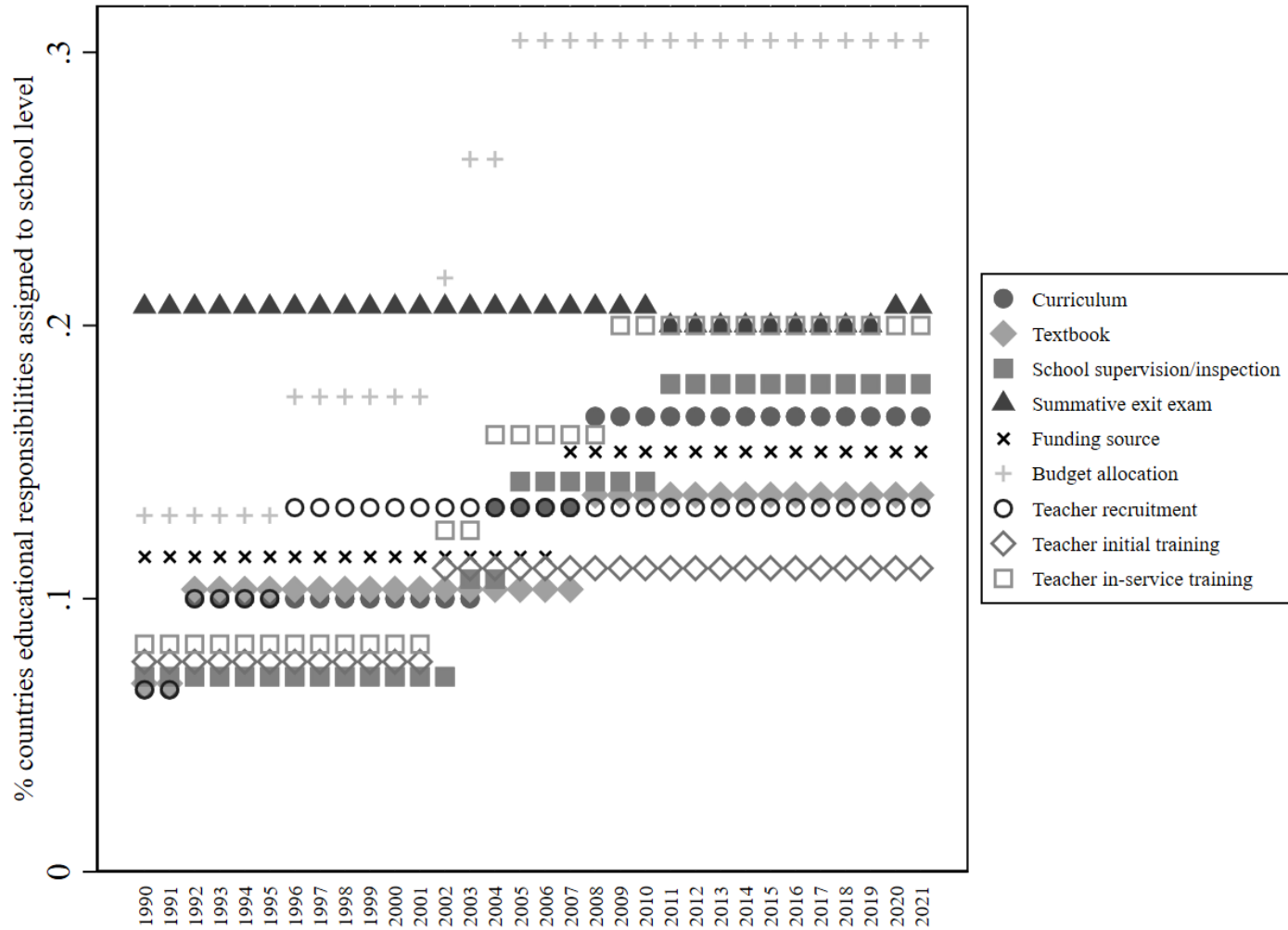
Notes: The same note applies as in Figure S8.

Table S9. The association between WB reforms and de jure decentralization of educational systems by separate indices, 1990-2019.

