Spending Smarter: How Efficient and Well-Allocated Public Spending Can Boost Economic Growth

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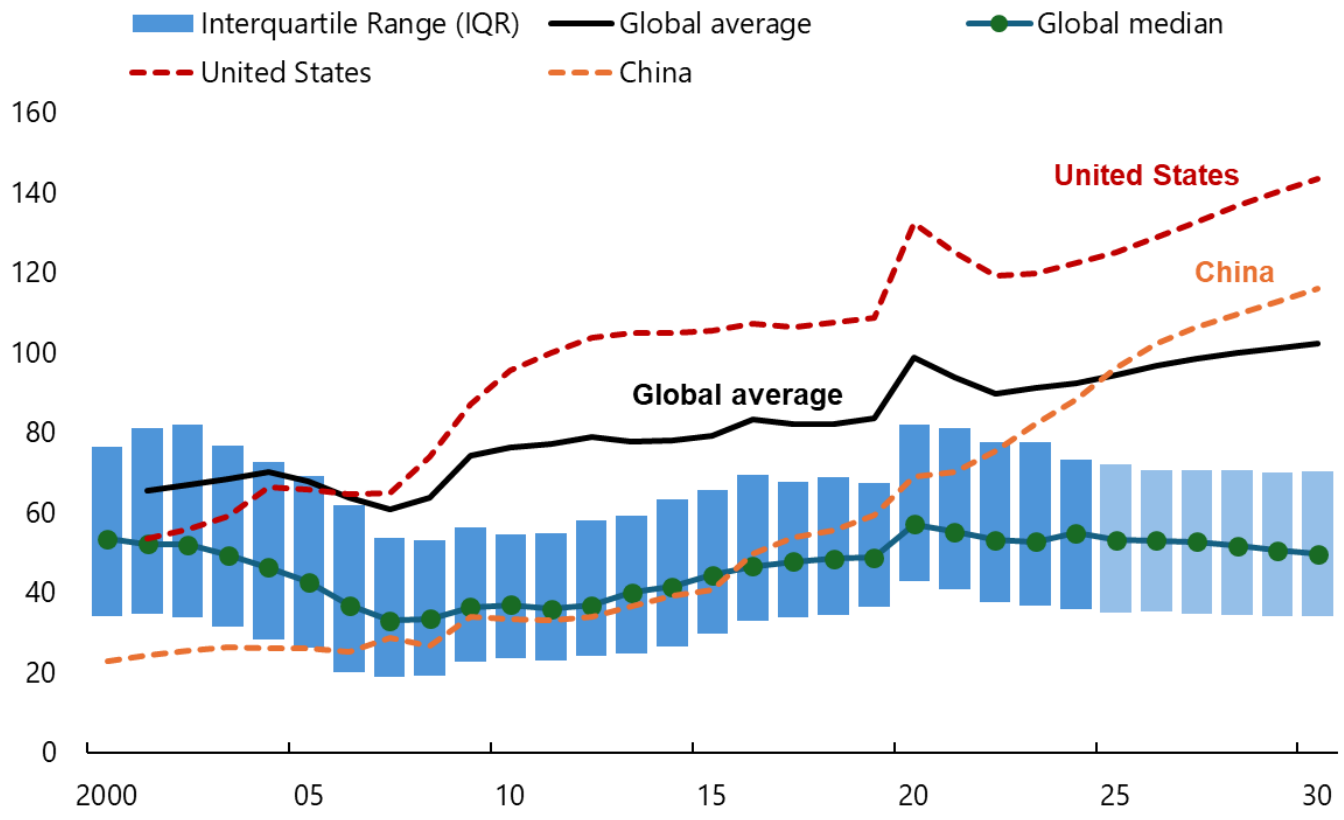
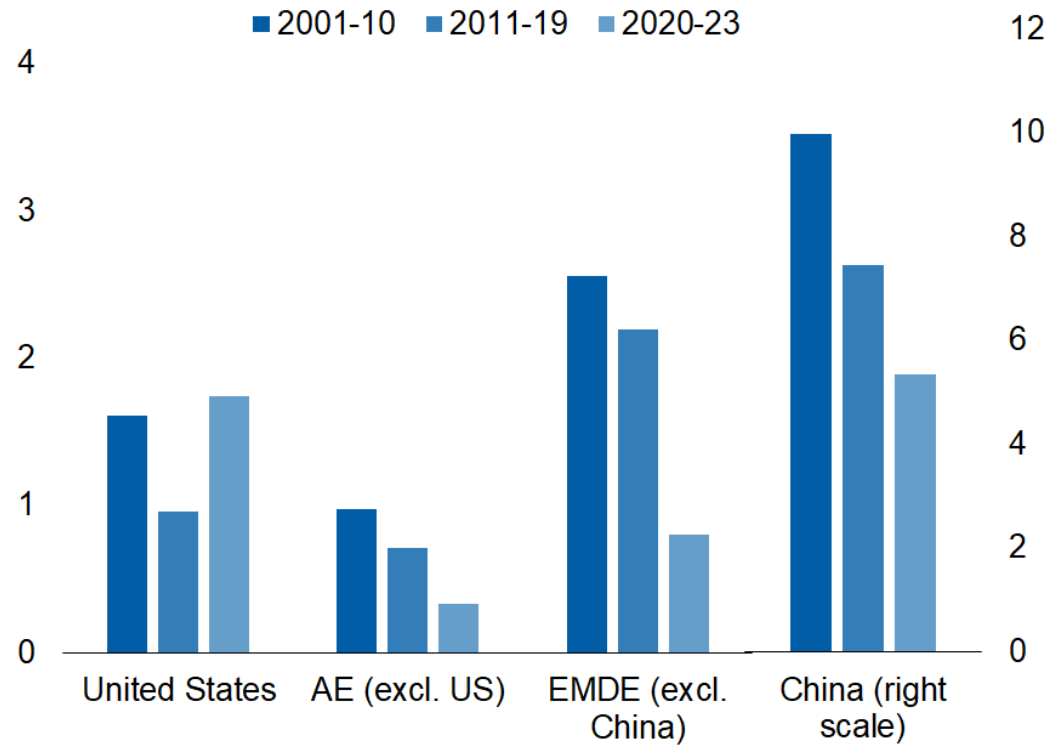
Motivation: Rising debt and weak growth prospects

Global Public Debt
(Percent of GDP)



Labor Productivity Growth
(Percent per year)



Sources: IMF, World Economic Outlook Database; and IMF staff estimates.
Note: In the left chart, debt numbers for China cover a narrower perimeter of the general government than IMF staff estimates in China Article IV reports (see IMF 2024 Article IV Staff Report for a reconciliation of the two estimates). In the right chart, labor productivity is calculated on a per worker basis. Annual averages in the indicated periods are shown. Country group averages are weighted with nominal GDP measured in constant PPP international dollars. AE is advanced economies and EMDE is emerging markets and developing economies.

Key questions

1. How have the composition and efficiency of public spending evolved over time and across country groups?

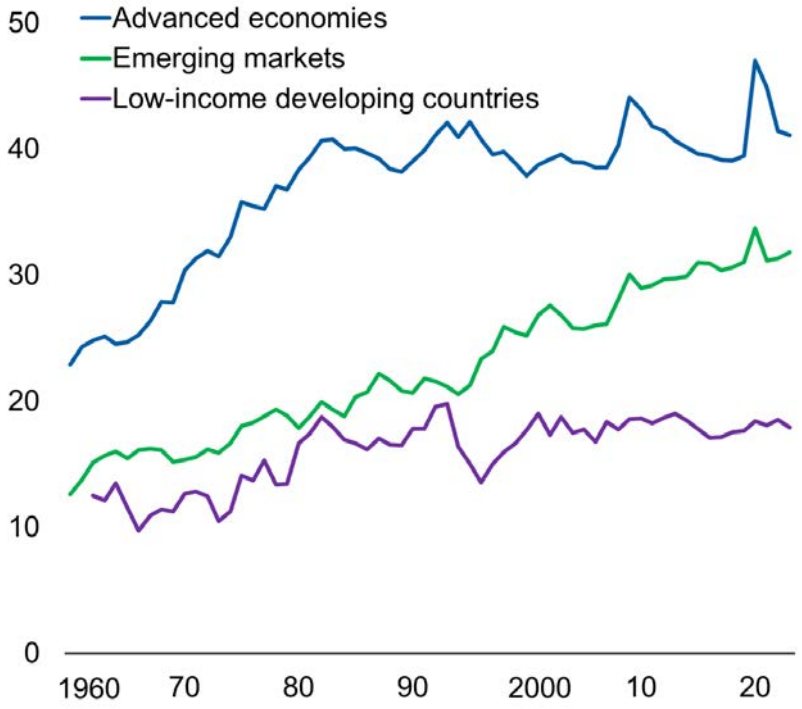
2. What factors drive the composition and efficiency of public spending?

3. How much could countries boost output by spending smarter?

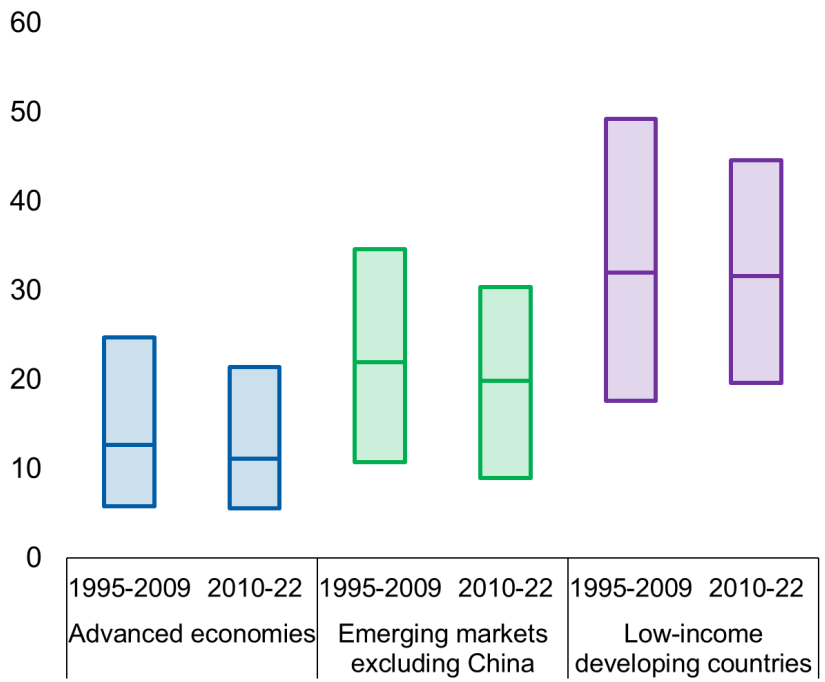
Public spending developments

Size of government has doubled, but spending not necessarily pro-growth

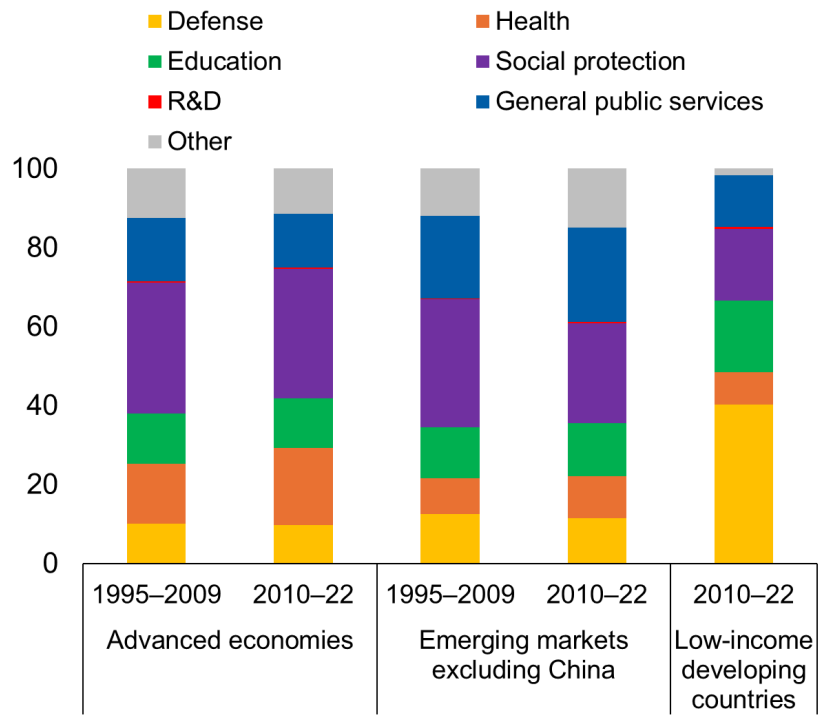
Government Expenditure
(Percent of GDP)



Public Investment
(Percent of total expenditure)



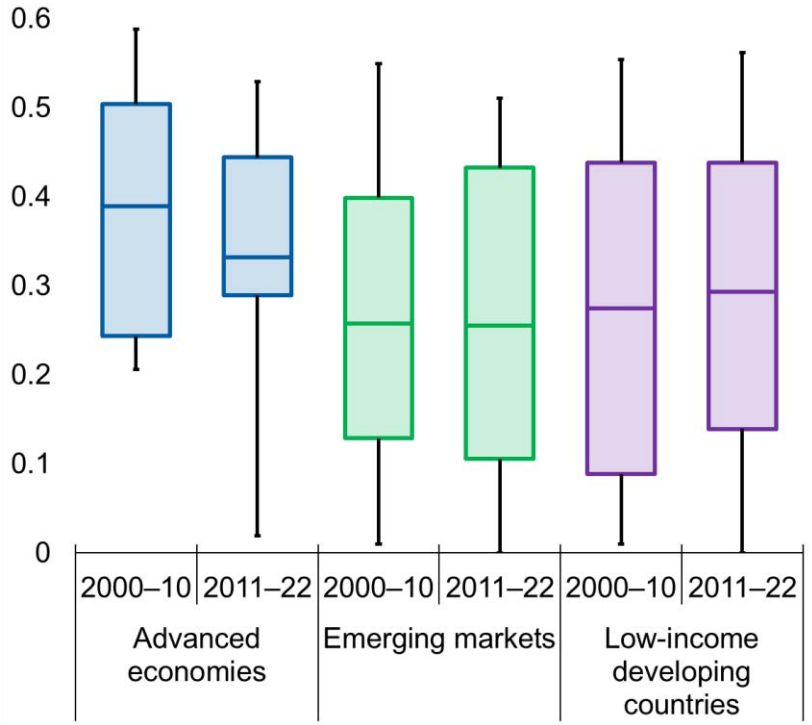
Composition of Public Spending
(Percent of total expenditure)



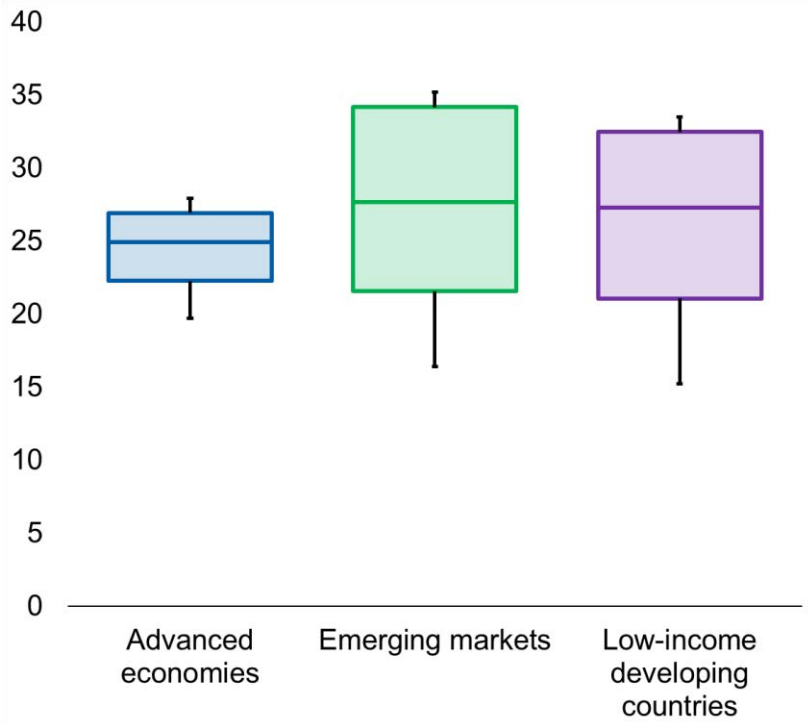
Sources: IMF, FAD Government Compensation and Employment Dataset; IMF, Government Finance Statistics; IMF, Public Finances in Modern History Database; IMF, World Economic Outlook Database; and IMF staff calculations.
Note: Spending refers to general government spending. Left panel presents PPP GDP-weighted averages within each income group. In the middle panel, the boxes show the simple average within each income group and 10th–90th percentile ranges. The right panel shows US dollar GDP-weighted averages. Defense includes spending on public order and safety; R&D is research and development.

