The Office of the Chief Economist of the South Asia Region

OCTOBER 2023

South Asia Development Update

Toward faster, cleaner growth

WORLD BANK GROUP

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Foreword

At first glance, South Asia is a bright spot in the global economy. The World Bank is forecasting that the region will grow more quickly than any other developing country region over the next few years. Some countries in the region are continuing a trend of strong growth, while others are recovering from a period of turmoil. While high inflation and interest rates have bogged down many emerging markets, South Asia seems to be forging ahead.

However, a second look reveals a more nuanced picture. The region is making progress, but at a slower pace than in the pre-pandemic years. That's an issue, because the region still has a long way to go. Per capita incomes average only about US$2,000—one-fifth of the level achieved by the neighboring East Asia and Pacific region or the upper-middle income average, and one-twentieth the level of high-income countries. Current growth rates may be higher than elsewhere, but they are still not sufficient for countries in the region to reach high-income status within a generation. Moreover, not all countries in the region are growing fast, and three—Afghanistan, Pakistan and Sri Lanka—are in acute crisis.

The region's progress is akin to that of mountaineers at the foothills of the Himalayas. Some have barely left the base camp. Others are moving at a brisk pace but still in low altitude. All still have a long way to go. And the path will get more difficult ahead.

This report provides a roadmap that policy makers can use to hasten their way towards their goal. There are four ingredients that are particularly important:

- *Boost private investment.* Strong private investment is critical for accelerating the pace of catch-up with high-income countries and enabling the energy transition. In all but one country in South Asia, private investment growth has slowed compared to the pre-pandemic period. Strengthening private investment will depend on many factors, including improving infrastructure, the institutional and business environment, the ability of the financial system to provide credit, and removing market distortions.
- *Restore fiscal sustainability.* Many countries in the region are carrying extra weight that makes this journey more difficult. Debt burdens around the world have gotten heavier in the last decade, but the increase in South Asia is above average. High public debt crowds out private investment and limits the room for spending on critical infrastructure and human capital bottlenecks and on improving resilience. Lightening this burden will require some combination of increased revenues, improved spending efficiency, and stronger fiscal rules to anchor better policies over time.
- *Speed the energy transition.* South Asia has been successful at adopting basic energy-saving technology but lags in the adoption of more advanced technologies. Modernizing the economy and increasing energy efficiency will help the region keep pace in the global energy transition.
- *Maintain a healthy labor market.* The energy transition offers many new employment opportunities but risks leaving behind lower-skilled, informal workers that have pollution-intensive jobs. Workers have a better chance of moving across sectors when they have access to education, training, finance, and markets. A robust labor market with strong social safety nets also make the path to new work easier for displaced workers.

The path to prosperity requires high growth rates to be sustained over long periods of time. Many countries have found their aspirations curtailed as growth faltered soon after an initial take-off. With the right policies and investments, South Asia can avoid this fate and reach the summit to create sustainable livelihoods on a livable planet for its people.

Martin Raiser

Vice President, South Asia Region

Executive Summary

At just under 6 percent, South Asia is expected to grow faster than any other emerging market and developing economy (EMDE) region in 2024–25. However, for all countries, this will represent a slowdown from pre-pandemic averages. Several potential adverse events could derail this outlook, including risks related to fragile fiscal positions. Government debt in South Asia averaged 86 percent of GDP in 2022, above that of any other EMDE region. In some countries, outright defaults have short-circuited growth while, in others, increasing domestic borrowing by governments has driven up interest rates and diverted credit away from the private sector. Elections could add to spending pressures. An urgent policy priority for the region is, therefore, to manage and reduce fiscal risks. Over the longer term, the policy priority is to accelerate growth and job creation in a sustainable manner. The energy transition, away from fossil fuels toward sustainable sources of energy, presents an opportunity for the region to lift productivity, cut pollution, reduce its reliance on fuel imports, and create jobs. South Asia uses twice as much energy to produce each unit of output as the global average and the region lags in the adoption of advanced energy-efficient technologies. Even fiscally constrained governments can take action to support the energy transition with market-based regulations, information campaigns, broader access to finance, and reliable public power grids. With about 9 percent of the region's workers employed in pollution-intensive activities, and these workers less educated and more often informally employed than the average worker, the energy transition will create challenging labor market shifts. This calls for measures to boost job creation and facilitate worker mobility, geographically and across sectors.

Chapter 1. Regional outlook: Solid progress, but a long way to go. At just under 6 percent, output growth in South Asia is expected to remain stronger than in other regions in 2023–25, even with weak growth in the countries recovering from recent balance-of-payments crises. Foreign exchange and financial markets in these countries have stabilized, in part owing to the introduction of IMF-supported policy programs. But the financial systems of many countries in the region remain vulnerable and fiscal positions remain fragile. In some cases, restrictions on imports and foreign exchange transactions have yet to be fully unwound. The outlook is subject to downside risks from weak financial systems and fiscal positions. Growth prospects would also worsen in the event of a further economic slowdown in China or climate change-related natural disasters. In the short term, policy priorities include preserving financial stability and improving fiscal sustainability. In the longer term, it is important to boost private investment growth, make economies more open to trade, and seize the opportunities offered by the global energy transition.

Box 1.1 Fiscal deteriorations around elections. Among EMDEs, primary fiscal deficits, primary government expenditures, and government wage bills have tended to rise significantly around election years. While primary spending increases have tended to be partially reversed in the following year, post-election reversals of primary deficit and government wage bill increases have been more variable and at best partial. The consequent ratcheting up of primary deficits around elections in EMDEs can erode fiscal sustainability over the longer term, while the expansion of government wage bills can result in spending rigidities. In South Asia, in particular, fiscal positions have tended to deteriorate around national elections, and, in some cases, there is also evidence of targeted fiscal actions around subnational elections. While this result is true on average for the region, some countries—notably India in its 2023 budget—have avoided the risk of election-induced current spending increases. This points to a way forward for fiscally constrained governments in South Asia.

Spotlight. An ounce of prevention, a pound of cure: Averting and dealing with debt default. South Asia has the highest average government debt-to-GDP ratio among EMDE regions, at 86 percent in 2022, and four of the region's countries are rated in or near sovereign debt distress. The risk of sovereign defaults in the region is heightened not only by high levels of government debt but also by the increases in global interest rates over the past two years: the vast majority of past defaults occurred around the end of U.S. monetary policy tightening cycles and in countries with above-median government debt-to-GDP ratios. Past experience also shows that more than one-third of defaults failed to lower government debt or borrowing costs in a lasting manner. Defaults that succeeded in lowering debt or borrowing cost were accompanied more frequently than others by above-median debt restructurings, growth accelerations, and fiscal consolidations. South Asia's above-average economic growth mitigates some of the default risks. Some South Asian countries have reduced their default risk by predominantly borrowing from domestic creditors. However, this strategy comes at a price: high domestic shares of government debt have been associated with higher borrowing costs and lower bank credit to the private sector. With the external environment likely to remain challenging over the next several years, it is all the more important to adopt policies to accelerate sustainable growth and shore up fiscal positions.

Chapter 2. Recruiting firms for the energy transition. As the world presses ahead with the energy transition, new energy-saving technologies offer South Asian countries an opportunity to modernize their economies. Currently, the energy intensity of South Asian economies is almost twice the global average—despite a decline over the past two decades that was almost entirely driven by firm-level, within-sector cuts in energy intensity. While the region's firms have been early adopters of basic energy-saving technologies, they have lagged in the adoption of more advanced technologies, with smaller firms lagging particularly far behind. Policies that have been effective at encouraging technology adoption among firms include market-based regulation, dissemination of accurate information on energy savings, and financial support.

Chapter 3. Stranded jobs? The energy transition in South Asia's labor markets. The transition away from fossil fuels in South Asia will have significant labor market impacts, which could leave many workers stranded in lower-wage jobs in declining industries. In all South Asian countries except India, pollution-intensive jobs outnumber green jobs and account for 6–11 percent of all jobs; only in India do green jobs outnumber—and then only slightly—pollution-intensive jobs, which account for 9 percent of all jobs. Pollution-intensive jobs are concentrated among lower-skilled and informal workers, whereas green jobs tend to be held by higher-skilled, better-paid, and formal-sector workers. Experience from past major economic transformations, especially in resource sectors, suggests that the transition away from fossil fuels will have large effects on the structure of employment and earnings, with lasting losses for some workers, and will cause significant internal worker migration. A wide range of policies will be needed to facilitate the necessary adjustment in labor markets while protecting vulnerable workers. These include: the provision of better access to high-quality education and training, finance, and markets; measures to facilitate labor mobility; and strengthening social safety nets.

Abbreviations

AE	advanced economy
CO_2	carbon dioxide
CPI	consumer price index
EAP	East Asia and Pacific
ECA	Europe and Central Asia
EMDE	emerging market and developing economy
EU	European Union
FDI	foreign direct investment
FY	fiscal year
G20	Group of Twenty: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Türkiye, the United Kingdom, the United States, and the European Union
GDP	gross domestic product
GEP	Global Economic Prospects
GHG	greenhouse gas
IMF	International Monetary Fund
LAC	Latin America and the Caribbean
LIC	low-income country
MNA	Middle East and North Africa
NBFIs	non-bank financial institutions
OECD	Organization for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
OPEC+	OPEC and Azerbaijan, Bahrain, Brunei Darussalam, Kazakhstan, Malaysia, Mexico, Oman, the Russian Federation, South Sudan, and Sudan
PM2.5	particulate matter 2.5
PMI	Purchasing Managers' Index
PPP	purchasing power parity
RHS	right-hand scale
SAR	South Asia
SOE	state-owned enterprise
SSA	Sub-Saharan Africa
TFP	total factor productivity
toe	tons of oil equivalent
VAR	vector autoregression
WDI	World Development Indicators

CHAPTER 1

Solid progress, but a long way to go

Chapter 1. Solid progress, but a long way to go

At just under 6 percent, output growth in South Asia is expected to remain stronger than in other regions in 2023–25, even with weak growth in the countries recovering from recent balance-of-payments crises. Foreign exchange and financial markets in these countries have stabilized, in part owing to the introduction of IMF-supported policy programs. But the financial systems of many countries in the region remain vulnerable and fiscal positions remain fragile. In some cases, restrictions on imports and foreign exchange transactions have yet to be fully unwound. The outlook is subject to downside risks from weak financial systems and fiscal positions. Growth prospects would also worsen in the event of a further economic slowdown in China or climate change-related natural disasters. In the short term, policy priorities include preserving financial stability and improving fiscal sustainability. In the longer term, it is important to boost private investment growth, make economies more open to trade, and seize the opportunities offered by the global energy transition.

Introduction

Global output growth continues to slow, but this has had only limited spillovers to South Asia, thus far. At just under 6 percent, growth in the region remains stronger than in any other EMDE region, supported by faster potential output, resilient exports, and increasing remittance inflows. Most countries are making solid progress, with the exception of a few countries recovering from recent balance-of-payments crises.

Headline inflation has been declining in the rest of the world, but has remained elevated in South Asia. Food inflation in the region remains particularly high owing to both high global food inflation and local supply disruptions. As currencies have stabilized and some import controls have been relaxed, inflation is expected to trend down throughout the region. This trend could be interrupted in a variety of ways, however, including by further commodity price increases, exchange rate depreciations, or more persistent second-round effects of past inflation pressures than currently anticipated.

Financial systems in many countries are fragile, with limited capital buffers, high exposure to heavily indebted sovereigns, and high levels of nonperforming loans. Global developments have added pressure as major central banks have continued to raise policy rates to reduce inflation. This has added to depreciation pressures and borrowing cost increases across the region.

South Asia's output growth is forecast to remain broadly steady in 2023–25, slowing from 8.2 percent in 2022 to 5.8 percent in 2023 and 5.6 percent in 2024 and 2025 (figure 1.1). In all South Asian countries, projected growth will remain below the 2015–19 pre-pandemic average, with the fading of post-pandemic rebounds accentuated by combinations of monetary tightening, fiscal consolidation, and slowing global demand growth. Projected growth will also be insufficient to return output to the path projected before the pandemic. Finally, current growth rates are not strong enough for most countries to reach high-income thresholds within a generation.

Relative to the spring forecast, growth in 2023 has been upgraded by 0.2 percentage points due to stronger-than-expected data in India. The 0.3 percentage-point downgrade to the 2024 growth projection reflects weaker prospects for Bangladesh and Pakistan as both countries struggle to emerge from balance-of-payments difficulties.

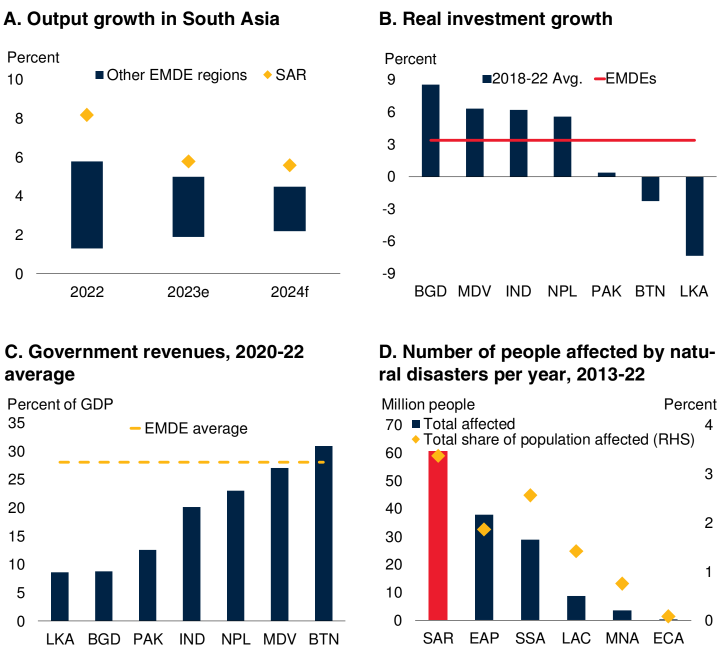
A number of downside risks could derail growth from the path projected in the baseline. A deterioration in market sentiment could re-ignite pressures on currencies, triggering renewed capital outflows, currency depreciations, rebounds in inflation, and further increases in borrowing costs. This risk is particularly elevated in countries with fragile financial systems and limited foreign exchange reserves.

The region would also be affected by any further slowdown in China's economic growth, though by somewhat less than other parts of the world. In addition, South Asia has become increasingly

Note: This chapter was prepared by Patrick Kirby, with contributions from Zoe Xie.

FIGURE 1.1 Overview

Output growth in South Asia is projected to remain stronger than in other regions. A sustained acceleration would require stronger private investment growth, which has been weak in most countries. The scope for government support is limited owing to high debt and still large deficits, an important source of which is weak revenue collection. Addressing these shortcomings would free up resources to fund the region's development priorities and support the growing number of people affected by natural disasters.



Sources: International Disaster Database (EM-DAT); WDI (database); WEO (database); World Bank (Macro Poverty Outlook).

Note: (e) = estimate; (f) = forecast; Avg.=Average; BGD = Bangladesh; BTN = Bhutan; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMDEs = emerging market and developing economies; IND = India; LAC = Latin America and the Caribbean; LKA = Sri Lanka; MDV = Maldives; MNA = Middle East and North Africa; NPL = Nepal; PAK = Pakistan; RHS = right hand side; SAR = South Asia; SSA = Sub-Saharan Africa.

A. Blue bars reflect the range of growth across all the other EMDE regions. Regional aggregate computed using 2015 GDP as weights. Sample includes 7 countries in SAR and 136 in other EMDE regions.

B. Figure shows the annual average growth of total real gross fixed investment (in local currency), over 2018-2022. EMDEs aggregate computed using 2015 GDP as weights. Sample includes 123 EMDEs (13 in EAP, 21 in ECA, 21 in LAC, 15 in MNA, 7 in SAR, and 46 in SSA).

C. EMDE average computed using 2015 GDP as weights. Bars show 2020-22 averages of government revenue.

D. Bars show the total population affected by natural disasters, and diamonds show the share of total population affected, annual averages over 2013-2022. Sample includes 144 EMDEs (22 in EAP, 20 in ECA, 31 in LAC, 18 in MNA, 8 in SAR, and 45 in SSA).

vulnerable to natural disasters. These can have substantial near-term economic and human impacts, and can also inflict lasting damage to productivity, especially in the agriculture sector, and food security.

In almost all countries in the region, private investment growth has weakened from its pre-pandemic pace. The slowdown in private investment comes at a time when public finances are severely constrained and a global energy transition is underway. This underscores the need for policies to boost private investment growth by expanding access to finance, improving business climates, ensuring that government support is well targeted, and increasing competition. Greater openness to foreign direct investment (FDI) and international trade would facilitate access to technology. It would also attract investment as advanced economies pivot toward more diversified supply chains.

Countries in South Asia have had persistently large fiscal deficits. Growing government debt burdens have become more costly to service as interest rates have risen. There is an urgent need for governments to reduce their borrowing requirements and the risks of debt default by strengthening government revenue collection and improving spending efficiency. This can include broadening tax bases, reducing subsidies on fossil fuels, and adhering to fiscal rules.

Chronically weak private investment growth and limited fiscal space risk delaying the adoption of technologies needed for the region to keep pace with the global energy transition. The region's energy intensity of output is twice the global average. The energy transition presents an opportunity to upgrade technologies and boost productivity, cut pollution, reduce reliance on energy imports, and increase employment.

At the same time, the transition to green technologies will have important labor market consequences. In most countries in the region, a larger share of workers is employed in pollution-intensive jobs than in green jobs. The adoption of green technologies will disproportionately favor better-educated workers in the formal sector. About 9 percent of the region's workers are employed in pollution-intensive jobs and they tend to be lower-skilled and informal. Policies to encourage the use of more energy-efficient technologies will need to be coupled with measures to boost overall job creation. A strong labor market can absorb workers who exit pollution-intensive activities and facilitate a smooth labor market adjustment for vulnerable workers.

Economic activity

Output growth in South Asia in 2023–24 is projected to remain stronger than in other EMDE regions. Nonetheless, it remains below pre-pandemic (2015–19) averages, and several countries are suffering from the aftermath of recent currency crises.

Global developments

Global economic growth is projected to slow further in 2023 and to stabilize in 2024. In the short term, most countries are grappling with continued high inflation and the effects of monetary policy tightening. In the longer term, output growth is projected to continue slowing in many countries, reflecting weakening growth of the labor force, productivity, or investment, or all three (Kilic Celik et al. 2023).

In the United States, there has been an extended period of robust expansion since late 2020, with rapid employment growth and low unemployment. This is now slowing as excess savings accumulated during the pandemic have largely been spent. Credit conditions have tightened along with monetary policy and also as a result of the banking sector turmoil earlier this year.

The euro area continues to struggle with above-target inflation and is expected to face a steep slowdown in growth. Confidence indicators point to persistent weakness and an increased risk of recession in the next few quarters.

In China, the rebound following the post-pandemic economic re-opening appears to have quickly faded. Continued fragilities in the property sector are having widespread spillovers to the rest of the economy, contributing to the emergence of deflation in recent months. Consumer spending has been relatively buoyant this year, but this has been offset by weakness in exports and investment. The government has thus far avoided implementing broad stimulus measures in favor of allowing the overheated real estate sector to cool.

The weakness of global growth is particularly pronounced in the manufacturing sector, whereas global services activity, while cooling, has remained robust. The global manufacturing PMI has been pointing to contraction since October 2022, while the corresponding services index has been at levels consistent with solid growth for most of this year (figure 1.2). The combination of slowing global growth and a shift away from the more import-intensive manufacturing sector means that external demand is providing little support to activity in most countries.

Regional developments

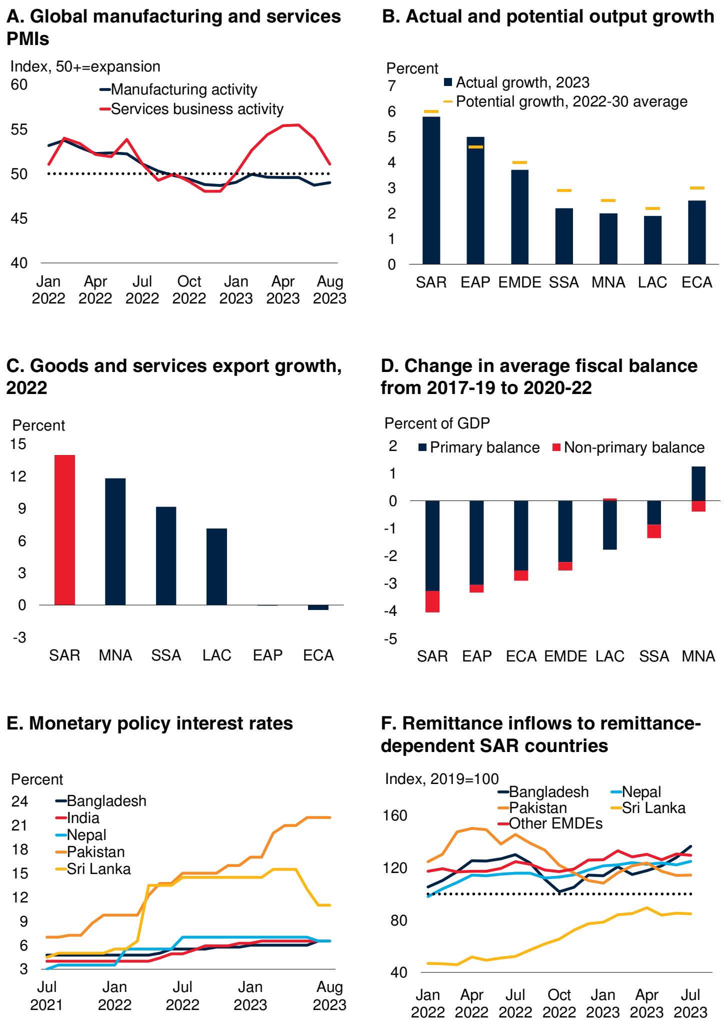
South Asia faces many of the same economic challenges as other regions, including elevated inflation, higher interest rates, the need for fiscal consolidation, and weak external demand. These are mitigated, however, by improving remittance inflows and tourist arrivals since the pandemic, and by the region's solid potential growth rate (Kose and Ohnsorge 2023). South Asia has also been less affected by slowing global growth than other regions, with export growth remaining relatively resilient. This may be due to differences in the composition of South Asia's exports, which tend to be more service-oriented. It may also be due to the region's below-average integration into the global economy as a result of limited transport connectivity and restrictions on trade and foreign currency transactions (World Bank 2016).

In *India*, robust output growth in the first half of 2023 was supported by a strong expansion of investment and, on a sectoral level, continued strength of services. Government infrastructure projects have supported momentum in the construction sector, which has grown at year-over-year rates of around 10 percent in recent quarters. Export growth has benefited from strong exports of services, such as those related to information technology and consulting, which have been little affected by the slowdown in global growth. India's services Purchasing Managers Index (PMI) reached 62.3 in August, nearly 10 points above the global index. Employment indicators have been weaker, however, suggesting that with appropriate policies the country's economic growth could deliver more robust job creation.

Activity in *Bangladesh, Pakistan*, and *Sri Lanka* has continued to suffer from the aftermaths of recent

FIGURE 1.2 Economic activity

Global output growth is slowing and shifting toward less trade-intensive services activities. South Asia is weathering this slowdown better than other EMDE regions, supported by solid potential output growth, resilient export growth, and strong remittance inflows. In recent years, fiscal deficits widened more in South Asia than in other regions. Now, however, fiscal consolidation as well as monetary tightening are contributing to the growth slowdown.



Sources: CEIC; Haver Analytics; Kilic Celik et al. (2023); Oxford Economics; United Nations Conference on Trade and Development; World Bank (GEP June 2023); World Bank (Macro Poverty Outlook).

Note: EMDEs = emerging market and developing economies; EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa.

A. Purchasing Managers' Indexes (PMIs) come from IHS Markit and are seasonally adjusted. PMIs above 50 (below 50) indicate expansion (contraction). Latest data are August 2023.

B. Potential growth is estimated based on production function approach. GDP-weighted averages. Potential growth averages cover 3 countries in EAP, 6 in ECA, 10 in LAC, 3 in MNA, 4 in SAR, and 3 in SSA.

C. Bars show GDP-weighted average of goods and services export forecasts. Sample includes 6 countries in EAP, 6 in ECA, 9 in LAC, 12 in MNA, 2 in SAR, and 14 in SSA.

D. Bars show changes in fiscal balances between the average for 2017-19 and the average for 2020-22. GDP-weighted averages.

F. Dotted line = 100.

balance-of-payments crises. All three countries have recently begun to implement IMF-supported policy programs to stem capital outflows and improve debt sustainability. Activity in all three cases has continued to be hampered by input shortages related partly to higher import costs and supply disruptions associated with remaining import restrictions. In all three countries, fiscal deficits remain large, while current account deficits have improved amid sharp import compressions.

Sri Lanka's economy has suffered the most severe contraction but appears to be past the worst of its crisis, with shortages of essential inputs easing and tourism recovering. The services PMI has been in expansionary territory since May 2023. Industrial production has been contracting since late 2021, but more slowly recently.

Pakistan's economic situation is also fragile. The U.S. dollar value of goods imports shrank by 26 percent in the year to August 2023 as a result of low demand alongside import and capital controls. Input shortages have affected production, with exports declining 5 percent in the year to August and industrial production shrinking by 15 percent in the year to June 2023.

Bangladesh has had the strongest recent growth of the three. However, economic activity is being restrained by supply disruptions from energy shortages and continued import and capital controls. Limited trade credit due to low quantities of foreign exchange in the banking system has also reduced imports. There was a noticeable deceleration in both private consumption and investment growth during FY23 as a result of high inflation and rising uncertainties related to the external sector.

Maldives, *Nepal*, and, to a lesser extent, *Bhutan* have been benefiting from the recovery in global tourism. Public investment in *Maldives* has been robust as a result of multiple ongoing projects, notably the expansion of its international airport. The associated increase in external debt has worsened the country's financial vulnerabilities, however. Growth in *Nepal* slowed in FY23, reflecting monetary policy tightening and import restrictions. It has improved more recently as the removal of import restrictions late last year has increased the availability of productive inputs. Growth in *Bhutan* has been lifted by spillovers from strong growth in India, despite a contraction in the electricity sector. Construction and manufacturing activities have strengthened, and the services sector has been supported by transport - and trade-related services activities.

Afghanistan is adjusting to a structurally lower level of aggregate demand following the cessation of grant inflows and the breakdown of international banking relationships in 2021. Inflation peaked in July 2022 at a year-on-year rate of 18 percent and then declined steeply, leading to deflation since April 2023. Deflation is likely the result of weak aggregate demand, improved supply conditions, and the appreciation of the exchange rate. Surveys show that about two -thirds of Afghan families face significant challenges in maintaining their livelihoods (World Bank 2023a).

Inflation

Inflation in South Asia rose sharply as a result of rising global commodity prices and currency depreciations. It remains above 7 percent in the median country, partly due to continuing increases in food prices.

Global developments

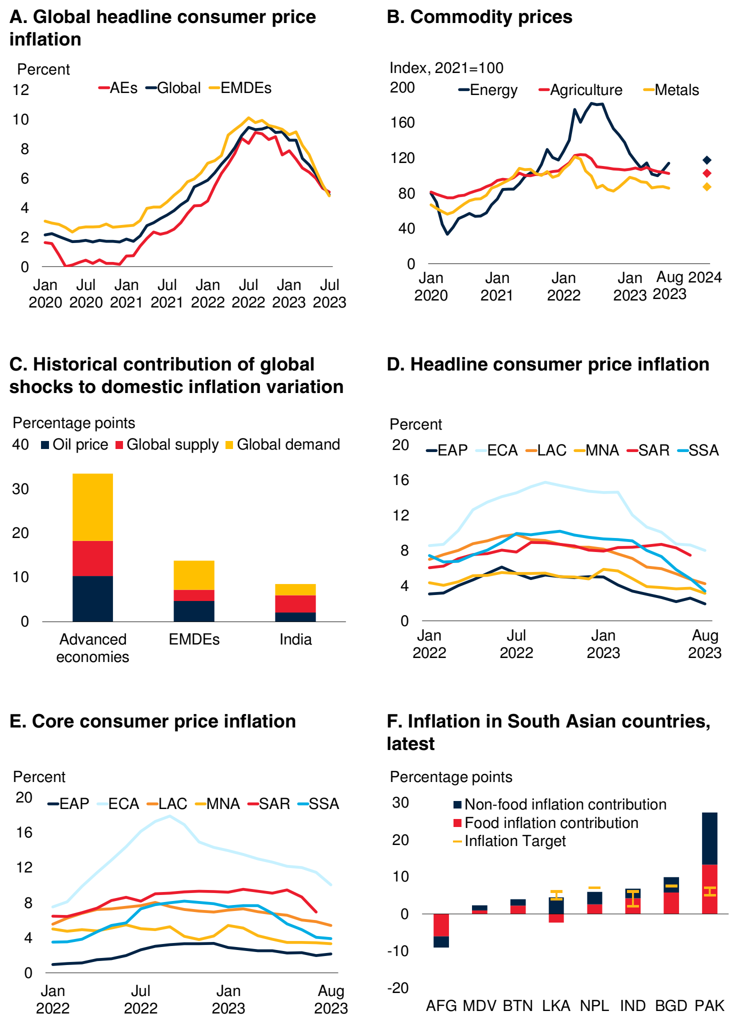
Global headline inflation declined from a peak of 9.4 percent year-on-year in July 2022 to 4.9 percent in July 2023 (figure 1.3). Until recently, falling commodity prices were contributing to this decline. More recently, extended production cuts by OPEC and its partners and high demand from the transportation sector have pushed up energy prices. Global core consumer price inflation remains stubbornly elevated.

Regional developments

Historically, inflation in South Asia has tended to be less driven by global developments than elsewhere, with domestic developments being more important (Ha et al. 2019). Recent events are an exception. The rise in global prices resulting from the end of the pandemic and Russia's invasion of Ukraine worsened local vulnerabilities in several countries in the region, leading to

FIGURE 1.3 Inflation

Inflation has been declining globally, but has remained elevated in South Asia. Falling commodity prices were dampening inflation until energy prices started to increase more recently. Historically, inflation in South Asia has tended to be less driven by global developments than elsewhere, but recent global shocks interacted with local vulnerabilities in many countries, triggering currency depreciations and large increases in domestic inflation. Rising food prices are contributing to continued high inflation in several South Asian countries.



Sources: Afghanistan National Statistics and Information Authority (NSIA); CEIC; Haver Analytics; World Bank.

Note: AEs = advanced economies; AFG = Afghanistan; BGD = Bangladesh; BTN = Bhutan; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMDEs = emerging market and developing economies; IND = India; LAC = Latin America and the Caribbean; LKA = Sri Lanka; MDV = Maldives; MNA = Middle East and North Africa; NPL = Nepal; PAK = Pakistan; SAR = South Asia; SSA = Sub-Saharan Africa.

A.D.E.F. Median year-on-year inflation by country group.

A. Sample includes 39 AEs and 101 EMDEs. Last observation is July 2023.

B. Diamonds show 2024 forecasted values from the April 2023 edition of the World Bank's *Commodity Markets Outlook*. Solid lines show the monthly values from the June 2023 edition of the World Bank *Global Economic Prospect* report. Last observation is August 2023.

C. Bars show the median shares of country-specific inflation variance accounted for by global shocks (global demand, global supply, and oil prices) based on country-specific factor-augmented vector autoregression models estimated for 29 advanced economies and 26 EMDEs for 1971-2017.

D. Sample includes 11 countries for EAP, 22 for ECA, 22 for LAC, 15 for MNA, 6 for SAR, 26 for SSA. Last observation is August 2023.

E. Sample includes 7 countries for EAP, 9 for ECA, 13 for LAC, 6 for MNA, 6 for SAR, 8 for SSA. Last observation is August 2023.

F. Latest CPI data is July 2023 for Afghanistan, Bhutan and Nepal, and August for Bangladesh, India, Pakistan, and Sri Lanka. The inflation target range for Pakistan is 5-7 percent, to be met by the end of FY25.

increases in current account deficits and currency depreciations. These were met with the imposition of import controls. As a result of these overlapping factors, several countries saw large increases in domestic inflation, especially Bangladesh, Nepal, Pakistan, and Sri Lanka.

Median headline and core inflation remain near 7 percent in South Asia, and inflation in the region has not slowed as rapidly as in other regions. Food inflation remains particularly high owing to both high global food inflation and local supply disruptions. As currencies have stabilized and some import controls have been relaxed, inflation is expected to trend down throughout the region. This trend could be interrupted in a variety of ways, however. Commodity prices could increase, exchange rates could depreciate, or the second-round effects of past shocks could be more persistent than currently anticipated.

In *India*, inflation was trending down below the upper bound of the inflation target range before a disruptive monsoon caused a substantial recent increase in food prices. To counter this, the government has implemented an export ban on most types of rice. The Reserve Bank of India increased interest rates substantially last year, and has kept them steady since this February.

In *Pakistan*, consumer price inflation stood at 27 percent in the year to August, down from a peak of 38 percent in May. The decline reflected the stabilization of the exchange rate since the beginning of the year, following 18 months of substantial depreciation, as well as an unwinding of the food price spike caused by the widespread damage from last year's floods. The central bank has tightened monetary policy to combat high inflation, increasing its benchmark interest rate by 100 basis points most recently in June, to 22 percent.

In *Bangladesh*, inflation soared to a decade high of 9.9 percent in the year to May, driven by double-digit food inflation. Headline inflation remains elevated as a result of currency depreciation alongside rising commodity prices. The central bank has tightened monetary policy in response and loosened an interest rate cap that was limiting the transmission of policy changes to the economy. It is also transitioning to an interest rate targeting regime from a system based on targets for monetary aggregates.