	De jure decentralization					
	Two-way fixed effects models					
	Subnational			School		
	Academic	Budget	Personnel	Academic	Budget	Personnel
Subnational decentralization by WB	0.0058	0.033	-0.015	0.037	-0.047	0.059
	(0.037)	(0.070)	(0.020)	(0.025)	(0.046)	(0.058)
School decentralization by WB	0.018	0.088	0.032	0.043	-0.046	-0.019
	(0.031)	(0.068)	(0.020)	(0.026)	(0.034)	(0.039)
Global goals (ref. UN goals until MDGs in 2000)						
MDGs in 2020 until 2015	0.46	0.34	0.14	0.34	-0.33	-0.58
	(0.31)	(0.65)	(0.13)	(0.39)	(0.29)	(0.41)
SDGs in 2015	0.48	0.33	0.12	0.40	-0.35	-0.67
	(0.31)	(0.78)	(0.13)	(0.48)	(0.33)	(0.43)
GDP per capita (log)	-0.051	0.17	-0.061	-0.031	0.36	0.41
	(0.10)	(0.32)	(0.085)	(0.18)	(0.20)	(0.27)
Share of ethnic groups	0.23	-0.18	0.29	0.30	0.76*	0.14
	(0.12)	(0.67)	(0.33)	(0.15)	(0.32)	(0.25)
Population size (in number)	-9.9e-10	-1.6e-09	1.0e-09	-2.6e-10	-1.7e-09*	-6.8e-10
	(6.6e-10)	(1.5e-09)	(7.3e-10)	(5.1e-10)	(8.3e-10)	(6.3e-10)
Clientelism	-0.86	-1.08	0.25	-0.059	0.69	-0.095
	(0.60)	(0.80)	(0.18)	(0.29)	(0.34)	(0.28)
Public sector corruption	-0.077	-0.13	0.10	0.11	0.27**	-0.078
	(0.061)	(0.15)	(0.061)	(0.067)	(0.090)	(0.060)
Decentralization of local government index	-0.29*	-0.18	0.23	0.027	-0.042	0.17
	(0.12)	(0.40)	(0.17)	(0.14)	(0.17)	(0.23)
Log of project cost	-0.0050	-0.10	-0.054	-0.065**	0.0019	-0.031
	(0.025)	(0.050)	(0.033)	(0.023)	(0.028)	(0.023)

Constant	1.55	-1.65	1.92	1.66	-8.75	-9.11
	(2.66)	(7.15)	(1.94)	(4.22)	(4.81)	(6.25)
Observations	677	677	677	677	677	677
Country	30	30	30	30	30	30

Notes: Standard errors in parentheses are robust to heteroskedasticity and clustering at the country level. * *p<0.05* ** *p<0.01* *** *p<0.001*.

Table S10. The association between WB -reforms and de jure decentralization of educational systems, 1990-2019.

	Dependent variable: De jure decentralization			
	Two-way fixed effects models			
	Subnational level		School level	
	Initial decentralization level in 1990			
	Low	High	Low	High
	(1)	(2)	(3)	(4)
Subnational decentralization by WB	-0.054	0.034	-0.033	0.077
	(0.052)	(0.034)	(0.035)	(0.072)
School decentralization by WB	0.063	0.0019	0.021	0.014
	(0.030)	(0.035)	(0.029)	(0.040)
Global goals (ref. UN goals until MDGs in 2000)				
MDGs in 2020 until 2015	0.89	0.16	0.46	-0.60
	(0.52)	(0.31)	(0.47)	(0.36)
SDGs in 2015	0.89	0.15	0.51	-0.73
	(0.57)	(0.36)	(0.54)	(0.39)
GDP per capita (log)	-0.23	0.13	-0.010	0.51
	(0.17)	(0.22)	(0.19)	(0.26)
Share of ethnic groups	0.40	-0.49	0.32**	0.96**
	(0.21)	(0.24)	(0.082)	(0.28)
Population size (in number)	-2.2e-09	-8.8e-10	-7.4e-09**	-1.2e-09
	(6.0e-09)	(9.0e-10)	(2.5e-09)	(7.8e-10)
Clientelism				
	-0.40	-0.76	-0.0047	0.78
Public sector corruption	(0.46)	(0.56)	(0.26)	(0.49)
	0.039	-0.067	0.13*	-0.028
Decentralization of local government index	(0.068)	(0.092)	(0.059)	(0.18)
	0.019	-0.19	0.061	0.16
Log of project cost	(0.17)	(0.16)	(0.21)	(0.15)
	-0.076*	-0.016	-0.025	-0.061
Constant	5.58	-1.31	-0.085	-11.3
	(4.17)	(5.20)	(4.47)	(6.45)
Observations	369	308	312	365
Country	15	15	15	15