Adjusting spending is often challenging due to high spending rigidity

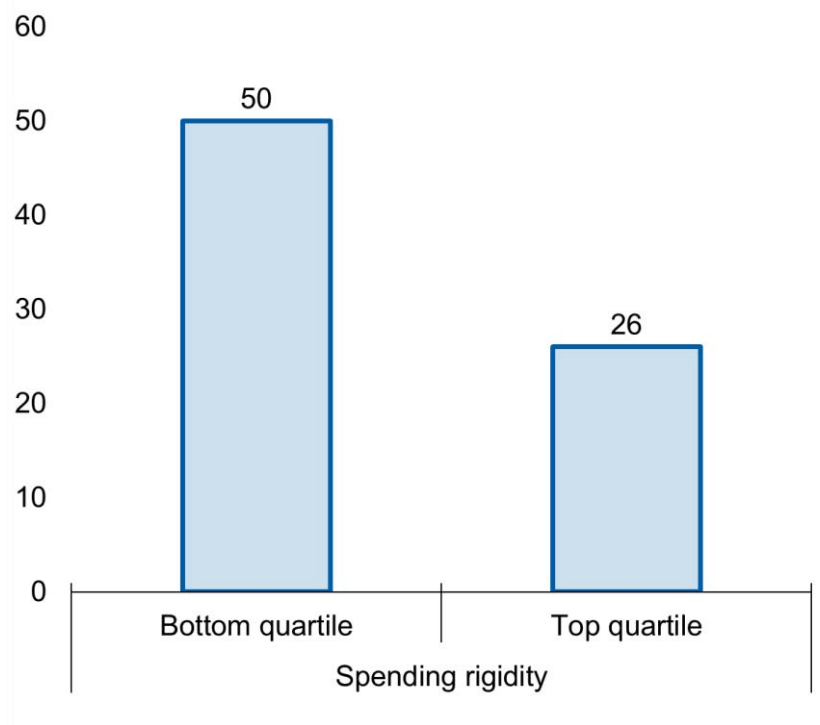
Public Spending Rigidity
(Between 0 and 1)



Public Wage Bill
(Percent of total expenditure)



Probability of a Pro-Growth Public Spending Episode
(Percent)

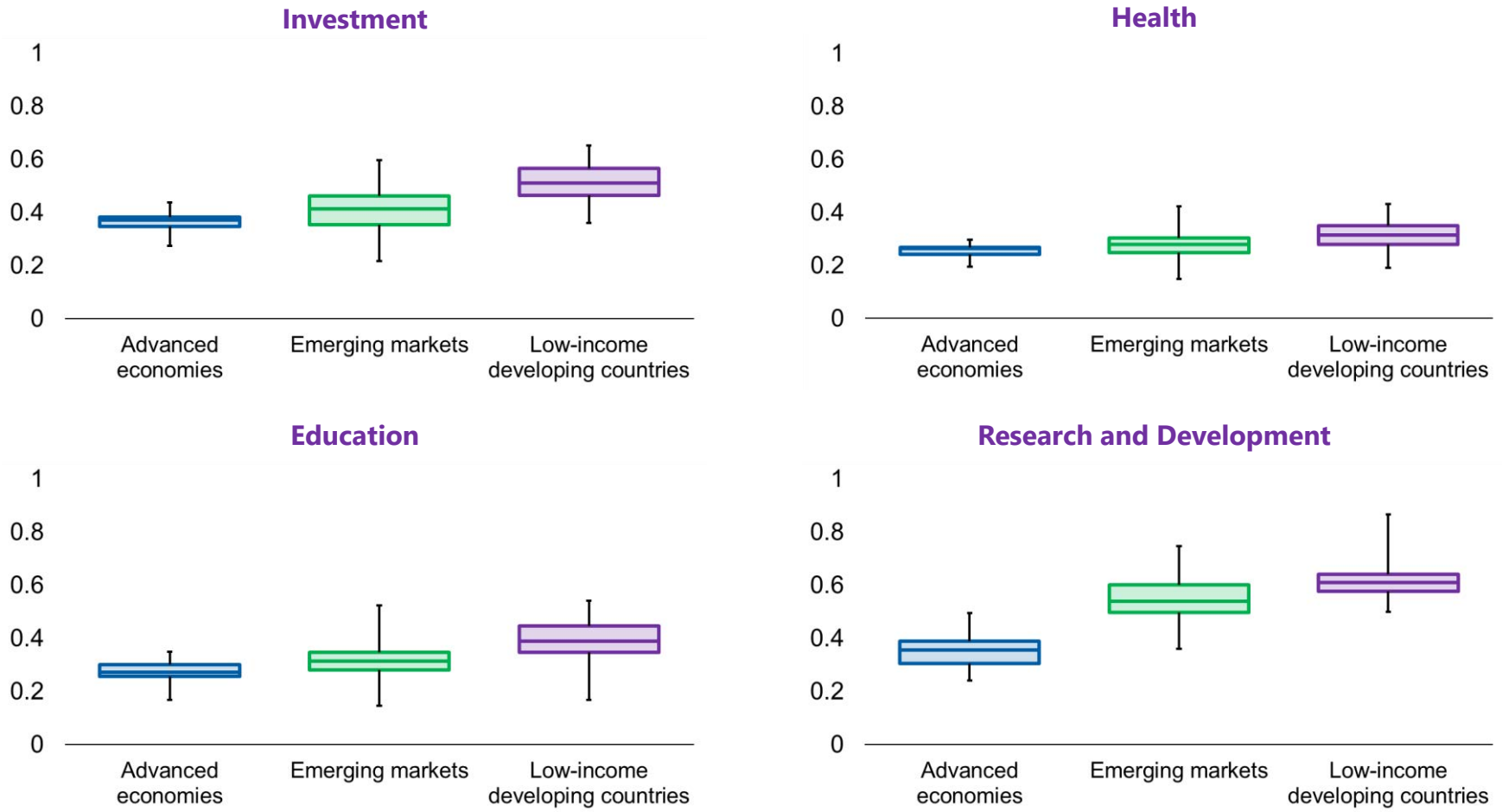


Sources: IMF, Government Finance Statistics; IMF, Public Finances in Modern History Database; IMF, World Economic Outlook Database; and IMF staff calculations.
Note: The left panel shows estimates of spending rigidity, calculated as the 1-year autocorrelation of each spending category as a share of total expenditure, in rolling windows of 5 years. The middle panel shows estimates of public wage bill. Boxes in the left and middle panels show the simple average within each income group and interquartile ranges; the whiskers show 10th–90th percentile ranges. The right panel shows the share of countries that have experienced an episode of a major increase in public education spending as a share of total expenditure during 2000–22, defined as any four-year period during which education spending increases in at least three of the years, with the increase in at least one of the years being 1.5 standard deviations or greater. Average rigidity in the bottom quartile is 0.18 and in the top quartile 0.38.

Governments could get one third more value for money by closing "efficiency gaps"

Public Spending Efficiency Gaps

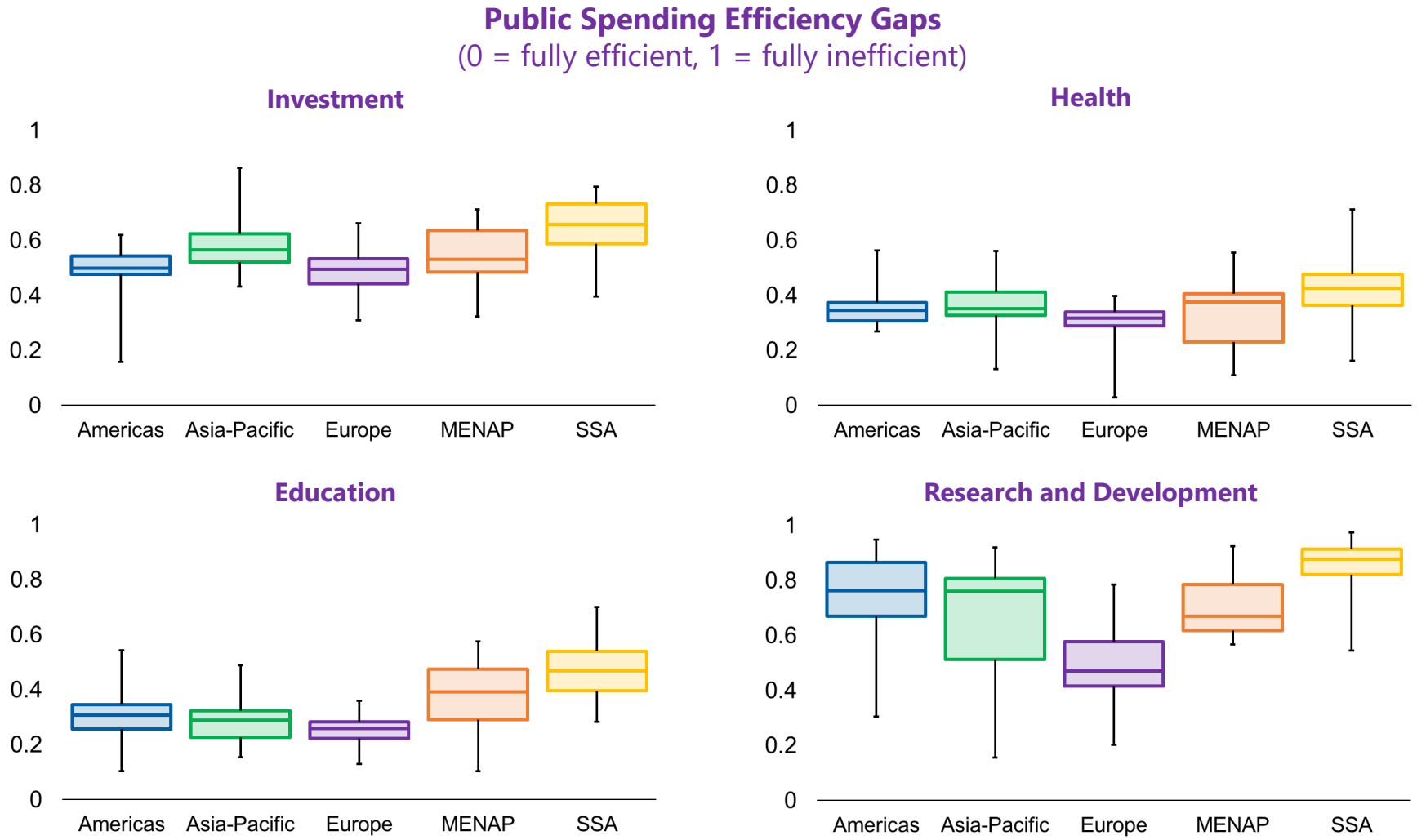
(0 = fully efficient, 1 = fully inefficient)



Source: IMF staff estimates.

Note: The figure shows efficiency gaps, which are distances to the spending efficiency frontier, for 174 countries since 1980. The frontier is estimated using multiple-output stochastic frontier analysis with country and year fixed effects. Inputs are 5-year averages of public spending in each category. For public investment, the outcomes include the quantity of roads, railways, air and seaport traffic, telephone lines, and electricity consumption, as well as access to electricity and drinking water, the proportion of roads that are paved, and perceptions of overall infrastructure quality. Health outcomes include life expectancy, immunization rates, hospital beds, doctors, and infant survival. Education outcomes include school enrolment and completion rates, literacy rates, adults' years of schooling, and perceptions of education quality. Research and development outcomes include scientific publications, patents, researchers, and citations. The analysis accounts for uncertainty in the choice of outcome variables by averaging across models. Boxes indicate medians and interquartile ranges (25th–75th percentiles) of the average efficiencies over time. Whiskers delineate the minimum and maximum values.

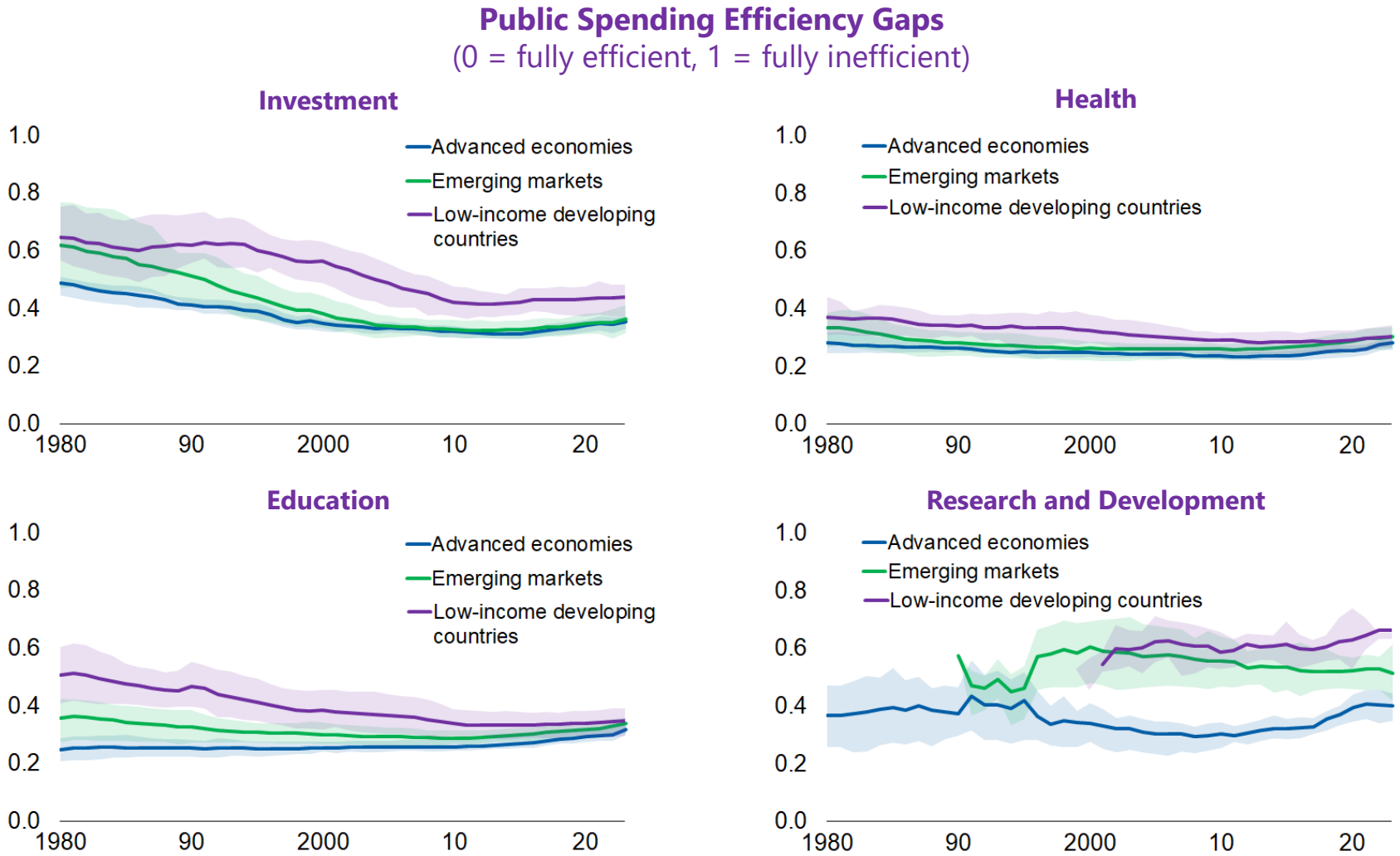
Regional variation in public spending efficiency gaps



Source: IMF staff estimates.

Note: The figure shows efficiency gaps, which are distances to the spending efficiency frontier, for 174 countries since 1980. The frontier is estimated using multiple-output stochastic frontier analysis with country and year fixed effects. Inputs are 5-year averages of public spending in each category. For public investment, the outcomes include the quantity of roads, railways, air and seaport traffic, telephone lines, and electricity consumption, as well as access to electricity and drinking water, the proportion of roads that are paved, and perceptions of overall infrastructure quality. Health outcomes include life expectancy, immunization rates, hospital beds, doctors, and infant survival. Education outcomes include school enrolment and completion rates, literacy rates, adults' years of schooling, and perceptions of education quality. Research and development outcomes include scientific publications, patents, researchers, and citations. The analysis accounts for uncertainty in the choice of outcome variables by averaging across models. Boxes indicate medians and interquartile ranges (25th–75th percentiles) of the average efficiencies over time. Whiskers delineate the minimum and maximum values.

Efficiency gaps have narrowed over time, but progress has stalled



Source: IMF staff estimates.

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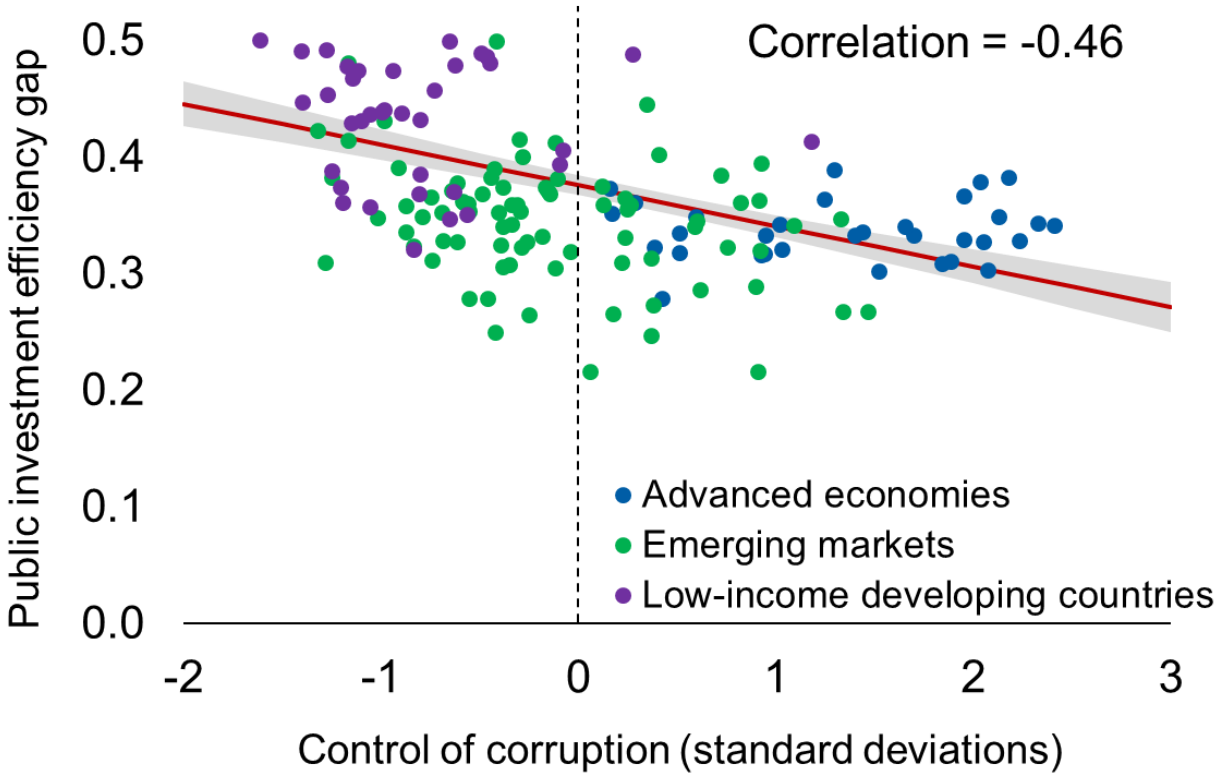
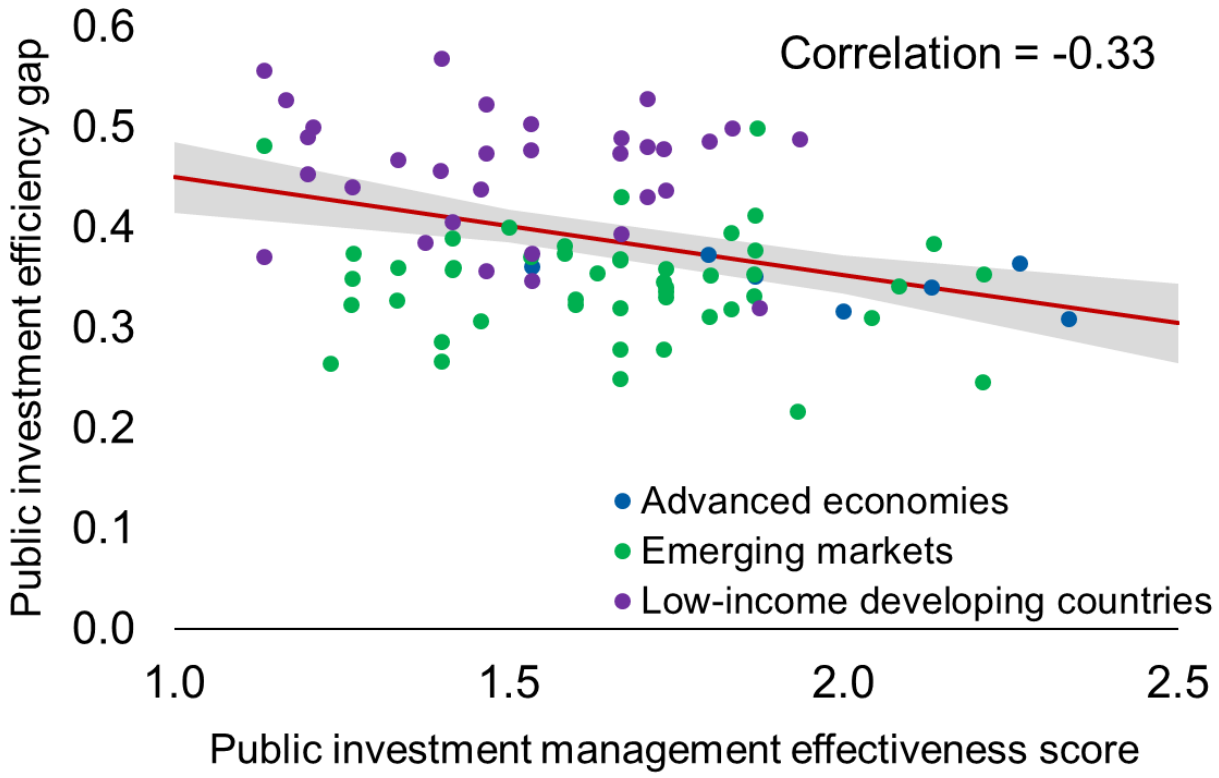
Determinants of public spending