In *Sri Lanka*, inflation peaked around 70 percent year-on-year in September 2022 but has since slowed sharply as the effects of last year's currency depreciation have faded. Unlike other central banks in the region, the Central Bank of Sri Lanka has been cutting its policy rates since June, in response to steep disinflation and economic contraction.

Financial conditions

Global financial conditions remain challenging, while several South Asian countries are recovering from recent balance-of-payments crises. Many remain vulnerable to further shocks.

Global developments

Between late 2021 and early 2023, central banks in most advanced economies hiked key interest rates at the fastest pace since the 1980s in response to persistent, above-target inflation. In recent months, however, the pace of increases has slowed, and policy rates in many major economies seem close to peaking (figure 1.4). The effects of monetary tightening can be seen in rising borrowing costs and credit standards. Despite these developments, volatility and risk spreads have remained low in most markets, and major stock indexes have risen markedly this year.

Most EMDEs have weathered this period of financial tightness without severe strain. Net capital inflows have been low but positive, and bond issuance has rebounded after a severe contraction last year. Most EMDE currencies have been stable since the beginning of the year.

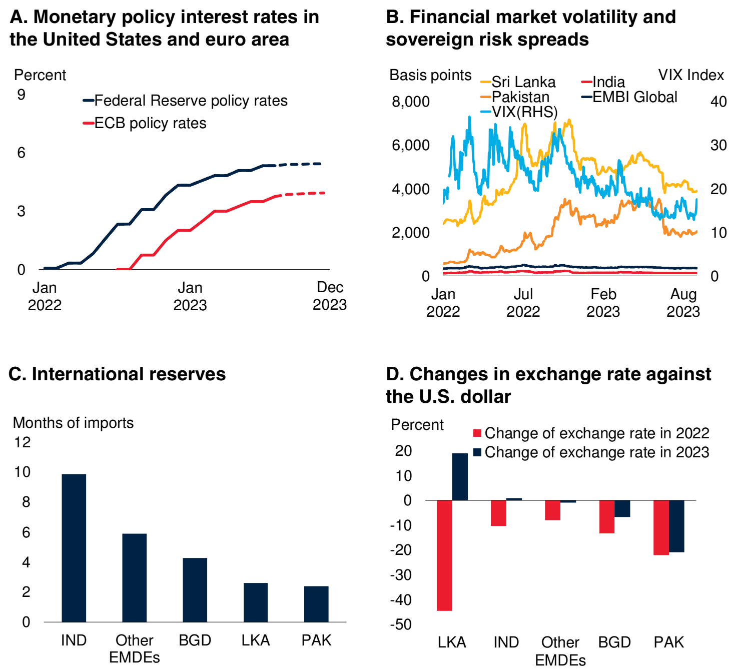
There are, however, pockets of weakness, as many countries with lower credit ratings are struggling with severe and unsustainable increases in borrowing costs. Historically, higher interest rates in advanced economies have often been associated with financial stress in EMDEs, particularly those with greater economic vulnerabilities (Arteta, Kamin, and Ruch 2023).

Regional developments

Recent global stresses helped to trigger balance-of-payments crises in several countries in South Asia. These countries suffered widening current account deficits, sharp exchange rate depreciations, capital outflows, widening credit spreads, and the depletion of foreign exchange reserves. In response to these developments, several countries introduced capital controls and import restrictions, many of which remain in place. The situation stabilized earlier this year due in part to the introduction of IMF-supported policy programs. Severe underlying problems remain, however, and the financial systems of several countries remain vulnerable to adverse shocks.

FIGURE 1.4 Financial conditions

Monetary policy interest rates in major advanced economies are close to peaking. Global financial market volatility and sovereign risk spreads worsened substantially last year, resulting in multiple currency crises, but have eased in 2023. Low international reserves and fragile financial systems make some countries vulnerable to further shocks.



Sources: Bloomberg; CEIC; Chicago Board Option Exchange; JP Morgan.

Note: BGD = Bangladesh; ECB = European Central Bank; EMBI = emerging market bond index; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; PAK = Pakistan.

A. Figure shows end of month policy rates from the U.S. Federal Reserve Board and European Central Bank. Dashed lines show policy rate expectations. Last observation is September 22, 2023.

B. Figure shows the sovereign spread for SAR countries and for the broader EMBI Global index, and the volatility index (VIX). Last observation is September 22, 2023.

C. Figure shows the number of months of imports that foreign reserves can cover. Last observation is 2023Q2.

D. Bars show the cumulative change in exchange rate—U.S. dollars per unit of local currency—during 2022 and 2023. A positive value indicates appreciation against the U.S. dollar. "Other EMDEs" is an unweighted average of 29 countries. The latest data is 2023Q2.

Financial stresses were most severe in *Pakistan* and *Sri Lanka.* In *Pakistan*, the rupee depreciated sharply between early 2022 and early 2023, and has been broadly stable since. Last year's attempts to limit capital outflows through import and capital controls diverted remittance inflows from formal channels, contributing to shortages of foreign currency. In *Sri Lanka*, the rupee has appreciated modestly since the beginning of the year, partially reversing last year's depreciation of more than 40 percent against the U.S. dollar. Remittances have rebounded as the economy has stabilized, although they remain well below 2019 levels. There has also been a recovery in tourism earnings. In both Pakistan and Sri Lanka, foreign reserve coverage is low, asset quality is weak in both the bank and non-bank financial sectors, and buffers against future shocks are thin.

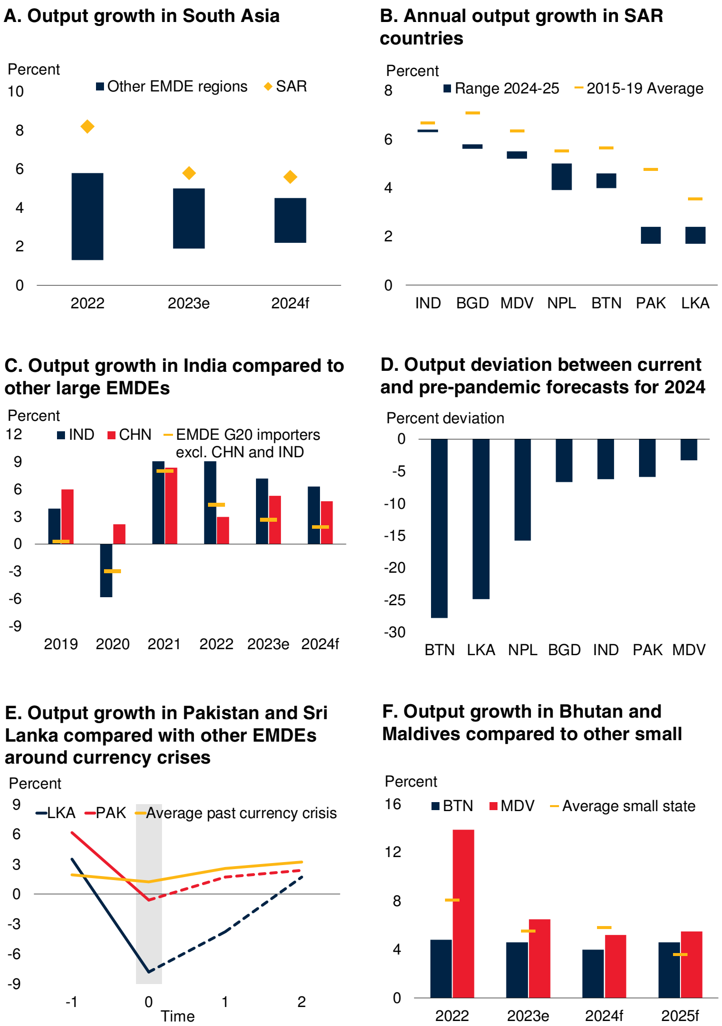
In *India*, the financial sector has shown few signs of strain. Bank balance sheets and corporate leverage ratios have improved substantially in recent years. The current account deficit has been predominantly financed by foreign portfolio investment and remittances. Foreign exchange reserves are at a healthy level, while the currency has alternated between periods of stability and mild depreciation. Nonperforming loans in the banking sector are low.

Bangladesh suffers from limited foreign reserves and a reliance on administrative policies—primarily import controls—to stem outflows. Remittance inflows have been volatile, and the currency has been depreciating steadily. The country has previously attempted to contain its current account deficit through exchange and import controls alongside multiple exchange rates. This has encouraged the growth of a substantial informal exchange market. The authorities are committed to unification of the exchange rate this year, but import and capital controls are expected to remain in place for an extended period.

In *Nepal*, the financial system appears robust. Remittance inflows have surpassed pre-pandemic levels, reaching nearly 22 percent of GDP in 2022 and helping to alleviate pressures on the balance of payments.

FIGURE 1.5 Outlook for output growth

Projected output growth in South Asia is stronger than in other regions, but below its potential rate and below pre-pandemic averages in all South Asian countries. Individual countries in the region are generally, but not always, outperforming other EMDEs with similar characteristics.



Sources: Consensus Economics; Laeven and Valencia (2020); WDI (database); World Bank.

Note: BGD = Bangladesh; BTN = Bhutan; CHN = China; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan; SAR = South Asia. Peer groups growth rates are calculated using simple averages.

A. Blue bars reflect the range of growth across all the other EMDE regions. Regional aggregate computed using 2015 GDP as weights. Sample includes 7 countries in SAR and 136 in other EMDE regions.

B. Blue bars show the range of annual GDP forecasts for the period 2024-25.

C. Sample in the comparator group includes 2 EMDE G20 commodity importers (Mexico and Türkiye) and excludes China and India.

D. Bars show the percent gap between level of output in the current forecast for 2024 and the forecast produced in 2019 for 2024.

E. Peer group includes 101 EMDEs experiencing currency crisis (as defined by Laeven and Valencia 2020) over the period 1970–2017. Currency crises are defined as nominal depreciation of the currency vis-à-vis the U.S. dollar of at least 30 percent that is also at least 10-percentage-points higher than the rate of depreciation in the year before. Shaded area represents FY2022/23 for Pakistan (which narrowly misses the definition of a currency crisis) and calendar year 2023 for Sri Lanka. For all other EMDEs, t = 0 represents the period in which a currency crisis occurred independently of the year. Dashed lines show GDP forecasts.

F. Peer group includes 19 EMDE small states (with populations between 0.25 million and 1.5 million).

In *Bhutan*, nonperforming loans in the banking sector remain elevated. Financial sector risks may be under-reported in official statistics due to ongoing forbearance measures that seek to prevent a loan from becoming nonperforming and resolve the stock of existing nonperforming loans.

Maldives has substantial external debt burdens related to fiscal strains from the pandemic, as well as major infrastructure investments. Servicing this debt could present challenges if growth or capital inflows disappoint.

Outlook

South Asia's growth (excluding Afghanistan) is forecast to slow from 8.2 percent in 2022 to 5.8 percent in 2023 and 5.6 percent in 2024 and 2025 (table 1.1). For most South Asian countries, growth in 2023–25 will remain below the pre-pandemic (2015–19) average, with the fading of post-pandemic rebounds accentuated by combinations of monetary tightening, fiscal consolidation, and slowing global demand growth (figure 1.5).

In all South Asian countries, projected growth is insufficient to return output in 2024 to the path projected before the pandemic. Current growth rates are also not high enough for most countries to reach high-income thresholds within a generation. Closing both of these gaps will require additional strong reforms.

Compared to the spring edition of this report, the 0.3 percentage-point downgrade for 2024 is accounted for by lower projected growth for Bangladesh and Pakistan. Both countries are struggling to emerge from balance-of-payments problems. In 2025, growth is generally expected to return to its underlying, potential pace.

Private consumption in the region is expected to be dampened by monetary tightening in response to continued inflation pressures. Import growth in several countries has been constrained in recent years by the combination of economic crises and restrictive policy measures. This is expected to rebound as currencies remain broadly stable and import restrictions are gradually relaxed.

The region's current account balances are expected to remain in deficit, with little change over the

TABLE 1.1 Growth in South Asia

	Country fiscal year	Real GDP growth at constant market prices (percent)				Revision to forecast from April 2023 (percentage point)	
Calendar year basis		2022	2023(f)	2024(f)	2025(f)	2023(f)	2024(f)
South Asia region (excluding Afghanistan)		**8.2**	**5.8**	**5.6**	**5.6**	**0.2**	**-0.3**
Maldives	January to December	13.9	6.5	5.2	5.5	-0.1	-0.1
Sri Lanka	January to December	-7.8	-3.8	1.7	2.4	0.4	0.7
Fiscal year basis		**21/22**	**22/23(e)**	**23/24(f)**	**24/25(f)**	**22/23(e)**	**23/24(f)**
Bangladesh	July to June	7.1	6.0	5.6	5.8	0.8	-0.6
Bhutan	July to June	4.8	4.6	4.0	4.6	0.1	0.9
India	April to March	9.1	7.2	6.3	6.4	0.3	0.0
Nepal	mid-July to mid-July	5.6	1.9	3.9	5.0	-2.2	-1.0
Pakistan	July to June	6.1	-0.6	1.7	2.4	-1.0	-0.3

Sources: World Bank Macro Poverty Outlook; World Bank staff calculations.
Note: (e) = estimate; (f) = forecast. GDP measured in 2015 prices and market exchange rates. Pakistan is reported at factor cost. National accounts statistics for Afghanistan are not available. To estimate regional aggregates in the calendar year, fiscal year data are converted to calendar year data by taking the average of two consecutive fiscal years for Bangladesh, Bhutan, Nepal, and Pakistan, as quarterly GDP data are not available.

projection horizon. Strong growth in services exports and remittances is expected to be essentially offset by a recovery in imports and weak growth of goods exports. The regional outlook is predicated on the assumption of no substantial worsening of balance-of-payment pressures.

Investment growth in parts of the region, particularly India, is expected to remain robust, especially due to strong public investment. In many other countries, however, it will be constrained by a combination of factors. These include higher borrowing costs, tighter credit conditions associated with stressed financial conditions and crowding out by public borrowing, and restrictions on access to imported capital goods.

Fiscal policy is expected to weigh on growth. Primary fiscal deficits are expected to narrow over the projection period, particularly in Bangladesh, Pakistan, and Sri Lanka, as these countries consolidate their fiscal positions in line with their IMF-supported policy programs. The Indian government is also tightening its fiscal position modestly, even as it maintains high capital expenditures.

Given the limited fiscal and external buffers of countries in the region, there are considerable downside risks to the baseline growth forecast, including rising import prices, stalled progress on structural reforms, and policy uncertainty.

Country developments

In *Bangladesh*, output growth is expected to slow further as a result of persistent balance-of-payments pressures. Growth is projected to slow from 6.0 percent in FY2022/23 to 5.6 percent in FY2023/24, before picking up to 5.8 percent in FY 2024/25. Investment growth is expected to be particularly weak, as lending is impaired by the financial system's elevated level of nonperforming and rescheduled loans, the tightening of monetary policy, and policy uncertainty. Import restrictions and shortages of foreign exchange, which are expected to continue in the near term, will also continue to impede growth. While weak global growth will weigh on exports in general, the country's largest export—ready-made garments—is less sensitive to changes in aggregate global demand. Consumption growth is expected to remain robust, supported by buoyant remittances and population growth. Inflation remains elevated and is expected to stay above the central bank's target in FY2023/24, even as the effects of last year's currency depreciation fade.

Bhutan's economy is estimated to have grown by 4.6 percent in FY2022/23 as borders re-opened and hydropower exports rebounded. Growth is expected to slow to 4.0 percent in FY2023/24, stronger than previously forecast in part due to a major salary increase for government workers. The recovery in tourism has lagged the broader recovery, largely owing to a sizable increase in the tourism levy in September 2022, which has since been partially relaxed. Bhutan's growth is expected to continue to underperform other small states. Private investment growth is expected to remain weak. Credit supply is being restrained by a moratorium on new housing and hotel construction loans and by high nonperforming loans in the banking sector.

Although *India's* post-pandemic economic rebound is now fading, growth is expected to remain stronger than in other large EMDEs. Output is forecast to grow by 6.3 percent in FY2023/24 and 6.4 percent in FY2024/25—roughly equal to the estimated pace of India's potential growth. The dampening effect of monetary policy tightening on domestic demand, particularly investment, will likely peak in the coming year. The effects of slowing global demand and rising interest rates will be mitigated by India's low external debt and the healthy balance sheets of its financial and corporate sectors. Growth of merchandise exports is expected to slow as a result of weak foreign demand growth, although this will be offset by robust services exports.

Output in *Maldives* is expected to grow by 6.5 percent this year before slowing to 5.2 percent in 2024 and 5.5 percent in 2025. Tourism has rebounded strongly from the global pandemic. The recovery is expected to continue for longer than in other small states because investments in the tourism sector will increase capacity, particularly the expansion of Velana International Airport.

In *Nepal*, growth is estimated to have slowed to 1.9 percent in FY2022/23 as the post-pandemic recovery waned, monetary policy tightened, and policy efforts to close the current account deficit weighed on activity. Import restrictions were put in place between April 2022 and January 2023 to contain the growing trade deficit. This led to shortages of many inputs needed for production, an expansion of informal markets, and a sharp fall in government revenues. Growth is expected to rebound to 3.9 percent in FY2023/24, as these shortages ease, and as tourism inflows and remittances continue to rise. Investment in hydropower remains strong, while activities related to the reconstruction of infrastructure destroyed by the 2015 earthquake is fading.

Pakistan's economy is estimated to have shrunk by 0.6 percent in FY2022/23, reflecting widespread damage from the 2022 floods, elevated inflation, and difficulties with its balance of payments. Positive growth is projected to return in FY2023/24, but at a rate of only 1.7 percent. The economy remains dependent on capital inflows to finance substantial fiscal and current account deficits. Import controls intended to narrow the trade deficit have also impeded the supply of industrial raw materials and depressed growth more than expected. These controls have been removed this year as an IMF lending program has stabilized the currency and boosted business confidence. Nonetheless, the economy still faces substantial challenges from continued inflation pressures, tight fiscal policy related to debt repayments, and extensive flood damage. Pakistan's foreign exchange reserves remain low, leaving the country with limited buffers against external shocks.

In *Sri Lanka,* the economy appears to have bottomed out after its severe recession and is showing signs of recovery. Support from the IMF and other external lenders has helped stabilize the currency and ease import shortages. The economy is also being supported by the recovery of tourism. After contracting by 3.8 percent in 2023, the economy is expected to grow by 1.7 percent in

2024 and 2.4 percent in 2025. The country's path to recovery is very narrow, however. Its limited fiscal and reserve buffers leave little room for error as it implements a broad set of reforms and restructures its external debt.

No forecast has been formulated for *Afghanistan*, as official data collection halted in 2021. The country's economy remains fragile, but surveys indicate that basic food and non-food items are available in sufficient quantities, and that employment and wages have improved this year (World Bank 2023a).

Risks and vulnerabilities

Risks to the baseline forecast remain tilted to the downside. The most pressing concerns are financial and fiscal stress, slowing activity in China, and climate change.

Financial crises

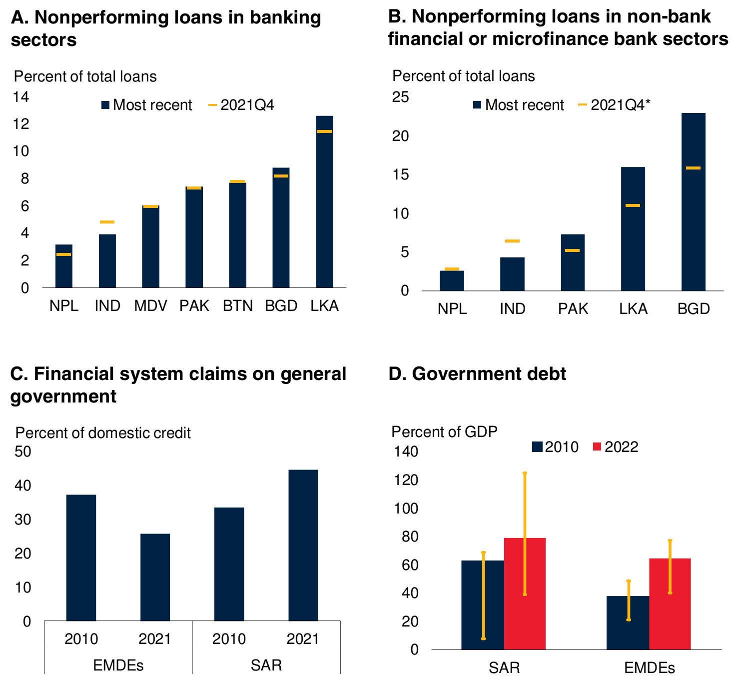
Several countries in the region are vulnerable to financial market disruptions. Bangladesh, Pakistan, and Sri Lanka have drawn on IMF assistance to weather the global shocks of higher commodity prices and borrowing costs and (in the case of Sri Lanka) reduced tourism earnings, and to stem capital outflows and currency depreciation. Maldives may also require assistance when its interest expenses triple to a peak of about US$1 billion in 2026. The region's persistent trade deficits have averaged 4 percent of GDP since 2015. These require financing by capital inflows, which can make countries vulnerable to adverse shifts in market sentiment. Such shifts can result from stress in either the private sector—particularly the financial system—or in governments' fiscal positions. Vulnerability to sudden changes in investor sentiment is particularly high in countries with low foreign currency reserves.

The financial systems of many South Asian economies are under pressure from challenging domestic economic conditions and rising borrowing costs. Nonperforming loans in bank and non-bank financial sectors have recently exceeded 5 percent of total assets in all South Asian countries for which there are data, except Nepal (figure 1.6). This leaves limited buffers against adverse shocks. In Sri Lanka, nonperforming assets, as a proportion of total assets, have recently been as high as 11 percent in the banking sector and 17 percent in the non-banking sector. In Bangladesh, the corresponding figures have been nearly 9 and 23 percent, respectively. In contrast, nonperforming loans in both India and Nepal appear to have been low.

The sovereign-bank nexus is strong throughout the region and could propagate adverse shocks (World Bank 2023b). On average, nearly half of South Asian countries' financial systems' assets are claims on the government. This share is higher

FIGURE 1.6 Financial risks

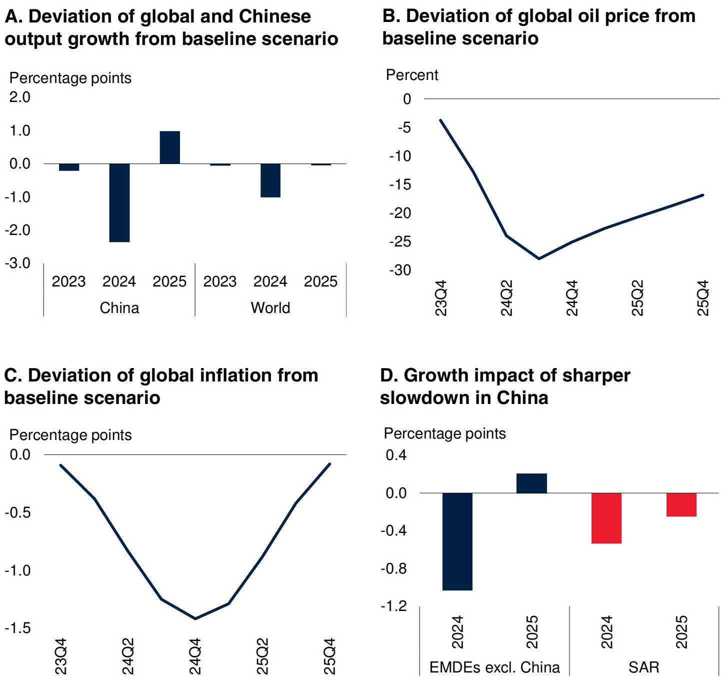
Nonperforming loan ratios are rising or are already elevated in most South Asian countries; further increases would erode capital buffers and could eventually alarm financial markets. Large and growing holdings of government debt by domestic financial systems leave them vulnerable to shifts in confidence in the sovereign and risk crowding out private sector credit.



Sources: CEIC; IMF (various staff reports); Kose et al. (2022); national sources; World Bank.
Note: BGD = Bangladesh; BTN = Bhutan; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan; SAR = South Asia.
A. The most recent data is 2023Q1 for Bangladesh, India, Nepal, and Sri Lanka, 2023Q2 for Bhutan, Maldives, and Pakistan.
B. The most recent data is 2022Q2 for Bangladesh, 2022Q3 for Nepal, and 2023Q1 for India, Pakistan, and Sri Lanka. 2021Q1 is used for India's historical number. The data is for microfinance banks for Pakistan, and for non-bank financial institutions for other countries.
C. GDP-weighted averages (at 2010-19 average prices and market exchange rates).
D. Bars show unweighted averages (at 2010–19 average prices and market exchange rates). Yellow whiskers indicate minimum-maximum range for seven South Asian economies, and interquartile range for EMDEs.

FIGURE 1.7 Scenario: Sharper economic slowdown in China

In a scenario where China's real estate sector slows down sharply before policy makers intervene with stimulus, global growth, commodity prices, and inflation would all be lower than in the baseline forecast. The spillover to South Asia would be smaller than to other regions.



Sources: Oxford Economics; World Bank.
Note: EMDEs = emerging market and developing economies; SAR = South Asia.
A. Bars show the percentage points deviation between the output growth assuming a sharper slowdown in China and output growth forecasted under the baseline scenario.
B. Solid line shows the percent deviation of the oil price assuming a sharper slowdown in China and the oil price forecasted under the baseline scenario.
C. Solid line shows the percent deviation between global inflation assuming a sharper slowdown in China and global inflation forecasted under the baseline scenario.
D. Bars show growth revisions between the China slowdown scenario and the baseline scenario. SAR includes 6 countries.

than in other EMDE regions and has risen sharply over the past decade. As a result, falls in the valuation of government debt can result in significant erosion of the market value of banks' assets. At 86 percent of GDP in the average South Asian country, government debt is higher than in other EMDE regions. And it is rising as a result of growing government spending, low (and in some cases declining) domestic revenue, and increasing debt service costs (spotlight). Any loss of credibility resulting from fiscal slippages, delays in debt restructuring negotiations, or the revelation of losses at a major state-owned bank or enterprise, could drive borrowing costs and debt to unsustainable levels.

In the longer term, capital outflows could increase governments' reliance on domestic financing. This could crowd out private borrowing, and make it more difficult for less connected and less formal firms to access finance than it already is. It has been estimated that a 10-percentage-point increase in the share of government loans in total bank assets is associated with a 1.6-percentage-point decline in annual loan growth to the private sector (World Bank 2023b). Increased debt service costs could also crowd out other essential public expenditures and increase the rigidity of government spending, and also contribute to high inflation to by encouraging governments to "print money" to erode high levels of debt.

Slowdown in China

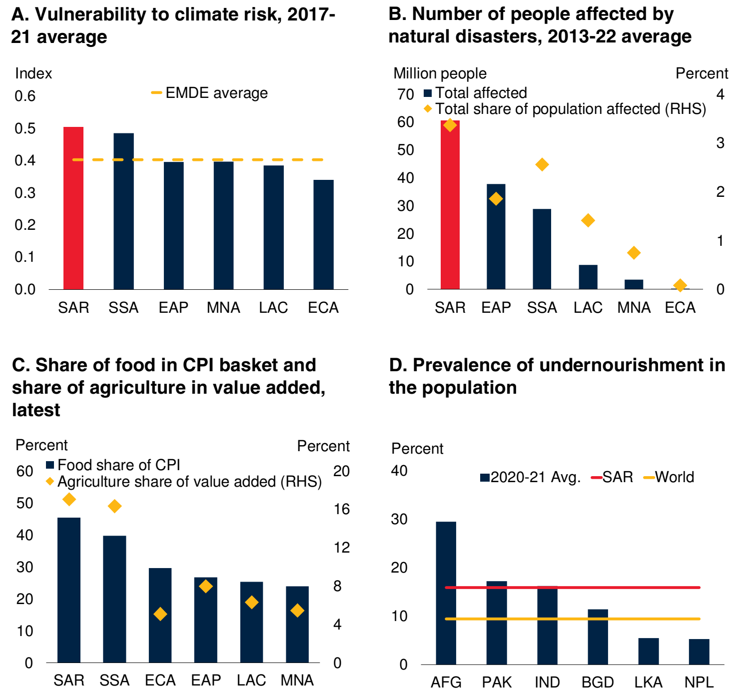
In the baseline forecast, China is expected to support global activity with output growth of 5.1 percent in 2023, 4.4 percent in 2024, and 4.3 percent in 2025. Persistent challenges in China's real estate market, however, present downside risks to this outlook. Falling housing prices, defaults by major developers, and declining lending are already weighing on consumption and investment.

In a scenario with a sharper-than-assumed real estate sector slowdown, the real estate sector would increasingly weigh on the Chinese economy, possibly reducing growth to 4.9 percent in 2023 and 2.0 percent in 2024. In response, the government could introduce a variety of stimulus measures, including infrastructure spending and support for credit issuance. These measures could push up growth in 2025 to 5.3 percent.

In this scenario, the slowdown and subsequent rebound would have widespread spillovers to other countries, primarily through external demand and commodity prices (figure 1.7). Oil prices would be 22 percent lower in 2024, on average, than in the baseline scenario. Global inflation would move in the same direction, and would be 1.4 percentage points lower at the end of 2024. On balance, central banks worldwide could be expected to begin loosening monetary policy earlier in this scenario than in the baseline. The U.S. Federal Reserve, for example, could begin cutting its policy rate as early as November 2023, reducing it by the end of 2024 to 150 basis points below the baseline.

FIGURE 1.8 Climate risks

South Asia is the EMDE region most vulnerable to climate risks, with the largest number of people affected by natural disasters in the past decade. Because of South Asia's large agricultural sector, extreme weather events can be especially disruptive. Shocks to food markets and prices can exacerbate food insecurity because South Asia is the EMDE region with the highest share of food in consumption baskets.



Sources: FAOData Explorer; Ha, Kose, and Ohnsorge (2023); IMF Consumer Price Index Database; International Disaster Database (EM-DAT); Maldives Bureau of Statistics; Notre Dame Global Adaptation Initiative; WDI (database); World Bank.

Note: AFG = Afghanistan; Avg. = Average; BGD = Bangladesh; BTN = Bhutan; CPI = Consumer Price Index; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMDEs = emerging market and developing economies; IND = India; LAC = Latin America and the Caribbean; LKA = Sri Lanka; MDV = Maldives; MNA = Middle East and North Africa; NPL = Nepal; PAK = Pakistan; SAR = South Asia; SSA = Sub-Saharan Africa.

A. Regional aggregates computed using 2015 GDP as weights. Values shown are average over 2017-21. Sample includes 148 EMDEs (22 in EAP, 22 in ECA, 31 in LAC, 18 in MNA, 8 in SAR, and 47 in SSA).

B. Bars show the total population affected by natural disasters, and diamond shows the share of total population affected; annual averages over 2013-22. Sample includes 144 EMDEs (22 in EAP, 20 in ECA, 31 in LAC, 18 in MNA, 8 in SAR, and 45 in SSA).

C. Regional aggregate computed using 2015 GDP as weights. The share of food and non-alcoholic beverages in CPI basket for the most recent reporting period is used. Sample includes 137 EMDEs (21 in EAP, 18 in ECA, 29 in LAC, 15 in MNA, 8 in SAR, and 46 in SSA). The share of agriculture, forestry, and fishing value added in GDP (2021-22 average). Sample includes 138 EMDEs (18 in EAP, 22 in ECA, 31 in LAC, 15 in MNA, 8 in SAR, and 44 in SSA).

D. Aggregates computed using 2015 population as weights, excluding countries with missing values. World sample represents 99 percent of world population.

The spillovers to South Asia would generally be smaller than to other EMDE regions. South Asian growth could be 0.5 of a percentage point lower in 2024, compared to a 1.0 percentage point growth slowdown for EMDEs overall (excluding China). This is partly because the region is more closed to trade than other EMDE regions, and partly because the region is heavily reliant on energy imports, whose prices would decline.

Climate change-related disasters

South Asia is highly exposed to both the short- and long-term adverse effects of climate change, more so than most other EMDE regions (figure 1.8). Much of the region's population lives in dense river valleys that are increasingly subject to severe floods. A recent example is the floods that submerged one-third of Pakistan last year, causing economic losses equivalent to more than 4 percent of GDP (World Bank 2022a). Bangladesh's losses from tropical cyclones alone are estimated to average 0.7 percent of GDP per year (World Bank 2022b). According to the Global *Climate Risk Index,* Bangladesh ranks seventh, Pakistan eighth, and Nepal tenth among the countries most severely affected by extreme weather events globally during 2000–19 (Eckstein, Künzel, and Schäfer 2021). A recent study designated Afghanistan among the countries most at risk from heat waves (Thompson et al. 2023). The countries at highest risk from natural disasters are often already poor and ill-equipped to weather shocks (Rentschler, Salhab, and Jafino 2022).

The growing frequency and severity of weather disasters pose risks to food production in both South Asia and elsewhere. Disruptions to either local or global food supplies could drive up food prices and households' living expenses. Food is a sizable part of households' consumption baskets in South Asia, with over 45 percent of the region's CPI basket consisting of food and non-alcoholic beverages, compared with an EMDE average of about 29 percent.

Rising food prices would hurt the urban poor most, as more than half of their budgets are devoted to food and, unlike their rural counterparts, they do not produce food themselves (Aksoy and Hoekman 2010; Dovonou and Xie 2023; Gill and Nagle 2022; Nasir, Kishwar, and Meyer 2023). High and volatile food prices make it more challenging to maintain a nutritious diet, exacerbating food insecurity, which is widespread in the region.

Increasing climate risks also have longer-term implications, especially since the agriculture sector accounts for 17 percent of total value-added and more than 40 percent of employment in South Asia. Agricultural production is already being depressed in areas rendered too hot for crops or destroyed by flooding. The heat waves, droughts, and changing weather patterns associated with climate change could make some areas entirely uninhabitable. Coastal areas and the entirety of Maldives risk being covered by rising water levels. Another risk is that coastal areas may become unsuitable for crop production due to soil and water salination (Hooijer and Vernimmen 2021).