Notes: Standard errors in parentheses are robust to heteroskedasticity and clustering at the country level. * *p<0.05* ** *p<0.01* *** *p<0.001*.

Table S11. The association between WB reforms using lags 6, 8, and 10 and de jure decentralization of educational systems.

	Dependent variable: De jure decentralization					
	Subnational			School		
	(1)	(2)	(3)	(4)	(5)	(6)
	lag 6	lag 8	lag 10	lag 6	lag 8	lag 10
Subnational decentralization by WB (lag 6)	0.0018			0.011		
	(0.030)			(0.038)		
School decentralization by WB (lag 6)	0.037			0.0075		
	(0.028)			(0.029)		
Subnational decentralization by WB (lag 8)		-0.024			0.025	
		(0.024)			(0.039)	
School decentralization by WB (lag 8)		0.025			-0.0063	
		(0.026)			(0.028)	
Subnational decentralization by WB (lag 10)			-0.056			0.026
			(0.029)			(0.034)
School decentralization by WB (lag 10)			0.0053			-0.0097
			(0.028)			(0.023)
Global goals (ref. UN goals until MDGs in 2000)						
MDGs in 2020 until 2015	0.42	0.60	0.69	-0.63	-0.45	-0.35
	(0.36)	(0.38)	(0.37)	(0.34)	(0.42)	(0.56)
SDGs in 2015	0.39	0.54	0.68	-0.72*	-0.55	-0.44
	(0.37)	(0.40)	(0.39)	(0.35)	(0.45)	(0.61)
GDP per capita (log)	-0.083	-0.16	-0.22	0.52*	0.45	0.43
	(0.15)	(0.15)	(0.15)	(0.22)	(0.26)	(0.33)
Share of ethnic groups	0.33	0.17	-0.026	0.56***	0.53***	0.44**
	(0.22)	(0.20)	(0.31)	(0.15)	(0.14)	(0.15)
Population size (in number)	1.2e-10	4.0e-10	1.1e-09	-1.6e-09	-2.0e-09	-2.4e-09
	(8.3e-10)	(1.1e-09)	(1.5e-09)	(1.0e-09)	(1.5e-09)	(2.1e-09)
Clientelism	-0.54	-0.70	-0.74	0.53	0.48	0.43

	(0.52)	(0.52)	(0.50)	(0.28)	(0.27)	(0.32)
Public sector corruption	-0.0065	0.013	0.014	0.11	0.13	0.15
	(0.072)	(0.071)	(0.071)	(0.057)	(0.067)	(0.082)
Decentralization of local government index	0.14	0.23	0.28	0.15	0.19	0.24
	(0.15)	(0.15)	(0.17)	(0.18)	(0.19)	(0.18)
Log of project cost	-0.032	-0.025	-0.028	-0.030	-0.022	-0.016
	(0.021)	(0.020)	(0.022)	(0.024)	(0.029)	(0.032)
Constant	2.29	4.00	5.54	-12.0*	-10.5	-10.1
	(3.64)	(3.56)	(3.56)	(5.22)	(6.28)	(7.68)
Observations	535	503	470	535	503	470
Countries	29	29	29	29	29	29

Notes: (a) Standard errors in parentheses are robust to heteroskedasticity and clustering at the country level.

* p<0.05 ** p<0.01 *** p<0.001.

Table S12. The association between WB reforms and de jure decentralization of educational systems, 1990-2019.