Improving governance and administration key for spending efficiency

Drivers of Public Spending Efficiency

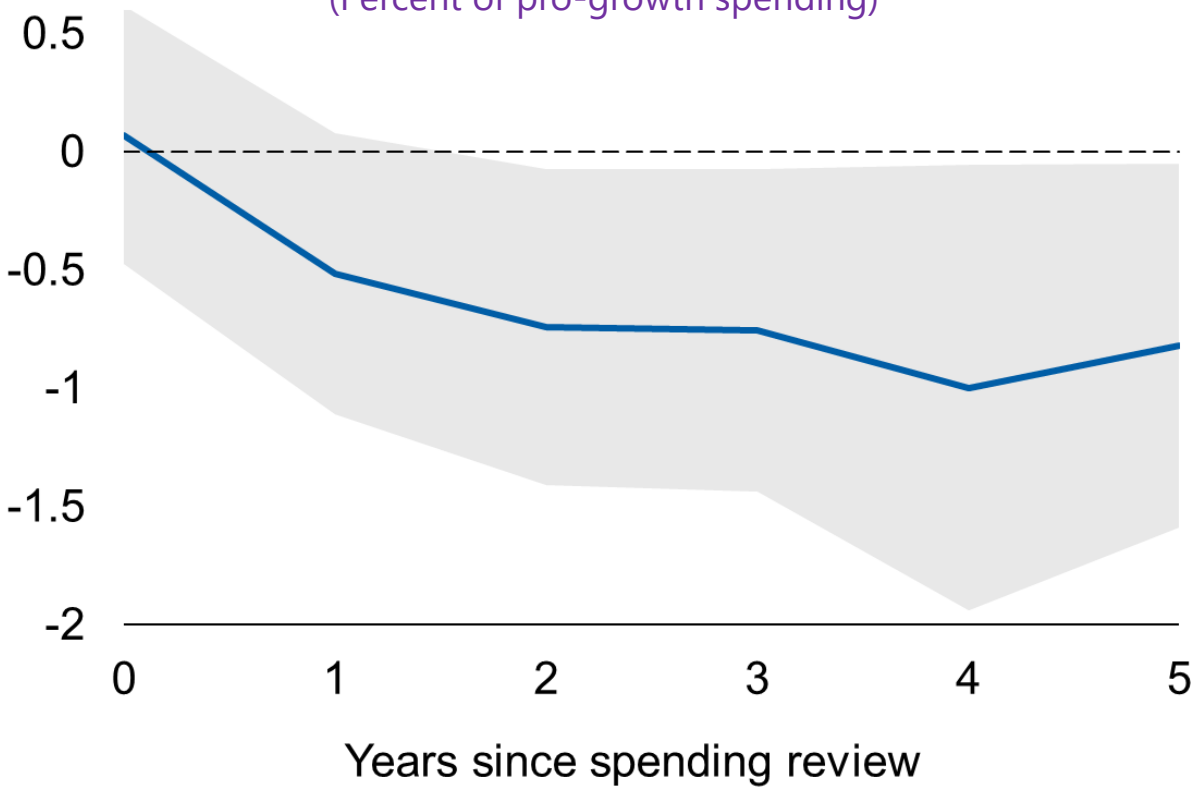




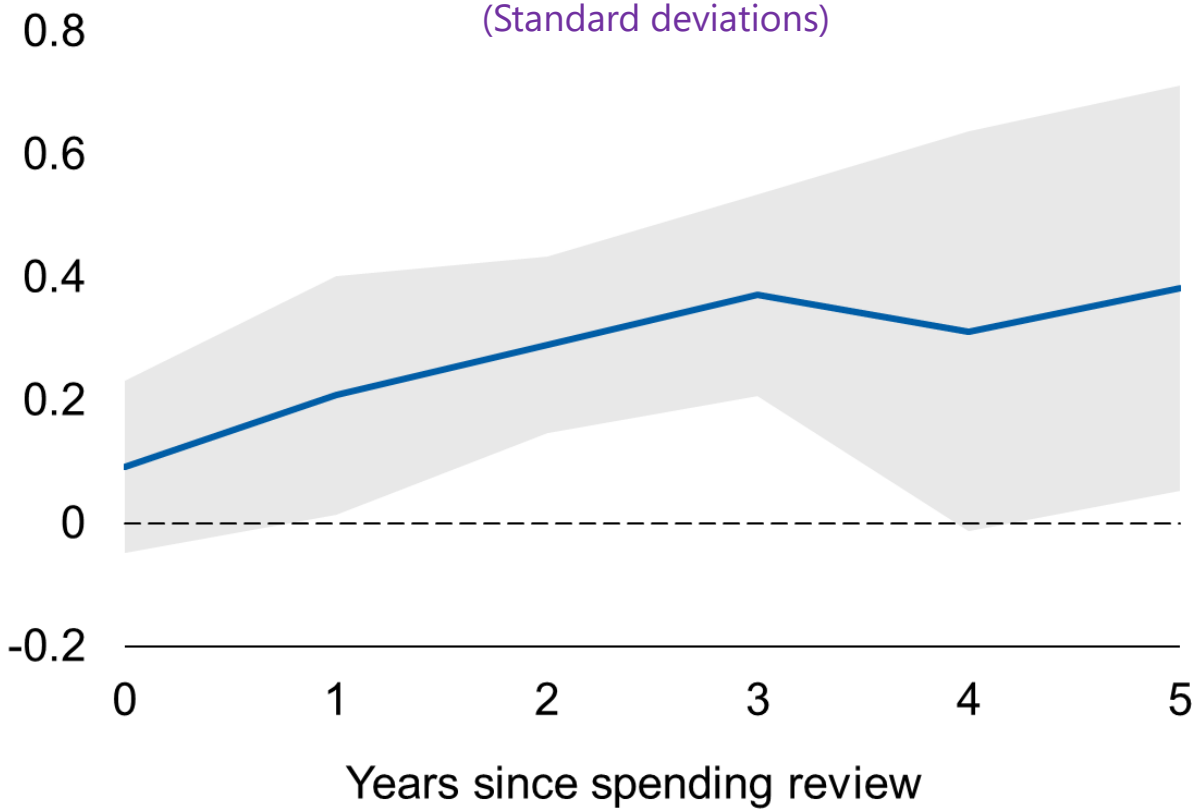
Sources: World Bank; Worldwide Governance Indicators; and IMF staff estimates.
Note: Efficiency gaps are measured from 0 (most efficient) to 1 (least efficient), as explained on previous slides. Control of corruption is a perception-based indicator, measured in standard deviations. In the right panel, Public Investment Management Assessment scores are measured on a scale of 1–3, with 3 being the highest and 1 the lowest. Allocation effectiveness evaluates the degree to which public investment allocation processes effectively operate.

Spending reviews can reduce public wage bills and increase efficiency

Public Wage Bill
(Percent of pro-growth spending)



Efficiency of Public Spending on Education
(Standard deviations)



Sources: IMF, Government Compensation and Employment Dataset; Organisation for Economic Co-operation and Development budgeting databases; and IMF staff estimates.
Note: The figure shows responses to spending reviews based on an event study regression analysis.

Potential output dividends

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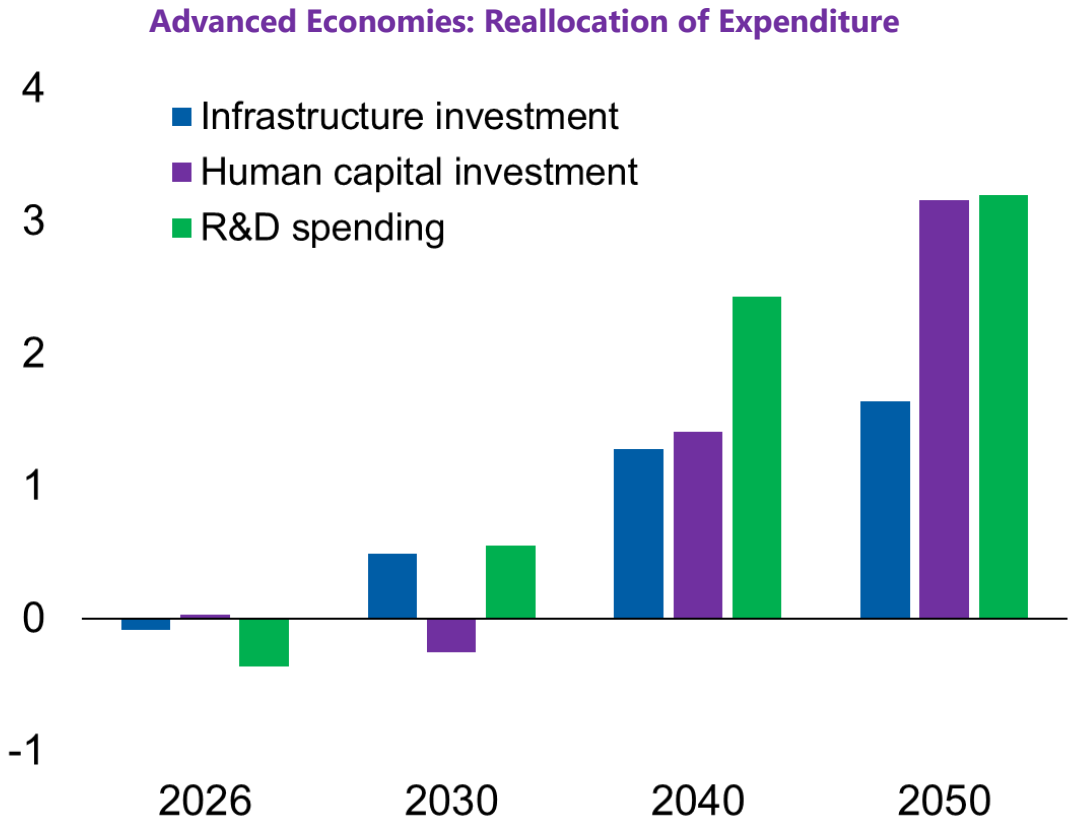
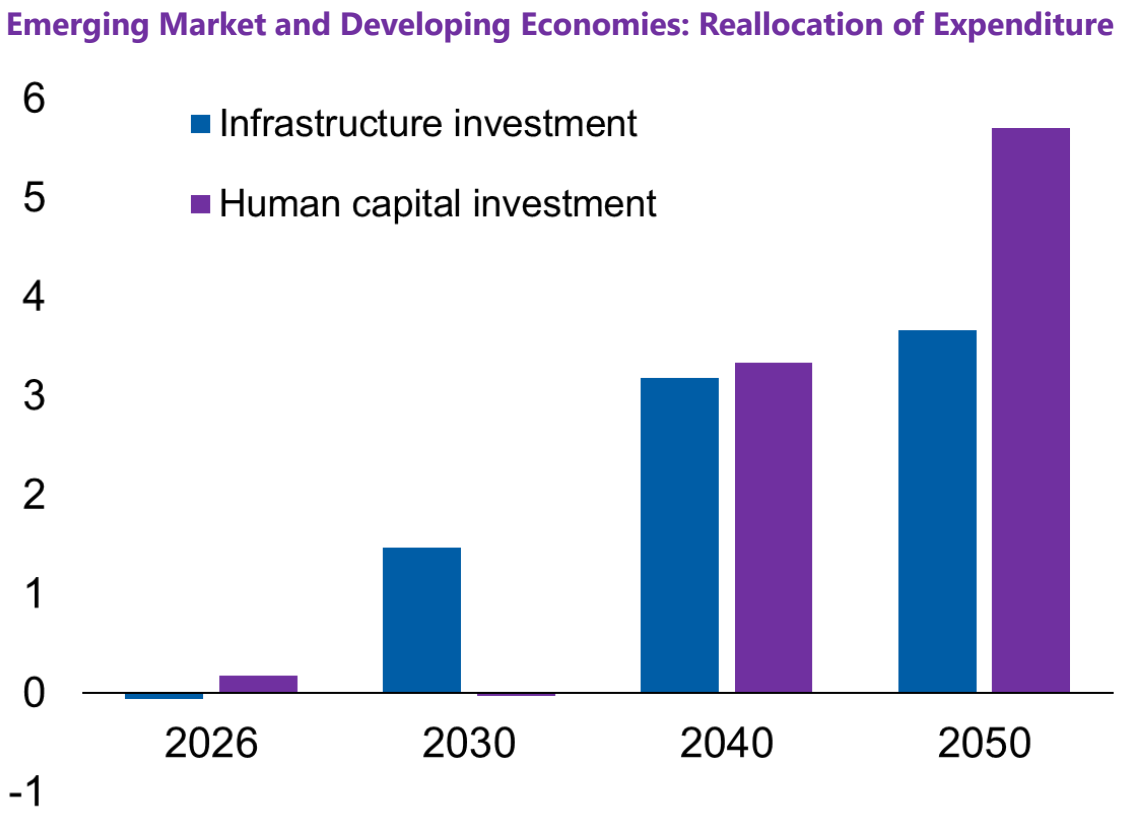
Redirecting spending to pro-growth areas yields significant long-term output gains

Long-Term Gains in Output
(Percent deviation from steady state)

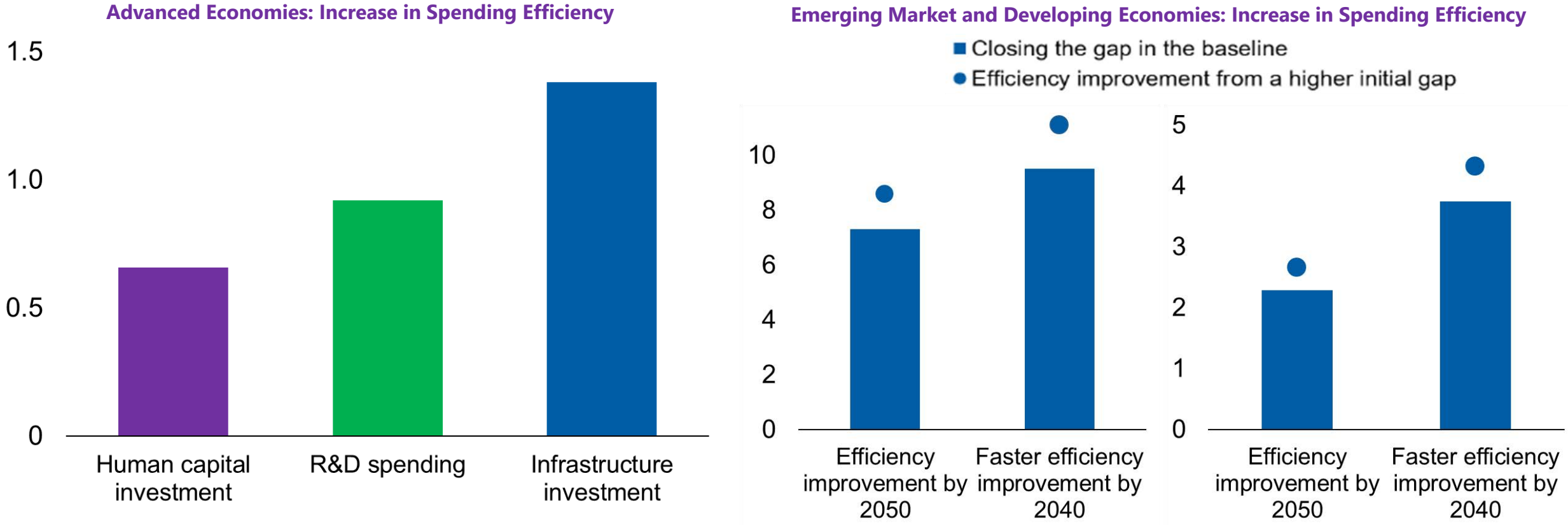




Source: IMF staff estimates.
Note: Panels depict output responses to a permanent increase, in the expenditure categories listed in the legends, of 1 percent of GDP in 2025, funded by a cut in public consumption. The output responses in both panels are simulated using a general equilibrium model of endogenous growth, which extends the work of Anzoategui and others (2019) to allow for spending efficiency. In the left panel, the model is calibrated to match the characteristics of a typical advanced economy, and in the right panel, of a typical emerging market and developing economy.

Improving spending efficiency significantly enhance these gains

Long-Term Gains in Output
(Percent deviation from steady state)

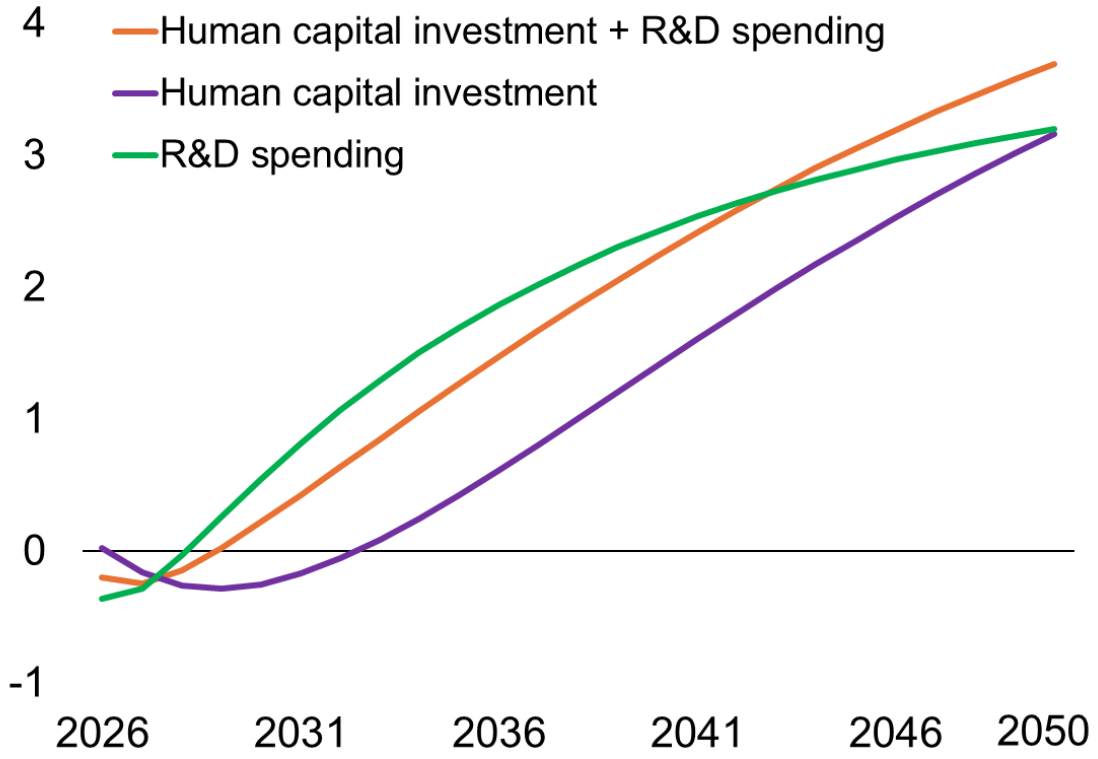


Source: IMF staff estimates.
Note: Left panel shows additional gains in output (on top of those from spending reallocation) by 2050 when gaps in spending efficiency are gradually closed by then. The right panel illustrates additional gains in output from gradually closing gaps in spending efficiency, by 2040 and 2050, as indicated on the horizontal axis, and from different initial efficiency levels, as described in the legend. The output gains in both panels are simulated using a general equilibrium model of endogenous growth, which extends the work of Anzoategui and others (2019) to allow for spending efficiency. In the left panel, the model is calibrated to match the characteristics of a typical advanced economy, and in the right panel, of a typical emerging market and developing economy.