Policy challenges

In the near term, policy priorities include preserving financial stability and restoring fiscal sustainability. In the longer term, a range of structural measures will be needed to accelerate growth and job creation in a sustainable manner. These include strengthening private investment growth and seizing the opportunities presented by both the global energy transition and the global effort to diversify supply chains.

Strengthening investment

Many factors that supported investment growth globally in the early 2000s weakened around the time of the global financial crisis. Investment growth subsequently trended downward around the world (Stamm and Voristek 2023). This included South Asia, as manufacturing growth weakened amid sluggish global demand, financial stress, and uncertainties related to government policies (Kasyanenko et al. 2023). However, the decline in South Asian investment growth was smaller than in other EMDE regions, although with wide disparities across countries.

More recently, investment growth has generally followed two contrasting patterns in South Asia. In Bhutan, Pakistan, and Sri Lanka, the average annual growth rate of investment in the past five years has been negative or near zero, with public investment particularly weak in Pakistan and private investment growth particularly weak in Bhutan (figure 1.9).

By contrast, in the second group of countries—Bangladesh, India, Maldives, and Nepal—investment growth has been robust and well above the EMDE average. In Bangladesh and India, this rapid growth has been supported by public investment growth of around 10 percent per year—triple the EMDE average. Sustaining this pace of public investment growth may become increasingly challenging as government debt and borrowing costs rise.

In all countries in the region, private investment growth has slowed since the pre-pandemic period (2015–19), or is forecast to do so. The weakness of private investment growth has been mirrored in the region's below-average net inflows of FDI. In 2021–22, FDI in South Asia accounted for around 1.5 percent of GDP, considerably less than the EMDE average of 2 percent.

Accelerating the pace of catch-up with high-income countries will require substantial new investment and substantial increases in productivity. The productivity gaps are large: productivity levels in South Asia are the second-lowest among EMDE regions after Sub-Saharan Africa (Dieppe 2021). Currently, growth in the region is not strong enough for most countries to reach high-income thresholds within a generation. Potential growth in the region averages about 5 percent, but would have to be 8 percent or higher in most countries to reach high-income status by 2050. Weak investment also threatens to delay the region's progress with the energy transition.

Strengthening private investment will depend on many factors. These include the presence of complementary infrastructure, a supportive institutional and business environment, a sound financial system, and fewer distortionary policies affecting markets.

- *Public investment*. Effective public investment and high-quality infrastructure can crowd in private investment. Public infrastructure projects, such as the construction of the Padma Bridge in Bangladesh, and various railways and road projects in India, have the potential to spur investment and economic activities in the surrounding area (World Bank 2023c, 2023d). The efficiency of public investment projects in many countries could be improved through a supportive public investment management framework (World Bank 2023e, 2023f, 2023g).

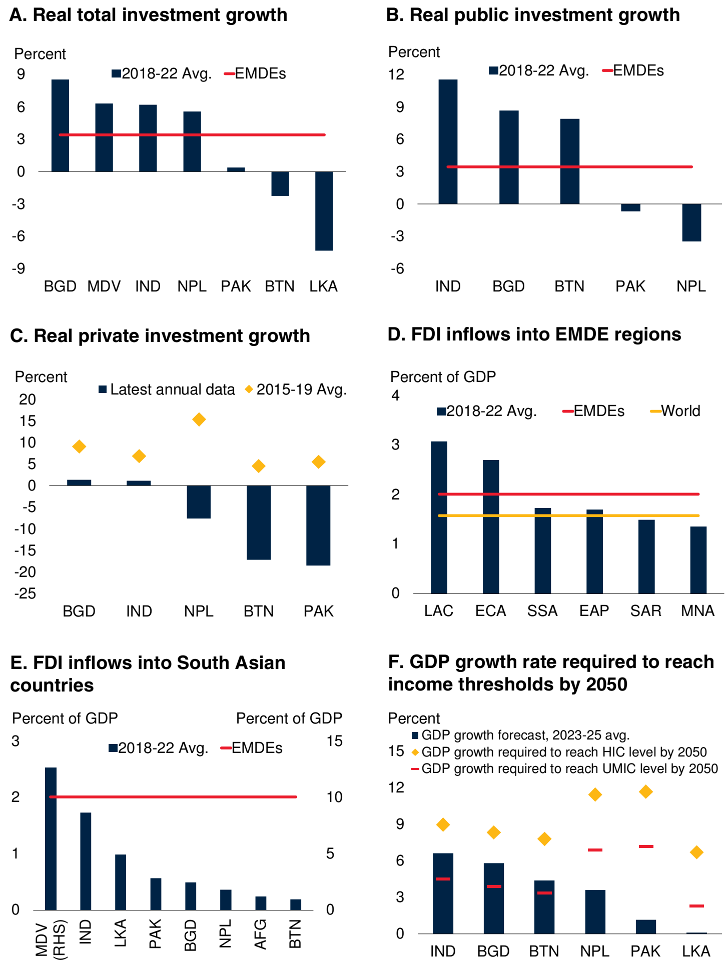
- *Supportive institutions.* Better public institutions also tend to attract more private investment and FDI (Ali, Fiess, and MacDonald 2010; Gwartney, Holcombe, and Lawson 2006; Heilbron and Whyte 2019). For example, spurts of investment climate reforms, especially in EMDEs, have been associated with an increase in real investment growth of about 6 percentage points per year (Stamm and Voristek 2023). Surveys of firms regularly show that policy and regulatory uncertainty, followed by taxation and burdensome regulations, are the most critical barriers to private sector investment (OECD 2015). Public institutions can also provide critical complementary services to enable functioning markets. For example, in many countries in the region, land records that are complete, transparent, and integrated across different parts of government would help improve the use of land for business purposes (World Bank forthcoming).

- *Business environment.* Allowing greater scope for competition could unleash private investment. For example, in Pakistan, certain tax policies discourage investment in the tradable sector, and certain investment laws discriminate against foreign investors (World Bank 2023f). In Bhutan, Nepal, and Pakistan, reducing subsidies or budgetary support to state-owned enterprises could allow for greater private sector participation while also increasing fiscal space (World Bank 2022c, 2023f, 2023h). In Pakistan, similarly, state-owned enterprises tend to have low investment rates, while also consuming government resources equivalent to around 23 percent of the fiscal deficit in FY2023 (World Bank 2023i).

- *Access to finance.* Private investment also depends on access to finance. Adverse liquidity shocks caused by troubled banks can hinder investment (Kalemli-Ozcan, Kamil, and Villegas-Sanchez 2016). In Sri Lanka, more robust deposit insurance, provisions for nonperforming loan resolution, and prudential supervision of concentrated loan exposures can help strengthen the financial system. Better governance of state-owned

FIGURE 1.9 Investment weakness

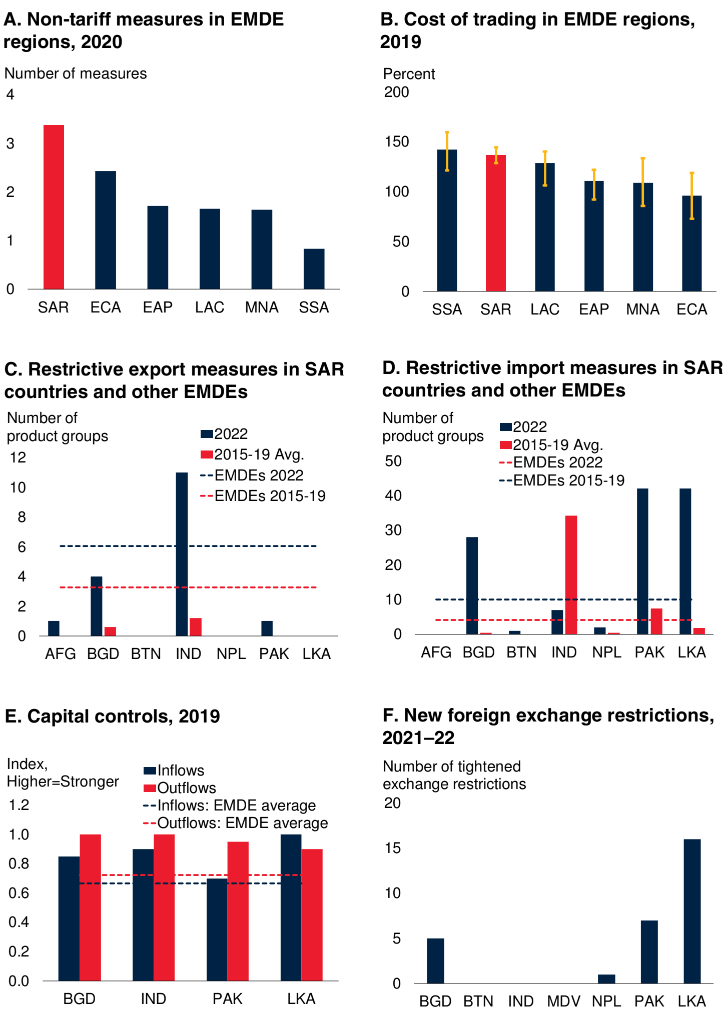
Investment growth in some South Asian countries has been negative or anemic in recent years, while in others it has been supported by robust public investment. Private investment growth in South Asia has slowed from its pre-pandemic averages. Private investment weakness has in part reflected below-average FDI inflows. Current growth rates are not sufficient for most countries to reach high-income thresholds within a generation.



Sources: UN Population Division (database); WDI (database); World Bank (Macro Poverty Outlook).
Note: Avg. = Average; AFG = Afghanistan; BGD = Bangladesh; BTN = Bhutan; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMDEs = emerging market and developing economies; FDI = Foreign Direct Investment; HIC = High-income country; IND = India; LAC = Latin America and the Caribbean; LKA = Sri Lanka; MDV = Maldives; MNA = Middle East and North Africa; NPL = Nepal; PAK = Pakistan; SAR = South Asia; SSA = Sub-Saharan Africa; UMIC = Upper middle-income country. Arithmetic annual averages. Aggregates computed using 2015 GDP as weights.
A. Figure shows the annual growth of real gross fixed investment (in local currency), average of 2018-22. Sample includes 123 EMDEs.
B. Figure shows the annual growth of real public fixed investment (in local currency), average of 2018-22. Sample includes 93 EMDEs.
C. Figure shows annual growth of real private fixed investment (in local currency), average of 2015-2019. "Latest data" refers to 2023, except for Bhutan and India, which are based on 2020-21 average due to limited data and to even out the deep contractions of 2020 and strong rebounds of 2021.
D. Figure shows net inflow of foreign direct investment as percent of GDP (2018-22 average). Sample includes 148 EMDEs (22 in EAP, 23 in ECA, 31 in LAC, 18 in MNA, 8 in SAR, and 46 in SSA). World sample includes 194 countries, representing 99.7% of world economy.
E. Figure shows net inflow of foreign direct investment as percent of GDP (2018-22 average). Sample includes 148 EMDEs.
F. Figure shows the GDP growth rate forecast for 2023-25 and the GDP growth rate required to achieve high-income and upper middle-income status by 2050. Population growth is from United Nation population projections. The threshold for high- and upper middle-income status is assumed to grow by 1.5 percent, its average growth rate between 1999 and 2019. The income threshold is based on GNI per capita in current U.S. dollars (Atlas method). Since the income threshold is based on GNI, while the forecast is based on GDP, this figure assumes equal growth rates of the two measures. Estimates for the required growth rate from other studies (e.g., Behera et al. 2023) assume an inflation rate differential and real appreciation between advanced economies and the country.

FIGURE 1.10 Restrictions on trade and foreign exchange transactions

South Asia generally employs an above-average number of trade and foreign exchange restrictions. In response to recent currency pressures, South Asian countries raised import and foreign exchange restrictions further to help address balance of payments issues and to stabilize foreign exchange markets.



Sources: Fernández et al. (2016); IMF (2022); Kose and Ohnsorge (2023); UNCTAD COVID-19 Trade Measures Database; World Bank; WTO Trade Monitoring Database.

Note: AFG = Afghanistan; BGD = Bangladesh; BTN = Bhutan; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan.

A. Bars show the unweighted average number of non-tariff measures (NTM) implemented by EMDEs in each region in 2020.

B. Data from Kose and Ohnsorge (2023; chart 6.5.B). Bilateral trade costs (as defined in the UNESCAP/World Bank database) measure the costs of a good traded internationally in excess of the same good traded domestically and are expressed as ad valorem tariff equivalent. Bilateral trade costs are aggregated into individual country measures using 2018 bilateral country exports shares. Bars show unweighted averages, whiskers show interquartile ranges. Sample includes 53 EMDEs (9 in EAP, 12 in ECA, 16 in LAC, 4 in MNA, 2 in SAR, and 10 in SSA).

C.D. Dashed lines mark the EMDE average, weighted by 2015 GDP. Restrictive measures include duties, tariffs, taxes, custom procedures, quantitative restrictions, and others. For export measures, EMDEs include 62 economies. For import measures, EMDEs include 90 countries. Product groups counted at the 2-digit Harmonized System (HS) level. Method counts number of measure-product group pairs, and so a product group affected by two restrictive measures is counted twice.

E. Dashed lines mark the average of 68 EMDEs, weighted by 2015 GDP. Index captures the severity of inflow and outflow capital control restrictions, including restrictions on money market, bonds, equity, mutual funds, financial credits, trade credits, and derivatives.

F. Number of tightened measures includes those in 2021 and part of 2022. The cut-off date is June 30, 2022 for Bhutan, Maldives, Nepal; July 31, 2022 for India and Sri Lanka; August 31, 2022 for Pakistan; and September 30, 2022 for Bangladesh.

enterprises would also improve the allocation of capital (World Bank 2023j). The dominance of state-owned banks in South Asia has been found to limit access to finance for smaller, newer businesses with strong growth potential but limited collateral or track records, as state-owned banks have tended to direct credit on the basis of non-economic criteria or have been managed inefficiently (IMF 2020; Melecky 2021). In Bangladesh, for example, reducing the role of the state in the financial sector, capital market reform, and stronger bank governance could help improve the allocation of capital (World Bank 2022b). Unclear or difficult-to-enforce ownership of assets such as land can limit the collateral available to potentially successful small companies, which could be an important engine of vigorous private investment growth (Zhang et al. 2020). Asset quality forbearance measures in banks can help zombie firms to stay afloat and crowd out credit for healthy productive firms (Chari, Jain, and Kulkarni 2021).

Vigorous private investment is critical not only for growth but also for environmental reasons. Private investment in energy-saving technologies will be key if the region is to keep pace with the global energy transition (chapter 2). Such investment could be encouraged through combinations of market-based regulations, carbon taxes, cuts in fossil fuel subsidies, more reliable grid power, and efforts to increase awareness among businesses of the benefits of energy-saving technological innovations.

Removing trade and foreign currency restrictions

South Asian countries impose more restrictions on trade and capital flows than countries in other EMDE regions (figure 1.10). Applied tariff rates are higher than in any other EMDE regions: the weighted average applied tariff on imports in South Asia was 9.4 percent in 2020, compared with 6.7 percent among other EMDE regions. Non-tariff trade barriers such as long custom clearance times and quantity control measures are also more numerous than the EMDE average. The cost of trading goods between South Asia and the rest of the world was around 140 percent of the value of the good itself, second highest among EMDE regions. The region also maintains more stringent capital controls than the average EMDE (Fernández et al. 2016). This was true prior to the pandemic and the use of these restrictions has expanded further over the past three years.

In recent years, increases in the prices of energy and other commodities, together with tightening monetary policies in advanced economies, have exacerbated balance-of-payments pressures in South Asia. In response, several countries in the region have increased the use of restrictive import measures, such as quantitative restrictions, tariffs, and more cumbersome custom procedures. In 2022, the number of product groups affected by various restrictive import measures in Bangladesh was seven times the EMDE average, and more than 10 times the EMDE average in Pakistan and Sri Lanka. While these restrictions may have helped reduce pressures in the external sector, they have also led to import shortages and depressed economic activity (World Bank 2023h, 2023k). They also added to fiscal pressures, particularly in countries such as Nepal that are dependent on import duties for government revenues.

Restrictions have also been introduced on the export side. These included a ban on Indian rice exports introduced in July 2023 to slow a rise in domestic rice prices that had resulted from an unfavorable monsoon, and to prepare for the possibility of agricultural productivity losses in the event of a severe El Niño.

Some South Asian countries imposed controls on foreign exchange transactions. Since 2021, many countries in the region adopted additional restrictions on foreign exchange. These included higher minimum financing requirements, more restrictive use of letters of credit, higher advance payments on imports, increased repatriation requirements on exports and other proceeds from overseas, and foreign exchange quotas. The most recent restrictive measures include a profit repatriation requirement for foreign investors in Bangladesh, foreign exchange quotas in Bhutan, increased cash margin requirements in Nepal, and increased scrutiny of the repatriation of revenues from exports in Pakistan (World Bank 2022d, 2023b). Such restrictions can be circumvented, for example by channeling foreign exchange through informal markets such as Hundi and Hawala (Biswas 2012; Steinkamp and Westermann 2022). This circumvention may eventually lead to even greater losses of foreign reserves (Gray 2021).

Lowering these barriers to trade and capital flows could help the region integrate into the global marketplace, with substantial benefits to long-term productivity. Pakistan, for example, could boost productivity, diversify its exports, and increase product sophistication by reforming export subsidy and import duty schemes (World Bank 2022e). The cost of shipping goods to and from Bhutan is elevated, and the country could unlock greater trade opportunities through investment in physical and digital infrastructure, combined with an improved and more predictable regulatory environment (World Bank 2020). Moving toward low and uniform import tariffs in Bangladesh could also spur private investment, increase competitiveness, and promote export diversification (World Bank 2023c).

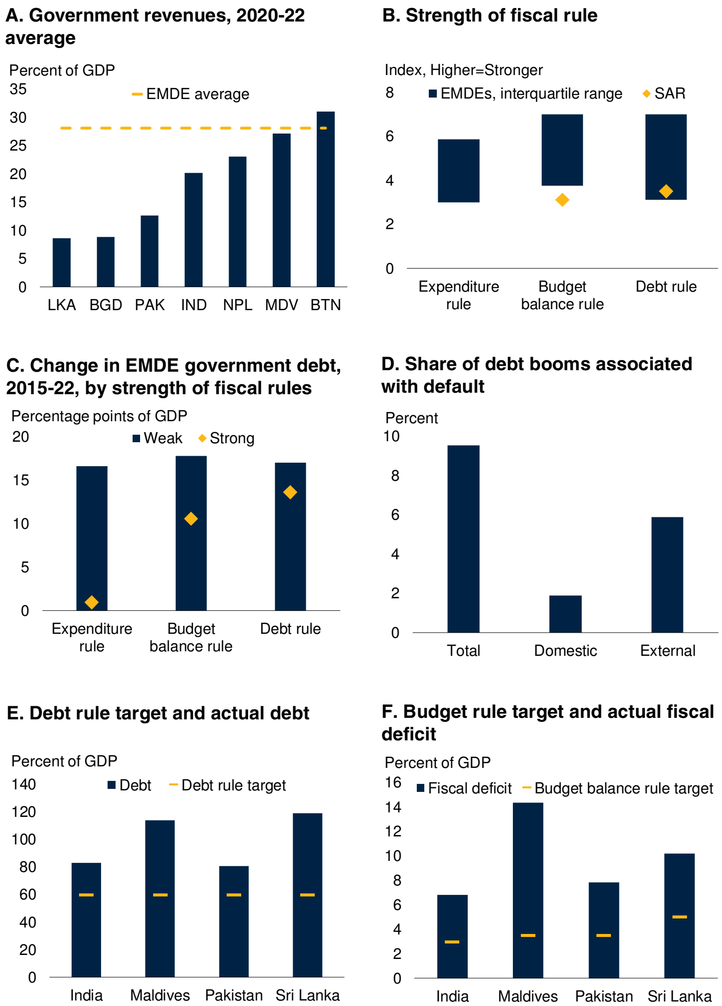
Improving fiscal positions

All countries in South Asia have had persistently large fiscal deficits. As a result, government debt burdens in the region have risen faster than in the average EMDE since 2010 (spotlight). As in other regions, government debt in South Asia soared during the pandemic as fiscal revenues fell and expenditures on support programs rose. The region's government debt has risen even during periods of strong growth, however. Slowing the rise in debt burdens will likely require continued strong growth, while reforms simultaneously limit financing costs, increase revenues, and improve spending efficiency.

Servicing this debt has become significantly more costly as global and national interest rates rise. To some extent, borrowing costs can be limited by sound and transparent debt management strategies that allows for financing to be provided at longer maturities, at fixed (and favorable) interest rates, and in local currency. On their own, however, such steps are unlikely to be sufficient to substantially reduce financing requirements. In Pakistan, for example, interest payments

FIGURE 1.11 Fiscal challenges

Revenue collection is below the EMDE average across South Asia, contributing to persistently large fiscal deficits. Stronger fiscal rules could help contain rising debt; current rules are generally weaker than the EMDE average. Governments in South Asia face the challenge of bringing government debt and deficits toward their indicative targets.



Sources: CEIC; IMF Fiscal Rules Dataset, 1985–2021; WDI (database); World Bank (Macro Poverty Outlook).

Note: AFG = Afghanistan; BGD = Bangladesh; BTN = Bhutan; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan; SAR = South Asia. Arithmetic annual averages.

A. EMDE average computed using 2015 GDP as weights. Bars show 2020–22 averages of government revenue.

B.C. The fiscal rule strength is constructed following Davoodi et al. (2022, appendix III), and is a sum of legal basis, monitoring, enforcement, and flexibility, weighted by the rule coverage (national, supranational, or both). SAR sample includes India, Maldives, Pakistan, and Sri Lanka. Sample includes 65 EMDEs (25 for the expenditure rule, 56 for the budget balance rule, and 52 for the debt rule). A higher index means a stronger fiscal rule.

B. Values shown are the unweighted average of fiscal rule strength index for countries in the group, over 2015–2021.

C. Values shown are the unweighted average change (2015–2022) in government debt for countries with above-average strength of fiscal rule (“Strong”) or below-average strength of fiscal rule (“Weak”), over 2015-21.

D. Bars show the share of total government debt booms associated with default (of any type), domestic government debt booms associated with domestic default, and external government debt booms associated with external default, up to one year after the end of a boom.

E.F. Latest data available. Budget balance rule for Pakistan is on federal budget deficit excluding foreign grants. Budget balance rule target and debt shown for India are for the central government.

accounted for more than half of federal current government expenditures in FY23.

A more direct approach to improving fiscal positions would be to tackle the region’s unusually low government revenue collection. All countries but one (Bhutan) collect less revenue than the EMDE average of nearly 30 percent of GDP, with revenues in Bangladesh and Sri Lanka below 10 percent of GDP (figure 1.11). Bhutan’s revenues are bolstered by external grants from India and other development partners.

A variety of measures can help increase revenues, such as expanding the tax base, closing loopholes, and strengthening collections. These could include reducing special exemptions and concessional rates of existing taxes. For example, targeting VAT exemptions to exclusively the consumption baskets of the poorest 40 percent could increase VAT revenue by 2 percent in Nepal (World Bank 2021). Similarly, in Maldives, halving the personal income tax threshold to MVR300,000 (equivalent to US$19,480) could raise income tax revenue by 0.5 percent of GDP (World Bank 2022f). Since low revenue collection is partly a consequence of large informal economies, a broader-based, simpler tax system that is perceived as fair could raise collections by smoothing the movement of businesses into the formal sector.

Spending efficiency could be improved by reducing subsidies, particularly those on fossil fuels. Energy subsidies in South Asia amounted to nearly 2 percent of GDP in 2021. South Asian governments in part provide such subsidies through fixed prices and support to state-owned enterprises in the energy sector. These subsidies are generally inefficient, regressive, costly, and environmentally damaging (Damania et al. 2023). Reducing these subsidies would improve fiscal sustainability and also speed the energy transition. Some countries in the region would also benefit from steps to avoid election-related increases in public spending (box 1.1).

In many countries globally, fiscal rules have been found useful for containing fiscal deficits (Caselli and Wingender 2018). Four South Asian countries have adopted debt ceilings—60 percent of GDP in India, Maldives, Sri Lanka, and Pakistan—and deficit targets—3 percent of GDP

BOX 1.1 Fiscal deteriorations around elections

Among EMDEs, primary fiscal deficits, primary government expenditures, and government wage bills have tended to rise significantly around election years. While primary spending increases have tended to be partially reversed in the following year, post-election reversals of primary deficit and government wage bill increases have been more variable and at best partial. The consequent ratcheting up of primary deficits around elections in EMDEs can erode fiscal sustainability over the longer term, while the expansion of government wage bills can result in spending rigidities. In South Asia, in particular, fiscal positions have tended to deteriorate around national elections, and, in some cases, there is also evidence of targeted fiscal actions around subnational elections. While this result is true on average for the region, some countries—notably India in its 2023 budget—have avoided the risk of election-induced current spending increases. This points to a way forward for fiscally constrained governments in South Asia.

Introduction

In 2023 and 2024, parliamentary or presidential elections will be held in seven out of the eight South Asian countries. With fiscal positions already fragile in several South Asian economies and government debt stocks high, spending increases, or revenue decreases around these elections would add to fiscal pressures.

A well-established literature has documented political budget cycles, in both advanced economies and EMDEs. These have been attributed to three factors. First, incumbents may adopt an expansionary fiscal policy designed to benefit voters directly, thus maximizing their chances of re-election (Nordhaus 1975; Dubois 2016). Second, incumbents may introduce policies ahead of elections to spur economic growth, in the hope of demonstrating the strength of their governments (Higashijima 2022; Han 2022). Third, if the expected outcome of an election is unfavorable for the incumbent or is uncertain, the incumbent may issue debt to constrain their successor's room for maneuver (Alesina and Tabellini 1990). The government wage bill, which accounted for 25 percent of primary spending in the average EMDE in 2010–20 (and 26 percent of paid workers), can be a particularly important instrument for influencing elections (Endegnanew, Soto, and Verdier 2017).

Several empirical studies have found evidence for election effects. A statistically significant—albeit generally small—political budget cycle has been identified in many cross-country studies.[a] This cycle appears to be more prominent in EMDEs, where income levels and governance are typically weaker than in advanced economies (de Haan and Klomp 2013; Kyriacou, Okabe, and Roca-Sagales 2022; de Haan and Gootjes 2023).

Thus, the evidence is that political budget cycles are common in EMDEs. This box examines political budget cycles for South Asia, in particular, to answer the following questions:

- How pronounced are political budget cycles in South Asia?
- How do political budget cycles in South Asia compare with those in other EMDEs?
- What are the policy implications?

This box contributes to the literature in three ways. First, it examines fiscal positions around national elections in South Asia, whereas the existing literature on political budget cycles in the region tends to focus on specific fiscal actions around subnational elections. Second, it documents that one spending category—the government wage bill—is particularly susceptible to political budget cycles around national elections in EMDEs. In contrast, the existing literature focuses on aggregate spending or fiscal deficits (de Haan and Klomp 2013; Kyriacou, Okabe, Roca-Sagales 2022; de Haan and Gootje 2023). Third, this box documents that political budget cycles tend to be only partially reversed after the election whereas the existing literature focuses on fiscal aggregates in the election year itself (Brender and Drazen 2005; Strong 2023).[b]

This box reports the following findings.

Note: This box was prepared by Jakob de Haan (University of Groningen), Franziska Ohnsorge, and Shu Yu.

a. See Brender and Drazen (2005); Shi and Svensson (2006); Vergne (2009); Klomp and de Haan (2011); Philips (2016); and Strong (2023).

b. An exception is Ebeke and Ölçer (2017), who report for a sample of low-income countries that governments have tended to raise trade taxes and cut government investment in the two years after elections, with no significant cuts in government consumption.

BOX 1.1 Fiscal deteriorations around elections (*continued*)

- In South Asia, primary fiscal deficits tended to widen in or just before national elections, on average by 0.5 percentage point of GDP, and only half of this deterioration was reversed in the two years after the election. For several South Asian countries, the literature finds evidence of narrowly targeted fiscal actions around subnational elections.
- Among EMDEs more generally, primary fiscal deficits, primary government expenditures, and government wage bills rose significantly around elections, on average by 0.7, 0.5, and 0.1 percentage point of GDP, respectively. South Asia is among the EMDE regions with particularly pronounced election effects.
- On average among EMDEs, primary spending increases averaging 0.5 percentage point of GDP were virtually fully reversed within a year following the election. However, increases in the government wage bill—small (0.1 percentage point of GDP) but statistically significant—were not reversed: in fact, they continued. There was wide variation in the extent to which primary fiscal deficit increases in election years were reversed but, on average, the reversal amounted to less than half of the increase during the election years. The consequent ratcheting-up of deficits as well as wage bills around elections could erode fiscal sustainability and lock in spending rigidities over the longer term.

This box draws on data for 122 EMDEs for 1984–2022. Data on fiscal outcomes and country characteristics are from the IMF's *World Economic Outlook and Government Finance Statistics* databases, and the World Bank's *World Development Indicators*. Election dates are from the *Database of Political Institutions* until 2020 and assembled from news reports for 2021–2022.

Political budget cycles in South Asia

Fiscal positions deteriorated considerably around several elections in South Asian countries. The literature has also found evidence of more narrowly targeted fiscal actions around subnational elections in several South Asian countries.

Literature review

The literature on political budget cycles in South Asia has identified significant budget cycles around subnational elections in the region's two largest countries between the 1960s and the mid-2000s.

In *India*, the existing literature covers the 1960s to the mid-2000s, restricting itself to frequently held subnational elections, and has documented narrowly targeted fiscal actions around state elections. Significant spending increases around state elections have been reported: in infrastructure-related social programs during 1960–2005 (Khemani 2010); in interest spending on subnational debt during 1960–2006 (Saez 2016); in capital spending during 1959–2012 (Ferris and Dash 2019, Khemani 2004); and in farm debt waivers in 2001/02 and 2018/19 (Mahambare, Dhanaraj, and Mittal 2022). State banks appear to have increased agricultural lending around state elections during 1992–1999 (Cole 2009). Similarly, contested constituencies benefited from greater improvements in power supply around state elections during 1992–2009 (Baskaran, Min, and Uppal 2015), while commodity revenue collections declined and capital spending rose around state elections during 1974–1995 (Chaudhuri and Dasgupta 2006).

In *Pakistan*, government spending was significantly higher in election years and significantly lower after elections during 2000–07 (Nasir, Nazir, and Khawaja 2022). Fiscal deficits were significantly larger in election years during 1973–2009 (Sieg and Batool 2012).

In contrast, for *Bangladesh*, no study has shown clear evidence of political budget cycles. The one study examining the question fails to find any systematic impact of political factors on disaster relief during 2010–14 (Karim and Noy 2020). However, monetary policy appears to have been significantly more accommodative in election years during 1980–2008 (Joarder, Hossein, and Ahmed 2016).

Event study

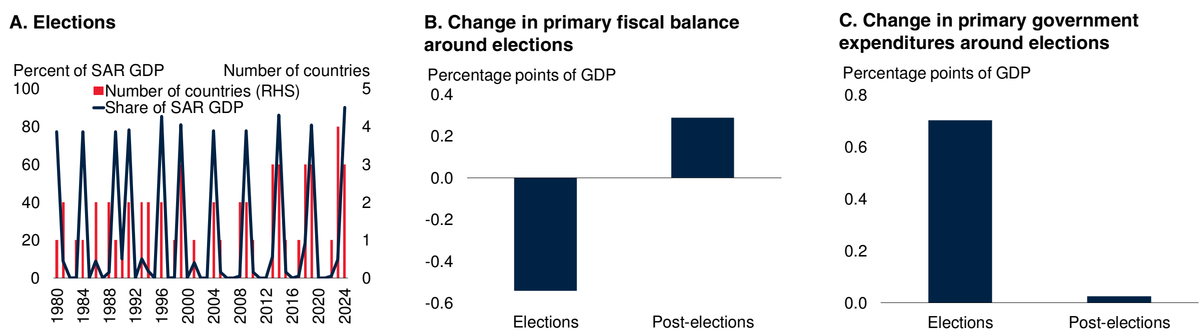
An event study of government spending around national elections in South Asia since 1991 suggests the presence of political budget cycles in most countries in the region, although of varying intensity.

Including elections planned for 2023–24, there will have been 53 presidential or parliamentary elections in the region since 1990: seven in Bangladesh; four in Bhutan; eight in India; eight in Pakistan; four in Nepal; twelve in the Maldives; and ten in Sri Lanka. Elections

BOX 1.1 Fiscal deteriorations around elections (*continued*)

FIGURE B1.1.1 Fiscal positions around elections in South Asia

There is a tendency toward a five-year bunching of elections in South Asia. Most elections have been accompanied by a considerable widening of primary fiscal deficits, and sometimes an increase in government spending, either in the election year or in the preceding year. The change in the primary balance tended to be partially reversed in the two years following the elections, although the increase in primary spending has not.



Sources: The Database of Political Institutions 2020; International Monetary Fund; World Bank; de Haan, Ohnsorge, and Yu (forthcoming).

Note: Based on 28 parliamentary or executive elections in SAR since 1991. Unweighted averages unless otherwise indicated. “Elections” is defined as the unweighted average of the change in the year before the election and the election year; “Post-elections” is defined as the unweighted average of the change in the year following the election and the subsequent year.

in South Asia have tended to be bunched together about every five years, as they are again in 2023–24.

For the seven South Asian countries in the sample, on average, the primary fiscal balance deteriorated either in the election year or in the year preceding the election by 0.5 percentage point of GDP; only half of this deterioration was unwound over the two years following the election (figure B1.1.1). In some cases, the widening of primary fiscal deficits in the runup to elections reflected spending increases.

Political budget cycles in South Asia and other EMDEs

Data for the South Asia region are severely limited and provide an inadequate basis for reliable policy lessons to be drawn. To broaden the analysis of political budget cycles, the larger group of EMDEs is examined (de Haan, Ohnsorge, and Yu forthcoming). On the assumption that the typical South Asian country behaves similarly to the typical EMDE, once the main country characteristics are controlled for, lessons may be inferred for South Asia.