	De jure decentralization at…	
	Subnational	School
	Two-way fixed effects models	
	(1)	(2)
Subnational decentralization by WB	0.013	0.066
	(0.046)	(0.067)
Subnational decentralization by WB (squared)	-0.0069	-0.024
	(0.021)	(0.020)
School decentralization by WB	0.052	-0.0025
	(0.038)	(0.044)
School decentralization by WB (squared)	-0.0040	-0.0031
	(0.010)	(0.011)
Global goals (ref. UN goals until MDGs in 2000)		
MDGs in 2020 until 2015	0.38	-0.19
	(0.26)	(0.30)
SDGs in 2015	0.38	-0.21
	(0.27)	(0.35)
GDP per capita (log)	-0.024	0.31
	(0.11)	(0.19)
Share of ethnic groups	0.23	0.55**
	(0.19)	(0.16)
Population size (in number)	-2.3e-10	-1.1e-09*
	(5.4e-10)	(4.9e-10)
Clientelism	-0.50	0.20
	(0.43)	(0.26)
Public sector corruption	-0.0058	0.13*
	(0.059)	(0.050)
Decentralization of local government index	-0.046	0.071
	(0.15)	(0.17)
Log of project cost	-0.059*	-0.053*
	(0.025)	(0.021)
Constant	1.59	-6.60
	(2.63)	(4.50)
Observations	677	677
Country	30	30

Notes: (a) Standard errors in parentheses are robust to heteroskedasticity and clustering at the country level.

* $p<0.05$ ** $p<0.01$ *** $p<0.001$.

Table S13. The association between WB reforms and de jure decentralization of educational systems, 1990-2019.

	Dependent variable: De jure decentralization	
	Two-way fixed effects models	
	Only countries experienced a change in de jure decentralization	
	Subnational level	School level
	(1)	(2)
Subnational decentralization by WB	0.0043	0.046
	(0.037)	(0.047)
School decentralization by WB	0.043	0.0083
	(0.030)	(0.040)
Global goals (ref. UN goals until MDGs in 2000)		
MDGs in 2020 until 2015	0.35	-0.22
	(0.22)	(0.37)
SDGs in 2015	0.33	-0.27
	(0.23)	(0.42)
GDP per capita (log)	0.032	0.33
	(0.11)	(0.22)
Share of ethnic groups	0.27	0.45*
	(0.21)	(0.21)
Population size (in number)	-3.6e-10	-1.1e-09
	(5.9e-10)	(5.5e-10)
Clientelism	-0.82	0.19
	(0.47)	(0.34)
Public sector corruption	-0.054	0.13
	(0.064)	(0.067)
Decentralization of local government index	-0.063	0.19
	(0.15)	(0.17)
Log of project cost	-0.064*	-0.069*
	(0.026)	(0.025)
Constant	0.56	-6.53
	(2.59)	(5.22)
Observations	625	514
Country	28	23

Notes: Standard errors in parentheses are robust to heteroskedasticity and clustering at the country level. * $p<0.05$ ** $p<0.01$ *** $p<0.001$.

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CODEBOOK

A. Codebook for the de jure decentralization of educational systems.

The term *de jure* means decisions made according to policy/law, unlike *de facto* decisions. Hence, de jure decentralization of educational systems refers to the level at which educational responsibilities/policies are decided involving the central government, subnational administration and schools. Since the data were collected from countries' education policy/law documents as described in the methods section, I term this de jure decentralization.

How were nine binary indicators constructed?

To construct the nine areas of education responsibilities, I use the following coding scheme. I assigned a code of 1 to indicate the nine responsibilities listed in Table 1 are decentralized at the subnational level. These conditions encompass situations where responsibilities are (1) solely carried out by subnational entities (e.g., districts, regions, or intermediary bodies between schools and central governments), or (b) shared between subnational entities and the central government, or (c) shared among schools, subnational entities, and/or the central government. These specific conditions are points 2, 3, and 4 in Table 2 below. Conversely, points 1, 5, and 6 in Table 2 are coded as 0, signifying the absence of decentralization at the subnational level.