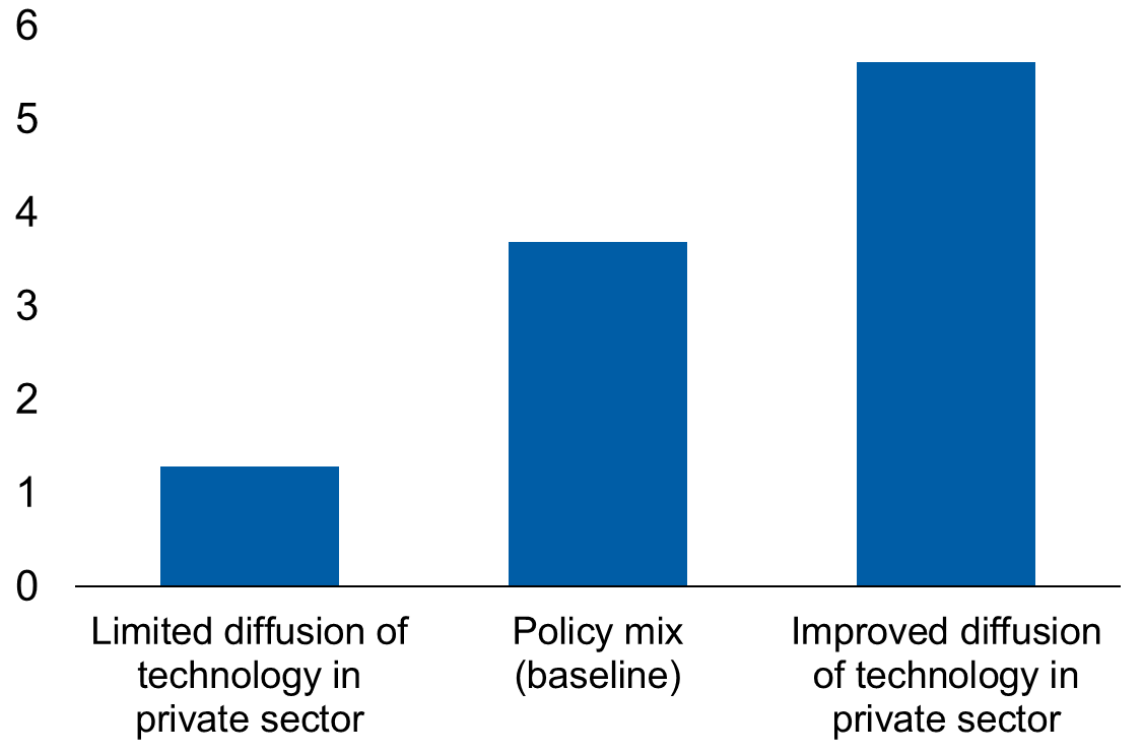
Advanced economies should exploit complementarities between human capital investment and R&D spending

Long-Term Gains in Output
(Percent deviation from steady state)

Advanced Economies: Combining Human Capital and R&D



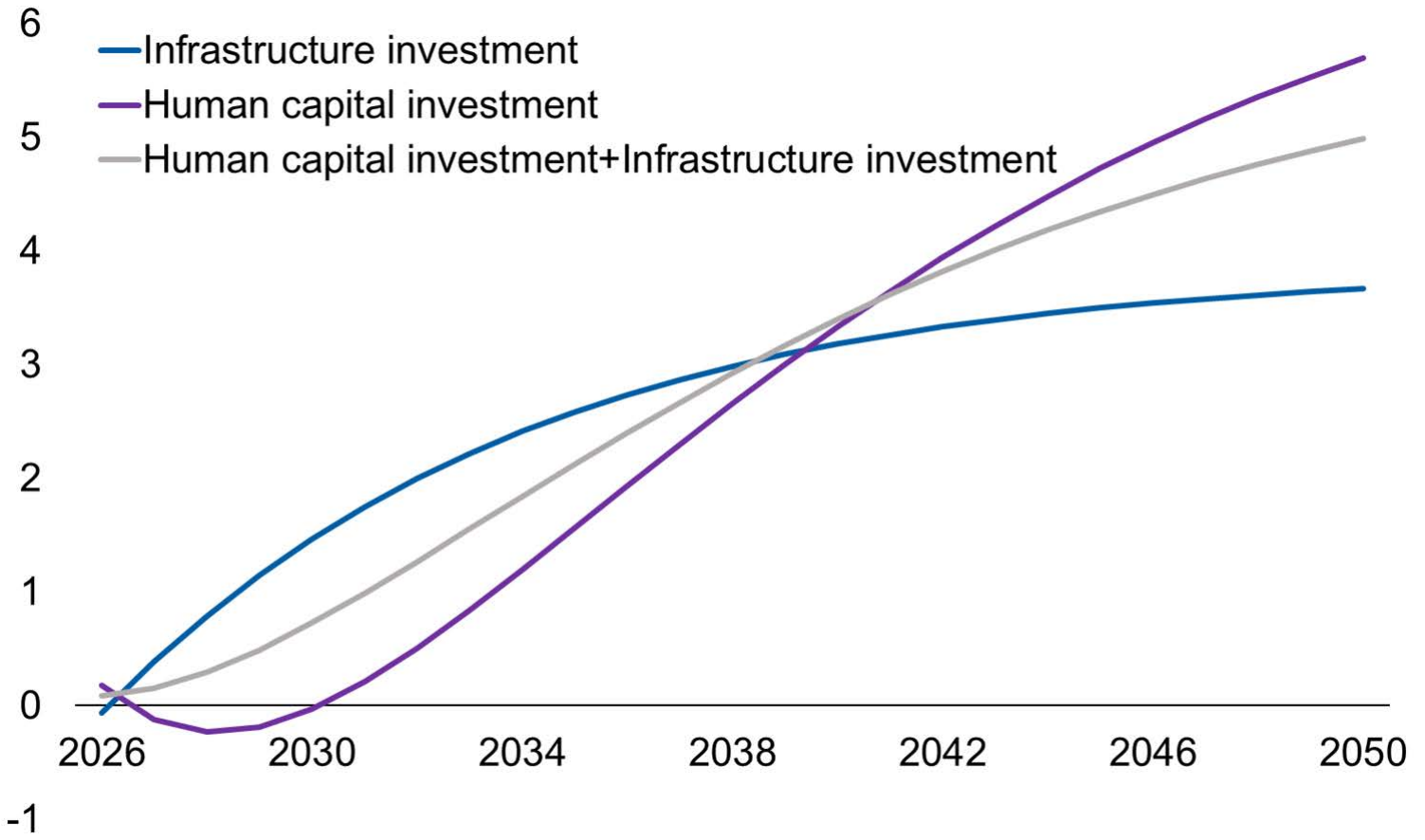
Advanced Economies: High versus Low Levels of Technology Diffusion, 2050



Source: IMF staff estimates.
Note: The left panel shows output gains from increasing public investment in human capital, public spending on research and development (R&D), and a 50/50 mix of both, financed by cutting public consumption. The right panel depicts output gains from the 50/50 mix in the left panel for different levels of diffusion of technology. The output gains in both panels are simulated using a general equilibrium model of endogenous growth, which extends the work of Anzoategui and others (2019) to allow for spending efficiency. The model is calibrated to match the characteristics of a typical advanced economy.

In EMDEs, investing in human capital and infrastructure can reinforce each other

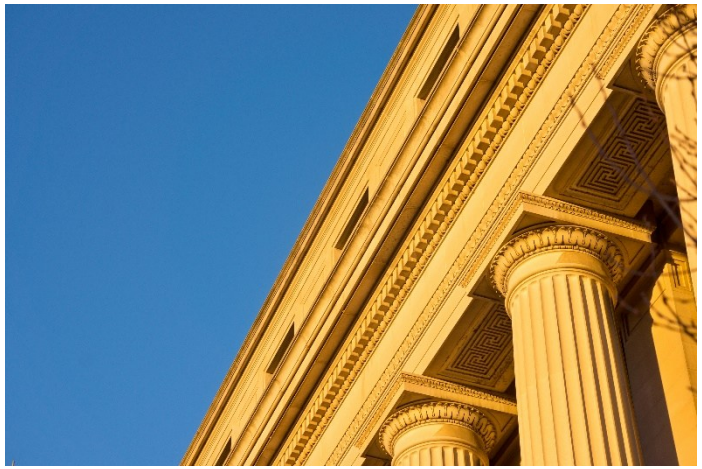
Output Gain from Combining Human Capital and Infrastructure Investment
(Percent deviation from steady state)



Source: IMF staff estimates.
Note: The figure shows the responses of output to a permanent increase of 1 percent of GDP in 2025 in public human capital investment, public infrastructure investment, and a 50/50 mix of both, financed by an equivalent cut to public consumption, in a typical emerging market and developing economy. The output responses are simulated using a general equilibrium model of endogenous growth, which extends the work of Anzoategui and others (2019) to allow for spending efficiency.

Policy discussion

Key policy messages



Strengthen Institutions

Upgrade Public Investment Management

Reform Pensions, Health, and Wage Bills

Review Spending

Digitalize Public Finances

Involve Private Sector

Thank you

Background slides follow

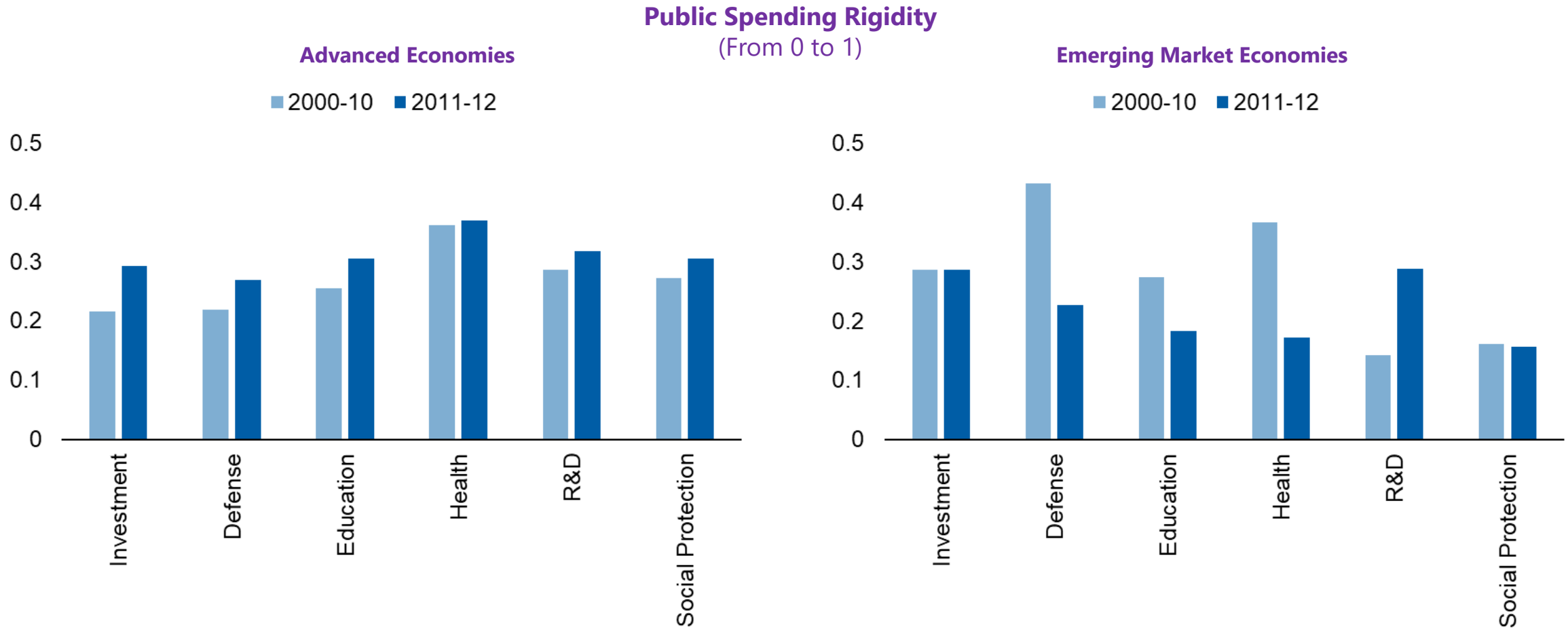
Estimating public spending efficiency

- Production function for each spending category (investment, health, education, and R&D)

$$y_{i,t} = f(x_{i,t}; \beta) \exp(v_{i,t} - u_{i,t})$$

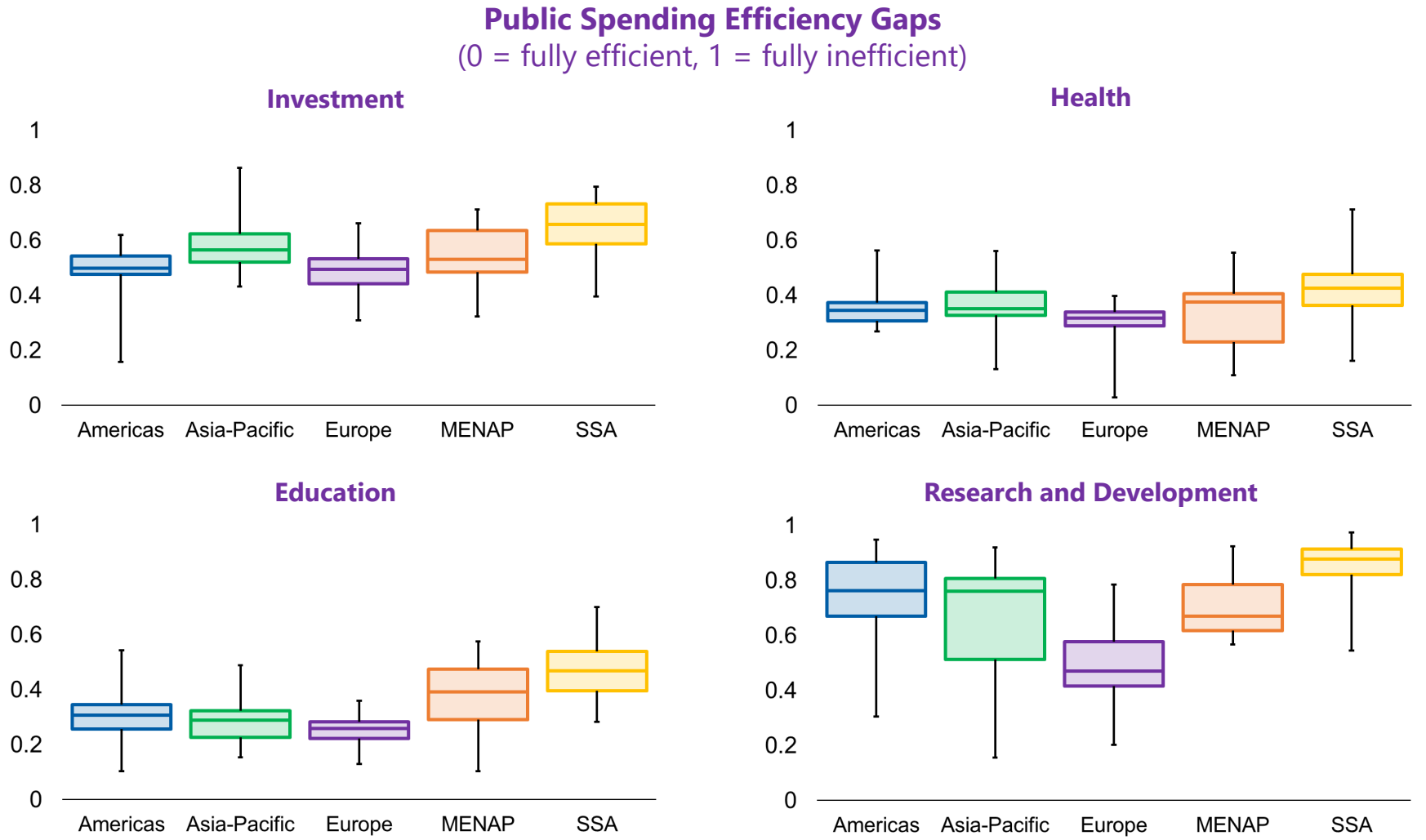
  - $y_{i,t}$: vector of multiple outputs, measuring quantity and quality of public service
  - $x_{i,t}$: is 5-year average real spending per capita
  - $v_{i,t}$: symmetric statistical noise
  - $u_{i,t} > 0$: asymmetric inefficiency – main object of interest
- Multiple outputs:
  - Investment (12 indicators): incl. energy, transport, communication, and water infrastructure
  - Health (8 indicators): incl. hospital beds, doctors, life expectancy, immunization, infant mortality
  - Education (7 indicators): incl. school enrolment, completion, literacy
  - R&D (4 indicators): scientific publications, patents, researchers, citations
- Estimation using the true fixed effects estimator of Greene (2005), with country and time FE
- Accounting for model uncertainty by estimating for all combinations of output variables (e.g., $2^{12} - 1 = 4095$ for public investment) and median-based aggregation.

Rigidity high across all categories, especially in AEs



Source: IMF Government Finance Statistics database; IMF World Economic Outlook database; and IMF staff estimates.
Note: The figures show the average of country-level rigidity of each spending category during 2000-10 and 2011-22. Rigidity is calculated as the one-year autocorrelation of each spending category as a share of total expenditure, in rolling windows of five years. 1 (0) denotes maximum (minimum) rigidity. Defense includes spending on public order and safety. R&D is research and development.