A generalized-method-of-moments regression is estimated of fiscal outcomes on elections (annex 1.1.1). The fiscal outcomes that are examined are aggregate primary government expenditures, primary fiscal balances, and the government wage bill (all in percent of GDP). The sample includes up to 122 EMDEs for 1984–2022. The regression results are shown in annex tables 1.1.1–1.1.3.

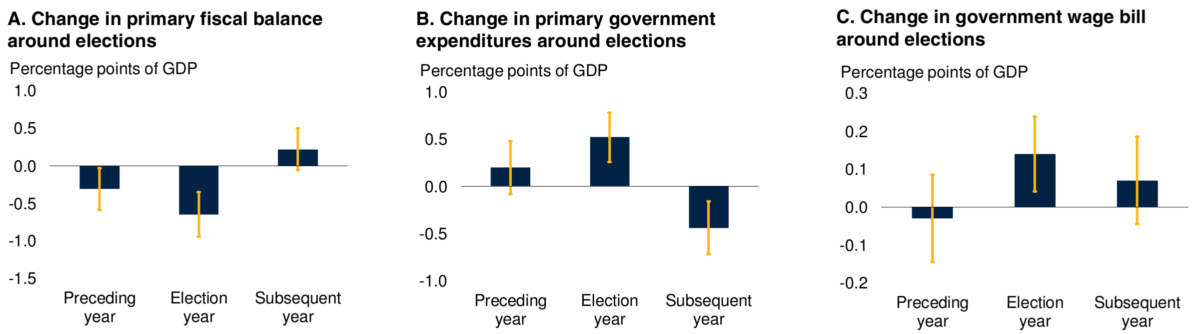
EMDE elections were typically accompanied by a fiscal deterioration (figure B1.1.2). In the average election year, the primary deficit widened by 0.7 percentage point of GDP, mostly because primary government spending rose by 0.5 percentage point of GDP. Government wage bills were higher in election years, on average by 0.1 percentage point of GDP. For robustness, other components of government spending, including government investment, were tested for similar systematic changes around elections but none was found.

Primary government spending increases around elections were short-lived and typically reversed within a year—with the exception of increases in government wage bills, which accounted for about 25 percent of primary expenditures in the average EMDE during 2010–20. Thus, the 0.5-percentage-point of GDP increase in primary government spending in the average election year was virtually entirely unwound in the year after the election. In contrast, the smaller (0.1

BOX 1.1 Fiscal deteriorations around elections (*continued*)

FIGURE B1.1.2 Political budget cycles in EMDEs

In election years and years preceding elections in EMDEs, primary fiscal deficits, primary fiscal spending, and the government wage bill tended to increase significantly. While primary spending increases have tended to be largely reversed in the following year, post-election reversals of primary deficits and government wage bills have been more variable.



Sources: The Database of Political Institutions 2020; de Haan, Ohnsorge, and Yu (forthcoming); International Monetary Fund; World Bank.

Note: Coefficient estimates from a generalized-method-of-moments (GMM) panel regression of elections on the primary fiscal balance (in percent of GDP), primary government expenditures (in percent of GDP), and compensation of employees (in percent of GDP), controlling for country characteristics. The sample includes up to 122 EMDEs for 1984–2022. Yellow whiskers indicate 90 percent confidence intervals unless otherwise specified. “Preceding year” is the coefficient on a lead of the election variable, and “Subsequent year” is the coefficient on the lagged election variable.

percentage point of GDP) but statistically significant increase in the government wage bill in the election year was not systematically unwound in the post-election year. With regard to the primary fiscal balance, the unwinding was more variable and, on average, smaller, than in the case of primary expenditure: in fact, there was too much heterogeneity in post-election movement for a statistically significant unwinding of the election-year increase to be identified.

Since increases in the primary fiscal deficit and the government wage bill around elections are not systematically unwound after elections, they can cumulate to sizable increases over the course of several elections. Since 1990, for example, the average EMDE in the regression sample has held a presidential or parliamentary election every three years. Assuming that fiscal deficits are financed by increases in government debt, the regression coefficients from annex table 1.1.1 imply that government debt would already be more than 10 percentage points of GDP higher and the government wage bill 0.6 percentage point of GDP higher than initially by the time that the fourth election cycle takes place.

Together with three other regions, South Asia has had particularly pronounced political budget cycles (figure B1.1.3). Election-year increases in fiscal deficits, primary balances, or government wage bills were statistically significant only in three regions, and South Asia was one of the only two regions where all three fiscal outcomes increased significantly. The inclusion of regional dummy variables left other coefficient estimates broadly unchanged. In South Asia, specifically, election years were associated with 0.6 percentage point of GDP higher primary deficits, 0.8 percentage point of GDP higher primary spending, and 0.2 percentage point of GDP higher government wage bills than in non-election years. Two of these three regions (including South Asia) were also the regions with more frequent switches between fully democratic and less democratic political regimes. These two regions accounted for two-thirds of all regime switches in EMDEs during 1975–2022.

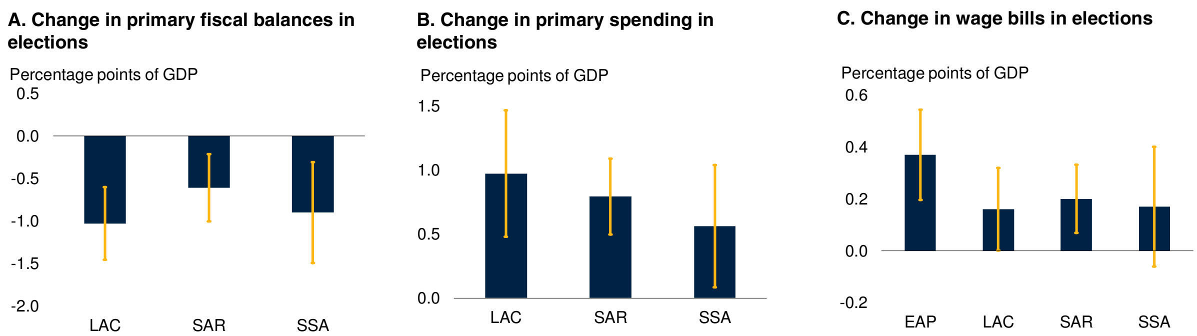
Policy implications

The empirical analysis suggests that deteriorations in fiscal positions, stemming particularly from spending increases, have been common in EMDEs at election times, regardless of political regimes. Yet the evidence that such fiscal actions affect election outcomes is decidedly mixed. Insignificant, or even adverse, effects on election outcomes for the incumbent government

BOX 1.1 Fiscal deteriorations around elections (*continued*)

FIGURE B1.1.3 Political budget cycles in EMDE regions

South Asia is among the regions with the most pronounced changes in fiscal positions around elections.



Sources: The Database of Political Institutions 2020; de Haan, Ohnsorge, and Yu (forthcoming); International Monetary Fund; World Bank.

Note: Coefficient estimates from a generalized-method-of-moments (GMM) panel regression of elections on the primary fiscal balance (in percent of GDP), primary government expenditures (in percent of GDP), and compensation of employees (in percent of GDP), controlling for country characteristics. The sample includes up to 122 EMDEs for 1984–2022. Yellow whiskers indicate 90 percent confidence intervals unless otherwise specified. LAC stands for "Latin America and the Caribbean", EAP stands for "East Asia and the Pacific", SAR stands for "South Asia", and SSA stands for "Sub-Saharan Africa.

have been reported for the United States (Peltzman 1992), EMDEs in Eastern Europe (Enkelmann and Leibrecht 2013) and Latin America (Kraemer 1997), and a large cross-country sample (Brender and Drazen 2008). However, more recent cross-country studies have reported that incumbents have benefited from fiscal actions in elections (Bojar 2017; Klomp and de Haan 2013), while voters sometimes punished incumbents for fiscal consolidation (Mulas-Granados 2004), although at other times they did not (Alesina 2012).

The lack of reversals of fiscal deficit increases around elections raises concerns about an erosion of fiscal sustainability over the longer term. Similarly, even the small, but statistically significant, ratcheting-up of government wage bills around elections in the average EMDE will tend to lock in spending rigidities that may become difficult to unwind in times of need.

To help prevent fiscal deteriorations around elections and their longer-term consequences, the establishment of more robust fiscal frameworks and institutional arrangements could be considered, as suggested by the experience of other countries.

- *Fiscal transparency.* There is empirical evidence that greater transparency in fiscal policymaking may make election-motivated fiscal policy action less likely by making them more visible (Alt and Lassen 2006 a, b; Gootjes and de Haan 2022).
- *Fiscal rules.* Fiscal rules, such as the Stability and Growth Pact in Europe and balanced budget requirements in some U.S. states, can constrain incumbents' ability to engage in election-motivated fiscal expansions (de Haan and Klomp 2013; Rose 2006; Alt and Rose 2009; Cioffi, Messina, and Tommasino 2012; Ebeke and Ölçer 2017; Gootjes, de Haan, and Jong-A-Pin 2021). A growing number of countries have adopted such institutional fiscal constraints: in 2015, 92 countries had fiscal rules in place, up from 7 countries in 1990 (Lledó et al. 2017).
- *Robust governance and control of corruption*. Political budget cycles have been less pronounced in countries with stronger checks and balances, stronger rule of law, and less corruption (Streb, Lema, and Torrens 2009; Shi and Svensson 2006; Lee and Min 2021). Checks and balances in the political system discourage incumbents from using policy for re-election purposes.

There are indications that, at least in some South Asian countries, the 2023–24 election season may break from past practice. In India, for example, the latest government budget is on track for fiscal consolidation amid upcoming elections (World Bank 2023d).

in India; 3.5 percent in the Maldives and Pakistan; and 5 percent in Sri Lanka. Yet, most of these countries are among those in South Asia with the highest government debt-to-GDP ratios. During the pandemic, many countries activated escape clauses to suspend fiscal rules. This allowed governments to provide much-needed support for vulnerable groups, but also added substantial debt. No countries in South Asia are projected to achieve their budget or debt rule targets in 2023. Achieving compliance represents a challenge.

The design of fiscal rules in South Asia is less binding than in other EMDEs, which can diminish their effectiveness. For example, in a sample of EMDEs with fiscal rules over 2015–21, those with weaker designs—measured in terms of coverage, legal basis, monitoring, enforcement, and flexibility—had larger increases in debt between 2015 and 2022. A variety of best practices in the design of fiscal rules has been identified, and could be adopted by South Asian governments (Caselli and Reynaud 2019).

- *Medium-term objectives with short-term flexibility*. A medium-term debt objective can provide the flexibility needed to prevent the erosion of political support for the rule during adverse events. Various types of escape mechanisms can ensure that the rule remains applicable even during economic shocks (Eyraud et al. 2018). In Germany and Switzerland, for example, deviations from target are accumulated over several years. Once this accumulation exceeds a certain threshold, adjustments must be made over the next few years to reduce the fiscal deficit (German Federal Ministry of Finance 2022; OECD 2011).

- *Safeguards for priority spending*. A fiscal rule that excludes capital expenditure can encourage public investment, but it needs guardrails against creative accounting (IMF 2009, 2018). Excluding capital expenditure from an expenditure rule can help ensure that governments' ability to raise recurrent spending (such as public wage bills) around elections is limited.

- *Transparency*. Effective fiscal rules tend to be clear and simple (Eyraud et al. 2018). Such characteristics can raise the reputational costs to governments of noncompliance and limit their ability to adjust targets around elections. Transparent implementation of fiscal rules, alongside regular reporting and monitoring, can help build their credibility and increase the probability of compliance (Andersen 2013).

Managing the energy transition

As the world presses ahead with the energy transition, South Asia will need to improve its energy efficiency to keep pace. In fact, the global energy transition presents an opportunity for South Asia to upgrade technologies and lift productivity, cut pollution, reduce reliance on energy imports, and create jobs. Currently, the energy intensity of the region's output is twice the global average, and substantially higher than in other EMDEs (figure 1.12).

India and Pakistan already rank among the world's five EMDEs with the largest *public* investment in renewable energies (chapter 2). But substantial *private* investment will be needed for firms to adopt green technologies. Governments can support the adoption of energy-saving and low-emission technologies. Measures could include ensuring the availability of financing, incentivizing a shift toward green energy by removing fossil-fuel subsidies, introducing carbon taxes, or introducing market-based regulation. Firms sometimes vastly underestimate the savings from new technologies. As a result, improving access to information about the availability, cost-saving potential, and competitiveness of green technologies can help boost adoption at limited cost. Access to reliable energy grids can encourage firms to phase out energy inefficient backup energy systems.

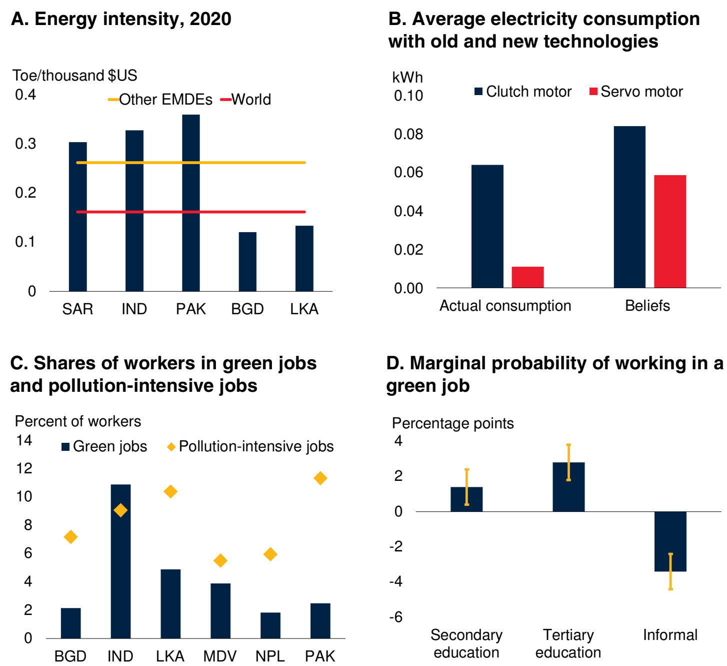
The energy transition is likely to create shifts in South Asia's labor markets (chapter 3). In almost all countries in the region, pollution-intensive jobs outnumber green jobs, and they account for 6–11 percent of all jobs in the region. Pollution-intensive jobs tend to be concentrated among lower-skilled and informal workers. Green jobs tend to be filled by higher-skilled and better-paid workers. Experience from economic transformations in other countries suggests they can have significant employment and earnings effects, both in the aggregate and for specific groups of workers.

A wide range of policies can facilitate the necessary adjustment in labor markets while protecting vulnerable workers. These include: enhancing access to education and training, finance, and markets; measures to facilitate labor mobility; and strengthening social safety nets. Some countries have already begun to put such policies in place. Nepal's *Green Resilient and Inclusive Development Strategic Action Plan* (*GRID SAP*) aims to combine climate-conscious growth strategies and improved air quality with equitable job creation. Channeling investments into green initiatives and supporting small and medium enterprises in areas that have potential for growth (particularly finance, tourism, resilient connectivity, renewable energy, forestry, waste management, and agriculture), as envisioned in the GRID, can foster labor participation and economic opportunities in the formal economy while reducing job disparities. Similarly, Bangladesh's *Climate-Smart Agriculture Investment Plan* aims to support and protect the livelihoods of farmers, especially women, and improve rural workers' green skill development, through capacity building, knowledge sharing, and financial resources.

An important collateral benefit of the energy transition will be reduced air pollution. The emission of pollutants that accompany South Asia's currently energy-intensive production processes has been shown to cause material economic and human losses by depressing worker productivity and worsening health and education outcomes (Behrer, Choudhary, and Sharma 2023; World Bank 2023l). Nine of the world's ten most-polluted cities are in South Asia (World Bank 2023l). Some 60 percent of South Asia's population live in heavily polluted areas. Pollution in the region is often trapped in large airsheds shaped by climatology and geography that span multiple countries (World Bank 2023l). In some cities, the majority of air pollution originates from neighboring states and countries. Airshed-wide air quality management, requiring cooperation across multiple South Asian countries, can benefit both the region's people and economy.

FIGURE 1.12 Managing the energy transition

The energy transition will require the adoption of greener and more energy-efficient technologies by firms, but such innovation is held back in part by the tendency of firms to underestimate potential savings. In almost all countries in South Asia, the share of workers in green jobs is less than that in pollution-intensive jobs. The energy transition will disproportionately improve job prospects for better educated workers in the formal economy



Sources: Annual Survey of Industries, India; European Commission; national statistical offices; OECD Green Growth database; World Bank.

Note: BGD = Bangladesh; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan; SAR = South Asia; Toe = tons of oil equivalent.

A. Energy intensity is defined as energy consumption (in tons of oil equivalent) relative to nominal GDP (in thousands of U.S. dollars) in 2020 (chapter 2).

B. Estimates of mean electricity consumption based on hourly readings of electricity meters installed in one clutch and one servo motor sewing machine in each of 124 intensive treatment firms. Meter readings collected for every day in January. Mean baseline beliefs about daily electricity consumption by a clutch motor and servo motor sewing machine in the full sample of firms measured in the baseline survey.

C. Green jobs are those in occupations with a positive share of environmentally friendly tasks. Pollution-intensive jobs are those with above-median pollution intensity. More details can be found in annex 3.1 (chapter 3). Labor force surveys are available for Bangladesh (2015), India (2018), Sri Lanka (2019), Maldives (2019), Nepal (2017), and Pakistan (2018).

D. Marginal probabilities as estimated in probit regressions of a dummy variable of being employed in a green job, conditional on being in an urban location, having completed secondary or tertiary education, being aged 24–54 or 55 or older, and being informally employed (annex 3.1.3, annex 3.1.4, chapter 3). The regressions control for industry and subnational entity dummies.

ANNEX 1.1.1. Methodology

The panel regression estimate the effect of elections on three fiscal outcomes. The election variable takes the timing of elections into account. Specifically, it prorates the months of the year up to the election date, as in Franzese (2000). The fiscal outcomes that are examined are aggregate primary government expenditures, primary fiscal balances, and the government wage bill (all in percent of GDP).

The regression controls for the following country characteristics: per capita real GDP (in logs; which proxies shifts in voter preferences as incomes rise), real GDP growth (to capture business cycle-related changes to fiscal outcomes), inflation (to control for inflation-related increases in nominal incomes that buoy government revenues), lagged government debt (to control for budget constraints that preclude any spending increases), and the lagged dependent variable (to control for path dependence). To mitigate concerns about endogeneity and the inclusion of the lagged dependent variable, the regression is estimated using a generalized method of moments (GMM) estimator as in Gootjes, de Haan, and Jong-A-Pin (2021). The regression results are shown in annex tables 1.1.1 -1.1.3. The results are robust to excluding insignificant variables such as real GDP per capita.

The sample includes up to 122 EMDEs for 1984-2022. These EMDEs cover all types of political regimes.

ANNEX TABLE 1.1.1 Election effects

(in percent of GDP)	Primary balance	Primary expenditures	Compensation of employees
Election	-0.65*** (0.18)	0.52*** (0.16)	0.14** (0.06)
GDP growth	0.08*** (0.02)	-0.04 (0.04)	-0.03*** (0.01)
Lagged government debt	0.01*** (0.00)	-0.01*** (0.00)	0.00 (0.00)
Inflation	-0.00*** (0.00)	0.00*** (0.00)	-0.01 (0.01)
Real GDP per capita (logs)	0.18 (0.30)	0.69 (0.50)	0.43 (0.37)
Lagged primary balance	0.61*** (0.07)		
Lagged primary expenditure		0.78*** (0.04)	
Lagged compensation of employees			0.74*** (0.06)
Constant	-0.65*** (0.18)	0.52*** (0.16)	0.14** (0.06)
Obs	3,011	3,011	1,521
Nr of countries	122	122	96
AR(1) p-val	0.00	0.00	0.00
AR(2) p-val	0.21	0.95	0.24
Sargan-Hansen test p-val	0.32	0.68	0.99
Cragg-Donald test p-val	0.00	0.02	0.00

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions use the GMM estimator and include year dummies. "Election" is a numerical variable that is constructed using the approach detailed in Gootjes, de Haan, and Jong-A-Pin (2021). The sample includes up to 122 EMDEs for the period 1984-2022. See de Haan, Ohnsorge, and Yu (forthcoming) for details.

ANNEX TABLE 1.1.2 Election timing effects in EMDEs

(in percent of GDP)	Primary balance			Primary expenditures			Compensation of employees		
Lead of election	-0.31* (0.17)			0.20 (0.17)			-0.03 (0.07)		
Election		-0.65*** (0.18)			0.52*** (0.16)			0.14** (0.06)	
Lag of election			0.22 (0.17)			-0.44** (0.17)			0.07 (0.07)
Observations	2,892	3,011	3,011	2,892	3,011	3,011	1,521	1,521	1,521
Nr of countries	122	122	122	122	122	122	96	96	96
AR(1) p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
AR(2) p-val	0.27	0.21	0.25	0.96	0.95	0.99	0.25	0.24	0.99
Sargan-Hansen test p-val	0.19	0.32	0.19	0.82	0.95	0.95	0.99	0.99	0.58
Cragg-Donald test p-val	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.00

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions use the GMM estimator and include year dummies. All dependent variables are in percent of GDP. "Election" is a numerical variable that is constructed using the approach detailed in Gootjes, de Haan, and Jong-A-Pin (2021). "Lead of election" captures the "Election" in the following year, while "lag of election" captures the "Election" in the previous year. The same set of controls as in annex table 1.1.1 is included but not shown here for brevity. The sample includes up to 122 EMDEs over the period 1984-2022. See de Haan, Ohnsorge, and Yu (forthcoming) for details.

ANNEX TABLE 1.1.3 Election effects

	Primary balance	Primary expenditures	Compensation of employees
Election (EAP region)	-0.31	0.43	0.37***
	(0.40)	(0.51)	(0.11)
Election (ECA region)	-0.19	-0.16	-0.05
	(0.35)	(0.41)	(0.09)
Election (LAC region)	-1.03***	0.97***	0.16*
	(0.26)	(0.30)	(0.10)
Election (MNA region)	0.95	0.18	0.02
	(0.70)	(0.64)	(0.44)
Election (SAR region)	-0.61**	0.79***	0.20**
	(0.24)	(0.18)	(0.08)
Election (SSA region)	-0.90**	0.56*	0.17
	(0.36)	(0.29)	(0.14)
Observations	3,011	3,011	1,521
Nr of countries	122	122	96
AR(1) p-val	0.00	0.00	0.00
AR(2) p-val	0.19	0.94	0.22
Sargan-Hansen test p-val	0.10	0.93	0.99
Cragg-Donald test p-val	0.11	0.02	0.00

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions use the GMM estimator and include year dummies. "Election" is a numerical variable that is constructed using the approach detailed in Gootjes, de Haan, and Jong-A-Pin (2021). The same set of controls as in annex table 1.1.1 is included but not shown here for brevity. The sample includes up to 122 EMDEs for the period 1984-2022. See de Haan, Ohnsorge, and Yu (forthcoming) for details.

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SPOTLIGHT

An ounce of prevention, a pound of cure: Averting and dealing with sovereign debt default

Spotlight. An ounce of prevention, a pound of cure: Averting and dealing with sovereign debt default

South Asia has the highest average government debt-to-GDP ratio among emerging market and developing economy (EMDE) regions, at 86 percent in 2022, and four of the region's countries are rated in or near sovereign debt distress. The risk of sovereign defaults in the region is heightened not only by high levels of government debt but also by the increases in global interest rates over the past two years: the vast majority of past defaults occurred around the end of U.S. monetary policy tightening cycles and in countries with above-median government debt-to-GDP ratios. Past experience also shows that more than one-third of defaults failed to lower government debt or borrowing costs in a lasting manner. Defaults that succeeded in lowering debt or borrowing cost were accompanied more frequently than others by above-median debt restructurings, growth accelerations, and fiscal consolidations. South Asia's above-average economic growth mitigates some of the default risks. Some South Asian countries have reduced their default risk by predominantly borrowing from domestic creditors. However, this strategy comes at a price: high domestic shares of government debt have been associated with higher borrowing costs and lower bank credit to the private sector. With the external environment likely to remain challenging over the next several years, it is all the more important to adopt policies to accelerate sustainable growth and shore up fiscal positions.

Introduction

South Asia has the highest average government debt-to-GDP ratio among EMDE regions, at 86 percent in 2022 (figure SL.1). Four South Asian countries are already rated by the Moody's ratings agency or by the IMF/World Bank Debt Sustainability Analysis as in or near sovereign-debt distress and default.

Sovereign debt defaults are costly. A large literature has identified lasting output losses and borrowing cost increases after external debt defaults, especially defaults that were accompanied by banking crises and were not pre-emptive (box SL.1). Defaults have also resulted in heavy social costs, including higher poverty and worse health outcomes (Farah-Yacoub et al. 2022). And many debt defaults have left government debt-to-GDP ratios higher after the default than before (Benjamin and Wright 2009; Bolton, Gulati, and Panizza 2022).

In light of the current increased risk of debt default in South Asia, this spotlight reviews past experience and draws policy lessons. Specifically, it explores the following questions:

- What were the salient features of past defaults?
- What were the characteristics of defaults that succeeded in improving fiscal positions?
- What are the policy implications?

The literature on debt defaults is extensive and has been growing rapidly. A key focus has been on the short-term debt dynamics around debt defaults (Asonuma and Trebesch 2016; Erce, Mallucci, and Picarelli 2022). A few studies have examined longer-term government debt dynamics after external debt defaults or through debt reduction episodes. However, these studies have predominantly focused on the role of either fiscal consolidation or face value reductions.[1] This spotlight extends this analysis to both external and domestic debt defaults and to a wider range of correlates that appear to have helped lower government debt or interest rates on government debt after a sovereign default.

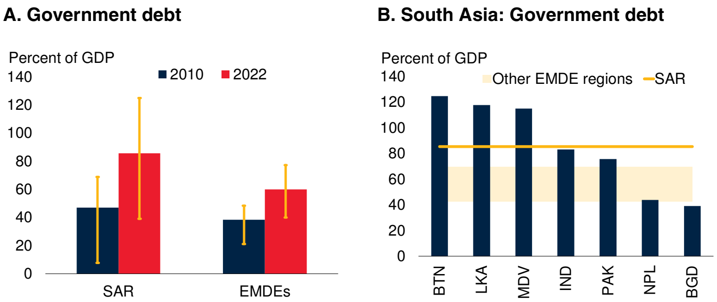
This spotlight reports several findings.

Note: This spotlight was prepared by Franziska Ohnsorge and Hayley Pallan.

[1] For studies on debt dynamics after external debt default, see Benjamin and Wright (2009); Bolton, Gulati and Panizza (2022); IMF (2023); Reinhart and Trebesch (2016); Sturzenegger and Zettelmeyer (2007). For studies on debt dynamics in debt reduction episodes, see Baldacci, Gupta, and Mulas-Granados (2012) and IADB (2023).

FIGURE SL.1 Government debt

Compared with other EMDE regions, South Asia has the highest average government debt-to-GDP ratio.



Sources: IMF (various staff reports); Kose et al. (2022); World Bank.
Note: Latest data for government debt are for 2022. All debt data are end-year.
A.B. Unweighted averages (at 2010–19 average prices and market exchange rates).
A. Yellow whiskers indicate minimum-maximum range for seven South Asian economies, and the interquartile range for EMDEs.
B. Yellow shaded area indicates range of GDP-weighted averages of other EMDE regions. Yellow line indicates GDP-weighted average for South Asia (SAR).

- *The how, when, and where of sovereign debt defaults.* The vast majority of defaults (including defaults on external debt) since 1979 have taken place within a year of the end of a U.S. monetary policy tightening cycle, in countries without fiscal rules, and in countries with above-median government debt-to-GDP ratios. The average debt default took almost three years to resolve, mostly because external debt defaults required multi-year resolutions. Fewer than half of all debt defaults since 1979 included a face value reduction rather than only a maturity extension and/or interest rate reduction.

- *Successful versus unsuccessful defaults.* Historically, fewer than two-thirds of sovereign debt defaults successfully reduced the government debt-to-GDP ratio or the effective interest rate on government debt five years later. Debt defaults that failed to lower government debt-to-GDP ratios were twice as likely as successful ones to be followed by another default within five years.

- *Features of successful defaults.* Sovereign debt defaults accompanied by above-median debt restructurings, domestic or global growth accelerations, fiscal consolidations, and IMF-supported policy programs more frequently turned out to be successful in reducing government debt-to-GDP ratios or government borrowing costs over the following five years.

- *Mitigating factors in South Asia: Above-average GDP growth and preponderance of domestic debt.* South Asia's above-average growth mitigates some of the default risks arising from its above-average government debt-to-GDP ratios. On balance, however, regression analysis suggests that the probability of default in the average South Asian EMDE is higher than in the average EMDE. Debt risks in some South Asian countries may also be mitigated by the high share of government debt (on average, more than half) that is owed to domestic creditors. In the past, predominantly domestically financed debt runups were less likely to end in default than externally financed debt runups. However, this strategy comes at a price: above-median share of domestic debt have been associated with higher government borrowing cost, shorter debt maturities, and a smaller share of bank credit allocated to the private sector.

- *Policy priorities: Debt restructuring, boosting growth, and putting fiscal positions on a sound footing.* Slowing global growth, elevated global borrowing costs, and high government debt levels increase the probability of sovereign debt default, and reduce the likelihood that sovereign debt defaults, when they occur, will be successful. But the historical record also suggests that measures to boost domestic growth and put fiscal positions on a sounder footing will improve the chances of success.

For the purposes of this study, a successful debt default is defined as one that is followed by a reduction in the government debt-to-GDP ratio or in the effective interest rate on government debt, or both, over the subsequent five years. The effective interest rate on government debt is defined as net interest payments relative to the stock of government debt at the end of the previous year.

This spotlight draws on a dataset of 177 external or domestic sovereign debt defaults in 64 EMDEs over 1979–2018 (annex table SL.1.1). Data for external sovereign debt defaults—defaults on private external creditors—are from Asonuma and Trebesch (2016), while data for domestic sovereign debt defaults—defaults on debt instruments governed by domestic law—are from Erce, Mallucci, and Picarelli (2022). For a subset of 88 external debt defaults between 1970 and 2014, estimates of the size of restructured debt, the "haircuts" (reductions in net present value), and face value reductions are available from Cruces and Trebesch (2013).

This spotlight builds on two quantitative exercises. A panel regression estimation corrected for selection bias is used to identify the correlates of more successful defaults (annex SL.1). Separately, an event study of past government debt booms—encompassing overall, domestic, and external government debt—is conducted to explore the consequences of the composition of government debt for debt default (annex SL.2).

The how, when, and where of sovereign debt default

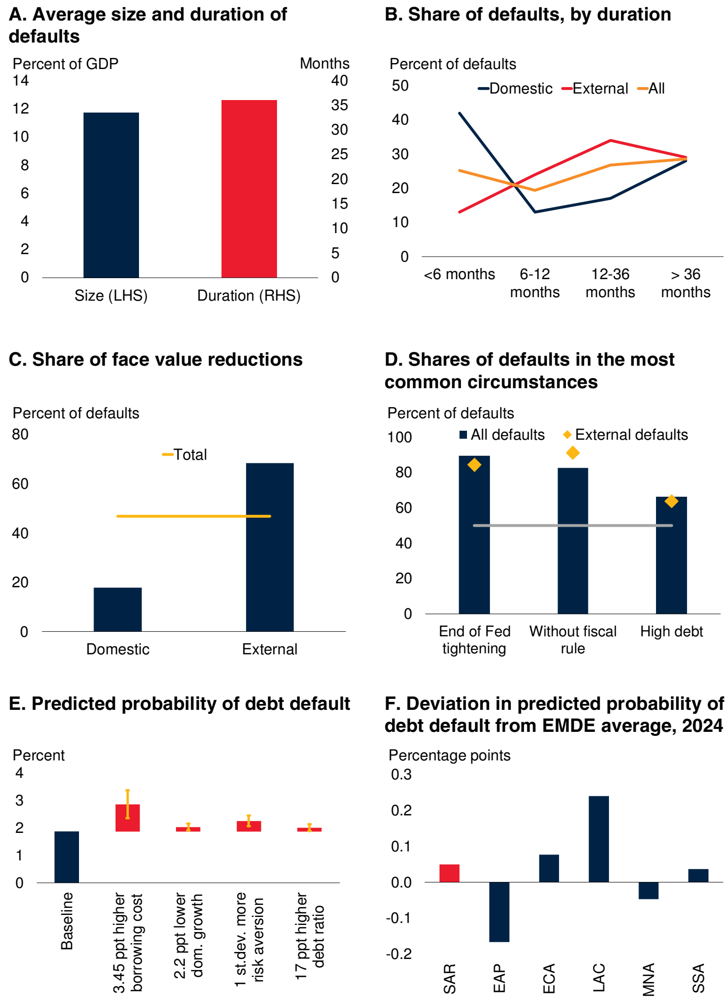
Among the 64 EMDEs in the sample, defaults occurred on average almost three times per country between 1979 and 2018. Only in about one-third of the countries in the sample did defaults occur just once in these four decades. Defaults took a wide variety of forms (Bolton, Gulati, and Panizza 2022). Three studies have detailed the anatomy of sovereign debt defaults in EMDEs (Asonuma and Trebesch 2016; Cruces and Trebesch 2013; Erce, Mallucci, and Picarelli 2022). They document the following findings.

- *Creditors.* Two-thirds of the defaults in the sample involved external creditors and most (70 percent) of these external defaults occurred in the 1980s. Since 1990, external debt defaults account for fewer than half of all defaults in the sample.