Likewise, to establish the nine dummies representing school-level decentralization, I assigned a code of 1 when responsibilities are decided either (a) exclusively by school actors, such as the school management committee (SMC), principals, or teachers, or (b) shared between schools and the central government, or (c) shared among school actors, local governments, and/or the central government. These particular conditions are delineated in points 4, 5, and 6 of Table 2. On the other hand, the remaining three conditions are coded as 0 to denote the absence of school-level decentralization.

Table 1. Nine areas of responsibilities

1. Who decides curricula…
2. Who decides textbook selection…
3. Main source of funding public education…
4. Who decides budget allocation…
5. Who decides teacher recruitment (hiring)…
6. Who determines the content of initial teacher training…
7. Who decides teacher recruitment (hiring)…
8. What is the main responsible body for school inspection/supervision…
9. Who is responsible for the exit exam…

Table 2. Who decides the above nine responsibilities at the primary/lower-secondary/upper-secondary level?

1 - Central government.

2 - Combination of subnational and the central government

3 – Subnational or regional government (i.e., region/directorate/district/sub-district).

4 - Combination of schools and subnational governments or Combination of national, local governments and schools

5 - Combination of schools and the central government

6 - School actors (i.e., school management committee).

Variables

Subnational-level de jure decentralization: binary indicators

1. curriculum_lcl: A binary variable suggesting whether the curriculum is decided partly or fully by subnational entities (coded 1) or not (coded 0).
2. textbook_lcl: A binary variable suggesting whether textbooks are decided partly or fully by subnational entities (coded 1) or not (coded 0).
3. exit_exam_responsibility_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) subnational entities are partly or fully responsible for conducting exit exams.
4. supervision_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) school supervision/inspection is partly or fully managed by subnational entities.
5. funding_source_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) subnational entities are partly or fully the funding source.
6. budget_allocation_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) budget allocation is partly or fully the responsibility of subnational entities.
7. teacher_recruitment_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) teacher recruitment is partly or fully the responsibility of subnational entities.
8. teacher_training_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) teachers' initial training is partly the responsibility of subnational entities.
9. teacher_inservice_training_lcl: A binary variable suggesting whether (coded 1) or not (coded 0) teachers' in-service training is partly the responsibility of subnational entities.

Subnational-level de jure decentralization: three disaggregated indices

10. mean_local_academic: The number of 'academic responsibilities' among the four variables listed here (curriculum_lcl textbook_lcl exit_exam_responsibility_lcl supervision_lcl) performed by schools.
11. mean_local_budget: The number of 'budget-related responsibilities' from the 2 variables listed here (funding_source_lcl budget_allocation_lcl) performed by schools.
12. mean_local_personnel: The number of 'personnel management responsibilities' among the three variables listed here (teacher_recruitment_lcl teacher_training_lcl teacher_inservice_training_lcl) performed by schools.

Subnational-level de jure decentralization: the overall indices by row sum and IRT score

13. mean_local: The number of nine responsibilities partly or fully performed by subnational entities.
14. lcl_mean_std: The standardized measure of the mean_local variable derived using the row mean of the nine responsibilities with a mean of 0 and a standard deviation of 1.

15. lcl_score_1pl: IRT score derived using the predicted latent trait score of decentralization from the 1PL IRT model.
16. lcl_score_1pl_se: Standard error of the lcl_score_1pl variable.
17. lcl_score_std: The standardized measure of the lcl_score_1pl variable derived using IRT with a mean of 0 and a standard deviation of 1.

School-level de jure decentralization: binary indicators

18. curriculum_sch: A binary variable suggesting whether the curriculum is decided partly or fully by schools (coded 1) or not (coded 0).
19. textbook_sch: A binary variable suggesting whether textbooks are decided partly or fully by schools (coded 1) or not (coded 0).
20. exit_exam_responsibility_sch: A binary variable suggesting whether (coded 1) or not (coded 0) schools are partly or fully responsible for conducting exit exams.
21. supervision_sch: A binary variable suggesting whether (coded 1) or not (coded 0) school supervision/inspection is partly or fully managed by schools, for instance, a peer school or the school committee.
22. funding_source_sch: A binary variable suggesting whether (coded 1) or not (coded 0) schools are partly or fully the funding source.
23. budget_allocation_sch: A binary variable suggesting whether (coded 1) or not (coded 0) budget allocation is partly or fully the responsibility of schools.
24. teacher_recruitment_sch: A binary variable suggesting whether (coded 1) or not (coded 0) teacher recruitment is partly or fully the responsibility of schools.
25. teacher_training_sch: A binary variable suggesting whether (coded 1) or not (coded 0) teachers' initial training is partly the responsibility of schools.
26. teacher_inservice_training_sch: A binary variable suggesting whether (coded 1) or not (coded 0) teachers' in-service training is partly the responsibility of schools.