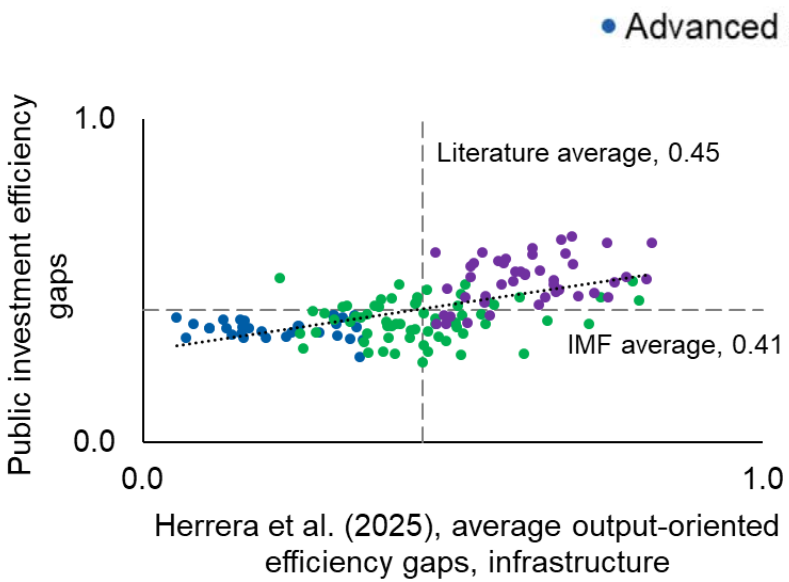
Regional variation in public spending efficiency gaps

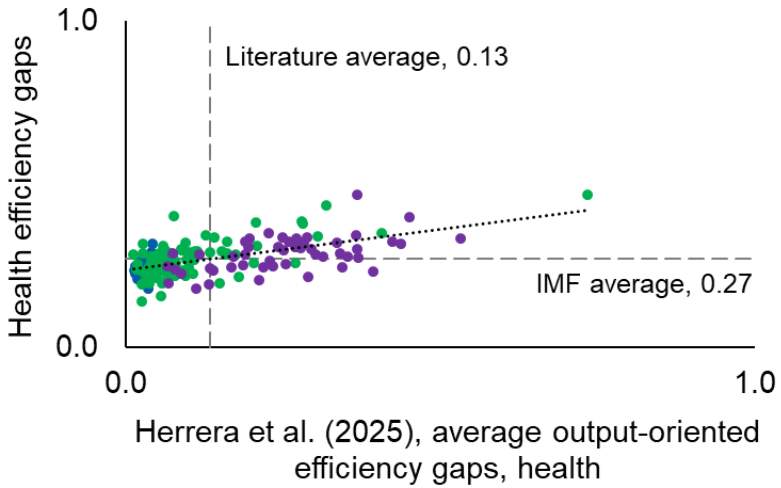


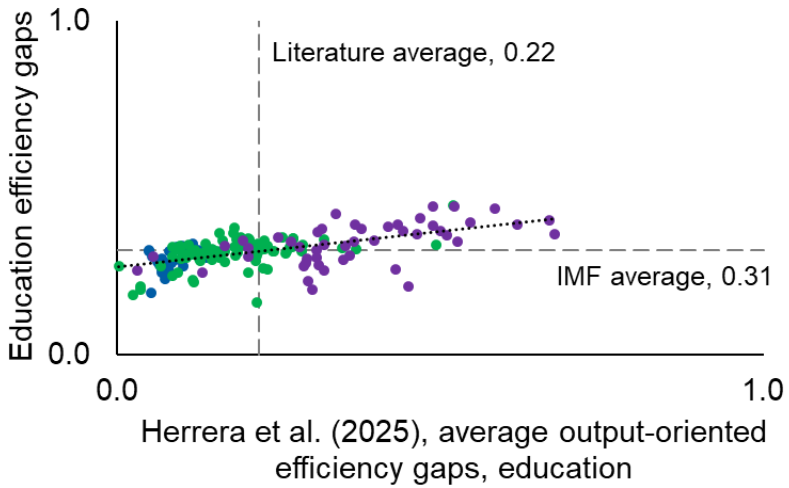
Source: IMF staff estimates.

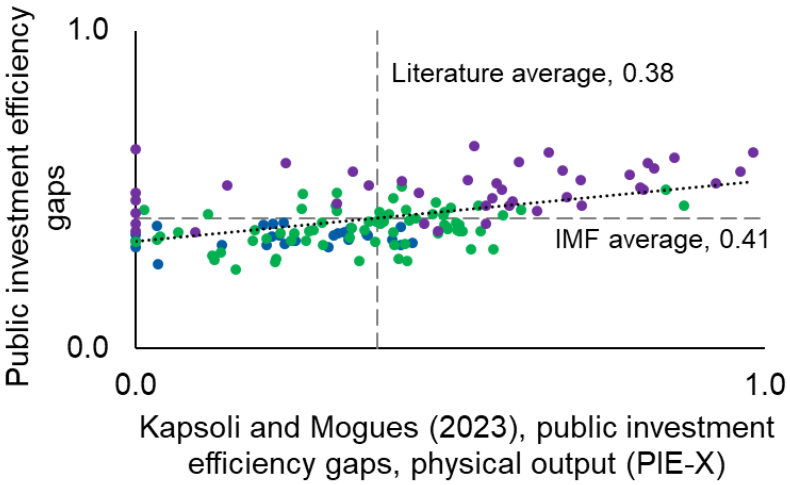
Note: The figure shows efficiency gaps, which are distances to the spending efficiency frontier, for 174 countries since 1980. The frontier is estimated using multiple-output stochastic frontier analysis with country and year fixed effects. Inputs are 5-year averages of public spending in each category. For public investment, the outcomes include the quantity of roads, railways, air and seaport traffic, telephone lines, and electricity consumption, as well as access to electricity and drinking water, the proportion of roads that are paved, and perceptions of overall infrastructure quality. Health outcomes include life expectancy, immunization rates, hospital beds, doctors, and infant survival. Education outcomes include school enrolment and completion rates, literacy rates, adults' years of schooling, and perceptions of education quality. Research and development outcomes include scientific publications, patents, researchers, and citations. The analysis accounts for uncertainty in the choice of outcome variables by averaging across models. Boxes indicate medians and interquartile ranges (25th–75th percentiles) of the average efficiencies over time. Whiskers delineate the minimum and maximum values.

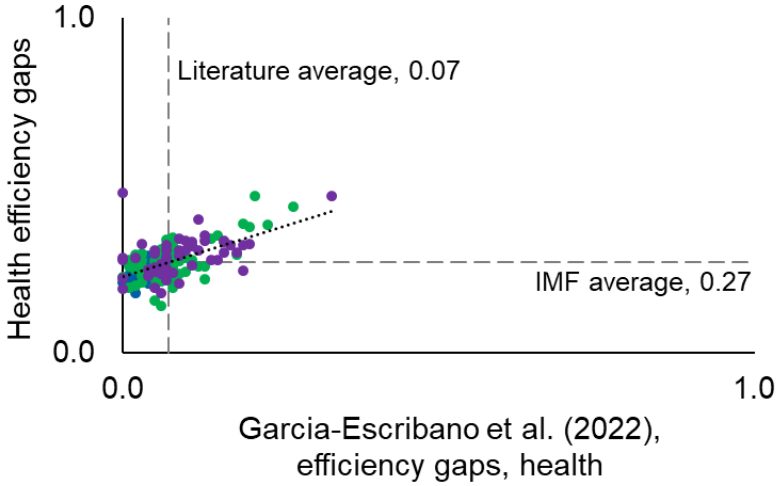
Comparison of spending efficiency gaps against literature







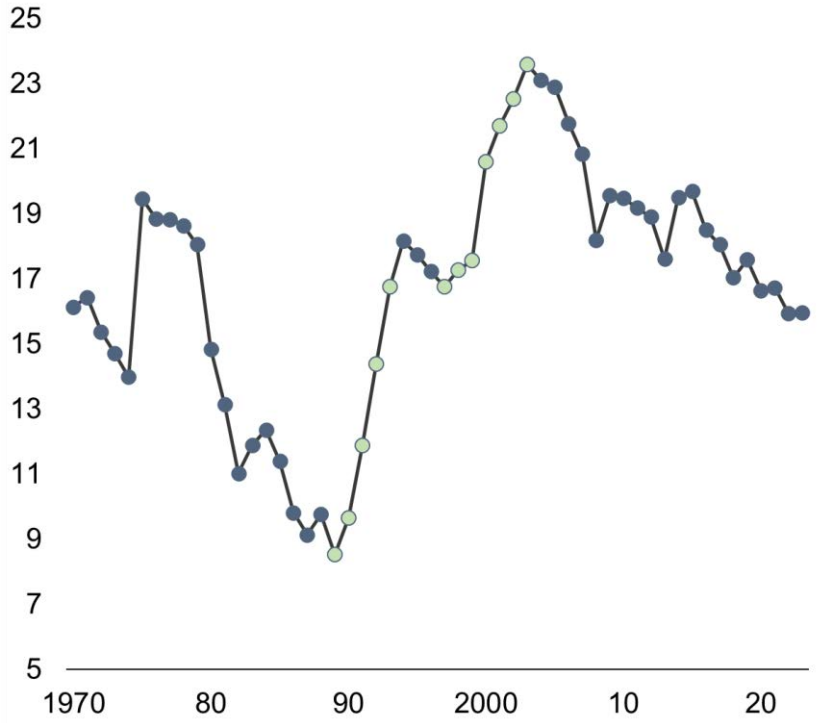




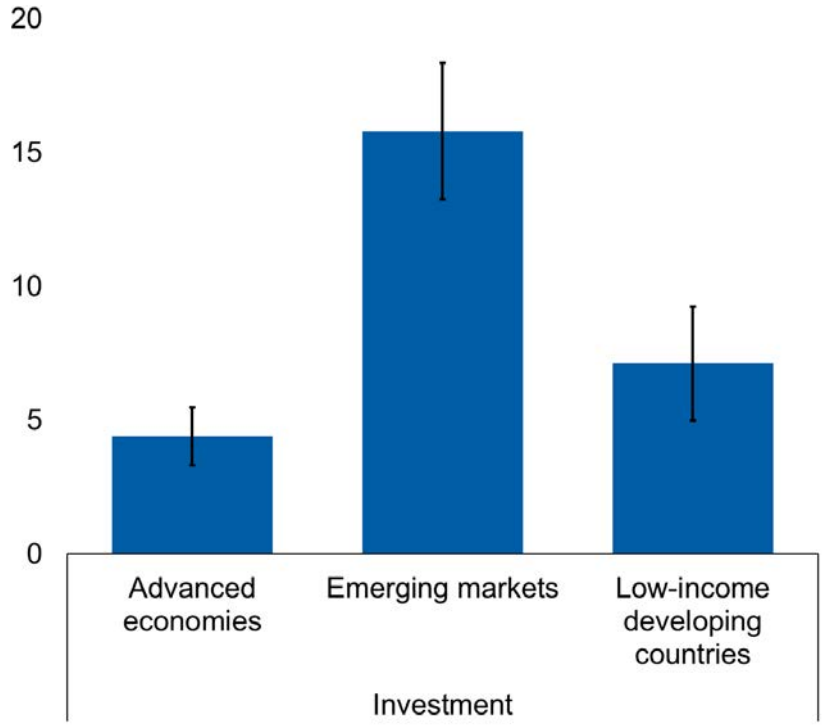
Source: Garcia-Escribano et al. (2022); Herrera et al. (2025); Kapsoli and Mogues (2023), and IMF staff calculations.
Note: The efficiency gap data from Herrera et al. (2025) were derived by averaging all available output-oriented efficiency scores for the respective sectors. The vertical axes, and "IMF average," show estimates from the October 2025 Fiscal Monitor. The sample of countries and years of each panel matches those used in the respective paper from the literature specified on the horizontal axis.

Defining episodes of large increases in pro-growth spending categories

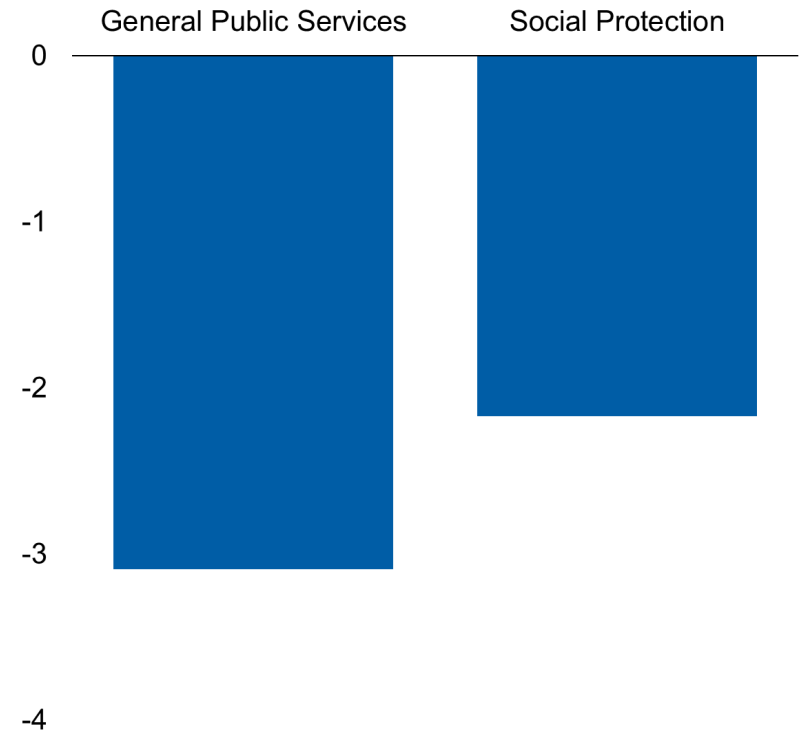
Mexico: Public Spending on Education
(Percent of total expenditure)



Impact of Public Investment Episode On Public Investment Spending Share
(Percentage points)



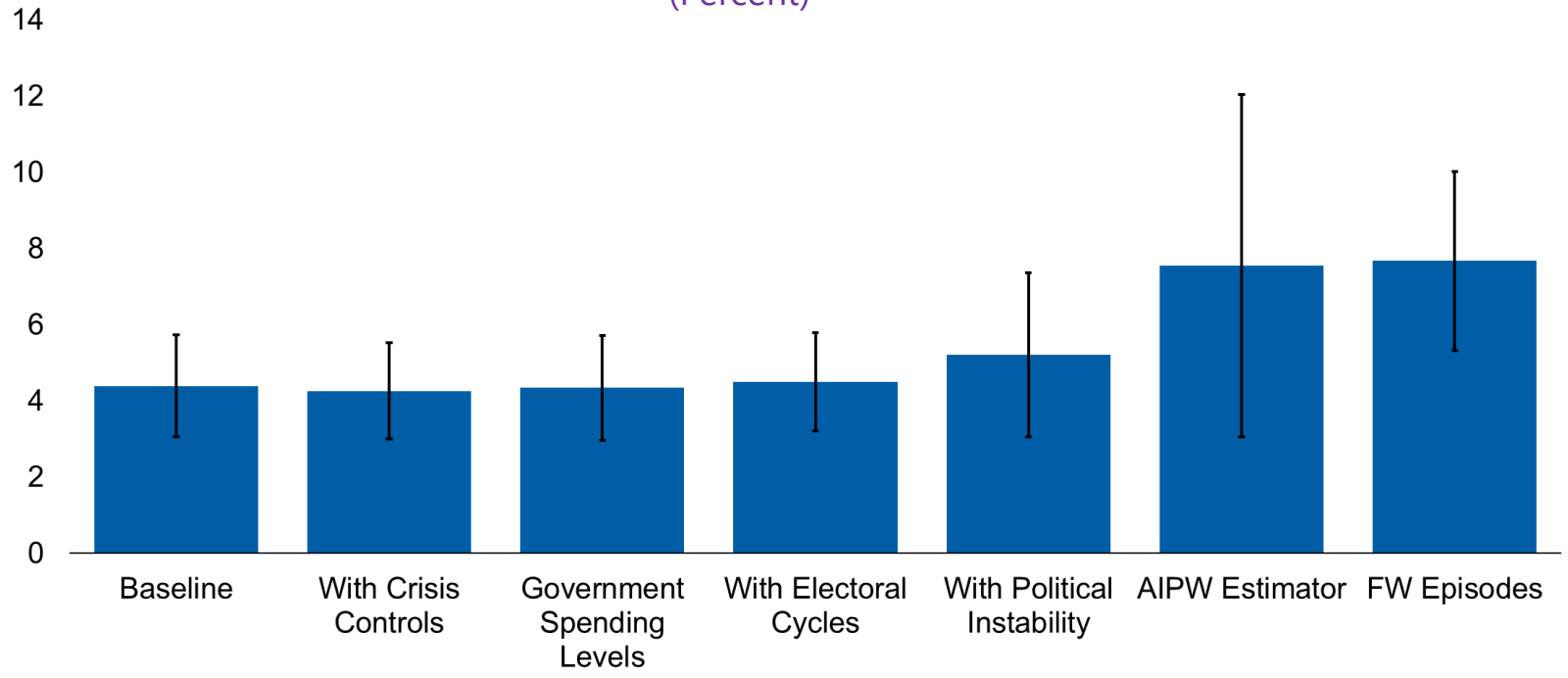
Spending Reallocation During Public Investment Episodes
(Percentage points)



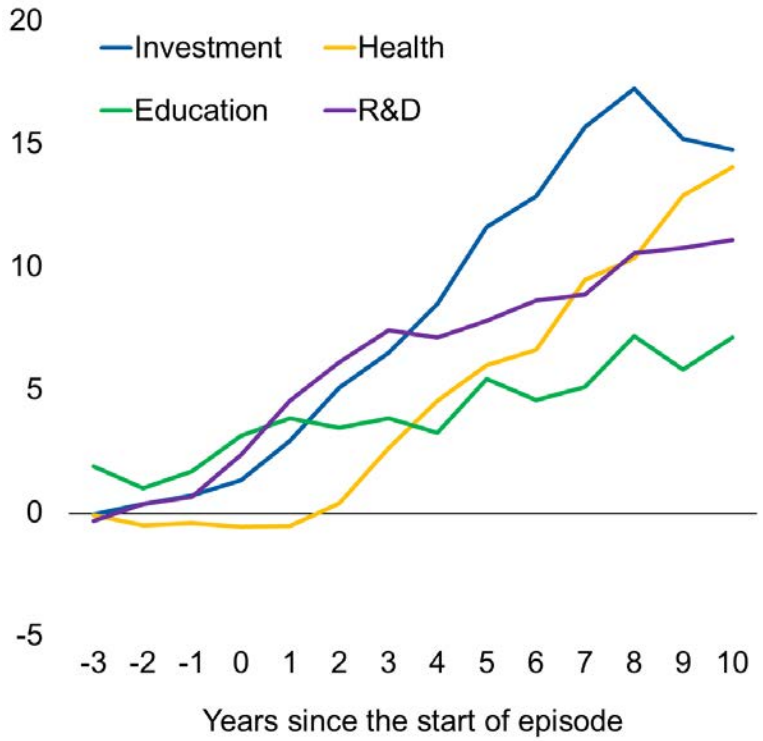
Source: IMF Government Finance Statistics (GFS) database; IMF staff estimates.
Note: The left panel shows education spending, with green markers indicating two rising-spending episodes; Mexico implemented reforms in the early 1990s reform (ANMEB) and introduced compulsory secondary education in 1997 (PROGRESA). The middle panel shows 10-year cumulative impulse responses estimated via local projections. Whiskers denote interquartile ranges across simulations. The right panel shows 5-year cumulative impulse responses of each spending category as a share of total government expenditure, estimated via local projections.