- *Magnitude.* On average, EMDEs defaulted on debt instruments equivalent to 12 percent of annual GDP (Figure SL.2; Erce, Mallucci, and Picarelli 2022). External debt defaults

FIGURE SL.2 The how, when, and where of sovereign debt defaults

On average in EMDEs, debt defaults in 1970–2018 took almost three years to resolve, although domestic defaults were often resolved much faster. Most external defaults involved face value reductions but most domestic ones did not. Defaults were bunched around the end of U.S. Federal Reserve monetary policy tightening cycles, and in countries with high debt -to-GDP ratios and without fiscal rules. South Asia's above-average growth mitigates some of the default risk arising from its above-average government debt levels.



Sources: Asonuma and Trebesch (2016); Cruces and Trebesch (2013); Erce, Mallucci, and Picarelli (2022); World Bank.

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SSA = Sub-Saharan Africa.

A. Derived as GDP-weighted averages of the unweighted average of defaults on domestic-law and foreign-law obligations in Erce, Mallucci, and Picarelli (2022).

B. Derived from shares of defaults on domestic-law and foreign-law obligations in Erce, Mallucci, and Picarelli (2022).

C. For domestic defaults, data from Erce, Mallucci, and Picarelli (2022) for 134 defaults in 1979-2018. For external defaults, data from Cruces and Trebesch (2013) for 180 defaults in 1970-2010.

D. Share of all defaults that occurred in the year of the end of U.S. Federal Reserve tightening cycle as defined in World Bank (2022) or in the subsequent year. Share of all defaults that occurred in countries without a fiscal rule or in countries with above-median (across the full EMDE sample) government debt at the time of default. All defaults include defaults on domestic and external creditors; external defaults refers to defaults on external creditors. Gray line denotes 50 percent.

E.F. Based on coefficient estimates from probit regression, specified in annex SL.1. Baseline probability of debt default is the coefficient estimate of the constant in a probit regression of default on a constant. Sample includes 156 EMDEs between 1970–2022.

E. Yellow whiskers indicate 95 percent confidence intervals.

F. Calculation assumes that global risk sentiment and the U.S. federal funds rate remain constant at their 2023 values and that global and regional growth materializes as forecast in the June 2023 Global Economic Prospects report.

were larger than domestic debt defaults: the affected debt instruments were equivalent in value to 13 percent of GDP, compared with 10 percent of GDP in domestic debt defaults.

- *Resolution period.* The average debt default took almost three years to resolve through restructuring (Erce, Mallucci, and Picarelli 2022). Domestic debt defaults were resolved much faster than external ones: more than four-fifths of domestic debt defaults were resolved in less than six months, compared with just over one-tenth of external defaults.

- *Face value reductions.* Macroeconomic conditions improved after a default only when it involved face value reductions (Reinhart and Trebesch 2016). Just under half of all debt defaults involved reductions in the face value of the defaulted debt, while the rest solely involved maturity extensions and/or interest rate reductions. Face value reductions were common in external debt defaults, occurring in about two-thirds of cases (Cruces and Trebesch 2013), but rare in domestic debt defaults, occurring in fewer than one-fifth of cases (Erce, Mallucci, and Picarelli 2022).

Most defaults occurred during the 1980s. However, whether the 1980s are included in the analysis or not, several regularities were found in the timing of their occurrence.

- *End of global policy tightening cycles.* Defaults were bunched around the end of U.S. monetary policy tightening cycles. Thus, 63 percent of defaults since 1990 occurred either in the year that a U.S. monetary policy tightening ended or in the next year (Figure SL.2).

- *Global recessions.* Defaults were also bunched around global recessions. Global recessions are rare events: they happened only about once a decade in the sample period (1982, 1991, 2009). Yet 23 percent of defaults occurred during these three years or the years immediately following. As a result, the average global recession was accompanied by almost three defaults whereas the average non-recession year featured only two.

- *National recessions.* Defaults were also more common during national recessions or in the subsequent year. The sample includes 323 national recessions, defined by negative annual output growth, in the 64 EMDEs that defaulted at some point during 1979–2018. Hence, national recession years and the first year after each national recession accounted for 26 percent of the country-years in the sample. However, 47 percent of the defaults occurred during these years. On average, there were three defaults in every 100 national recession country-years, which is three times as many as in every 100 non-recession country-years.

Defaults were more common in countries with weaker fiscal institutions and fiscal positions. Most defaults (70 percent since 1990) occurred in countries that did not have a fiscal rule in place at the time. Similarly, 67 percent of defaults occurred in country-years when government debt was above the EMDE median.

An econometric exercise helps establish the main correlates of the probability of debt default. A probit regression is used to model the probability of a debt default, drawing on the main factors identified in the literature on early warning indicators for financial crises (e.g., Kaminsky and Reinhart 2000). The probability of default is modeled as a function of the U.S. federal funds rate (as a proxy for global borrowing costs), a proxy for global investor risk sentiment, changes in global GDP growth, lagged domestic GDP growth, lagged currency depreciation, and the lagged government debt-to-GDP ratio. For lack of a measure with a sufficiently long time series, global risk sentiment is proxied by the excess number of domestic and external debt defaults globally that cannot be explained by the U.S. federal funds rate and changes in global growth.

The general patterns described above also emerge in the econometric estimation of the probability of default in the more limited sample of countries and years for which a complete set of data is available (annex table SL.1.2; Figure SL.2). Defaults occurred in about 2 percent of country-year pairs. Defaults were more likely in years when global borrowing costs (as proxied by the U.S.

federal funds rate) or investor risk aversion (as proxied by global excess defaults) were higher, after a domestic growth slowdown, or when government debt was high. For example, the coefficient estimates suggest that a 3.5-percentage-point increase in the U.S. federal funds rate—the actual change since early 2022—would have increased the probability of default by almost one-half. South Asia's above-average growth mitigates some of the default risk arising from its above-average government debt level. On balance, however, the regression estimates suggest that the probability of default in the average South Asian EMDE is higher than in the average EMDE.

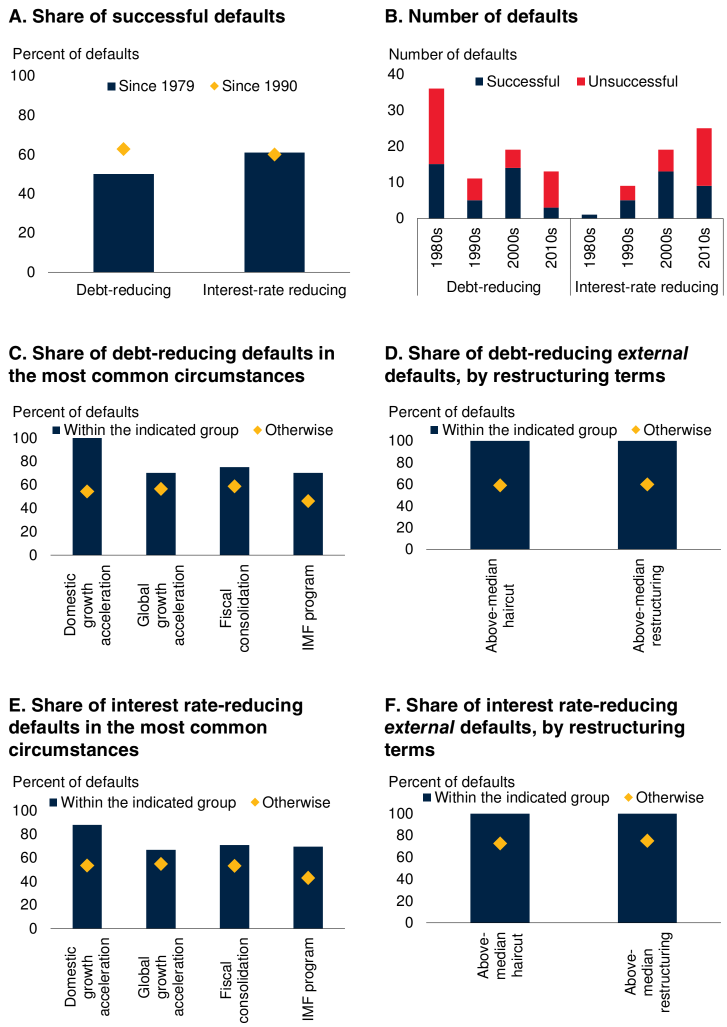
A large literature has estimated the short- and long-term macroeconomic and financial consequences of debt default (box SL.1). It finds that external sovereign debt defaults have been associated with significant and often lasting output losses, increases in borrowing costs, exclusion from international capital markets, and disruptions in trade and financial systems. In the short term, trade flows plunged temporarily as trade credit was disrupted, sovereign bond yields rose by as much as 400 basis points, and output declined by 1–6 percent. Since 2000, a return to international capital markets has, on average, taken about two years, somewhat less time than in the 1980s and 1990s. In the medium term, output was still 3–10 percent lower five years after default and, when reductions in the face value of debt were large, sovereign borrowing costs were still more than 100 basis points higher.

Features of successful debt defaults

Fewer than two-thirds of the sovereign debt defaults in the sample were successful in the sense that government debt-to-GDP ratios or effective interest rates on government debt were lower after five years (Figure SL.3). Five years after successful defaults, government debt was, on average, 24–34 percentage points of GDP lower, whereas it was 5–27 percentage points higher after unsuccessful defaults. Effective interest rates on government debt were up to 2 percentage points lower five years after successful defaults, whereas they were up to 1 percentage point higher after unsuccessful

FIGURE SL.3 Features of successful debt defaults

Since 1990, fewer than two-thirds of sovereign debt defaults were successful in lowering government debt-to-GDP ratios or effective interest rates on government debt five years after the default. Defaults on the eve of global or domestic growth accelerations, with fiscal consolidation, or during IMF-supported policy programs were more often associated with success than other defaults. External defaults with above-median haircuts and restructurings were also more often successful.



Sources: Asonuma and Trebesch (2016); Cruces and Trebesch (2013); International Monetary Fund; World Bank.

Note: Default episodes are differentiated between those that featured lower ("Successful") or higher ("Unsuccessful") government debt-to-GDP ratios or effective interest rates on government debt five years after the default than in the year of default. Based on 177 domestic or external default episodes in 64 EMDEs during 1979–2018.

C.E. Defaults since 1990. Share of successful defaults among defaults under the circumstances indicated on the horizontal axis. "IMF program" indicates that an IMF-supported policy program was in place at the time of default; "Fiscal consolidation" indicates an improvement in the cyclically adjusted fiscal balance between the year of default and five years after default; "Global growth acceleration" and "Domestic growth acceleration" indicate a two-year global or domestic growth acceleration from the time of default.

D.F. "Above-median restructuring" indicates above-median size of restructured debt in percent of total government debt at time of default, as calculated by Cruces and Trebesch (2013). "Above-median haircut" indicates above-median market haircut at time of default, as calculated by Cruces and Trebesch (2013). Sample includes 88 external debt defaults since 1979, of which 43 occurred from 1990 onwards.

BOX SL.1 Literature review: Costs of sovereign debt default

Sovereign debt defaults have been associated with significant and sometimes lasting output losses, increases in borrowing costs, exclusion from international capital markets, and trade and financial system disruptions. In the short term, trade flows plunged temporarily as trade credit was disrupted, sovereign bond yields rose by as much as 400 basis points, and output declined by 1–6 percent. In the 2000s, a return to international capital markets took two years on average. Over the medium term, output was still 3–10 percent lower, on average, than before defaults.

A large literature has identified the costs of debt default, typically focusing on external debt defaults. Several types of cost have been identified: output losses and disruptions to international trade, borrowing cost increases and exclusion from capital markets, financial system disruptions, political strains, and social costs (Borensztein and Panizza 2009; Farah-Yacoub et al. 2022; Gelpern and Panizza 2022; Tomz and Wright 2013). This box reviews the empirical literature on the following questions:

- What have been the output and trade losses associated with debt default?
- What has been the impact of default on borrowing costs and private credit?
- How long were defaulting countries excluded from capital markets?

Output and trade losses

Since government debt is typically the foundation of domestic financial systems, debt default disrupts financial flows and economic transactions more broadly. This can cause lasting economic damage.

Short-term output losses. For external debt defaults, many studies have shown significant output declines in the year of default. Most studies have identified output contractions in the year of external debt default of 1–6 percent (Borensztein and Panizza 2009; Esteves, Kenny, and Lennard 2021; Furceri and Zdzienicka 2011; Tomz and Wright 2007). Causality in this correlation could go in either direction. In quarterly data for 39 (mostly) EMDEs during 1970–2005, Levy-Yeyati and Panizza (2011) show that output declines preceded default and that output did not decline significantly further in the quarter of default. Over the longer term, Marchesi and Masi (2018) even find that output rose more after defaults in 1975–2013.

Long-term output losses. Several studies have shown lasting output losses after external default, with output levels 3–10 percent below a no-default baseline four to eight years after default (Esteves, Lennard, and Kenny 2021; Furceri and Zdzienicka 2011; Sturzenegger 2004). Over the ten years it took, on average, to resolve the 32 external debt defaults among 37 EMDEs during 1970–1998, output was 5 percent below a no-default baseline (De Paoli, Hoggarth, and Saporta 2009). In a few cases, output losses compared with a no-default baseline may have been as large as 23 percent over the course of the resolution of debt default (Jorra 2011). While these level effects were long-lived, growth effects were short-lived. Levy-Yeyati and Panizza (2011) show that trend (Hodrick-Prescott-filtered) output growth did not change statistically significantly after default over the medium term.

Heterogeneity in output losses. Several studies have found that long-term output losses after default depended on country characteristics and circumstances. Output losses were larger when external defaults coincided with financial crises (Borensztein and Panizza 2009; Kuvshinov and Zimmermann 2019), when they were not pre-emptive (Asonuma et al. 2020; Asonuma and Trebesch 2016), when they were more coercive (Trebesch and Zabel 2017), and when they were not accompanied by face value debt reductions (Reinhart and Trebesch 2016). Output losses associated with domestic debt defaults were larger than those associated with external defaults. For example, among 40 EMDEs during 1950–2010, domestic debt defaults were followed by statistically significant 2.7 percent per capita GDP losses after five years whereas external debt defaults were not associated with statistically significant lasting losses (Malinen and Ropponen 2019). Larger post-default debt reductions were associated with smaller output losses (Forni et al. 2021).

Trade losses. By disrupting financial systems, debt default can reduce trade credit and, hence, trade. Trade credit and trade flows were indeed significantly lower in default years (Borensztein and Panizza 2009; Rose 2005). Similarly, defaults were particularly damaging to export-oriented firms; however, the impact was short-lived (Borensztein and Panizza 2010).

BOX SL.1 Literature review: Costs of sovereign debt default (*continued*)

Borrowing cost increases

Sovereign borrowing cost increases. After default, sovereign bond spreads were as much as 400 basis points higher in a sample of 31 EMDEs during 1997–2004, but the effect faded quickly (Borensztein and Panizza 2010). This may account for the fact that long-term average returns on sovereign bonds of EMDEs—despite defaults—outperformed benchmark returns by 3–4 percentage points (Meyer, Reinhart, and Trebesch 2022). That said, in a larger sample of defaults during 1970–2014, borrowing spreads were still 200 basis points higher five years after default (Catão and Mano 2017). Borrowing cost increases were larger and longer-lasting when haircuts on debt were larger: The average 40 percent haircut in a sample of 23 countries was associated with 127 basis points higher spreads five years later (Cruces and Trebesch 2013). Spreads were also larger for serial defaulters (Catao and Mano 2017).

Loss of capital market access. On average since the 1970s, it took five to six years for partial capital market access to be restored after default (Cruces and Trebesch 2013; Richmond and Dias 2008). The period of exclusion appears to have shrunk from 4–6 years in the 1980s to 2–3 years in the 2000s (Richmond and Dias 2008; Gelos, Sahay, and Sandleris 2011). Market access was delayed when haircuts on debt were large (Cruces and Trebesch 2013), when countries were smaller, or when international risk sentiment was unfavorable (Richmond and Dias 2009).

Private borrowing cost increases. The increase in sovereign bond yields in the defaulting country tended to spill over to private sector borrowing costs and private credit. Corporate borrowing spreads were 30–200 basis points higher during episodes of sovereign stress, although there is some evidence that the correlation between corporate and sovereign bond yields weakened during sovereign defaults (Bevilaqua, Hale, and Tallman 2020). Default led to credit rationing for corporate borrowers that was large and persistent (Esteves and Jalles 2016).

Private credit contractions and slowdowns. Defaults were associated with reductions in private credit. While debt was being renegotiated in defaults during 1981–2004, foreign bond issuances and syndicated bank loans declined by 30 percent during debt renegotiations and another 14 percent in the first year after restructuring (Arteta and Hale 2008). Domestic private sector credit growth was also significantly lower during defaults in 81 countries during 1980–2005 (Gennaioli, Martin, and Rossi 2014). In defaults during 1998–2012, banks with higher sovereign bond holdings reduced their lending more than their less exposed peers (Gennaioli, Martin, and Rossi 2018). Even foreign direct investment (FDI) flows declined after defaults, especially from creditor countries (Fuentes and Saravia 2010).

ones. Defaults that succeeded in lowering government debt-to-GDP ratios were more likely to “stick”: fewer than one-quarter of them relapsed into another default over the next five years, compared with about one-half of unsuccessful defaults. Government debt defaults in the 1980s were particularly prone to failing to reduce government debt relative to GDP.

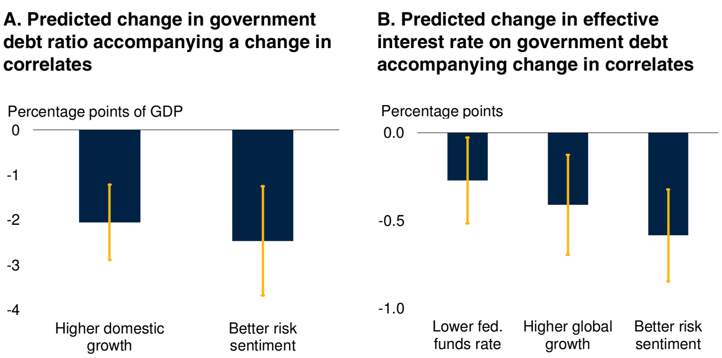
Since 1990, there have been several circumstances in which defaults were more likely to succeed in reducing interest rates and government debt-to-GDP ratios over the subsequent five years (Figure SL.3; annex table SL.1.3). These circumstances were common to both the full sample of defaults and the subsample of external defaults.[2]

- *Domestic growth accelerations*. Defaults were more frequently successful when they occurred at the beginning of a domestic output growth spurt. Nine-tenths of all defaults that occurred just before a two-year growth acceleration were successful at lowering debt-to-GDP ratios or interest rates,

[2] Defaults in the 1980s shared most of these features, but with global growth accelerations and fiscal consolidations playing smaller roles in helping to lower debt-to-GDP ratios in external defaults.

FIGURE SL.4 Debt and borrowing costs after successful and unsuccessful debt defaults

Reductions in government debt ratios in the five years after default were steeper when domestic output growth was stronger and when global investor risk sentiment was more favorable. Interest rate reductions were steeper when global growth was stronger, global borrowing costs declined more, and global investor risk sentiment was more benign.



Source: World Bank.
Note: Predicted change in government debt (A) or effective interest rate on government debt (B) is defined as 1 percentage point increase in the variable indicated on the horizontal axis (0.5 of a standard deviation decline in the case of global risk sentiment) during the sample period multiplied by the coefficient estimate from a panel regression estimation, controlling for selection bias, as described in annex SL.1. Charts only show calculations for statistically significant coefficient estimates. Yellow whiskers indicate 95 percent confidence intervals.

compared with around one-half of defaults that occurred without such growth accelerations.

- *Global growth accelerations.* Defaults that occurred on the eve of global growth accelerations were also more likely to succeed. Since 1990, more than two-thirds of defaults that occurred just ahead of global growth accelerations lasting at least two consecutive years were successful, about twice the proportion that were successful in other years. This pattern was less pronounced in the 1980s, when the vast majority of defaults were unsuccessful in lowering debt-to-GDP ratios despite a global growth spurt in the middle of the decade.

- *Fiscal consolidation.* Defaults that were accompanied by fiscal consolidations were considerably more likely to succeed. Almost three-quarters of defaults that were followed by an improvement in the cyclically adjusted fiscal balance over the subsequent five years were successful, compared with fewer than one-half of other defaults.

- *IMF-supported policy programs.* Two-thirds of fiscal consolidations in the sample were accompanied by IMF-supported policy programs. As a result, more than two-thirds of defaults in the context of IMF-supported programs were successful, compared with fewer than one-half of those that were not accompanied by IMF-supported programs.

- *Debt restructuring.* In the subsample of 88 external debt defaults since 1970 for which debt restructuring estimates are available, greater restructuring was more frequently associated with successful defaults (Cruces and Trebesch 2013). Two-thirds of external debt defaults with an above-median share of restructured debt in total government debt were successful, compared with about one-half of other defaults. Similarly, almost nine-tenths of external debt defaults with above-median haircuts turned out to be successful, compared with about one-half of other defaults.

An econometric exercise helps establish the most robust correlates of debt and borrowing cost reductions in the event of default. Correcting for the selection of countries defaulting, a panel regression is used to estimate the effects of macroeconomic conditions on the cumulative changes in the government debt-to-GDP ratio and in the effective interest rate on government debt over the five years following default. The correlates of these two dependent variables include cumulative changes in global GDP growth, in global borrowing costs (proxied by the U.S. federal funds rate), in global risk aversion (proxied by the excess number of defaults), and in domestic GDP growth over the five years following default. The results are robust to several alternative specifications (annex SL.1). Ideally, the regression would also account for the effects of the features of national defaults, including the terms and duration of restructuring agreements, and for the magnitude of fiscal consolidation (i.e., changes in the cyclically-adjusted or structural fiscal balance). However, the data needed for such analysis are available for too small a subset of the sample of debt defaults to yield meaningful results.

The results of the panel regression broadly accord with the patterns described above (Figure SL.4; annex SL.1; annex table SL.1.4).

- *Government debt.* The estimation shows that reductions in government debt-to-GDP ratios in the five years after default tended to be steeper when they were accompanied by stronger domestic growth and more favorable global investor risk sentiment. Thus, a 1-percentage-point increase in domestic growth after default was associated with a decline in the government debt-to-GDP ratio that was steeper by 2 percentage points of GDP. An improvement in global investor risk sentiment by half a standard deviation (approximately the improvement observed between 2020 and 2021) was also associated with a similarly-sized decline in the government debt-to-GDP ratio.

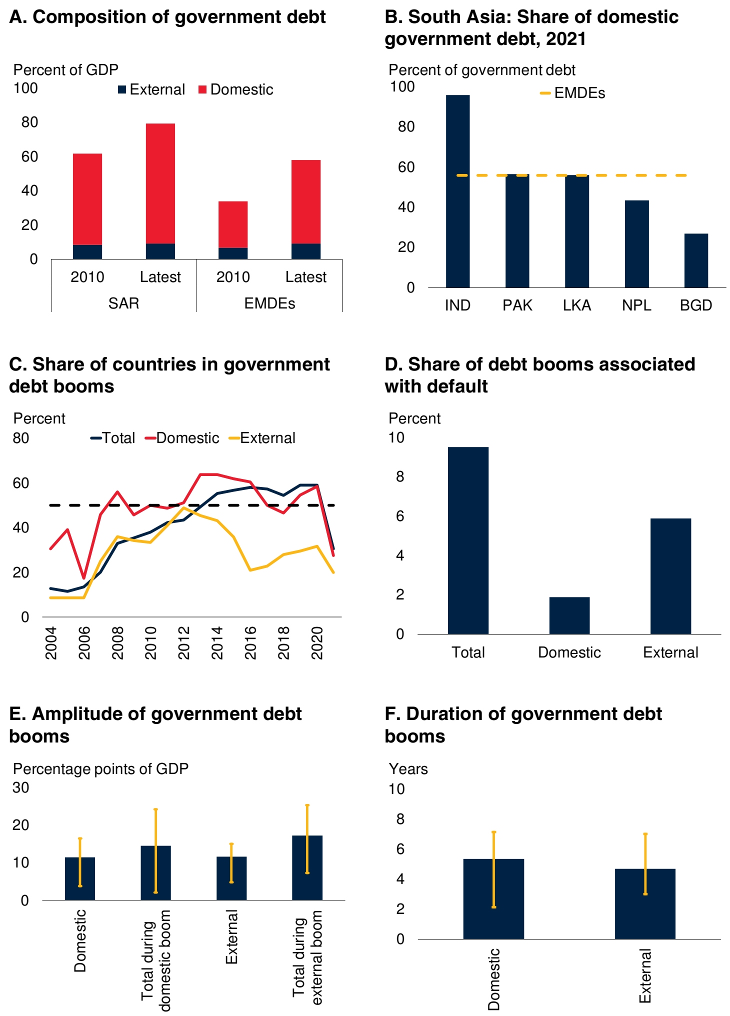
- *Government borrowing costs.* While domestic growth was the main correlate of reductions in government debt-to-GDP ratios after default, global growth and global interest rates were the main correlates of reductions in government borrowing costs. Specifically, a 1-percentage-point decline in the U.S. federal funds rate, a one-half standard deviation improvement in global investor risk sentiment, or 1 percentage point faster global growth was each associated with 0.3–0.6 of a percentage point lower government interest rates five years after default.

Domestic debt: A costly mitigating factor

South Asia stands out among EMDE regions for governments' high reliance on domestic borrowing (Figure SL.5). It accounts for almost three-quarters of government debt accumulation between 2010 and 2021 in the average South Asian country, compared with less than two-thirds in the average EMDE. At end-2021 (the latest available data), it accounted for 56 percent of government debt in the average South Asian country and more than half in three of the region's four largest economies.

FIGURE SL.5 Government debt composition and features of debt booms

In South Asia and EMDEs more broadly, domestic debt accounts for most government debt and for most of the government debt buildup over the past decade. Since 2004, domestic debt booms have been more common than external debt booms. While domestic and external debt booms have had similar average amplitudes, speeds, and durations, domestic government debt booms have been less likely than external debt booms to be associated with debt default.



Sources: Asonuma and Trebesch (2016); Erce, Mallucci, and Picarelli (2022); Kose et al. (2022); Reinhart and Rogoff (2011); World Bank.

Note: BGD = Bangladesh; IND = India; LKA = Sri Lanka; NPL = Nepal; PAK = Pakistan; SAR = South Asia region.

A.B. Latest data are for 2021 for measures of debt composition. Weighted averages for South Asia (SAR) and EMDEs. SAR includes Bangladesh and India (from Kose et al. 2022) as well as Nepal, Pakistan, and Sri Lanka (from various IMF Article IV staff reports). Domestic government debt for Nepal, Pakistan, and Sri Lanka is domestic currency-denominated debt; for Bangladesh and India domestic government debt is debt held by domestic residents.

C.-F. Debt booms are defined as debt accumulations where in at least one year the debt-to-GDP ratio rises above its Hodrick-Prescott-filtered trend by more than one standard deviation. Gaps in the domestic and external government debt series are interpolated. There have been 105 government debt booms, 53 domestic government debt booms, and 34 external government debt booms since 2004.

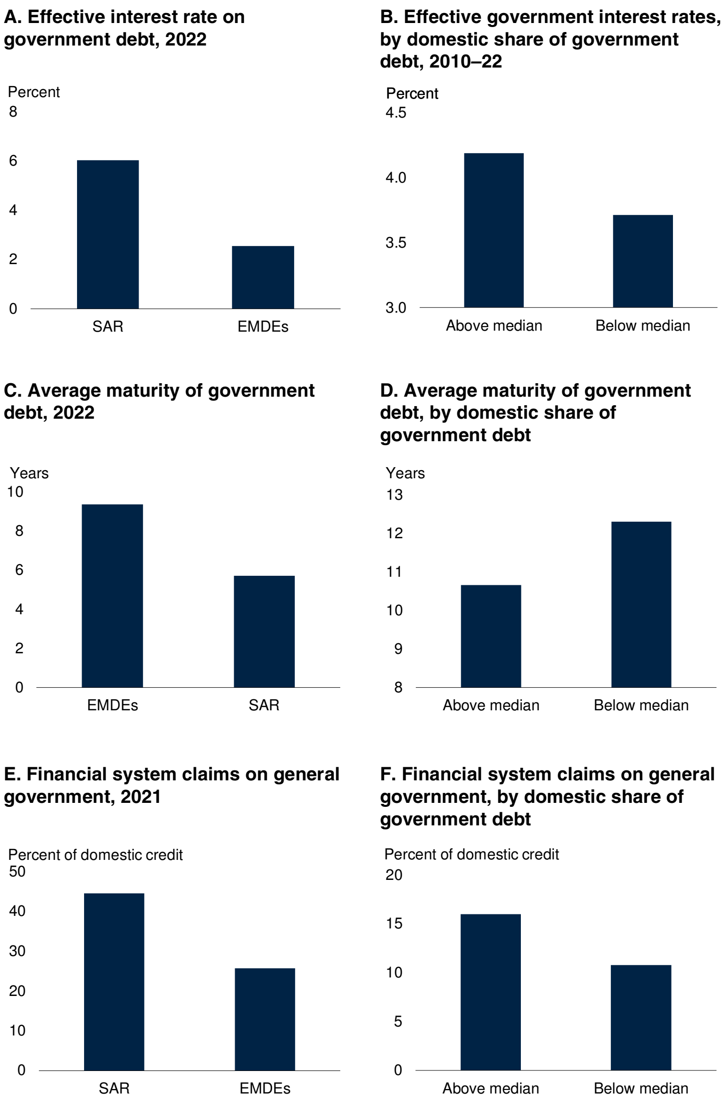
C. Lines show the share of countries per year experiencing a total government debt boom, domestic government debt boom, or external government debt boom. The denominator is the total number of countries with available data per year and per debt type.

D. Bars show the share of total government debt booms associated with default (of any type), domestic government debt booms associated with domestic default, and external government debt booms associated with external default, up to one year after the end of a boom.

E.F. Bars show the average amplitude and duration of government debt booms. Yellow whiskers correspond to the interquartile range. Amplitude is defined as the change in government debt from the start to the end of a boom. Duration is the number of years the government debt boom lasts.

FIGURE SL.6 Costs of domestic debt

Above-median shares of domestic debt in government debt have been associated with shorter debt maturities, higher interest rates, and larger shares of domestic credit directed toward the central government. This may have contributed to above-average interest spending in South Asia.



Sources: IMF (various staff reports); Kose et al. (2022); World Bank.

Note: Latest data is for 2022 for interest spending and typically 2021 for average maturity of government debt.

A. Net interest spending is defined as the difference between the primary fiscal balance and the overall fiscal balance. South Asia includes Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

B. Effective government interest rate is defined as net interest spending as share of gross government debt in the previous year. For South Asia, data are only available for India, Sri Lanka, and Pakistan.

A.C.E. GDP-weighted averages (at 2010–19 average prices and market exchange rates).

B.D.F. Unweighted averages for 2010–22 (B) or 2021 or latest available data (D, F) for EMDEs with above-median or below-median share of domestic debt of government debt.

Greater reliance on domestic debt is associated with a lower probability of debt distress, given that domestic debt is usually denominated in the domestic currency (and is therefore less vulnerable to exchange rate shocks) and that domestic investors are less prone to loss of market confidence (Grigorian 2023; Panizza 2010).

This conclusion is supported by an event study of the resolution of past government debt booms (annex SL.2). Domestic and external government debt booms were similar in amplitude and duration: on average, they lasted about five years and featured cumulative government debt increases of, on average, 11 percentage points of GDP. However, external debt booms were about three times more likely to result in debt default either in the last year of the boom or in the subsequent year (Figure SL.5).

This reduction in crisis risk, however, comes with costs. EMDEs with above-median shares of domestic debt have an average government debt maturity that is shorter by two years and an average effective interest rate that is higher by nearly 1 percentage point than other EMDEs. Reliance by governments on domestic financing could also compound other obstacles to private investment by crowding out financing for private investment: the share of total bank credit of credit that is allocated to the central government is 6 percentage points higher in EMDEs with above-median domestic shares of government debt. Reflecting the relatively high share of domestic debt in South Asia, governments in the region spend almost 3 percentage points of GDP more on net interest payments, the average maturity of their debt is shorter by four years, and government credit accounts for almost 20 percentage points more of the banking system's domestic credit (Figure SL.6).

A high share of domestic debt does not appear to reduce the cost of debt distress once it occurs. In fact, output losses associated with domestic debt default have, on average, been higher than those associated with external default. In a study of 40 EMDEs during 1950–2010, domestic debt defaults were followed by statistically significant per capita income losses, averaging 2.7 percent after five years, whereas external debt defaults were not associated with statistically significant lasting per capita income losses (Malinen and Ropponen 2019).

Policy implications

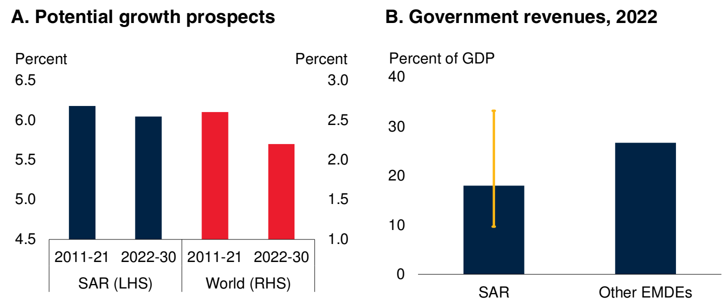
The results suggest that the current, challenging global economic environment increases the probability of sovereign debt defaults and reduces the chance that, when defaults occur, they will improve fiscal positions. Global output growth is expected to weaken in 2023, with global financial conditions expected to remain tight. Unfavorable global economic conditions are likely to persist beyond 2023. Global growth over the remainder of the 2020s is projected at 2.2 percent a year, down from 2.6 percent a year in the 2010s (Kilic Celik, Kose, and Ohnsorge 2023). Meanwhile, global financing conditions are expected to remain tight as advanced-economy central banks maintain elevated policy rates to rein in inflation, with bouts of financial stress likely to recur (World Bank 2023).