School-level de jure decentralization: three disaggregated indices

27. mean_school_academic: The number of 'academic responsibilities' among the four variables listed here (curriculum_sch textbook_sch exit_exam_responsibility_sch supervision_sch) performed by schools.
28. mean_school_budget: The number of 'budget-related responsibilities' from the 2 variables listed here (funding_source_sch budget_allocation_sch) performed by schools.
29. mean_school_personnel: The number of 'personnel management responsibilities' among the three variables listed here (teacher_recruitment_sch teacher_training_sch teacher_inservice_training_sch) performed by schools.

School-level de jure decentralization: the overall indices by row sum and IRT score

30. mean_school: The number of nine responsibilities partly or fully performed by schools.

31. sch_mean_std: The standardized measure of the mean_school variable derived using the row mean of the nine responsibilities with a mean of 0 and a standard deviation of 1.
32. sch_score_1pl: IRT score derived using the predicted latent trait score of decentralization from the 1PL IRT model.
33. sch_score_1pl_se: Standard error of the sch_score_1pl variable.
34. sch_score_std: The standardized measure of the sch_score_1pl variable derived using IRT with a mean of 0 and a standard deviation of 1.

B. Codebook for World Bank (WB) reforms

Originally this dataset includes 99 low- and middle-income countries (LMICs) using 897 WB projects in primary and secondary education, after sorting all other projects as described in the paper. However, for this study, I include 30 countries involving a total of corresponding 300 WB projects. I have provided many (45) examples of how I coded the decentralization reforms at the subnational and school levels in Table S3 in the online supplement. Below is the codebook for the dataset.

I coded the variables as a proportion. As described in the variable section with an example of a project in Box S1 in the online supplement, each WB project has one or more components. Hence, the raw measures indicate the proportion of components that have focused on decentralizing the educational system at both or either of the levels (subnational or school).

I considered a project being focused on decentralization at the subnational level when it aims to:

1. Create subnational entities such as district education offices.
2. Devolve educational responsibilities (such as teachers' recruitment, training, budget, curriculum decisions, and developing plans for schools) to subnational entities.
3. Encourage citizens' participation in subnational-level decision-making processes.
4. Build capacity to make this decentralization more sustainable through various initiatives, but most commonly training officials, providing financial and technical resources and providing informational capital through establishing an education information management system (EMIS).
   a. I include EMIS also because the WB promotes it to build e-governance capacity and decision-making ability at the subnational level rather than relying on the central government. This is also to efficiently connect regional offices to the central government.

I considered a project being focused on decentralization at the school level when it aims to:

1. Promote school-based management, school autonomy, and community involvement in school decisions including parents and local stakeholders.[4]
2. Create school-management committees and parent-teacher associations. This also includes providing resources for establishing these platforms.
3. Build capacity by training principals and teachers so that they can run schools more autonomously.
4. Promote school supervision/inspection by school committees and peer schools in nearby areas.
5. Provide training to teachers by school leaders.

Variables

Subnational-level reforms

1. subnational_wb: This indicates the proportion of WB project components focusing on decentralizing the educational systems to the subnational level.

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[4] This also includes mobilizing local resources such as collecting donations and fees, helping schools with infrastructural development, and providing other support as appropriate in the local areas since the motivation for these activities is to get customized community support according to resources available.

2. subnational_wb_std: The standardized measure of the subnational_wb variable with a mean of 0 and a standard deviation of 1.

School-level reforms

1. school_wb: This indicates the proportion of WB project components focusing on decentralizing the educational systems to the school level.
2. school_wb_std: The standardized measure of the school_wb variable with a mean of 0 and a standard deviation of 1.