Robustness of empirical analysis

10-Year GDP Response to Public Investment Episodes: Robustness Specifications
(Percent)



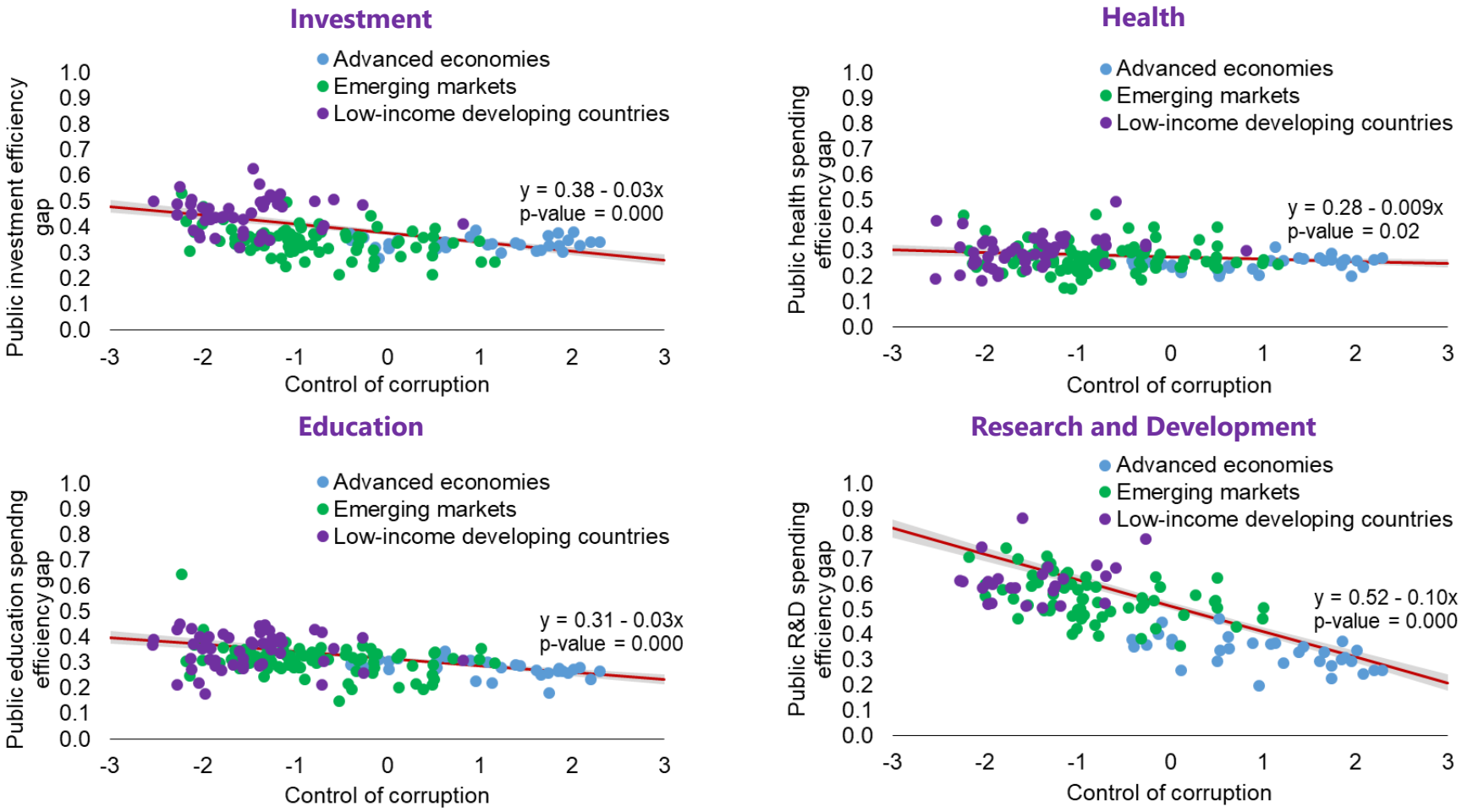
GDP Impacts of Reallocation Episodes Using Synthetic Control Method
(Percent)



Source: IMF staff calculations.
Note: In the left panel, bars report cumulative GDP responses at a 10-year horizon following public investment episodes, estimated via local projections. Error bars denote 90 percent confidence intervals using Driscoll-Kraay standard errors. Each specification adds controls or varies the estimation method: Baseline, with crisis dummies (from Laeven and Valencia 2018), the level of government spending to account for expansion of fiscal envelope, executive and legislative electoral year dummies, and a principal component index of political instability (PC) based on Bernal-Verdugo et al. (2013), augmented inverse probability weighting (AIPW), and alternative episode definition based on Forbes–Warnock (FW). In the right panel, the chart depicts the GDP impacts of reallocation episodes using the synthetic control method. R&D = research and development.

Control of corruption and efficiency

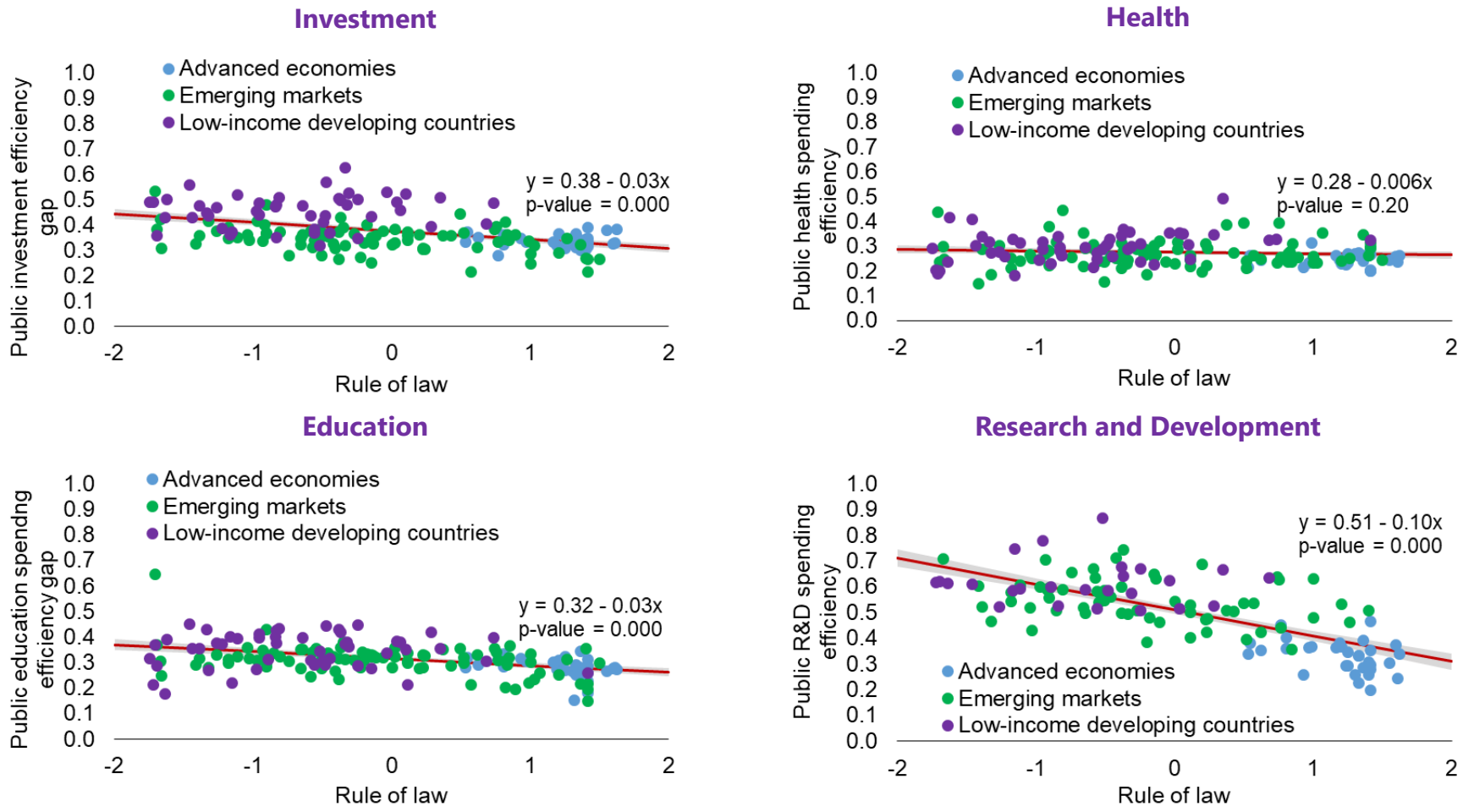
Control of Corruption and Efficiency Gaps



Source: World Bank, Worldwide Governance Indicators database; and IMF staff estimates.
Note: Efficiency gaps range from 0 (fully efficient) to 1 (fully inefficient). Control of corruption is a perception-based indicator measured in standard deviations. Higher scores indicate increased control of corruption. Country averages are used for plotting; regression lines reflect cross-section OLS estimates.

Rule of law and efficiency

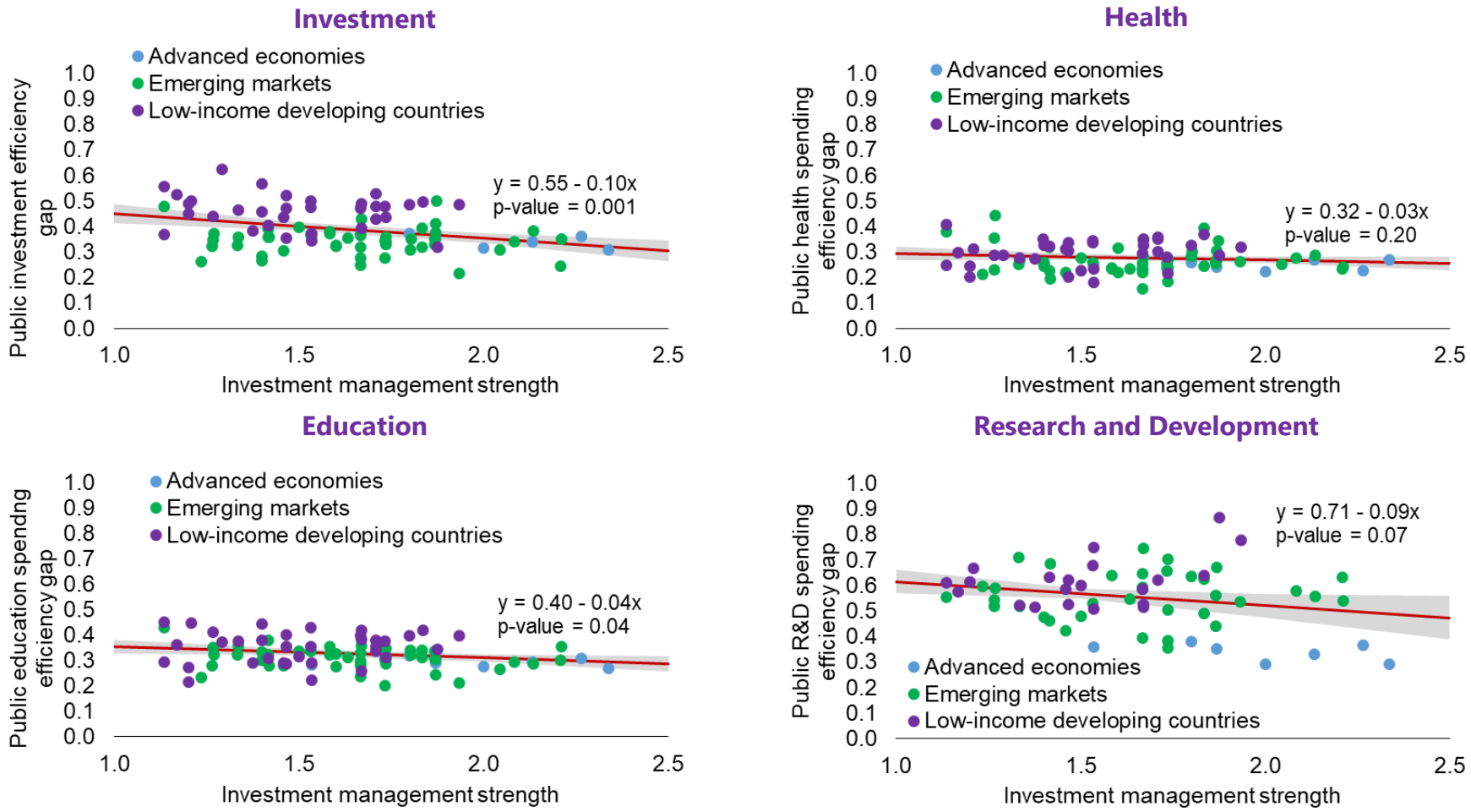
Rule of Law and Efficiency Gaps



Source: Quality of Government database; and IMF staff estimates.
Note: Efficiency gaps range from 0 (fully efficient) to 1 (fully inefficient). Rule of law is a rating from Freedom House, from 0 (weakest) to 16 (strongest). It measures the level of judicial independence, prevalence of rule of law, civilian control of police, protection from political violence, absence of conflict, and equal treatment under law. Country averages are used for plotting; regression lines reflect cross-section OLS estimates.

Public investment management and efficiency

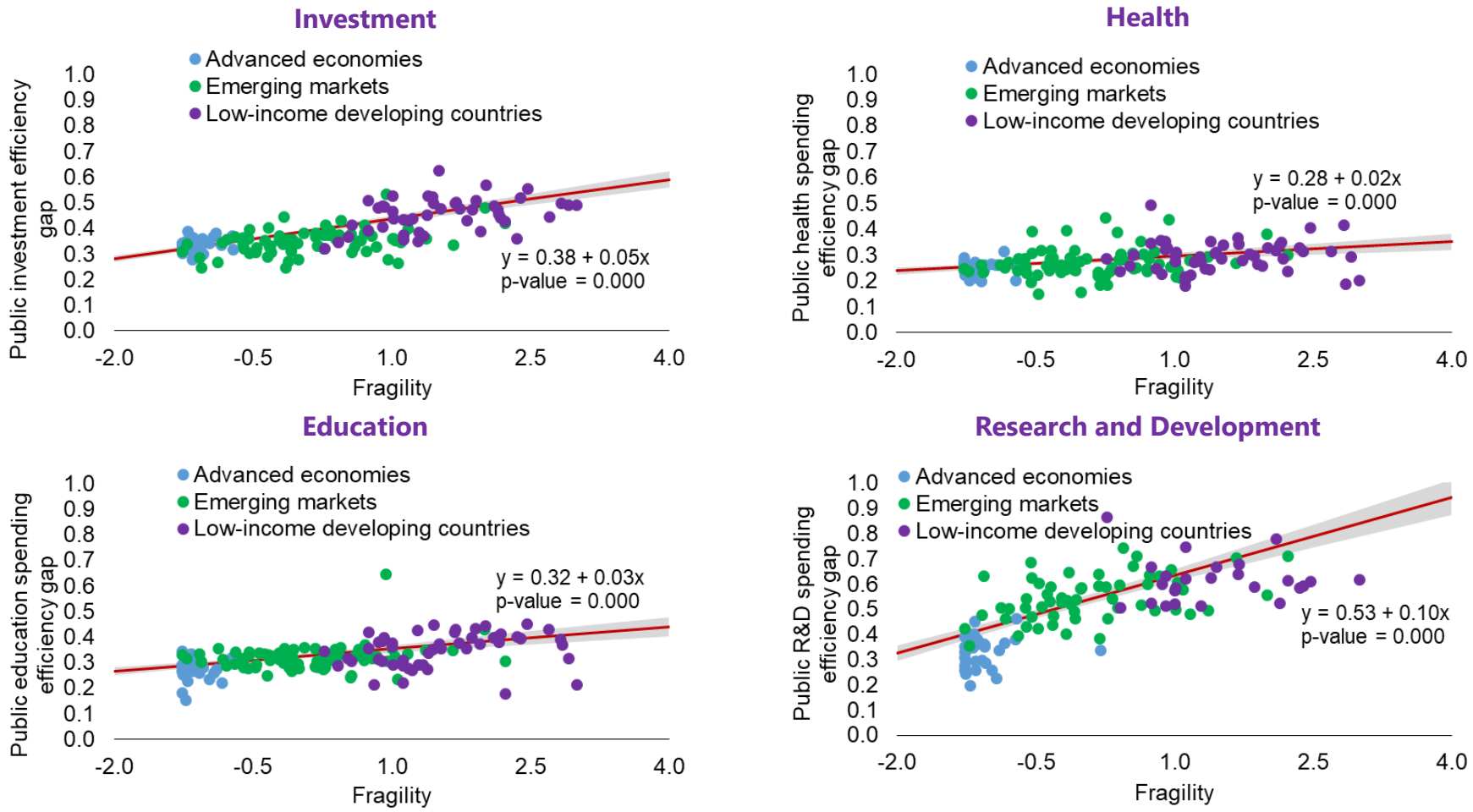
Public Investment Management and Efficiency Gaps



Source: IMF staff estimates.
Note: Efficiency gaps range from 0 (fully efficient) to 1 (fully inefficient). Public Investment Management Assessment scores are measured on a scale of 1–3, with 3 being the highest and 1 the lowest. Allocation effectiveness evaluates the degree to which public investment allocation processes effectively operate. Country averages are used for plotting; regression lines reflect cross-section OLS estimates.

Fragility and efficiency

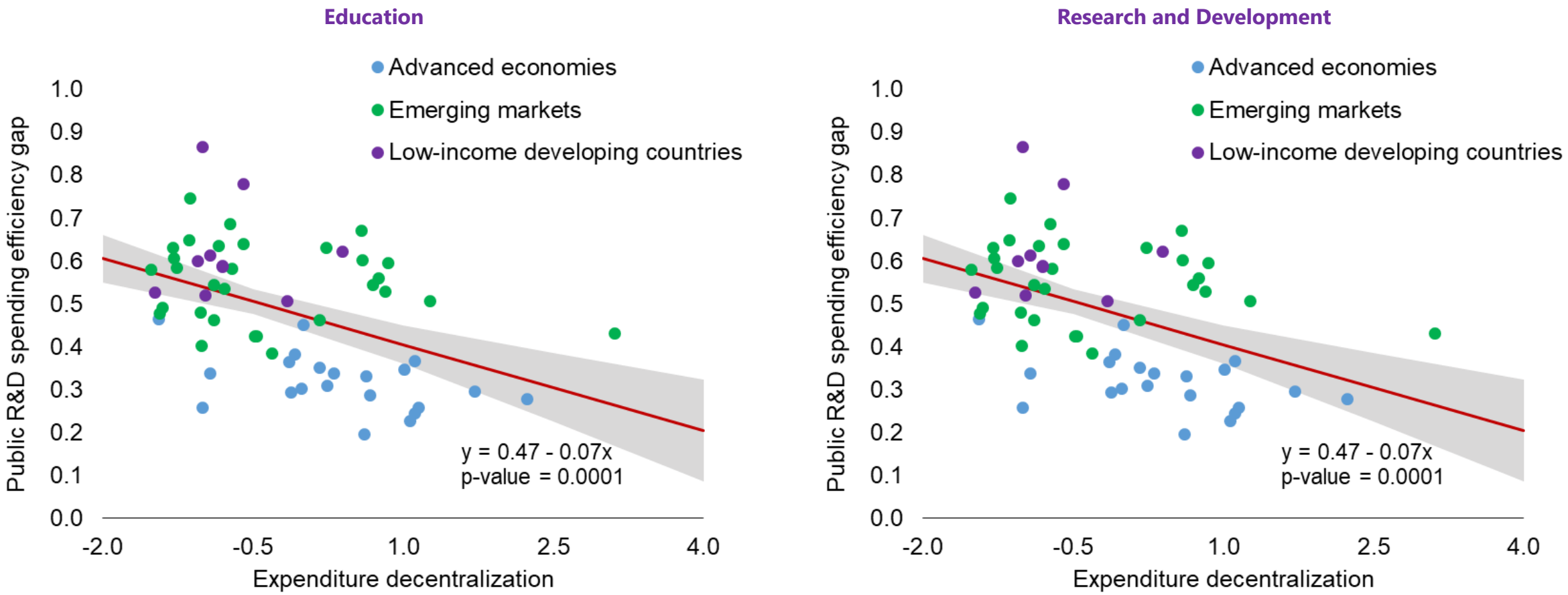
State Fragility and Efficiency Gaps



Source: World Bank, Worldwide Governance Indicators database; and IMF staff estimates.
Note: Efficiency gaps range from 0 (fully efficient) to 1 (fully inefficient). Fragility is an index from the Center for Systemic Peace, from 0 (no fragility) to 25 (extreme fragility). It measures the sum of effectiveness and legitimacy scores in security, political, economic, and social dimensions. Higher scores indicate higher fragility. Scores are normalized. Country averages are used for plotting; regression lines reflect cross-section OLS estimates.