Headwinds from the challenging external environment heighten the importance of national policies that reduce the probability of default and increase the chances of successful defaults when they occur. Building the foundations for stronger growth is critical, as is fiscal consolidation that returns fiscal positions to a sound footing embedded in robust fiscal institutions. Encouragingly, South Asia's potential growth over the remainder of the 2020s is expected to remain the highest among EMDE regions, at 6.0 percent per year (Figure SL.7; Kasyanenko et al. 2023). But South Asian countries may struggle to achieve lasting fiscal consolidations given their above-average government debt levels and below-average revenue ratios.

Faced with these external and structural headwinds, a policy agenda that combines fiscal consolidation with growth-boosting reforms has the potential to yield particularly high dividends. Chapter 1 details specific policy priorities for boosting growth and strengthening fiscal positions and management in South Asia. Growth will help sustain fiscal consolidation efforts. In general, only

FIGURE SL.7 Prospects for GDP growth and government revenues

South Asia's potential output growth—defined as the highest growth rate that can be maintained in the long term without igniting inflation—is expected to remain stronger than in other EMDE regions over the remainder of the 2020s but below the rate achieved in the 2010s. Shoring up fiscal positions in a lasting manner will be challenging given the region's exceptionally low revenue ratios.



Sources: Kasyanenko et al. (2023); Kilic Celik, Kose and Ohnsorge (2023); World Bank.

A. GDP-weighted average (at 2010–19 average exchange rates and prices) of potential growth, based on a production function approach, as defined in Kasyanenko et al. (2023) and Kose and Ohnsorge (2023).

B. Data for Afghanistan is unavailable. Blue bars are aggregates for South Asia (SAR) and EMDEs and GDP-weighted averages (at 2010–19 average exchange rates and prices). Yellow whiskers indicate the minimum-maximum range for South Asian countries.

one-fifth to two-thirds of fiscal consolidations have been successful at achieving lasting reductions in debt or deficits (Balasundharam et al. 2023; Gupta et al. 2004). But there is some evidence that faster domestic growth increased the probability of a fiscal consolidation episode beginning or being sustained (Gupta et al. 2004). Conversely, at the high levels of government debt prevailing in much of South Asia, fiscal consolidation is unlikely to weigh on growth. Fiscal multipliers at high levels of debt have been shown to be near-nil (Huidrom et al. 2020; Ilzetzki, Mendoza, and Vegh 2013).

In addition, fiscal consolidation can be designed in a manner that is more likely to succeed. For example, cuts in current spending (especially on transfers and wages), while simultaneously protecting or raising capital spending, have been associated with a higher likelihood of consolidation being sustained (Gupta et al. 2004). Fiscal adjustment, when necessary, has been more likely in countries with less rigid spending, in particular where wages, pensions, and debt service accounted for a smaller share of spending (Munoz and Olaberria 2019). Revenue increases also raised the probability of a consolidation being sustained (Gupta et al. 2004, 2005). Other factors that increased the probability of success included a competitively valued currency and broad-based political support (Balasundharam et al. 2023).

Prompt and comprehensive debt restructuring helps both creditors and debtors (Kose et al. 2020). Waiting to restructure debt until after a default occurs has been associated with larger declines in output, investment, private sector credit, and capital inflows than preemptive debt restructurings (Asonuma et al. 2020; Asonuma and Trebesch 2016;). In the past, shallow agreements have been followed by more restructurings until a more lasting resolution was found (Meyer, Reinhart, and Trebesch 2019).

If history is any guide, any sovereign defaults in South Asia in the foreseeable future would incur considerable economic and social costs. Reducing the likelihood of defaults, and ensuring that any defaults that do occur achieve lasting improvements in debt profiles and service costs, requires proactive policy efforts to boost long-term growth and put fiscal positions on a sustainable footing.

ANNEX SL.1. Regression analysis: Methodology and data

Data

This spotlight draws on a dataset of up to 177 external or domestic sovereign debt defaults in 64 EMDEs spanning 1979–2018 (annex table SL.1.1). Data for external sovereign debt defaults are from Asonuma and Trebesch (2016) while data for domestic sovereign debt defaults are from Erce, Mallucci, and Picarelli (2022). Data for the cyclically adjusted fiscal balance and total, external, and domestic government debt are from Kose et al. (2022). Data for global growth rates are from the World Bank's *Global Economic Prospects* report. Data for the U.S. federal funds rate (as a proxy of global borrowing costs) are from *Haver Analytics*. Data for real GDP growth, inflation, and depreciation are from the IMF *World Economic Outlook* database (April 2023 edition).

Estimation of correlates of successful default: Approach and baseline results

A selection-bias corrected panel regression is used to estimate the correlates of successful default. The selection bias correction takes into account the specific characteristics and circumstances that tip countries into debt defaults. The implicit assumption of the approach is that sovereigns are forced into default by circumstances rather than strategically choosing default to achieve specific macroeconomic outcomes (Gelpern and Panizza 2022).

The approach follows a two-step process to estimate the evolution of fiscal outcomes after default, as in Heckman (1976). First, a probit regression is used to estimate the probability of default depending on global circumstances and country characteristics. In a second step, correcting for the selection into default, a panel regression is used to estimate the effects of macroeconomic conditions on the cumulative changes in government debt-to-GDP ratios and the effective interest rate on government debt in the five years following default. This exercise is

ANNEX TABLE SL.1.1 Countries and default years

Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
AGO	2010	CPV	2018	LKA	1996	PAK	1998	TUR	1999
ARG	1982	CRI	1981	MAR	1983	PAK	1999	UKR	1981
ARG	1985	CRI	1984	MAR	1985	PAN	1984	UKR	1998
ARG	1988	CRI	1986	MAR	1989	PAN	1987	UKR	1999
ARG	1989	DMA	2003	MDA	2001	PAN	1988	UKR	2000
ARG	2001	DOM	1981	MDA	2002	PAN	1998	URY	1983
ATG	1998	DOM	1982	MDG	1981	PER	1979	URY	1985
ATG	2008	DOM	1987	MDG	1982	PER	1983	URY	1987
BIH	1992	DOM	1996	MDG	1985	PER	1984	URY	1989
BLZ	2006	DOM	2004	MDG	1987	PER	1985	URY	2002
BLZ	2012	ECU	1982	MDG	2002	PER	1992	URY	2003
BOL	1980	ECU	1983	MEX	1982	PHL	1983	VEN	1983
BOL	1982	ECU	1984	MEX	1984	PHL	1986	VEN	1986
BOL	1984	ECU	1986	MEX	1986	PHL	1988	VEN	1989
BOL	1988	ECU	1997	MEX	1987	PHL	1990	VEN	1995
BRA	1982	ECU	1999	MEX	1988	POL	1981	VEN	1998
BRA	1983	ECU	2008	MKD	1991	POL	1982	VEN	2002
BRA	1984	EGY	1984	MKD	1992	POL	1983	VNM	1982
BRA	1986	GAB	1997	MLI	2011	POL	1986	ZAF	1985
BRA	1989	GAB	2001	MMR	1984	POL	1988	ZAF	1989
BRA	1990	GHA	1982	MMR	1987	POL	1989	ZAF	1992
BRA	1996	GMB	2017	MNE	1991	PRY	1986		
BRB	2018	GTM	1989	MNG	1997	PRY	2002		
CAF	1992	HND	1981	MNG	2003	ROU	1981		
CHL	1983	HND	1990	NGA	1982	ROU	1983		
CHL	1984	IDN	1997	NGA	1983	ROU	1986		
CHL	1986	IRQ	1986	NGA	1986	RUS	1991		
CHL	1990	JAM	1980	NGA	1987	RUS	1998		
CIV	1983	JAM	1983	NGA	1988	RUS	1999		
CIV	1989	JAM	1984	NGA	1989	RWA	1989		
CIV	2000	JAM	1986	NGA	1995	RWA	1994		
CIV	2001	JAM	1990	NIC	1981	SDN	2007		
CIV	2011	JAM	2010	NIC	1982	SLB	1996		
CMR	1985	JAM	2013	NIC	1983	SLV	1981		
CMR	1993	JOR	1989	NIC	1985	SLV	2017		
CMR	2001	KWT	1990	NIC	1994	SRB	1991		
COD	1997	LBR	1980	NIC	1996	SRB	1992		
COG	1992	LBR	1989	NIC	2003	SYC	2010		
CPV	1998	LBR	2016	NIC	2008	TTO	1988		

Sources: Asonuma and Trebesch (2016); Erce, Mallucci, and Picarelli (2022); World Bank.

ANNEX TABLE SL.1.2 Marginal probability of default

	(1)	(2)	(3)
Federal funds rate (percent)	0.00256***		0.00284***
	(0.000738)		(0.000752)
Change in global growth (percentage points)	0.000155		-0.000368
	(0.000953)		(0.000965)
Sentiment (number)	0.00323***		0.00297***
	(0.000766)		(0.000773)
Lagged government debt (percent of GDP)		8.58e-05**	8.16e-05**
		(3.79e-05)	(3.77e-05)
Lagged domestic growth (percent)		-0.000702**	-0.000733**
		(0.000349)	(0.000346)
Lagged depreciation (percent)		0.0322***	0.00517
		(0.0119)	(0.00601)
Lagged inflation (percent)		-7.64e-05	
		(6.43e-05)	
Observations	4,338	4,338	4,338

Source: World Bank.

Note: Estimated marginal probabilities of a probit regression. The dependent variable is one when a country enters default and zero otherwise. Investor risk sentiment ("Sentiment") is proxied by the "excess" global number of defaults that cannot be explained by the U.S. federal funds rate and changes in global growth, computed as the residual from a regression of global defaults on the U.S. federal funds rate and the first difference in global output growth. Domestic variables are lagged by one year, including output growth, depreciation, and inflation. The sample includes 145 EMDEs, encompassing 84 defaults in 46 EMDEs, over 1982–2018. The regression sample spans 1982 to 2022. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

intended to assess the correlates of default and, in cases where default does occur, the correlates associated with fiscal outcomes. The direction of causality remains an open question.

First stage. The first stage estimates a probit regression:

$$\Pr(\text{default}_{it}) = \Phi\,(\beta_0 + \Omega Z_t + \alpha C_{it-1}) + \varepsilon_{it}.$$

The cumulative normal distribution is denoted by **Φ**. The dependent variable is a dummy set to 1 if a default occurs and zero otherwise in Equation 1. Regressors in the probit model (Z_t, C_{it-1}) include global and domestic factors, respectively. Global factors included in the first stage are the U.S. federal funds rate, an indicator for investor risk sentiment, and the change in global output growth. For lack of an alternative measure with a sufficiently long time series reaching back into the 1970s, the sentiment variable is defined as "excess defaults." This measure is computed as the residual from a regression of the global number of debt defaults on the U.S. federal funds rate and the change global output growth. Domestic factors in the first stage are all lagged by one year, including government debt (in percent of GDP), output growth and depreciation.[3] The implicit assumption is that external factors and lagged domestic factors are exogenous to the occurrence of debt default.

The first stage results are shown in annex table SL.1.2. The table shows three columns: one with only global factors, a second with only domestic factors, and a third with both global and domestic factors. The third column is the most comprehensive and is the baseline specification. It shows that an increase in the U.S. federal funds rate is associated with a statistically significant

[3] Note that in alternative specifications the first stage regression includes inflation. However, it is not statistically significant and, as a result, not included in the baseline estimations.

ANNEX TABLE SL.1.3 Share of successful defaults

(Percent of defaults in the group)

	Success = reduction in government debt		Success = reduction in effective interest rate	
	Within the indicated group	Otherwise	Within the Indicated group	Otherwise
All defaults				
Defaults since 1990				
Domestic growth acceleration	100	54	88	53
Global growth acceleration	70	57	67	55
Fiscal consolidation	75	59	71	53
IMF program	70	46	69	43
Defaults since 1979				
Domestic growth acceleration	72	43	88	55
Global growth acceleration	57	46	67	57
Fiscal consolidation	71	53	71	53
IMF program	64	43	69	47
Defaults on external creditors				
Defaults since 1990				
Domestic growth acceleration	100	54	100	67
Global growth acceleration	70	57	83	67
Fiscal consolidation	75	59	100	50
IMF program	70	46	100	25
Above-median haircut	100	59	100	73
Above-median restructuring	100	60	100	75
Defaults since 1979				
Domestic growth acceleration	67	41	100	70
Global growth acceleration	38	52	83	71
Fiscal consolidation	67	67	100	50
IMF program	75	42	100	40
Above-median haircut	50	48	100	75
Above-median restructuring	100	45	100	77

Sources: Asonuma and Trebesch (2016); Cruces and Trebesch (2013); Erce, Mallucci, and Picarelli (2022); World Bank.
Note: Successful default is defined a default that is followed by a reduction in the government debt-to-GDP ratio or, alternatively, in the effective interest rate on government debt between the year of default and five years later. The effective interest rate on government debt is defined as net interest spending relative to the previous year's government debt stock. The percentage of successful defaults is calculated among all defaults that occurred under the circumstances indicated in the first column. "Fiscal consolidation" indicates an improvement in the cyclically adjusted fiscal balance between the year of default and five years after default; "IMF program" indicates that an IMF program was in place at the time of default; "Domestic growth acceleration" and "Global growth acceleration" indicate a two-year domestic or global growth acceleration from the time of default. For the subset of 88 external debt defaults since 1979, including 43 that occurred from 1990 onwards, data is available for restructuring terms. "Above-median restructuring" indicates above-median size of restructured debt in percent of total government debt at time of default, as calculated by Cruces and Trebesch (2013). "Above-median haircut" indicates above-median market haircut at time of default, as calculated by Cruces and Trebesch (2013).

increase in the probability of debt default. An increase in global output growth is associated with a somewhat lower probability of default but this result is not statistically significant. Among domestic factors, both higher government debt and lower output growth are associated with statistically significantly higher probabilities of default. Exchange rate depreciation is controlled for in the baseline specification, but is not statistically significant once global factors are included. Predicted probabilities from the estimation in the third column are presented in the text and figures. Annex table SL.1.3 shows the share of successful defaults associated with different circumstances.

Second stage. The second stage estimates a panel regression:

ANNEX TABLE SL.1.4 Fiscal outcomes after default

Dependent variable	Five-year change in government debt	Five-year change in effective interest rate
Change in domestic growth (percentage points)	-2.053***	0.0578
	(0.510)	(0.0387)
Change in global growth (percentage points)	2.289	-0.410**
	(2.127)	(0.173)
Change in federal funds rate (percentage points)	-0.394	0.272*
	(1.722)	(0.149)
Change in sentiment (number)	3.895***	0.923***
	(1.478)	(0.319)
Lagged government (percent of GDP)	-0.609***	
	(0.114)	
Lagged effective interest rate (percent)		-0.476***
		(0.0721)
Constant	181.2***	8.441**
	(34.21)	(3.876)
Inverse Mill's Ratio	-57.48***	-2.36
	(14.796)	(1.44)
Observations	4,333	4,309

Source: World Bank.

Note: Results of the outcome (second) stage of a Heckman selection bias regression. The second stage is a panel regression, where the dependent variable is the change in government debt (in percent of GDP) or change in the effective interest rate on government debt (in percent) between default and five years after default. Global investor risk sentiment is defined as in the probit model. The sample includes up to 145 EMDEs, and 59 debt defaults in 37 EMDEs over 1982–2018. The regression sample ranges from 1982 to 2022. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

$$\Delta y_{it}^{t+H} = \beta_0 + \beta_1 \Delta g_{it}^{domestic,t+H} + \beta_2 \Delta g_t^{global,t+H} + \beta_3 FFR_t^{t+H} + \beta_4 Excess_t^{t+H} + \beta_5 IMF_{it} + \beta_6 y_{it-t} + \varepsilon_{it}$$

where the dependent variable is the change in either the government debt-to-GDP ratio or the change in the effective interest rate on government debt between horizon H and the start of default. The regressions include the following correlates: the change in domestic output growth $\Delta g_{it}^{domestic,t+H}$, the change in global output growth $\Delta g_t^{global,t+H}$, the change in the U.S. federal funds rate FFR_t^{t+H} , the change in investor risk sentiment $Excess_t^{t+H}$, a dummy variable for an IMF program being in place at the time of default, and the lagged level of the dependent variable (either government debt or net interest spending). The results of the second stage focus on five-year changes (H=5) and are shown in annex table SL.1.4.

Domestic output growth after default is the most important factor associated with a decline in government debt. A 1-percentage-point increase in domestic output growth is associated with an about 2-percentage-point steeper decline in government debt, and the relationship is statistically significant. Investor sentiment is also important: a 0.5 standard deviation improvement in global risk sentiment—comparable to the change between 2020 and 2021—is associated with an about 2-percentage-point steeper decline in government debt over the five years following default.

Global output growth, global interest rates, and global risk sentiment after default are the most important factors associated with effective interest rates on government debt after default. All of these coefficients are statistically significant. The overall conclusion is that (i) to reduce debt in a lasting manner, domestic growth is key; and (ii) to lower effective interest rates on government debt, "luck" in the form of external developments is an important factor. Overall, the analysis suggests that growth-enhancing domestic policies and good luck can re-enforce each other to achieve "success" after default.

Since the approach used here imposes a clear sequencing—default first, debt or interest rate reduction second—there is little *a priori* reason to believe that the exogenous external or past developments that triggered the default event should affect how debt or interest rates evolve over the five years following default. Nevertheless, the exclusion restriction is tested for each of the explanatory variables of the first stage regression. When the second-stage regression is augmented by each of the five first-stage variables, global borrowing cost and sentiment are both statistically insignificant. In the interest rate reduction regressions, changes in global growth, lagged domestic growth, and lagged exchange rates are also statistically insignificant. These results suggest that the exclusion restriction holds for at least two variables in each second-stage regression.

The inverse Mills ratio is statistically significant in the debt reduction regressions, and marginally significant in the interest rate reduction regressions that include a smaller sample of debt defaults (at 15 percent significance). This suggests that a selection model approach is appropriate in this context.

Endogeneity is, of course, a concern when including contemporaneous changes in domestic growth as a correlate of fiscal outcomes in the second-stage regression. However, an appropriate instrumental variable for domestic growth is not immediately apparent. Therefore, the results presented here can only be interpreted as correlations, not as causal effects.

Robustness tests

A dummy variable for an IMF program being in place at the time of default was not always significant in either the first or second stage regression once other factors were controlled for. Neither was the lagged current account balance or interactions between global growth and trade openness or lagged current account balances and the U.S. federal funds rate. Face value reductions, size of restructured debt, and the haircut to restructuring debt, as well as the magnitude of fiscal consolidation (measured as changed in the cyclically adjusted or structural fiscal balance), are also likely to have important relationships with fiscal outcomes after default. However, data on these measures are too limited to derive meaningful results.

ANNEX SL.2. Event study: Methodology

An event study of government debt booms is conducted to examine how different types of debt booms ended. Government debt booms are defined as episodes in which government debt-to-GDP ratios increased above their Hodrick-Prescott-filtered trend by more than 1 standard deviation in at least one year.

This yields 105 total government debt booms, 53 domestic government debt booms, and 34 external government debt booms, among 114 EMDEs since 2004. By this definition, four South Asian countries (Bangladesh, Bhutan, Nepal and Sri Lanka) were in government debt booms in 2021, three (Bangladesh, Nepal and Sri Lanka) in 2022, and two (Nepal and Sri Lanka) in 2023. Two South Asian countries (Bangladesh and India) were in domestic government debt booms in 2020, but only one (Bangladesh) in 2021 and 2022.

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CHAPTER 2

Recruiting firms for the energy transition

Chapter 2. Recruiting firms for the energy transition

As the world presses ahead with the energy transition, new energy-saving technologies offer South Asian countries an opportunity to modernize their economies. Currently, the energy intensity of output of South Asian economies is almost twice the global average—despite a decline over the past two decades that was almost entirely driven by firm-level, within-sector cuts in energy intensity. While the region's firms have been early adopters of basic energy-saving technologies, they have lagged in the adoption of more advanced technologies, with smaller firms lagging particularly far behind. Policies that have been effective at encouraging technology adoption among firms include market-based regulation, dissemination of accurate information on energy savings, and financial support.

Introduction

Widespread adoption of energy-saving technologies is needed as a critical part of South Asia's energy transition away from fossil fuels. With a strong and concerted effort, the region can avoid lagging behind in progress toward its climate goals and remaining reliant on old, energy-inefficient technologies that the rest of the world will be abandoning more quickly. The region's policy makers are well aware of this challenge and have begun to take action. This chapter examines policies that can further accelerate the adoption of energy-saving technologies.

Compared to its share in the global population, South Asia's contributions to global greenhouse gas (GHG) emissions is small, at just under 10 percent of global GHG emissions versus 24 percent of the global population. However, per unit of output, South Asia's emissions are almost twice the global average. The discrepancy in part reflects low labor productivity (chapter 3). The good news is that this is already changing, and that further improvements are possible even without large amounts of new investment.

The region is currently contributing disproportionately to global greenhouse gas emissions: the region's share of GHG emissions is more than twice its share in global GDP (figure 2.2.1). India accounts for 80 percent of South Asia's GHG emissions, but the share of global emissions is also more than twice that of global GDP in Bhutan, Nepal, and Pakistan, which together with India account for 87 percent of the region's GDP. All South Asian countries except Bangladesh and India witnessed faster emissions growth than other EMDEs between 2010 and 2020.

The sources of growth in emissions vary across South Asian countries but, in general, the main sources relate to energy use (figure 2.1).[1] The power generation sector is a major source of growing emissions, being the largest contributor to GHG emissions growth between 2010 and 2020 in three countries (Bangladesh, India, and Sri Lanka). In addition to grid energy use, the heavy use of fuels for in-house energy generation in the manufacturing, mining, and construction sectors has also been among the three largest contributors to emissions growth in Bangladesh, Bhutan, India, and Nepal. The expansion of grid electricity supply from renewable sources, notably hydroelectricity in Nepal, may reduce the need for such in-house energy sources. Nonetheless, improvements in energy efficiency among industrial firms will need to be an important part of any strategy to reduce GHG emissions.

A slowdown in energy consumption growth through rising energy efficiency will have important environmental benefits, in addition to lowering GHG emissions. The region's power sector is not only the largest source of the region's GHG emissions but also its largest source of PM2.5 pollution (figure 2.2). Except for the

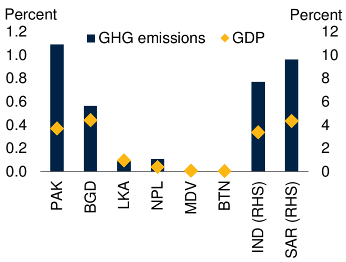
Note: This chapter was prepared by Siddharth Sharma, with contributions from Jonah Matthew Rexer.

[1] At 20 percent, South Asia has the second-lowest share of renewable electricity generation among EMDE regions (after the Middle East and North Africa), despite a 4-percentage-point increase since 2016. While Bhutan and Nepal rely virtually entirely on renewable energy, the share of renewable electricity generation is well below the global average in Bangladesh, India, and the Maldives

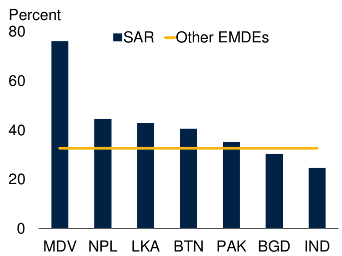
FIGURE 2.1 South Asia's contribution to global emissions

SAR's share of global GHG emissions in recent years has been more than twice its share of global GDP. Emissions rose faster in most SAR countries than in other EMDEs, on average, during 2010–20, but only slightly faster in most cases. Energy use, including that in the manufacturing sector, was the major source of emissions growth.

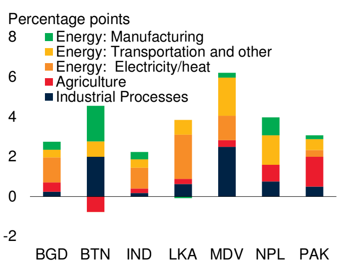
A. Share of global GHG emissions, 2021



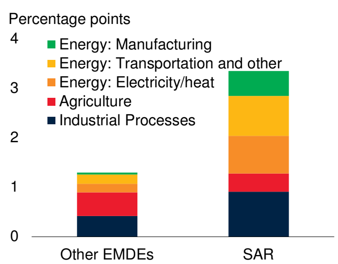
B. Growth in GHG emissions, 2010–20



C. Source of growth in GHG emissions, 2010–20



D. Sources of growth in GHG emissions, 2010–20



Sources: Climate Watch; EDGARv7.0_GHG database; European Commission; OECD; World Development Indicators.

Note: BGD = Bangladesh; BTN = Bhutan; EMDEs = emerging market and developing economies; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan; SAR = South Asia.

A. Chart shows South Asia's share of global GHG emissions compared with global nominal GDP in U.S. dollars for 2021.

B.-D. Charts show annual average growth in emissions between 2010 and 2020 using Climate Watch data. Latest available data (2020) for GHG emissions sources. "Energy: Electricity/heat" comprises emissions from fossil fuel use in electricity and heat plants, that is, the power sector. "Energy: Transportation and other" category comprises emissions from fossil fuel use in transportation, buildings, agriculture, and fishing. "Energy: Manufacturing" comprises emissions from fossil fuel use in manufacturing, mining, and construction (excluding grid energy use).

Maldives, all South Asian countries' shares of global PM2.5 emissions are multiples of their shares of global GDP, ranging from 2 to 15 times higher. In Bhutan and Nepal, where the energy sector is predominantly based on hydro power, the high PM2.5 and GHG intensity of GDP is driven by other sources. These sources include brick kilns and other small firms, solid fuel combustion in the residential sector for cooking and heating, current management practices for municipal waste in the region (including the burning of plastics), and transport.

As a result of these PM2.5 emissions, South Asia is home to nine of the world's ten most polluted cities (World Bank 2023a). The region also has the second-highest rate of deaths attributable to air pollution (after Sub-Saharan Africa). In 2019, deaths from air pollution in SAR outnumbered deaths from tuberculosis by a factor of five. Average life expectancy across Bangladesh, India, Nepal, and Pakistan would be five years higher if pollution concentrations permanently complied with WHO guidelines (Greenstone, Hasenkopf, and Lee 2022). Pollution-induced sickness, mortality, and learning losses have been shown to reduce incomes materially in the region (Behrer, Choudhary, and Sharma 2023).

The transition away from fossil fuels will have wide-ranging consequences. This chapter focuses on policies to encourage the transition among firms. Specifically, it discusses the following questions.

- How has energy consumption evolved in South Asia?
- Which factors are associated with shifts by firms toward less polluting technologies?
- What are the policy implications?

Contributions to the literature

This chapter provides the first region-wide overview of the policy challenges facing South Asia in reducing energy-related GHG emissions, building on the World Bank's *Country Climate and Development Reports* for Bangladesh, Nepal, and Pakistan, and similar work underway in the rest of the region. It makes several additional contributions to the literature.

First, it examines the contributions of firm- and sector-specific factors to high energy consumption in South Asia. Previous studies have conducted such analysis only for individual countries (Kumar, Mittal, and Pradhan 2023; Martin 2011). The consistent approach applied here enables more robust cross-country comparisons.

Second, using new survey data, this chapter is the first study to compare the diffusion of energy-saving technologies among firms in South Asia and other EMDEs, and to identify which types of firms have been more successful in adopting energy-efficient technologies.

Third, using the interim findings of a randomized control trial for the leather goods industry in Bangladesh, the chapter illustrates the potential energy-efficiency gains that could be achieved by the adoption of low-cost new technology among firms. The analysis reinforces the results of a large literature that demonstrates the benefits of technology adoption among farmers, non-agricultural firms, and households, but is the first to illustrate how information spillovers among firms can accelerate this process.

Fourth, this chapter includes the first systematic review of the literature on policies that can encourage firms to adopt more energy-efficient technologies. Previous reviews have pertained to obstacles that firms face in technology adoption more broadly (e.g., Verhoogen 2023), but this chapter focuses specifically on obstacles to the adoption of energy-saving technologies and on experiences with policies to remove such obstacles and encourage energy savings by firms.

Main findings

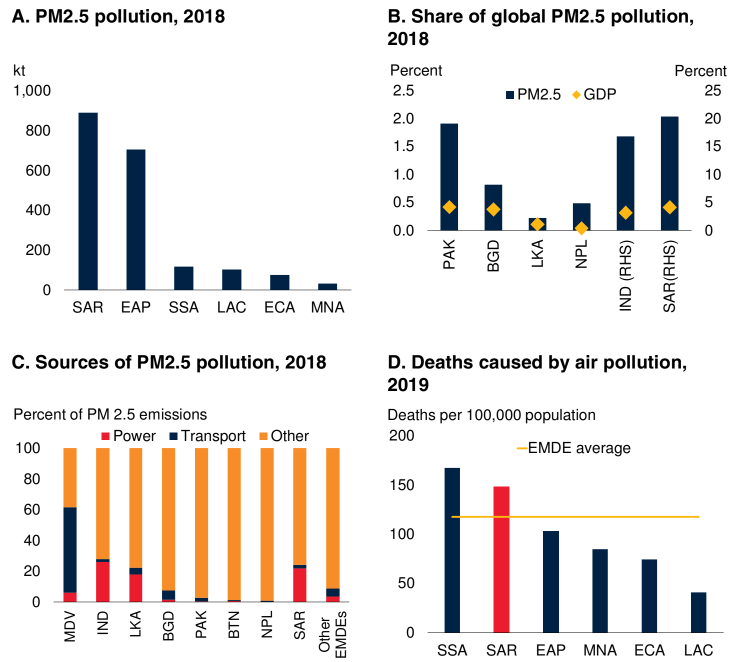
This chapter offers the following main findings.

First, the energy intensity of output in South Asia is almost twice the global average, despite having fallen faster than elsewhere over the past decade. The energy intensity of its economic activity has fallen mainly owing to declining energy intensity within sectors, as opposed to shifts of activity and resources toward less energy-intensive sectors. In the case of India, the only country with available firm-level panel data, energy intensity has declined markedly within firms.

Second, while firms in South Asia have been earlier adopters of simple energy-efficient technologies than firms in other EMDE regions, they have been slower adopters of more advanced technologies. The adoption of such technologies has tended to be faster among larger firms, including those with better-educated managers and better management practices.

FIGURE 2.2 Air pollution in South Asia

SAR is the EMDE region with the highest air pollution and second-highest rate of deaths from air pollution after Sub-Saharan Africa. The energy and transport sectors are important sources of pollution, especially in India, the Maldives, and Sri Lanka.



Sources: EDGARv7.0_GHG database; European Commission; World Development Indicators; World Health Organization.

Note: EMDEs = emerging market and developing economies; EAP = East Asia and the Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SAR = South Asia; SSA = Sub Saharan Africa. BGD = Bangladesh; BTN = Bhutan; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan. kt = kiloton.

A. Unweighted cross-country averages. PM2.5 pollution is defined as the amount of small dust or soot particles in the air measuring 2.5 microns or less in width.

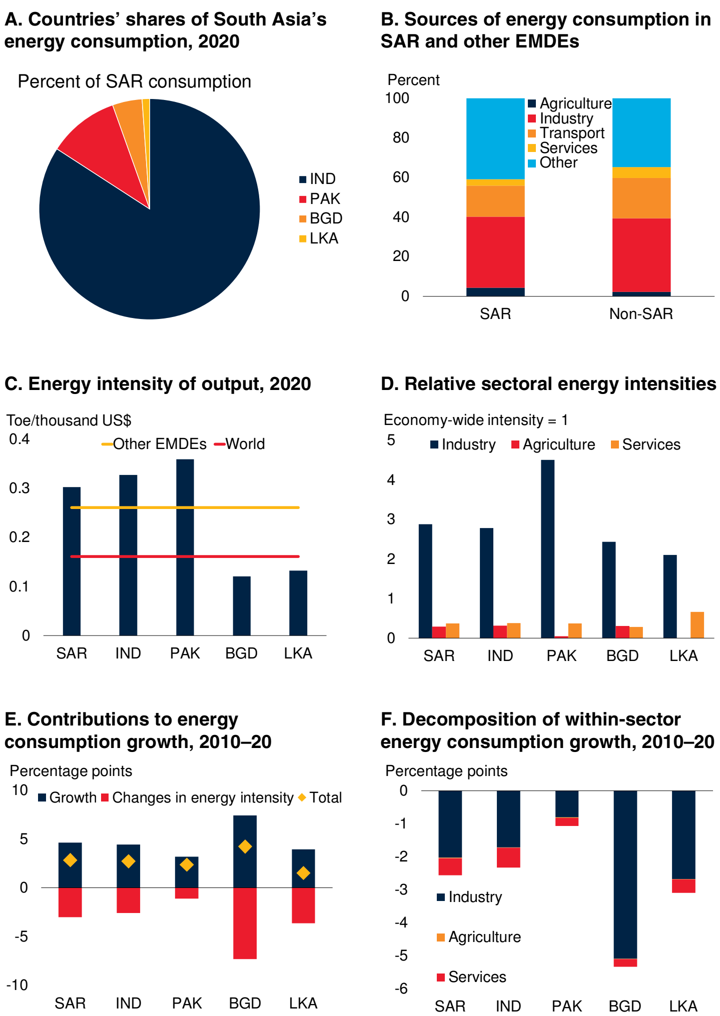
C. The “other” category includes manufacturing, agriculture, residential sector, municipal waste and soil dust.

Third, interim results from the midline survey of a randomized control trial conducted among leather firms in Bangladesh suggest that firms significantly underestimate the potential savings from energy-efficient new technologies. Firms were, on average, initially willing to pay only 56 percent of the purchase price of a new energy-saving product. Once given the relevant information, 10 percent of firms adopted the new technology within the short span of three months. This information appears to have spread rapidly to geographically close firms, spurring technology adoption.

Fourth, a wide range of policies will be needed to improve economy-wide energy efficiency. Besides well-designed informational interventions and nudges, firms’ technology adoption could be

FIGURE 2.3 Energy intensity in South Asia

India, and especially its industrial sector, is the main source of energy consumption in South Asia. The region's two largest economies are more energy intensive than other EMDEs outside South Asia, with the industrial sector's energy intensity a multiple of that of other sectors. While rapid output growth has lifted energy consumption, this was partially offset by improving energy efficiency in all four South Asian countries with available data. The sources of the decline in aggregate energy efficiency varied widely across countries.



Sources: European Commission; OECD Green Growth database; World Development Indicators.

Note: EMDEs = emerging market and developing economies; SAR = South Asia. BGD = Bangladesh; IND = India; LKA = Sri Lanka; PAK = Pakistan. Data on energy consumption in South Asia are only available for Bangladesh, India, Pakistan, and Sri Lanka. Latest available data are for 2020.

C. Energy intensity is defined as energy consumption (in tons of oil equivalent, toe) relative to nominal GDP (in thousands of U.S. dollars) in 2020.

D.E.F. Based on decomposition into three sectors—agriculture, industry, and services—as detailed in annex 2.1.1.

D. Energy intensity in each sector relative to economy-wide energy intensity in 2020.

accelerated by a comprehensive package of regulations, carbon taxes, subsidy cuts, and policies to improve access to reliable electricity, finance, and external markets. Apart from its direct benefits, greater energy efficiency can also serve such development goals as job creation and productivity improvements.

Evolution of South Asia's energy consumption

South Asia's economic activity is unusually energy -intensive and the industrial sector accounts for the bulk of this energy intensity. Improvements in energy intensity can unlock improvements in air quality, production gains, and job creation, while also lowering GHG emissions.

South Asia in global comparison

The energy intensity of economic activity in South Asia is almost twice the global average (figure 2.3). In contrast to energy use per unit of output—which is the focus of this section—South Asia's energy use per capita is lower than the EMDE average. The divergence between South Asia's above-average energy intensity of economic activity and below-average energy intensity per capita in large part reflects its low labor productivity.

India and Pakistan, the region's two largest economies, are one-quarter to one-third more energy-intensive than the average EMDE outside South Asia, respectively. In contrast, Bangladesh and Sri Lanka are less energy intensive, by one-half, than the average non-South Asian EMDE. The latest data show that, in 2020, manufacturing accounted for the largest share of South Asia's energy consumption, and a larger share than in other EMDE regions. For three of the four South Asian countries with available data, the manufacturing sector was the single-largest consumer of energy, with India's manufacturing sector alone consuming one-third of South Asia's total energy production. This reflects the fact that, in South Asia, energy intensity in manufacturing is a multiple of that in other sectors.

Growth versus energy intensity

South Asia's energy consumption has increased by less than 3 percent per year over the past decade—about one-half the rate of output growth over the same period (figure 2.3). In fact, in all four South Asian countries with available data, energy intensity has declined since 2010, although not sufficiently to offset the impact of rapidly rising output growth on energy consumption, especially in manufacturing (figure 2.3, annex 2.1.1).

In the two economies with the highest energy intensity, India and Pakistan, the declines in energy intensity were more modest than in Bangladesh and Sri Lanka. That said, India's rate of decline in energy intensity compares favorably to the average for Latin America and the Caribbean (World Bank 2022a). The sector that was the main source of declines in energy intensity in the region was manufacturing, which is by far the region's most energy-intensive sector. In India, the services sector also contributed to the decline.

Sectoral shifts versus firm-level energy intensity

The decline in South Asia's energy intensity appears to have reflected improvements in energy efficiency within subsectors, rather than shifts in production to less energy-intensive subsectors in manufacturing and services. Indeed, the output of the average firm in South Asia's manufacturing and services sectors has become significantly less energy-intensive over time.

This conclusion is supported by data reported in the World Bank Enterprise Surveys, which report the electricity expenses and total wage bills of more than 73,000 firms in 15 two-digit manufacturing and services subsectors in 43 EMDEs, including Bangladesh (2006 and 2022), India (2014 and 2022), and Pakistan (2006 and 2022; annexes 2.1.2 and 2.1.3). Firm-level energy intensity is proxied by electricity expenses in percent of the wage bill. Qualitatively similar results are obtained if energy intensity is measured as electricity expenses in percent of revenue.

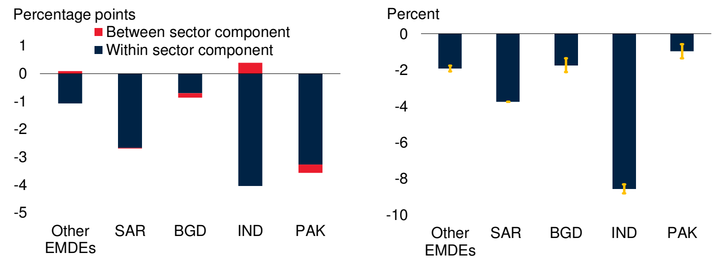
These data suggest that, on average, within-subsector declines in energy intensity reduced overall energy intensity in South Asia by 3 percent per year between 2006 and 2022. Furthermore, shifts in activity between subsectors with differing energy intensities played a negligible role in reducing overall energy intensity. Other EMDE regions, on average, experienced smaller within-subsector declines in energy intensity between

FIGURE 2.4 Firm-level energy intensity

Within-subsector declines have been the main source of overall declines in energy intensity in the manufacturing and services sectors in South Asia since 2001, with shifts of resources between sub-sectors contributing little. Within subsectors, mean firm-level energy intensity in South Asia declined by about 4 percent a year between 2006 and 2022.

A. Contributions to average annual changes in energy intensity, 2006–22

B. Average annual change in firm-level energy intensity, 2006–22



Source: World Bank Enterprise Survey (WBES), World Bank.

Note: EMDEs = emerging market and developing economies; SAR = South Asia; BGD = Bangladesh; IND = India; PAK = Pakistan. Based on two waves of WBES: Bangladesh 2022 and 2006; India 2022 and 2014; Pakistan 2022 and 2006; Other EMDEs 2006 and 2022. India 2006 unavailable. Total sample size is 73,171 firms. Unweighted country average for other EMDEs. The WBES do not cover firms in agriculture, transportation, mining, and construction. Energy intensity defined as ratio of electricity and wage bill.

A. The chart shows the annual average growth rate of aggregate energy intensity decomposed into changes within-subsectors and between subsectors. This is estimated for 15 2-digit subsectors in manufacturing and services. Method detailed in annex 2.1.2.

B. The chart shows the annual within-subsector growth rate of mean firm-level energy intensity. It is based on OLS regressions of log firm-level energy intensity on year, with country-specific subsector fixed effects. Separate regressions estimated for Bangladesh, India, Pakistan and a pooled dataset of all other EMDEs. The SAR average is the unweighted average of the estimated annual growth rate of South Asian countries. Method detailed in annex 2.1.2.

2006 and 2022 (figure 2.4). The results of a linear regression analysis suggest that, within subsectors, the average firm's energy intensity declined by 4 percent per year between 2006 and 2022, compared with 2 percent per year, on average, in other EMDE regions. The fastest rate of decline in average firm-level energy intensity within subsectors occurred in India.

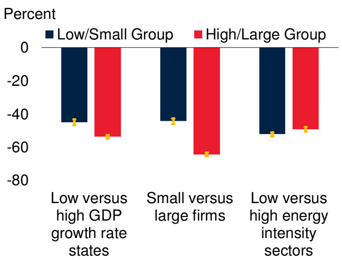
Case study: India

In India, the Annual Survey of Industries (ASI) followed a sample of 150,000 firms in 23 manufacturing subsectors during 2001–18. It collected detailed data on firm characteristics, including energy (grid electricity and fuel) expenses and the wage bill (annex 2.1.4). These data make it possible to compare energy intensity in the same firm at different points in time. Firm-level energy intensity is defined as energy expenses in percent of the wage bill. Using an alternative definition of energy intensity—energy expenses in percent of firm revenues—does not alter the key results.

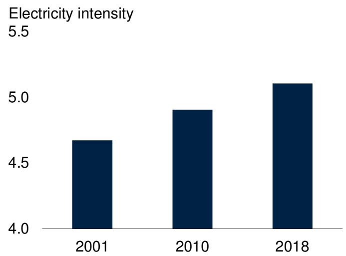
FIGURE 2.5 India: Within-firm reductions in energy intensity

From 2001 to 2018, there were significant declines in energy intensity within India's manufacturing firms, on average. But divergences in energy intensity grew as a result of significantly faster declines among larger firms in faster-growing states with lower initial energy intensity.

A. Changes in energy intensity within firms, 2001-18, by firm type



B. Mean firm-level dispersion in energy intensity within sectors, 2001-18



Sources: Annual Survey of Industries for India; World Bank.
Note: The sample size is 519,849 firm-year observations with 156,927 unique firms. The measure of electricity (or energy) intensity is the ratio of energy expenses to the total wage bill of each firm.
A. Chart is based on firm-level panel regressions of log of energy intensity on year dummies interacted with dummies for above versus below median GDP growth rate states (first pair of bars); firm size below 50 workers versus firm size above 50 workers (second pair of bars); and above versus below median energy intensity sectors (third pair of bars). Each pair of bars depict the cumulative percentage drop in energy intensity between 2001 and 2018 in the two corresponding groups. Method detailed in annex 2.1.4.
B. Chart depicts the within-sector ratio of the 75th percentile and 25th percentile energy intensity levels, averaged across sectors in 2001, 2010, and 2018.

On average, within-firm energy intensity in the Indian manufacturing sector halved between 2001 and 2018 (that is, fell by 4 percent per year). This is broadly in line with the decline in average energy intensity in the broader South Asian sample. It is also consistent with results from another recent study of energy intensity trends in Indian firms based on a different dataset (Kumar, Mittal, and Pradhan 2023). However, the rate of decline in energy intensity varied with regional economic growth, initial sectoral energy intensity, and firm size (figure 2.5). Firms in states with above-median output growth rates, firms in sectors with below-median initial energy intensity (in 2001), and larger firms reduced their energy intensity significantly faster than other firms. In particular, firms with more than 50 employees cut their energy intensity 20 percentage points more than smaller firms. As a result, the dispersion of energy intensity across firms within sectors widened over time.

In principle, if the price elasticity of energy demand is low, the decline in energy intensity might reflect declining energy prices or growing subsidies. Conversely, the decline in energy intensity could be explained by rising energy prices and a high elasticity of demand. In practice, however, the results are robust to controlling for energy prices. Alternatively, the decline in energy intensity might reflect improved electricity grid reliability that makes the use of less efficient private generators unnecessary. However, electricity intensity and fuel intensity declined, which suggests that improving grid reliability alone did not drive the observed decline in energy intensity.

In Indian manufacturing firms, faster cuts in energy intensity were associated with faster employment growth. Between 2001 and 2018, employment growth in sectors with above-median reductions in energy intensity was 1.5 percentage points per year higher than in sectors with below-median declines in energy intensity (figure 2.6). Within firms, a 1 percent reduction in energy intensity was associated with a 0.2 percent increase in employment during this period. While these results do not necessarily indicate a causal effect of reduced energy intensity on employment, they are robust to defining energy intensity as energy expenses in percent of revenues, and are indicative of energy savings unlocking firm expansions.

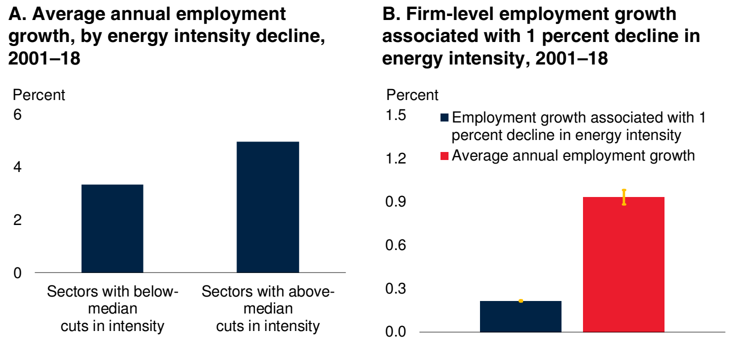
The roles of firm-level and within-sector declines in energy intensity among Indian firms are also a feature of advanced economies that have undergone steep declines in energy intensity. In advanced economies, declines in energy intensity were driven initially by structural change but subsequently by within-sector, firm-level improvements. In the United States, for example, market share reallocation toward less energy-intensive sectors was an important driver of falling economy-wide energy intensity during 1960–80 but since then, within-industry declines in energy intensity have accounted for the larger share of declines in overall energy intensity (Levinson 2021; Wing 2008). A similar pattern is observed in a survey of studies that examine energy-intensity in a broad range of advanced economies (Ang and Zhang 2000).

Structural change that reallocated market share to less energy-intensive sectors may have been limited in recent years in South Asia for two reasons:

limited relative price changes and the timing of major structural reforms. First, energy subsidies remain high in much of the region (see the policy section of this chapter). In India, ASI data on electricity prices and wages in firms during 2001–18 indicate that electricity prices have increased over time but not as rapidly as wages. As a result, the price of electricity relative to labor cost has fallen. Second, major structural reforms largely pre -date the sample used in this exercise. In India, major trade liberalization and industrial de-licensing led to structural change that reallocated market shares toward less energy-intensive industries (Barrows and Ollivier 2018; Martin 2011). The impacts of these policy changes, which were enacted in large part in the 1990s, may have begun to diminish in the 2010s.

FIGURE 2.6 India: Energy intensity cuts and employment growth

In 2001-18, deeper declines in energy intensity were associated with faster employment growth, both within sectors and within firms.



Sources: Annual Survey of Industries for India; World Bank.

Note: The measure of electricity (or energy) intensity is the ratio of energy expenses to the total wage bill of each firm.

A. Chart depicts the annual employment growth rate between 2001 and 2018 in 23 manufacturing sectors. The sectors are grouped into those with below-median and above-median cuts in sector-level energy intensity.

B. The sample size is an unbalanced panel of 519,849 firm-year observations with 156,927 unique firms for the 2001–18 period. Chart depicts the correlation between log employment and energy intensity at the firm level, estimated with a firm level panel regression with firm fixed effects, as detailed in annex 2.1.4.

Energy-efficient technology adoption by firms

The important role of within-sector and within-firm cuts in energy intensity suggests that the accelerated adoption of new green technologies at the firm level could make a meaningful contribution to the energy transition and efforts to lower GHG and other pollutant emissions. The speed of technology adoption, however, depends on firms' characteristics, the nature of new technologies, and the context in which firms operate.

Cross-country evidence

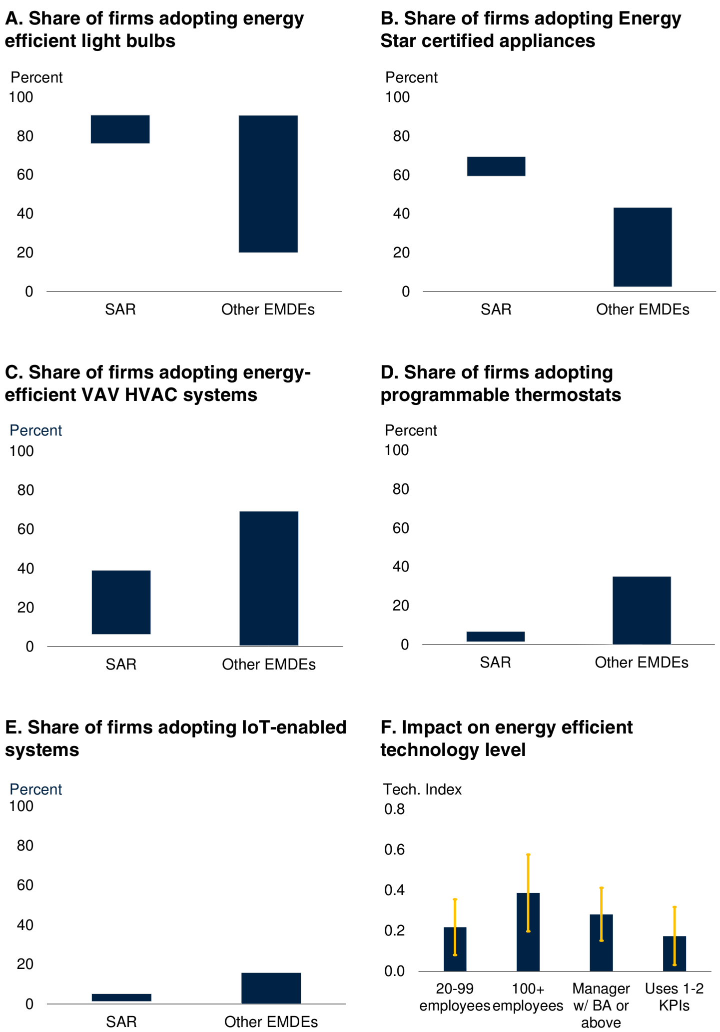
South Asia's firms have been early adopters of basic energy-saving technologies but lagging adopters of more advanced technologies. In 2022, the World Bank's Firm Adoption of Technology (FAT) Survey collected data from 10,090 firms in seven EMDEs, including 1,936 firms in Bangladesh and 1,455 in India, on technology use, as well as other firm characteristics (annex 2.1.5). The surveys are part of a World Bank project on technology adoption in EMDE firms (Cirera, Comin, and Cruz 2022).

More than three-quarters of South Asian firms had adopted energy-efficient lighting, one of the most basic energy-efficient technologies. This adoption rate was higher than in the other EMDEs surveyed. Similarly, almost two-thirds of South Asian firms had adopted Energy Star certified appliances, another basic energy-efficient technology. This adoption rate was in the upper half of the range of adoption rates among the other EMDEs surveyed. However, fewer than 7 percent of firms had installed programmable thermostats, a more advanced energy-efficient technology, a rate in the lower half of the range of the other EMDEs. More advanced technologies, such as Internet-of-Things (IoT)-enabled heating, cooling, and ventilation systems, also had a low uptake in South Asia, broadly in line with other EMDEs (figure 2.7).

The faster-than-average adoption of basic energy-saving technologies in South Asia is driven to a large extent by the high rate of adoption among Indian firms. This may reflect the effects of energy pricing and efficiency policies in India. There is evidence that a high electricity price for industrial users (compared with households and farmers) has caused firms to shift to less energy-intensive products (Abeberese 2017). Moreover, as discussed in more detail in the policy section of this chapter, India's high adoption rates of basic energy efficiency technologies may be due to its

FIGURE 2.7 Energy-efficient technology adoption by firms: Cross country evidence

Firms in South Asia have been early adopters of basic energy-efficient technologies but lag in the adoption of more advanced technologies. Larger firms with better-educated managers who rely on key performance indicators have a higher level of energy-efficient technology adoption.



Source: Wave 2, Firm-level Adoption of Technology (FAT) Surveys, World Bank.

Note: EMDEs = Emerging Markets and Developing Economies; SAR = South Asia Region. Includes data from World Bank's FAT Surveys of 10,090 firms in seven EMDEs (Brazil, Bangladesh, Cambodia, Chile, Ethiopia, India, and Georgia).

A.–E. The charts depict the range of country-level averages of percent of firms adopting technologies in South Asia and other EMDEs. For each country, the average percent of firms adopting a technology is estimated using sampling weights. The technologies are energy-efficient lighting, Energy Star-rated equipment, Variable Air Volume HVAC systems, programmable thermostats, and IoT-enabled systems to control temperature, lighting, or refrigeration.

F. Charts depict coefficient estimates with 95 percent confidence intervals from OLS regressions of Energy Efficient Technology Index on firm attributes, including employment size, sector, and region dummies. KPI = Key Performance Indicator. The Technology Index ranges from 0 to 6 in value. The sample for the regression is the FAT Survey Wave 2 pooled data for 2,436 firms in Bangladesh, India and five other EMDEs. Method detailed in annex 2.1.5.

flagship energy efficiency programs—notably, a large-scale LED lights dissemination program known as the Unnat Jyoti by Affordable LED for All (UJALA) program.

Larger firms, firms with better-educated managers, and firms that regularly relied on performance indicators tended to be more energy efficient. A linear regression of a firm-level energy-efficient technology index, which ranges in value from 0 to 6, was used to identify firm characteristics associated with greater adoption of energy-saving technologies in the pooled sample of Bangladesh and India (annex 2.1.5). Compared with a baseline average of 1.7 index points, the energy-efficient technology index in larger firms was 0.2–0.4 of a point higher than in their smaller peers. Additionally, firms whose manager held a bachelor's degree had a 0.3-of-a-point higher energy-efficient technology index than other firms; and firms that used Key Performance Indicators (KPIs) as a management practice had a 0.2-of-a-point higher energy-efficient technology index than those that did not (figure 2.7).

Unreliable electricity grids may lock in energy-intensive technologies such as backup power generators. Backup power generators are inefficient and polluting (Tong and Zhang 2015). Moreover, generators only partially compensate firms for productivity losses incurred due to an unreliable power grid (Allcott, Collard-Wexler, and O'Connell 2016). Firms in Bangladesh and India had significantly higher rates of generator use than the firms surveyed in other EMDE regions: three-quarters of surveyed firms in India and Bangladesh reported using generators, three times as many as the one-quarter of firms, on average, in other EDME regions (figure 2.8). In India, almost 30 percent of surveyed firms had experienced a power outage in the month preceding the FAT survey; and those that had experienced outages were significantly more likely to be using a power generator (figure 2.8; annex 2.1.5).

South Asia's firms may be early adopters of basic energy-saving technologies, but they are not EMDE leaders in technology adoption more broadly. The World Bank's FAT survey has collected information on the adoption of a wide range of general-purpose and industry-specific technologies, in addition to energy-saving technologies. The data suggest that, in general, the level of technology adoption among firms in South Asia is at or below the EMDE average (Cirera, Comin, and Cruz 2022).

Case study: Bangladesh

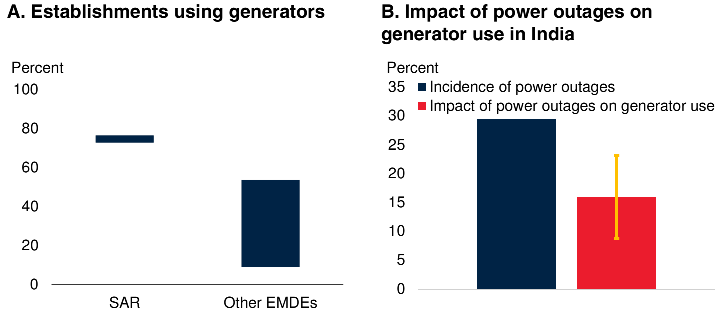
To assess the potential for promoting the adoption of energy-efficient new technologies among firms through enhanced information provision, a randomized control trial (RCT) is being conducted among 504 firms engaged in leather goods and footwear manufacturing in Bangladesh since 2022 (annex 2.1.6; Chaurey et al. 2023).[2] Firms in this industry have traditionally used sewing machines fitted with clutch motors, but a significantly more energy-efficient replacement—the servo motor—is now available. The RCT conducted a baseline survey and then implemented a randomized intervention to examine how the provision of information on the energy efficiency and ease of installation of servo motors could accelerate its adoption. A midline survey was conducted during March–May 2023 to measure the effects of the intervention approximately three months later. A final, endline survey will be conducted to measure the effects nine months after the intervention, from September-November 2023. Pending the endline survey, the midline survey results already point to some patterns in firms' adoption of energy-efficient technologies (Chaurey et al. 2023).

Technology adoption after information intervention

Most of the firms in the RCT are micro, small, or medium firms, with 90 percent of them having 20 or fewer workers. In the baseline survey, the RCT firms were asked about their beliefs or expectations about the new technology, their willingness to pay for it, their pre-existing technology, and other firm characteristics. Following the baseline survey, the RCT firms were randomly assigned into four groups: one control group, and three treatment groups.

FIGURE 2.8 Unreliability of grid power and use of electricity generators

The use of backup generators among firms is exceptionally high in South Asia. Firms that face power outages are more likely to use generators.



Source: Wave 2, Firm-level Adoption of Technology (FAT) Surveys, World Bank.
Note: EMDEs = Emerging Markets and Developing Economies; SAR = South Asia Region. Includes data from World Bank's Firm FAT Surveys of 10,090 firms in seven EMDEs (Brazil, Bangladesh, Cambodia, Chile, Ethiopia, India, and Georgia). Method is detailed in annex 2.1.5.
A. Chart depicts the range of country-level averages of percent of firms using generators for South Asia and other EMDE groups. For each country, the average percent of firms adopting a technology is estimated using sampling weights.
B. Chart depicts the percentage of firms that experienced a power outage (left bar) and the estimated marginal effect of power outages (with 95 percent confidence intervals) on the probability of owning/sharing a generator in India. The latter results from a firm-level probit regression of generator use on a dummy for whether firm faced a power outage in the past month, controlling for sector, size and firm age.

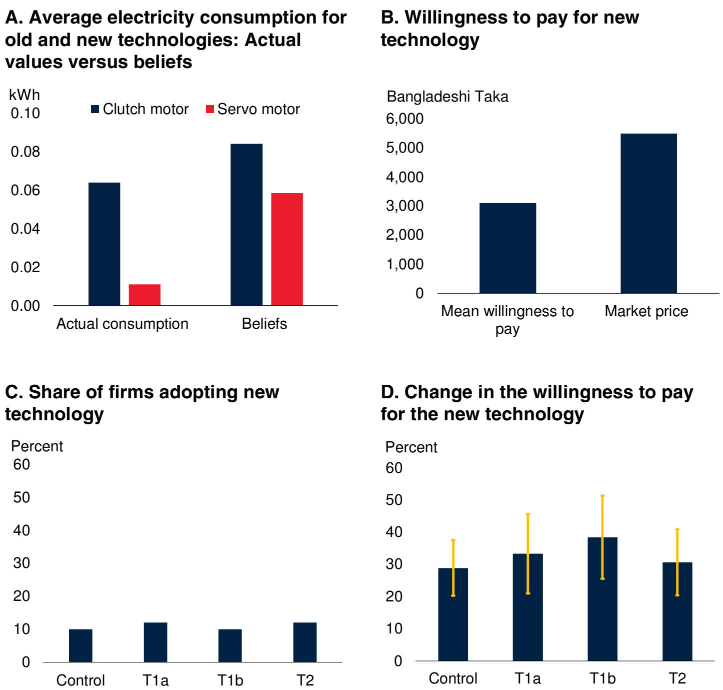
The treatment groups differed in the intensity of the provision of information to them. The first treatment group ("T1a") was shown a video explaining the energy-saving benefits of the servo motor and the ease with which it can replace a clutch motor in an existing sewing machine. The second group ("T1b") was shown the same video and also had an electricity meter installed in one of their existing clutch motor sewing machines. Firms in the third treatment group ("T2") were not only shown the video and provided with a meter, but also given the opportunity to try a servo motor themselves. The details of the intervention are discussed in annex 2.1.6.

Firms initially vastly underestimated the energy savings from the new motors. The readings taken from the electricity meters installed in T2 firms confirmed that servo motors are significantly more energy-efficient than clutch motors. Specifically, mean electricity consumption per hour in a servo motor machine was 83 percent lower than that in

[2] The RCT is a collaboration between the World Bank and researchers from Columbia University and Johns Hopkins School of Advanced International Studies.

FIGURE 2.9 Energy-efficient technology adoption by firms: Randomized control trial

Firms tended to underestimate the potential energy savings from a new technology (servo motors) and were only willing to pay 56 percent, on average, of the actual purchase price. About 10 percent of firms in each of the four RCT groups of firms adopted servo motors after an informational intervention was delivered to the three treatment groups. Their willingness to pay increased by 33 percent.



Sources: Chaurey et al. 2023; World Bank.

Note: RCT baseline and midline surveys and meter readings, 2022. Sample includes 504 firms in Bangladesh in the leather goods and footwear industry.

A. Estimates of mean electricity consumption based on hourly readings of electricity meters installed in one clutch and one servo motor sewing machine in each of 124 T2 firms. Meter readings collected for every day in January. Mean baseline beliefs about daily electricity consumption by a clutch motor and servo motor sewing machine in the full sample of firms measured in the baseline survey.

B. Mean baseline willingness to pay (WTP) for a servo motor in the full sample of firms. WTP elicited through Becker-De Groot-Marshack procedure.

C. Share of firms adopting a servo motor after the intervention, measured in midline survey.

D. Change in willingness to pay for servo motor after the intervention. Methodology as in Chaurey et al. (2023).

a clutch motor machine (figure 2.9). And yet, in the baseline survey, firms on average believed that a servo motor consumes only 30 percent less electricity per hour than a clutch motor. Perhaps as a result, the average firm was willing to pay only 56 percent of the actual purchase price of the servo motor featured in the trial. The degree of underestimation was broadly uniform: there were no statistically significant differences in expectations across different types of firms.

By the time of the midline survey—three months after the intervention—about one-tenth of the firms participating in the study had already replaced a clutch motor with a servo motor (figure 2.9). Unexpectedly, the preliminary results indicate that firms in the control group (which had not been provided with information) also adopted the new motors at a similar rate. Moreover, firms' average willingness to pay had increased by one-third. The average price that firms were willing to pay at the midline was close to the lower end of the price range of servo motor brands available in the local market.

Information spillovers

Qualitative information collected by informally interviewing firms in the study locations suggested that firms in the control group adopted the new technology because of information spillovers. Information from the baseline survey also suggested that, for firms participating in the RCT, other firms are a major source of information about new technologies. According to data collected in the baseline survey, 74 percent of the firms that were aware of servo motors at the start of the experiment had heard about them from another firm in the same industry (figure 2.10).

This suggests that the information about the energy efficiency of the servo motor that was provided in the RCT could have spread from treatment to control firms. To test for such information spillovers, a measure of (indirect) "exposure" to the informational intervention was constructed using detailed data on the geographic locations of the RCT firms (Chaurey et al. 2023). A probit regression was estimated to examine the adoption of new servo motors in the control group as a function of each firm's geographic distance from treated firms.

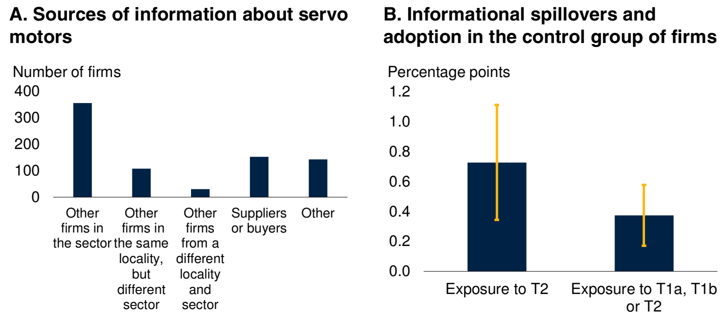
Geographic proximity to a larger number of treatment firms significantly increased the probability of adoption among control firms, pointing to sizable information spillovers among firms. The exposure effect was stronger for proximity to strong treatment (T2) firms—those which had received a servo motor—than proximity to any treatment firm. Quantitatively, the results suggest that the spillover effect could account for 70 percent of the adoption rate in the control group.

Policy implications

A wide range of policies can promote transition away from fossil fuels. Many of these policies go beyond the scope of this chapter, including measures to reduce energy use in buildings, the reduction of environmentally harmful subsidies, measures to promote the switching of fuels used for electricity and heat generation, and policies to promote a shift toward battery-powered motor vehicles (World Bank 2023b, 2023c). For example, policies to promote the use of energy-efficient cooling technologies in buildings, cold-chains, and transportation can help meet the rising demand for adaption to heat stress in a sustainable manner, and are being operationalized in India through the India Cooling Action Plan (Government of India, 2019; World Bank, 2022b). There is also considerable merit in regional initiatives to reduce emissions of GHG and other pollutants since emissions spread across borders along airsheds (World Bank 2023a).

FIGURE 2.10 Information spillovers among firms

Firms closer to treatment firms that had received information about the new technology (servo motors) were significantly more likely to adopt that technology.



Sources: Chaurey et al. 2023, World Bank.
Note: Sample of 504 firms in the leather goods and footwear industry.
A. Chart summarizes the responses to the baseline survey question: “From whom did you learn that servo motors can be replaced by clutch motors”, directed at firms that reported knowing that servo motors can replace clutch motors in sewing machines. The chart depicts the number of firms selecting each possible response (multiple responses possible).
B. Chart depicts the estimated marginal impact on the probability of servo motor adoption of exposure to treatment through spillovers among control groups firms, based on a probit regression of a dummy indicating whether the firm adopted a servo motor after the intervention on an exposure measure and controls for firm size, age, manager education, and management variables. The probit is estimated on the midline survey sample of 162 control group firms. Method detailed in Chaurey et al. (2023).

The analysis of this chapter demonstrates the potential benefits of multi-pronged government policies that remove a variety of constraints on firms’ adoption of energy-efficient technologies (box 2.1). The chapter has focused on the role of firms’ access to accurate information about new technologies and the role of human capital and management quality and access to reliable power grids in the adoption by firms of energy-efficient technology. The literature has also identified regulations addressing market failure (such as the failure to compensate firms for the positive externalities from green technology adoption), access to credit, and openness to trade and FDI as important factors in the adoption of energy-efficient technologies.

South Asia’s above-average energy intensity suggests considerable room for technological catchup among firms, with limited risk of “stranded assets.” Stranded assets could arise if firms make major capital investments into technologies that may rapidly become obsolete as a result of the energy transition. Since South Asian firms lag in technology adoption for all but the most basic energy-efficient technologies, there appears to be ample room for firms to adopt energy-efficient technologies in a small-scale and incremental manner that is unlikely to cause stranded asset. For example, the energy-efficient motor examined in the Bangladesh RCT can replace inefficient motors in existing sewing machines and, hence, its diffusion need not cause a “stranding” of existing sewing machines (the key assets of firms in leather goods and garment sectors).