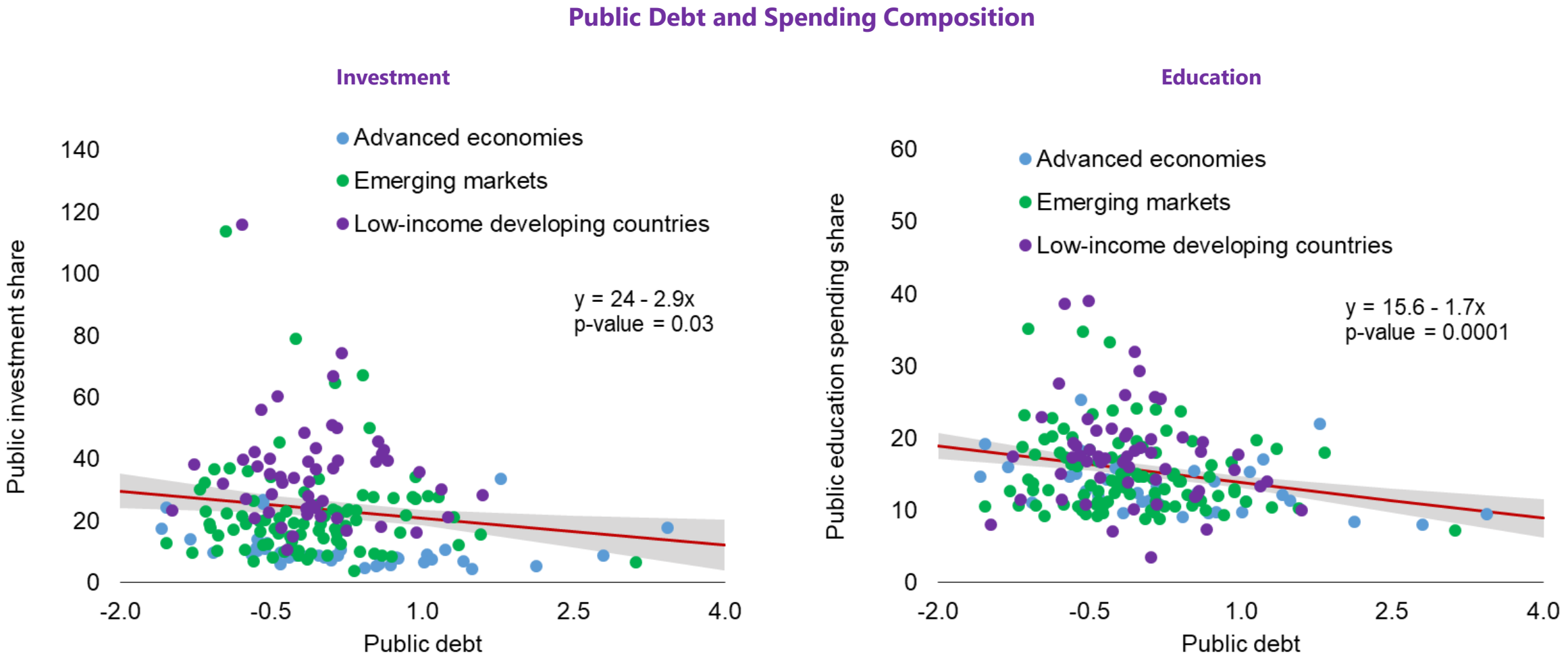
Decentralization and efficiency

Expenditure Decentralization and Efficiency Gaps



Source: IMF, Fiscal Decentralization database; and IMF staff estimates.
Note: Efficiency gaps range from 0 (fully efficient) to 1 (fully inefficient). [Decentralization measures the share of local government spending to general government spending.] Country averages are used for plotting; regression lines reflect cross-section OLS estimates. R&D refers to research and development.

Public debt and spending composition

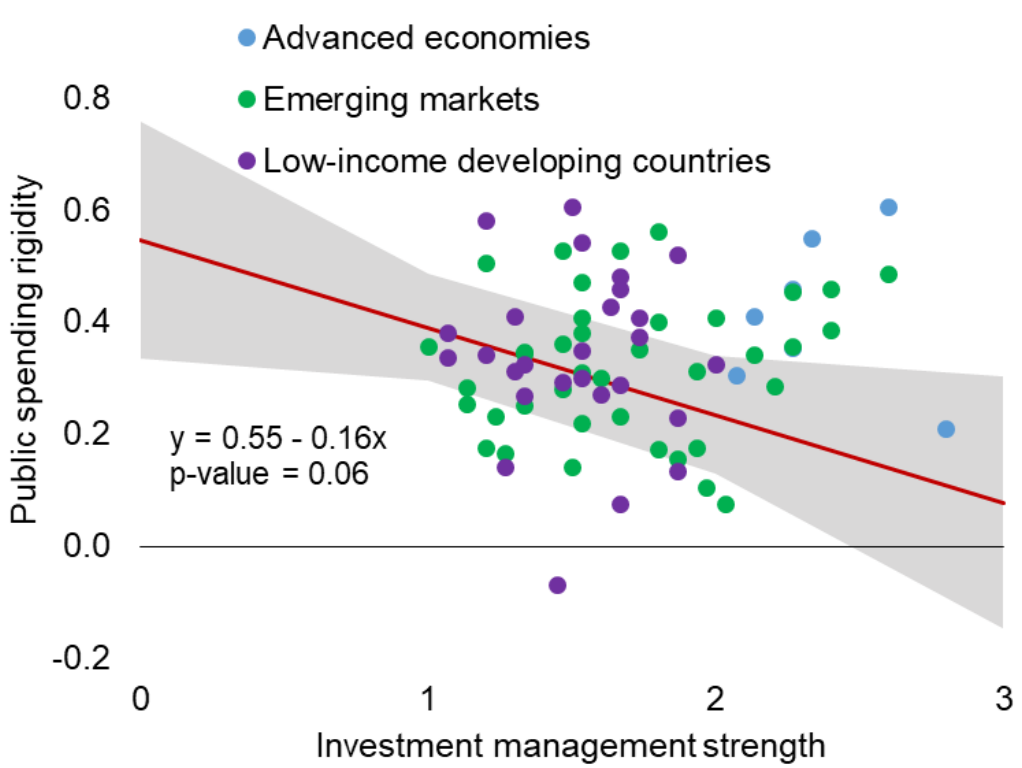


Source: IMF, World Economic Outlook database; and IMF staff estimates.
Note: Public investment and education spending shares are in percent of total government spending. General government gross debt is expressed as a percent of GDP and normalized in standard deviation units. Country averages are used for plotting; regression lines reflect cross-section OLS estimates.

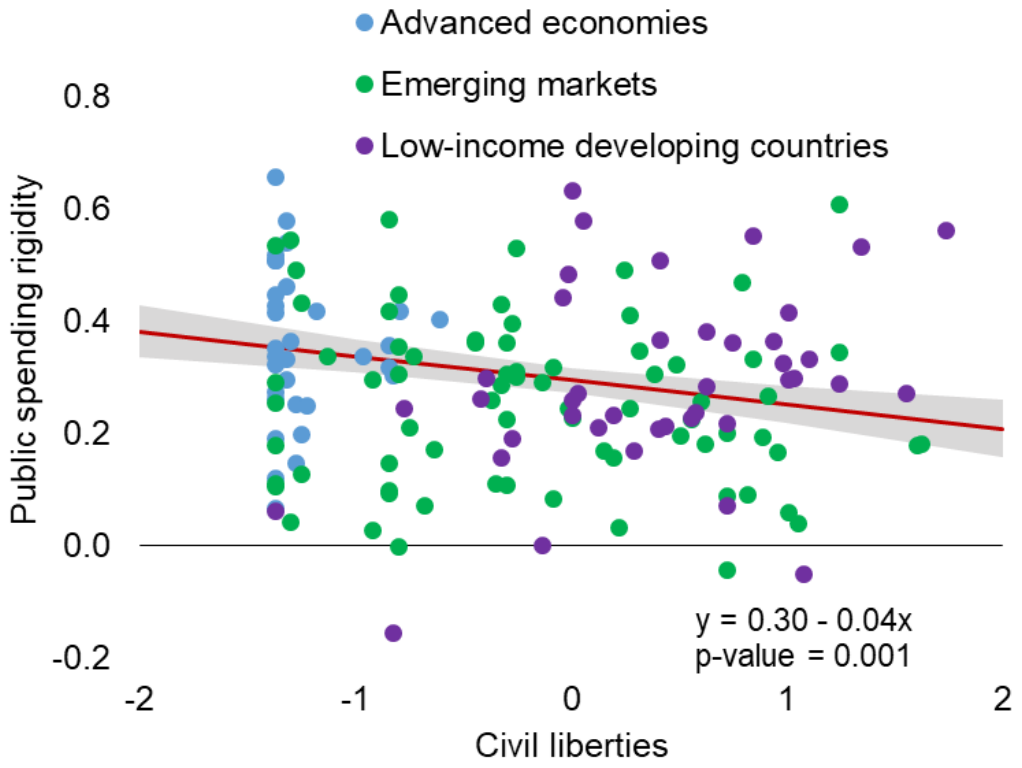
Drivers of spending rigidity

Public Spending Rigidity

vs. Public Investment Management Strength

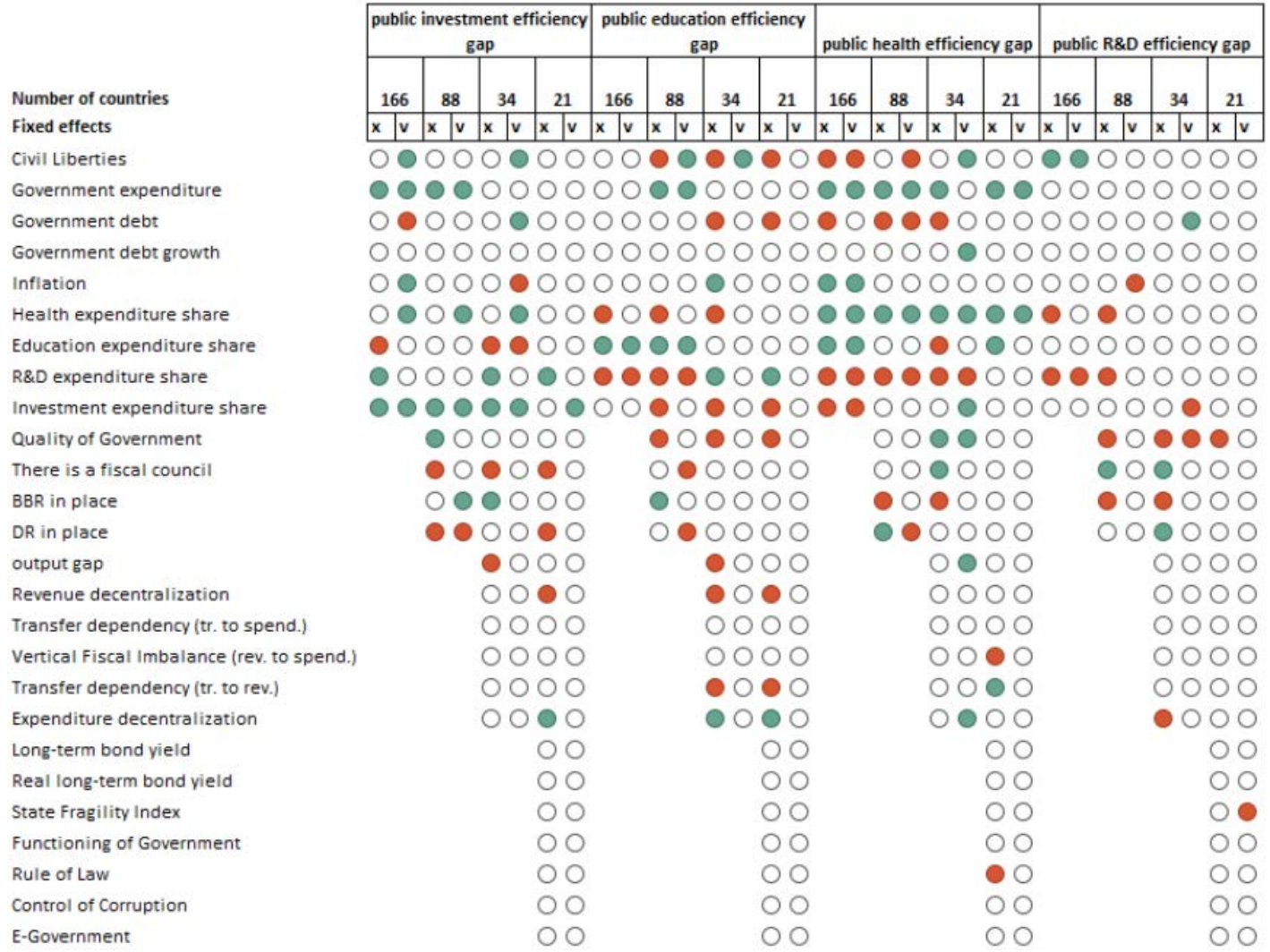


vs. Civil Liberties



Source: Quality of Government dataset; and IMF staff calculations.
Note: Spending rigidity is estimated as the 1-year autocorrelation of each spending category as a share of total expenditure, in rolling windows of 5 years. Public Investment Management Assessment scores are measured on a scale of 1–3, with 3 being the highest and 1 the lowest. Civil liberties is a rating from Freedom House, from 1 (most free) to 7 (least free). It measures freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. Both investment management and civil liberties are normalized. Each dot in the chart represents the average value for a given country over the sample period. In contrast, the fitted OLS regression line is estimated using the full panel dataset, which includes all available country-year observations.

Bayesian Model Averaging Results



Source: IMF staff estimates.

Note: Solid circles indicate coefficients with t-statistics greater than 1 in absolute value (green = positive, red = negative); hollow circles indicate insignificance. Bayesian Model Averaging (BMA) is run on cross-section and panel models with and without fixed effects. There are four separate BMA analyses on four separate sets of explanatory variables; the larger the set of variables, the fewer countries have the data available. Number of countries specifies how many are left in the dataset used for the BMA, depending on the explanatory variables considered. Fixed effects "x" and "v" stands for BMA without and with fixed effects respectively.

Empirical estimation of short- to medium-term impacts

- Country-level local projections to estimate the effects of major episodes of changes in physical capital investment, education, health, and R&D spending:

$$y_{i,t+h} - y_{i,t} = \theta_t^h + \alpha_i^h + \beta^h d_{i,t} + \gamma^h c_{i,t} + e_{i,t+h}^h$$

where $y_{i,t}$ is (log) output, and $d_{i,t} = 1$ in the first year of the episode and zero otherwise, and $c_{i,t}$ are controls (lagged and expected economic growth, lags of $d_{i,t}$, and product/labor market reforms).

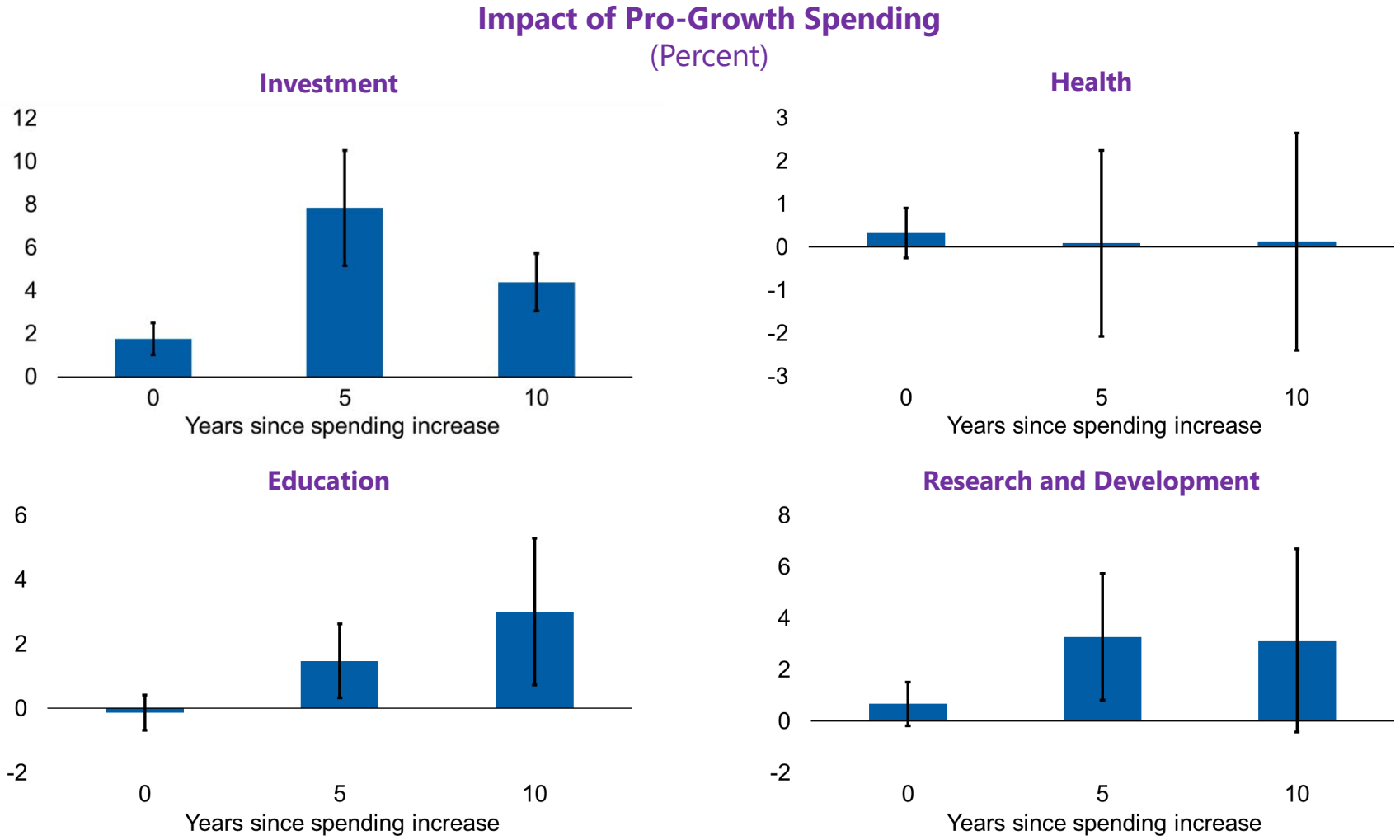
Episodes are defined as four-year periods during which spending in a particular category increases in at least three of the years, with the increase in at least one of the years being 1.5 standard deviations or greater.

- Sector-level local projections to examine transmission to productivity and misallocation at the sector level:

$$y_{s,i,t+h} - y_{s,i,t-1} = \beta^h H_{s,i} d_{i,t} + \gamma^h c_{s,i,t} + \alpha_{i,s}^h + \alpha_{s,t}^h + \epsilon_{s,i,t+h}^h$$

where $H_{s,i}$ is a dummy variable indicating whether characteristic of sector s is in the top or bottom quartile of the distribution of production flexibility and trade openness across firms. Controls ($c_{s,i,t}$) include two lags of the independent and dependent variables.

Reallocating spending can boost output in the short- to medium-term

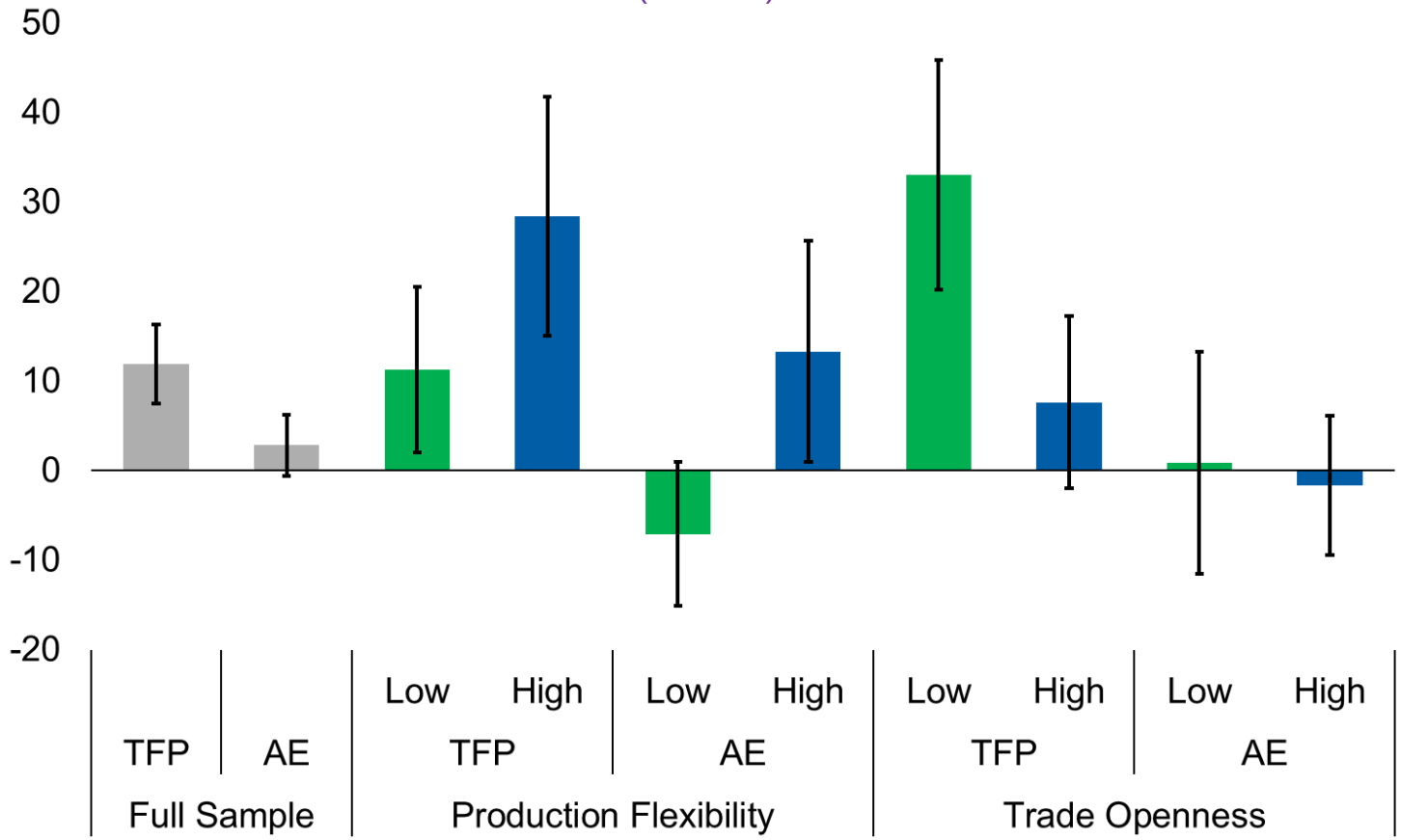


Source: IMF staff estimates.

Note: The figure shows the percent change in output in response to episodes of major reallocations of public spending toward the respective areas. Estimates uses local projections and control for potential confounding factors, as explained on the previous slide. The error bars show 90 percent confidence intervals using Driscoll—Kraay standard errors.

Public investment boosts productivity more in sectors with more flexible production and openness to trade

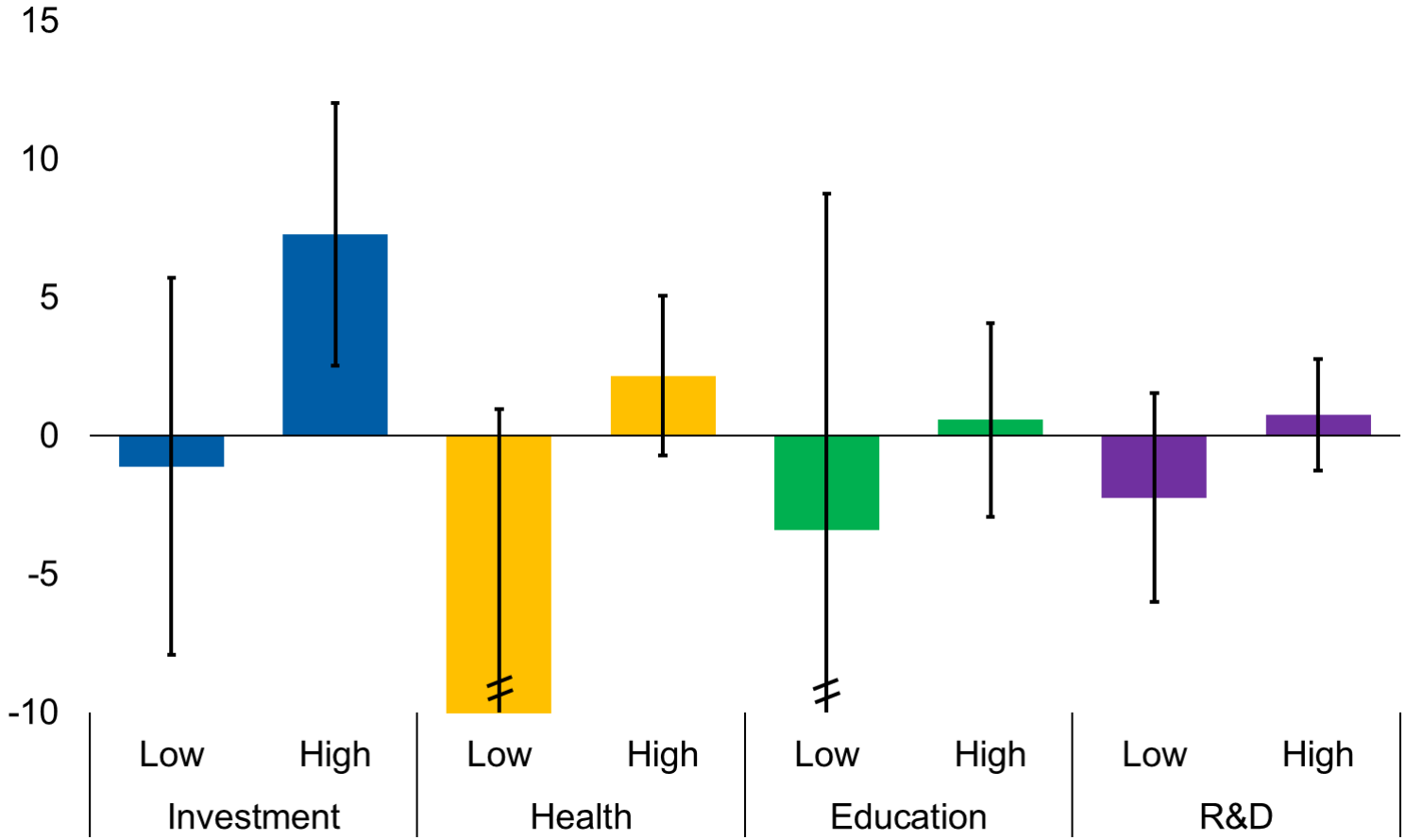
Impacts of Reallocation toward Public Investment
(Percent)



Source: Baquie and others 2025; Ciminelli, Duval, and Furceri 2018; IMF, April 2024 *World Economic Outlook,* Chapter 3; Moody's, Orbis; Organisation for Economic Co-operation and Development, Activity of Multinational Enterprises Database; and IMF staff estimates.
Note: Bars represent point estimates for cumulative changes in the logarithm of average sector-level total factor productivity (TFP) and within-sector allocative efficiency (AE) over five years after the start of the public investment episode. Whiskers represent 90 percent confidence intervals. Standard errors are clustered at the country-sector level. Production flexibility denotes the elasticity of substitution between labor and capital. "Low" denotes sectors at the 25th percentile or below for elasticity of substitution or trade openness, and "High" indicates sectors at the 75th percentile or above. Allocative efficiency is estimated as in Hsieh and Klenow (2009).

Closing spending efficiency gaps magnifies growth impacts

Impact of Pro-Growth Spending on Output
(Low versus High Levels of Efficiency)



Source: IMF staff estimates.
Note: The figure shows the percent change in output in response to episodes of major increases in public spending in the respective areas. The figure compares the response after 10 years in countries with high (75 percent) and low (25 percent) efficiency of spending in each spending category. Estimates uses local projections and control for potential confounding factors, as explained on the preceding slides. The error bars show 90 percent confidence intervals using Driscoll—Kraay standard errors. Jagged whisker ends indicate that the bounds exceed the axis range. R&D = research and development.

Long-run impacts: Macro model in a nutshell

- Productive fiscal spending in an endogenous-growth DSGE framework:
  - Public investment builds up public infrastructure capital (e.g., roads), which raises production capacity:

$$y_t = A_t^{\vartheta-1}(K_t^{\alpha}(H_t\,L_t)^{1-\alpha})\left(K_t^{GI}\right)^{\alpha_G}$$

  - Public human capital investment (e.g., schools, hospitals) accelerates the accumulation of productive private human capital:

$$H_t = \left(1-\delta^{h}\right)H_{t-1} + \lambda(E_t)^{\gamma}\left(K_t^{GE}\right)^{\mu}$$

  - Public R&D spending (G_t^{RD}) in advanced economies accumulates unadopted innovations, which firms then gradually adopt:

$$\log\left(\frac{Z_t}{Z^{ss}}\right) = \rho_A \log\left(\frac{Z_{t-1}}{Z^{ss}}\right) + (1-\rho_A)(\alpha_{HA}\log\left(\frac{H_{t-1}}{H^{ss}}\right) + \alpha_{RD}\log\left(\frac{G_{t-1}^{RD}}{G^{RD,ss}}\right))$$

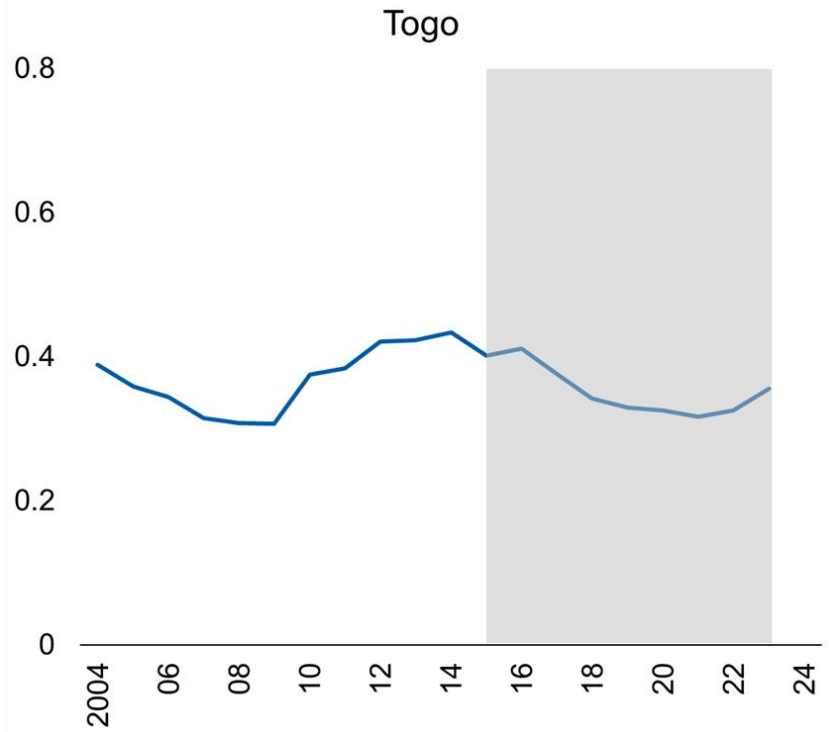
- Capital accumulation and public R&D inputs are efficiency-adjusted using sector-specific inefficiency factors:
  - Public infrastructure: $K_t^{GI} = \left(1-\delta^{GI}\right)K_{t-1}^{GI} + \left(1-e^{GI}\right)I_t^{GI}$
  - Public human capital: $K_t^{GE} = \left(1-\delta^{GE}\right)K_{t-1}^{GE} + \left(1-e^{GE}\right)I_t^{GE}$
  - Public R&D: $G_t^{RD} = \left(1-e^{GRD}\right)G_t^{RDspend}$

Messages of country case studies

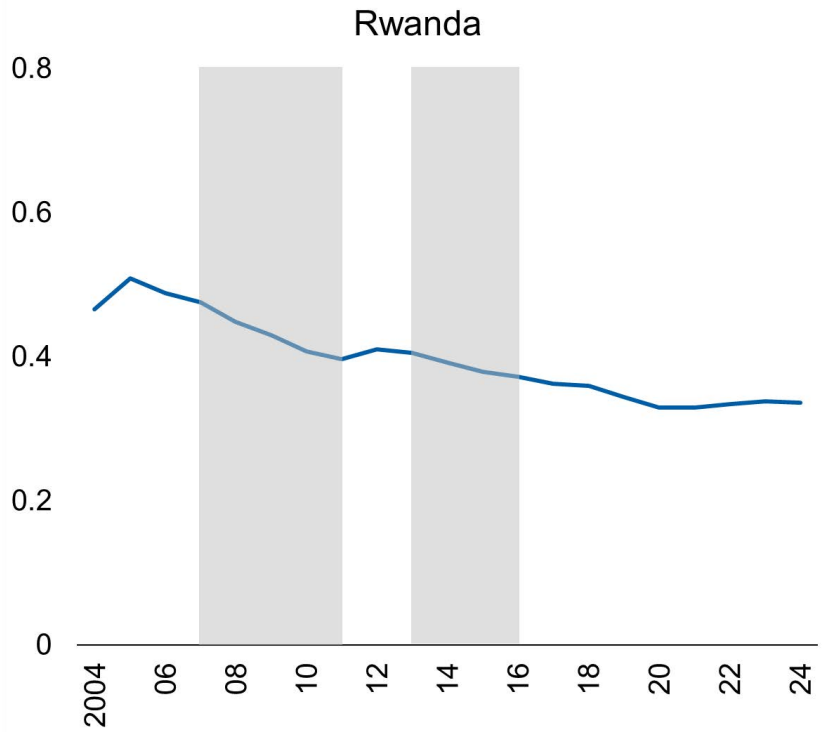
- Better public financial management can help improve the efficiency of public spending (*Serbia, Togo, United Kingdom*).
- Increased mobilization of private funding can contribute to higher spending efficiency (*United Kingdom*).
- Enhancing the efficiency of education spending can be demand-driven (through improved access to schools) (*Bahrain, Rwanda*), or supply-driven (through better teacher education) (*Bahrain*).
- Digitalization of public finances can contribute to higher (education) spending efficiency (*Rwanda*).
- Reforms might yield substantial gains over a relatively short period of time (*Croatia, Serbia*).
- Support from Fund-supported programs, and IMF and other institutions' capacity development can be pivotal (*Serbia*).
- Combining policies, such as education with social assistance, can promote equity and learning outcomes (*Brazil*).
- Spending reviews can help identify areas of fiscal savings (*Slovak Republic*).

Selected examples of countries that reduced inefficiencies

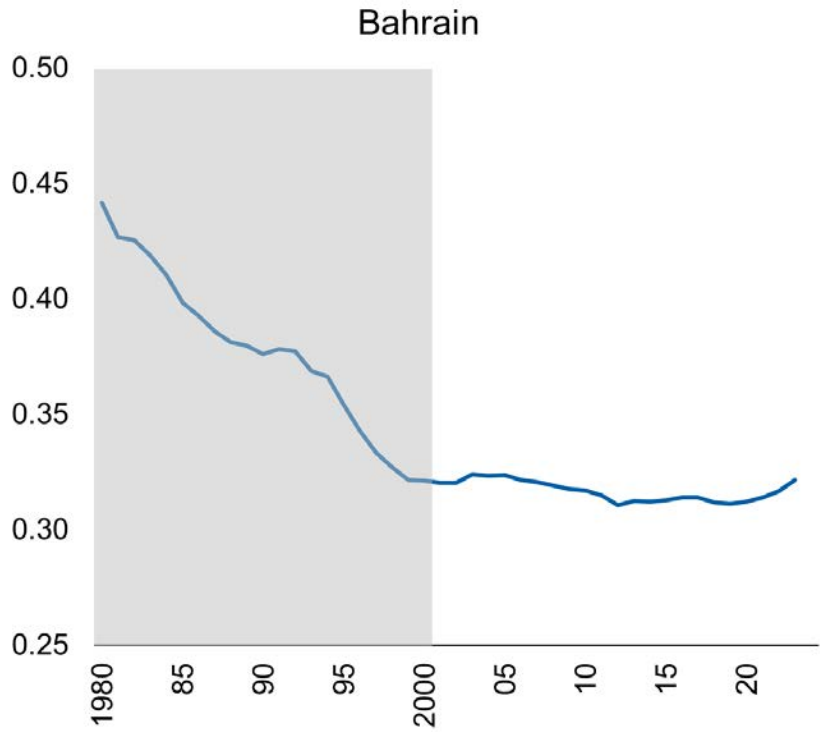
Public Investment Efficiency Gap
(0 = fully efficient, 1 = fully inefficient)



Public Education Spending Efficiency Gap
(0 = fully efficient, 1 = fully inefficient)



Public Education Spending Efficiency Gap
(0 = fully efficient, 1 = fully inefficient)



Source: IMF staff estimates.
Note: The charts spending efficiency gaps, which are distances to the spending efficiency frontier estimated using multiple-output stochastic frontier analysis with country and year fixed effects, as explained on previous slides. Periods of notable decreases after reforms are highlighted in gray: 2015-2023 for Togo (left panel), 2007-2011 and 2013-2016 for Rwanda (middle panel), and 1980-2000 for Bahrain (right panel).