The extent to which constraints on technology adoption are binding depends, in part, on the technology. Energy-efficient technologies range from basic LED lights to highly advanced IoT-enabled heating, cooling, and ventilation systems. There are also many industry-specific energy-saving technologies, such as servo motor sewing machines in the leather goods and garment industries. In addition, there are a host of beneficial emission abatement technologies, such as industrial air purifiers. These technologies differ along many dimensions, including maturity, upfront costs, and divergences between private and social benefits.

BOX 2.1 Literature review: Addressing barriers to technology diffusion in firms

The literature identifies several constraints on the adoption of new technologies in general, including energy-efficient technologies: lack of finance, information, or scale economies, as well as high costs and perceived difficulty of operating new technology. Advisory support, financial support, and regulation have been shown to accelerate technology adoption.

This chapter focuses on the adoption of energy-efficient technologies by firms. An extensive literature has established broader patterns in firms' adoption of new technologies in general—not just energy-efficient technologies. This box distills the main findings of this broader literature on two questions.

- Which factors have been associated with technology adoption?
- Which interventions have encouraged technology adoption?

Constraints on, and enablers of, new technology adoption

Reviews of the evidence on technology diffusion, mostly from advanced economies, identify several constraints on firms' adoption of new technologies. These include: low or heterogenous benefits of new technologies; high upfront costs of acquiring the technology or learning how to use it effectively; lack of access to accurate information about the technology; uncertainty about the costs and benefits of the technology; costly access to inputs that are complementary with the technology; and low returns from early adoption of technologies that require a large network of users to be viable (Hall 2005; Williams and Bryan 2021).

Evidence also suggests that technological diffusion in EMDEs is accelerated by exporting to advanced-economy markets and easier availability of higher-quality inputs, and that it is constrained by restricted access to credit, limited managerial ability, and misaligned incentives between workers and managers (Verhoogen 2023). A review drawing largely on evidence from agriculture in EMDEs highlights several factors that encourage technology adoption: low cost of new technologies; a simple process of learning about the new technology from own experience, peers, and technology extension agents; better schooling; larger scale economies; access to finance; and conducive behavioral factors (Foster and Rosenzweig 2010).

Interventions to encourage technology adoption

A recent meta-analysis of the evidence from firm-level studies suggests that a range of interventions can be successful in promoting the adoption of new technologies in EMDEs (Alfaro-Serrano et al. 2021). The review considers the following types of interventions: (i) direct funding (including loans, subsidies, insurance, and in-kind or cash grants); (ii) indirect financial support (such as loan guarantees and policies that reduce input costs); (iii) direct non-financial support (informational interventions, public technology extension services, and advisory and consulting support); and (iv) regulations and standards (defined as rules, policies, and characteristics of the environment that affect agents' incentives, such as business regulation and trade policies).

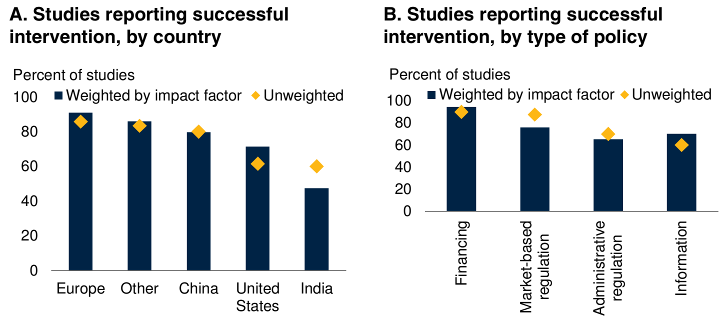
Barring one, the studies that meet the systematic review criteria employed in the meta-analysis are all from EMDEs. Most of the studies examine direct non-financial support or direct financial support. About half find positive and statistically significant effects of interventions on technology adoption. For each type of intervention, some studies find the expected positive and significant impact. However, there is no intervention type for which all, or all but one, studies find a significant positive impact. The meta-analysis suggests that tailoring the intervention to the context may improve their impact.

Policy initiatives to improve energy efficiency are already underway in SAR. For example, Bangladesh's Energy Efficiency and Conservation Master Plan includes a series of programs aimed at large industrial energy consumers, residential consumers, buildings, private companies, and government agencies (Government of the People's Republic of Bangladesh 2015). These include energy auditing and benchmarking; energy efficiency-label certification; low-interest loans and subsidies for energy-efficient investment; preferential taxes that apply to high-efficiency equipment; and technical capacity building. In partnership with the World Bank, Bangladesh is also facilitating the adoption of green practices and environmental standards in microenterprises through the Sustainable Microenterprise and Resilient Transformation project (World Bank 2023d). India introduced several flagship programs to improve energy efficiency in households and firms after the passage of the Energy Conservation Act (2001) (Kumar, Mittal, and Pradhan 2023). The innovative UJALA program distributes LED lighting at a large scale through bulk procurement and a delayed payback schedule. Consumers face a small upfront fee and can pay back the cost of the lights through adjustments in their electricity bill. Although UJALA is aimed at households, it may have had spillover impacts on firms by reducing the cost of LED lights. The retail price of LED lightbulbs fell by 70 percent between 2014 and 2017 (Singh and Bajaj 2018). The "Perform-Achieve-Trade" (PAT) program helps firms reduce energy intensity through energy audits, technical advice, and tradable energy savings certificates (Government of India 2023).

To identify the policy options with the best track record of encouraging energy-efficient technology adoption by firms, a comprehensive literature review was conducted, based on 45 studies published in peer-reviewed journals or policy publications over the past three decades. The studies considered were specifically about energy-efficient or pollution-abatement technologies. The review included 18 studies of regulation and environmental taxes, 16 studies of information campaigns or behavioral nudges, and 11 studies of financing constraints (figure 2.11). Most of the studies were for the United States (15 studies), the Euro area (15 studies), China (six studies), and India (six studies).

FIGURE 2.11 Literature on policies for firm technology adoption and energy efficiency gains

There is strong evidence that regulation, especially market-based regulation, is effective in encouraging energy-saving technology adoption. Information campaigns and behavioral nudges have fewer unintended consequences, but their effectiveness is more uncertain. Evidence that financing policies can promote technology adoption has only recently begun to emerge.



Source: World Bank.
Note: Results from a review of 45 academic and policy studies on the impact of specific policy interventions (regulation, information/behavioral, and finance) on either firm technology adoption or firms' energy efficiency. Impact weighting according to the RePEc ranking of the journal or working paper series in which the study was published.

There are three takeaways from the literature review.

- *First*, regulation and/or environmental taxation can help close the gap between the social and private costs of emissions. They are typically effective in achieving this primary objective but command-and-control regulation, especially, can bring considerable unintended consequences. In addition, in an environment of weak regulatory capacity, such as in South Asia, regulation may be less effective (Duflo et al. 2013; 2018).
- *Second*, information campaigns and nudges can avoid these unintended costs, but generally have smaller effects.
- *Third*, policies can appropriately be used to subsidize technology adoption, to the extent that environmental benefits are not fully captured by adopters, or to ease financing constraints that prevent technology adoption. Empirical evidence on the effectiveness of

financing support, although promising, is limited. These policy options are discussed in more detail below.

Regulation, taxes, and subsidies

Regulation is the most common approach to reducing CO_2 emissions and pollution, and improving energy efficiency. Environmental regulations generally fall into two categories: command-and-control policies, such as mandates on energy efficiency standards and programs that set hard quotas on firms' harmful emissions, and market-based mechanisms, such as cap-and-trade schemes, that allow firms to exceed quota limits by purchasing permits from those that do not.

Command-and-control regulations have often proven effective. About two-thirds of the studies of the impact of regulations document significant impacts. Policies to manage air and water pollution often involve quotas on emissions and phase-outs of technologies that do not meet minimum environmental standards (Greenstone and Hanna 2014; Harrison et al. 2015). Such policies have been effective in reducing air pollution in China (He, Wang, and Zhang 2020; Bu et al. 2022), India (Harrison et al. 2015), and the United States (Shapiro and Walker 2018). Harrison et al. (2015) study an Indian supreme court ruling that imposed air pollution quotas on firms in 17 cities across the country. Firms adapted to the regulation, not by scaling down output, but rather by adopting new pollution abatement technologies that allowed them to lower overall emissions at given output levels. Command-and-control environmental regulations are more common in SAR than market-based regulations. For example, India's 2020 National Clean Air Program has identified 122 cities that do not meet India's air quality standards for particulate matter concentrations and requires Air Quality Action Plans that will include the phasing -out of certain non-compliant technologies. Similar city-focused action plans are being implemented in urban areas of Bangladesh and the Punjab province in Pakistan (World Bank 2023a).

However, command-and-control policies can also have costly unintended consequences. First, firms may respond to quotas by shifting their operations to unregulated entities, particularly where environmental policy is only partially enforced. An example is China's regulation applying energy use quotas to the "Top 1,000" most energy-intensive firms. Regulated firms, typically large conglomerates, used their corporate structures to shift energy consumption to unregulated entities, undermining energy savings, while still suffering substantial output losses (Chen et al. 2021). Second, regulation may cause productivity losses. Water pollution regulations in China reduced firms' productivity by 24 percent, implying large losses from the policy (He, Wang, and Zhang 2020). Such productivity losses are more pronounced in the case of pollution controls, since abatement technology imposes costs on firms without any concomitant benefit to them (as opposed to society). In contrast, regulations relating to energy efficiency yield benefits to firms by promoting the adoption of technologies that lower energy costs (Allcott and Greenstone 2012) and improve productivity (Adhvaryu, Kala, and Nyshadham 2020). Third, voluntary compliance tends to be ineffective, so robust enforcement of environmental quotas is essential (Kube et al. 2019). But enforcement is challenging, requiring monitoring and penalties that may be difficult to implement in the face of low state capacity (Duflo et al. 2018), corruption (Duflo et al. 2013), or complex incentive design (Blundell 2020).

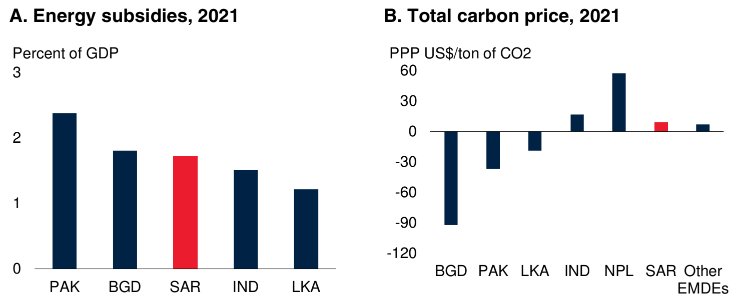
Market-based regulations have shown similar benefits to command-and-control regulation, but with fewer distortions. Thus, almost nine-tenths of the studies of market-based regulations documented positive effects. Two of the best-known market-based schemes are the 2005 European Union Emissions Trading System (ETS) and California's cap-and-trade program for carbon and other air pollutants. Both programs have strong records of success. The EU carbon market not only increased the adoption of energy-efficient technologies and reduced carbon emissions (Colmer et al. 2023), but also boosted low-carbon technological innovation, as measured by patenting activity, by as much as 10 percent (Calel and Dechezleprêtre 2016). This aligns with evidence on pollution taxes in OECD countries (Brown, Martinsson, and Thomann 2022). In California, provisions of the Clean Air Act were implemented via a cap-and-trade scheme rather than quotas, avoiding the adverse side-effects of quota systems experienced in other U.S. states (Curtis and Lee 2019). Studies of the EU ETS suggest no adverse effects on competitiveness (Colmer et al. 2023), firms' relocation (Martin et al. 2014), or carbon leakage (Dechezleprêtre et al. 2022). Sadayuki and Arimura (2021) demonstrate positive technology adoption and emissions spillovers from a carbon market in Japan, as firms transferred green technologies to their unregulated plants. These approaches are, of course, not entirely immune to the risk of emissions shifting, particularly if regulations are unevenly applied across integrated markets (Bartram, Hou, and Kim 2022). Another important caveat is that these regimes generally have imposed low carbon prices; higher-priced regimes could generate more adverse consequences.

Market-based approaches are already being piloted in South Asia, with encouraging results. A recent randomized experiment with emissions trading for particulate matter in the Indian state of Gujarat reduced emissions by up to 30 percent, and it did so at a low cost (Greenstone et al. 2023). India's PAT program incorporates a market-based regulatory mechanism to help participating firms achieve energy efficiency improvements at a low cost (Government of India 2023). In this program, highly energy-intensive firms are assigned an energy-intensity target and can trade excess energy savings certificates on an active exchange market.

Carbon taxes are another policy option, one that retains the desirable properties of emissions trading but also generates government revenue and reduces monitoring costs. One benefit is that revenue from carbon taxes can be used to offset the negative welfare impacts of emissions restrictions on the poor. Another oft-cited justification for carbon taxes is that they encourage firms to innovate and adopt low-carbon technologies (Timilsina 2022). Empirical support for this hypothesis comes from experience with pollution taxes, which have been shown to increase research and development expenditures on clean technology (Brown, Martinsson, and Thomann 2022). Notwithstanding the promise

FIGURE 2.12 Subsidies and effective carbon prices

Most countries in South Asia spend more than 1.5 percent of their GDP on energy subsidies. In some South Asian countries, subsidies are sufficiently large to turn carbon prices negative.



Sources: Agnolucci et al. (2023); International Energy Association; World Bank.
Note: EMDEs = emerging market and developing economies; SAR = South Asia; BGD = Bangladesh; IND = India; LKA = Sri Lanka; NPL = Nepal; PAK = Pakistan.
A. Unweighted averages for South Asia (SAR) and EMDE commodity importers.
B. The Total Carbon Price combines a comprehensive set of direct carbon pricing policies with indirect interventions on carbon-containing energy source to measure the aggregate carbon price signal faced by agents in the economy. The Direct Carbon Price component of the Total Carbon Price includes all carbon taxes and emission trading systems, adjusted for the share of the country's carbon emissions covered by such direct carbon taxes. The Indirect Carbon Price component includes fuel excise taxes, fuel subsidies, and value-added tax (VAT) deviations (arising if VAT rates on fuels are below the standard VAT rate). For each fuel and sector, the Indirect Carbon Price is estimated as the deviation between the retail price and the supply cost, adjusting for the upstream carbon price. A negative Total Carbon Price is to be interpreted as a net subsidy on carbon, while a positive Total Carbon Price is to be interpreted as a tax. Further details are available in Agnolucci et al. (2023). SAR and EMDE averages are emissions-weighted.

and increasing adoption of carbon taxes, their effects on firm technology choices and energy intensity remain under-studied.

The elimination of subsidies on fossil fuels can be a powerful mechanism to discourage their use. Most countries in SAR spend more than 1.5 percent of their GDP on energy subsidies. India ranks among the world's five largest providers of fossil-fuel subsidies, especially for coal and liquified petroleum gas (Damania et al. 2023). In Bangladesh, Pakistan, and Sri Lanka, fossil fuels and fossil fuel-generated electricity are so heavily subsidized compared with world prices that the effective price of carbon is negative (figure 2.12). In contrast, Nepal does not subsidize petroleum products, and even imposes a pollution tax on them (World Bank 2021). The removal of energy subsidies would encourage more efficient use of fossil fuels and shifts toward green energy sources and less fossil-fuel-intensive activities—provided alternatives are readily available and affordable (Damania et al. 2023). Lasting subsidy reduction tends to be politically challenging; it has often been more successful when implemented at times of falling energy prices and in combination with social benefit reform (World Bank 2020a).

Information and behavioral nudges

The empirical evidence presented in this chapter suggests that well-targeted, low-cost interventions to address informational constraints can help boost the adoption of energy-efficient technologies by firms provided the benefits to them outweigh the costs. Such programs can exploit informational spillovers to economize on program costs. For example, the government could focus interventions on early or "lead" adopters in manufacturing clusters, with the expectation that other firms in the cluster will be influenced by these early adopters. Technology diffusion programs in the agriculture sector already employ such low-cost designs leveraging spillovers, but evidence to support similar programs in non-agriculture sectors has been limited so far.[3] Interventions to address informational constraints include both information campaigns and behavioral nudges to encourage firms to adopt energy-saving technologies.

Firms often report a lack of awareness about energy-efficient technologies in surveys, and these information shortfalls correlate negatively with technology adoption (De Groot, Verhoef, and Nijkamp 2001; Hochman and Timilsina 2017).

However, for a number of reasons, there are often only limited benefits from information campaigns alone.

First, especially among smaller firms and households, new technologies do not always work as well in real-world conditions as they do in laboratory settings. For example, the actual benefits from a cleaner cookstove may fall far short of laboratory estimates because households do not use and maintain their stoves properly (Hanna, Duflo, and Greenstone 2016). A related literature on agricultural technology adoption generally finds that differences in expected returns are reflected in farmers' adoption of new technologies (Jack 2013; Suri 2011). The literature also suggests that in some cases, the low adoption of seemingly profitable energy-saving technologies—dubbed the "energy efficiency paradox"—reflects rational, well-informed decisions on the part of firms or households: that is, the technology in question is not profitable in real world conditions (Allcott and Greenstone 2012; Anderson and Newell 2004; Gerarden, Newell, and Stavins 2017; Gillingham, Keyes, and Palmer 2018).

Second, lack of information is usually only one of many constraints, and it may not be the one that is binding. It is often for this reason that policies that provide firms information on their energy use and strategies to raise its efficiency—so-called energy audits—have produced mixed results. In the Industrial Assessment Centers program in the United States, firms adopted recommendations from energy audits only 50 percent of the time (Anderson and Newell 2004). Similarly, a randomized evaluation of an intensive energy consulting program among large Indian manufacturing firms showed only modest effects on energy efficiency and technology adoption (Ryan 2018). In fact, increased efficiency enabled firms to expand, leading to increases in overall energy usage despite a reduction in energy intensity, an example of the so-called "rebound effect" (Gillingham, Rapson, and Wagner 2016).

Third, there are complementarities between information acquisition and broader business practices that may need to be exploited for more efficient technology use to result. Energy audits have been found to be more effective when paired with monitoring (Yajima and Arimura 2022), financing (Bodas-Freitas and Corrocher 2019; Kalantzis and Revoltella 2019) and top management participation (Blass et al. 2014). Business training programs have been shown to be effective in diffusing better business practices along with more efficient technologies (Bloom et al. 2013; Cirera and Maloney 2017; Piza et al. 2016). Among both U.K. and U.S. firms, better

[3] Positive spillovers between firms, learning externalities, or externalities from lower pollution might justify subsidizing the adoption of green technologies. That said, this chapter does not examine the case for large-scale "industrial policies," typically understood to be sectoral or place-based, and "explicitly target(ing) the transformation of the structure of economic activity in pursuit of some public goal" (Juhasz, Lane, and Rodrik 2023, page 4). The policies that this chapter discusses do not have a sector or location focus because there is scope for energy-saving technologies in most sectors. The typical case for industrial policy would be more relevant for issues related to the growth of the renewable energy production sector.

management practices have been associated with reduced energy intensity (Bloom et al. 2010; Boyd and Curtis 2014; Martin et al. 2012). Management has been shown to matter for pollution abatement, while credit constraints also matter for investment in new "green" machinery (De Haas et al. 2023). Good management has also limited the costs of regulatory compliance by reducing the productivity losses associated with pollution abatement technology (Hottenrott, Rexhäuser, and Veugelers 2016). Similarly, reductions in coal usage among Chinese firms in response to higher carbon pricing has been greater with better management (Yong et al. 2021).

"**Nudges**" that address behavioral biases can be a cost-effective complement to information provision. Interventions such as reminders, defaults, and peer comparisons have been found to reduce household energy consumption at a cost of only 2.8c per kWh saved—just half of the social marginal cost of electricity generation (Gillingham, Keyes, and Palmer 2018). Social pressure has been shown to increase the adoption of environmentally friendly propane fuel among Mexican brickmakers (Blackman and Bannister 1998). Default settings also matter: automatic bill-pay increased energy use by reducing the awareness of energy consumption for both households and firms (Sexton 2015). While this evidence is generally from studies of households, it may be particularly relevant in South Asia where more than 90 percent of firms are small and informal, and the distinction between firms and households is often not meaningful (Bussolo and Sharma 2022).

Access to finance, markets, and public services

Financing constraints are an oft-cited obstacle to firms' technology adoption. A number of studies document correlations between firms' reported credit constraints and technology adoption (Caporale, Donati, and Spagnolo 2023; Fleiter, Schleich, and Ravivanpong 2012), energy intensity (Biscione et al. 2023; Zhang, Li, and Ji 2020), and emissions (Andersen 2017). While these studies typically rely on self-reported constraints in survey data, some recent work presents more objective evidence. Even temporary boosts to U.S. firms' cashflows reduced firms' emissions (Xu and Kim 2022). Similarly, contractions in bank credit supply have been shown to reduce green technology adoption (Accetturo et al. 2022; De Haas et al. 2023) and increase emissions (De Haas et al. 2023). Capital structure also matters: a 2006 tax reform in Belgium that lowered the cost of equity relative to debt reduced firms' emissions intensity (De Haas and Popov 2023). But while there is strong evidence that household and consumer subsidies encourage the adoption of energy-saving technologies (Gillingham, Keyes, and Palmer 2018), there is limited evidence of the effectiveness of policies that ease firms' credit constraints.

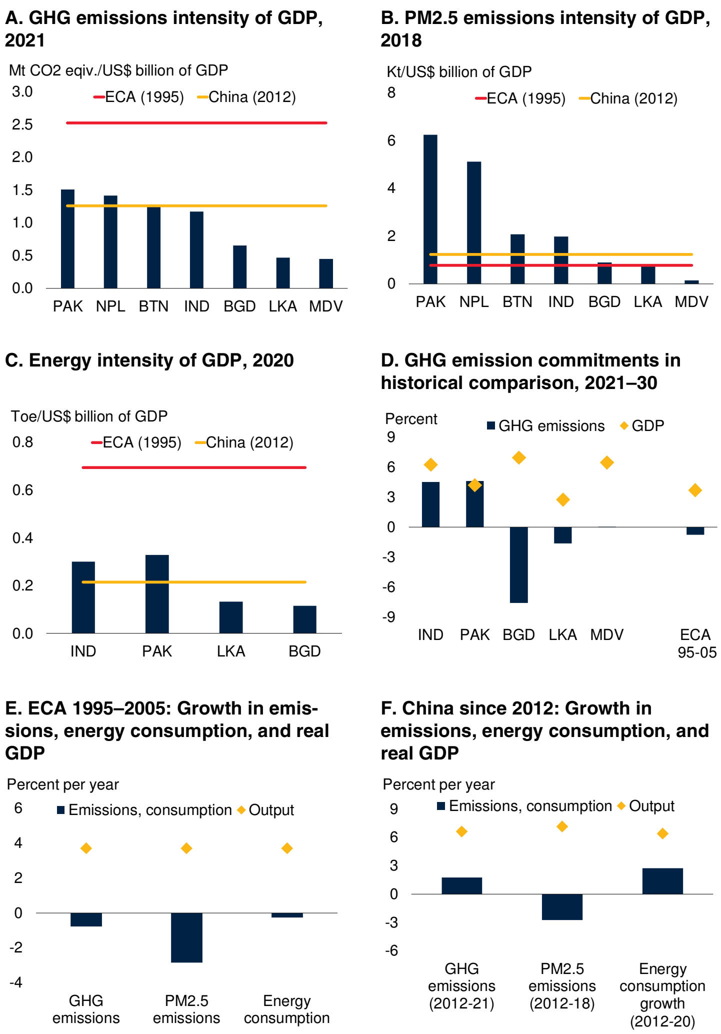
Better access to grid electricity may reduce reliance on inefficient, polluting substitutes. As suggested by the findings from the FAT surveys discussed in this chapter, a more reliable grid may reduce the use of portable generators. It may also improve firm revenues and productivity (Allcott, Collard-Wexler, and O'Connell 2016). Measures to improve grid reliability may be complemented by interventions to promote the diffusion of cleaner electricity backups that use renewable energy sources.

Policy reforms that make economies more open internationally, including by improving access to export markets and foreign investment may, among their many potential benefits, induce faster adoption of energy-efficient technologies. First, local firms must compete more with imports, incentivizing investment in energy-saving technology (Gutiérrez and Teshima 2018). Second, firms have greater access to imported inputs, which may be more energy efficient (Martin 2011). Third, external demand shocks may lead firms to upgrade technology, reducing emissions intensity (Barrows and Ollivier 2018).

The effects of FDI are in some respects similar to those of international trade. Since multinational subsidiaries usually have access to better technology, they are likely to be able to reduce the energy intensity of their activity more easily (Eskeland and Harrison 2003). This can lead to some unintended consequences, however: for

FIGURE 2.13 Historical comparison

Compared with their elevated levels in ECA economies in the 1990s, the emissions and energy intensities of GDP in SAR economies is significantly lower. However, the pollution intensity of several SAR economies is significantly higher. Several SAR countries also have considerably higher pollution intensities than China had in 2012 when it embarked on reforms aimed at lowering air pollution. Despite rapid economic growth, ECA countries, and to a lesser extent, China, reduced their emissions and energy consumption in the years following 1995 and 2012.



Sources: Crippa et al. (2022); EDGAR database; European Commission; World Development indicators; World Bank.

Note: EMDEs = emerging market and developing economies; SAR = South Asia; BGD = Bangladesh; BTN = Bhutan; IND = India; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan.

A. GHG emissions (in mt of CO2 equivalent) relative real GDP (at 2021 prices and exchange rates). Data for SAR for 2021. Data for ECA in 1995 are the GDP-weighted average of 9 ECA countries.

B. Emissions in kt per real GDP in billions of U.S. dollars (in 2021 prices and exchange rates). 2018 data for SAR countries . Data for ECA in 1995 are the GDP-weighted average of nine ECA countries.

C. Energy intensity of GDP is defined as energy consumption in tons of oil equivalent relative to real GDP in billions of U.S. dollars (in 2021 prices and exchange rates). Data for ECA economies in 1995 are the GDP-weighted average of nine ECA countries. Data for South Asian economies are for 2020, the latest available data.

D. For South Asia, average annual percent change in GHG emissions consistent with emissions commitments in latest national Nationally Determined Contributions and real GDP growth consistent with potential growth through 2030. For ECA region, annual average aggregate GHG emissions and real GDP growth during 1995–2005. The ECA region includes nine countries (Bulgaria, Belarus, Georgia, Kazakhstan, Moldova, Poland, Romania, Russian Federation, and Ukraine).

E.F. Average annual percent change in GHG emissions, energy consumption, and real GDP.

E. Real GDP-weighted average for nine ECA economies.

F. Latest data: GHG emissions 2021; PM2.5 emissions 2018; for energy consumption 2020.

example, a policy-driven multinational divestment in the Nigerian oil sector increased pollution because local firms were heavier polluters (Rexer 2022). One concern about increased openness is the "pollution haven hypothesis"—that economic integration with uneven regulation will lead firms to relocate production to less regulated countries. While Eskeland and Harrison (2003) find no support for this hypothesis, more recent work has found some evidence in its favor (Kellenberg 2009; Levinson and Taylor 2008; Wagner and Timmins 2009). Nonetheless, environmental regulation is just one of many factors driving FDI and trade flows.

Besides reforms to enhance openness to foreign trade and capital flows, policies to support national innovation systems and orient them toward green technologies may help facilitate the development of energy-efficient technologies suited to local conditions. Such policies would include measures to strengthen intellectual property rights protection, enhance research and development capabilities, facilitate collaboration between public and private actors, and incentivize technology transfer (Cirera and Maloney 2017).

It can be done; it has been done

Given the unintended consequences of, and interactions among, individual policy interventions, comprehensive policy packages are more likely to be successful than narrowly targeted ones. This has been the experience both of a group of nine countries in Europe and Central Asia (ECA) between 1995 (when their GHG emissions and energy intensity peaked) and 2005, and of China between 2012 (when its PM2.5 emissions peaked) and 2018. In both cases, emissions, energy consumption, and pollution were cut despite rapid economic growth.

ECA region, 1995–2005. Despite 4 percent average annual output growth between 1995 and 2005, PM2.5 pollution and GHG emissions declined by a cumulative 37 and 8 percent, respectively, in nine countries of the ECA region (Bulgaria, Belarus, Georgia, Kazakhstan, Moldova, Poland, Romania, Russia, and Ukraine; figure 2.13). These declines reflected a plunge in energy intensity, which was accompanied by a 2.6 percent decline in energy consumption. This change occurred as overindustrialized former Soviet Union economies restructured away from heavy industry. In addition, the share of coal in electricity and non-electric heat production declined, reducing the emissions intensity of power generation (Breitenfellner et al. 2021). This transformation was achieved through a comprehensive structural transformation that involved: privatization; enterprise restructuring; the liberalization of prices, foreign exchange, and trade; competition policy; financial sector reform; and legal reform (Sachs 1996; Sachs and Woo 1994).

China, 2012–18. Despite 7 percent average annual output growth, PM2.5 air pollution was cut by one-sixth in these six years, again through a comprehensive policy shift. Monitoring and reporting of air pollution was enhanced. Tightened emission standards for motor vehicles and power plants were robustly enforced. Straw burning was prohibited. New air pollution control standards were put in place and enforced. Performance evaluations and promotion of government officials were tied to emission reductions (Greenstone et al. 2021; Lu et al. 2020; Zeng et al. 2019). These efforts also helped reduce growth of emissions and energy consumption to one-quarter to one-half the pace of output growth.

ANNEX 2.1. Methodology

2.1.1 Sectoral decomposition of energy consumption growth

Energy consumption growth is decomposed into within-sector changes in energy intensity and between-sector changes in the shares of each sector in real GDP. Matching data from the OECD's *Green Growth Database* for energy use with sectoral national accounts data from Haver Analytics allows for a decomposition into three sectors: agriculture, industry, and services. Since different classifications are used for energy use and real GDP, industry in the national accounts is interpreted as industry including construction. Energy use in industry is interpreted as including energy consumption in "other" sectors, which is largely building-related. Services in the national accounts are interpreted as services including transport services, and energy consumption in services is interpreted as including transport services. For Sri Lanka, energy consumption in the agriculture sector is unavailable.

Energy intensity is defined as energy consumption (in tons of oil equivalent) relative to real GDP (in constant local currency terms). This allows the following sectoral decomposition:

$$\frac{E_t}{E_{(t-1)}}-1=\sum_{i=1}^{3}\frac{(e_t^i-e_{(t-1)}^i)}{e_{t-1}^i}\frac{(Y_t^i+Y_{(t-1)}^i)}{Y_{t-1}^i}+\sum_{i=1}^{3}\frac{(Y_t^i-Y_{t-1}^i)}{Y_{t-1}^i}\frac{(e_t^i+e_{(t-1)}^i)}{e_{(t-1)}^i},$$

where E_t is aggregate energy consumption, Y_t is aggregate real GDP, Y_{it} is real value added of sector i, E_t^i is energy consumption in sector i, and $e_t^i=\frac{E_t^i}{Y_t^i}$ is energy intensity of sector i. The first term on the right of the equation denotes the contribution of sectoral changes in energy intensity to energy consumption growth; the second term denotes the contribution of sectoral output growth to energy consumption growth.

2.1.2 Firm-level approaches to measuring energy intensity

Definition. At the firm level, energy intensity is defined as energy expenses as a percentage of the wage bill.

Conceptual framework. At the firm level, the physical definition of energy intensity, that is, the unit of energy consumed per unit output, cannot be applied for lack of data: firm-level datasets typically do not report units of energy consistently. Instead, they report expenditure on energy (or electricity). Moreover, because physical units of output are not comparable across firms from different sectors, the denominator in the expression for energy intensity would necessarily consist of output in value terms and could reflect differences in output prices across firms.

Studies of firm-level energy intensity typically use expenditure-based definitions, such as energy expenses in percent of costs (Shapiro and Walker 2018). The interpretation of this definition can be clarified by illustrating the firm's optimality conditions with a general production function. Consider a firm whose production involves using labor and electricity as imperfect substitutes. The output is given by:

$$Y = A((A_L L)^{\frac{\sigma-1}{\sigma}} + (A_E E)^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma-1}{\sigma}}$$

Here, A_E and A_L represent the efficiency associated with energy use and labor use, respectively, and σ is the elasticity of substitution between the inputs (and the elasticity of input demand). A is a general (that is, not input-specific) efficiency term.

The total cost incurred by the firm is given by:

$$Expenditure = P_E E + P_L L$$

Here, P_E and P_L represent the price of a single unit of energy and labor, respectively.

Solving the firm's cost minimization problem yields the following expression:

$$\frac{P_E E}{P_L L} = (\frac{A_E}{A_L} * \frac{P_L}{P_E})^{(\sigma-1)}$$

Note that

$$\frac{P_E E}{P_L L} = \frac{Energy\ Expenditure}{Wage\ Bill} = Energy\ Intensity$$

Hence, the energy intensity of a firm, which is the ratio of the share of expenditures on energy and labor, depends on the elasticity of substitution, the relative efficiency of energy use, and the relative price of the two factors. The literature on the elasticity of energy demand typically finds that $\sigma < 1$, which signifies a complementary relationship between labor and energy (Martin 2010). Assuming that $\sigma < 1$, energy intensity falls with higher relative energy efficiency A_E / A_L and lower relative energy price P_E / P_L.

Hence, given relative prices, lower energy intensity can be interpreted as higher relative energy efficiency.

A change in the relative energy price can also lead to changes in energy intensity. For example, if $\sigma < 1$, a decline in the energy price faced by the firm would lower energy intensity. The firm-level regression analysis of energy intensity undertaken in this chapter includes controls for relative prices of energy and labor in robustness checks when data availability permits. The results reported are robust to controlling for relative prices.

An alternative definition of energy intensity, energy expenditure in percent of total costs, is also used in robustness checks, and the results reported are robust to this alternative definition.

2.1.3 Firm-level approaches: World Bank Enterprise Surveys

Sample. The *World Bank Enterprise Surveys* (WBES) are firm-level surveys covering a representative sample of the formal private sector. The surveys are stratified by firm size, sector and location. The repeated cross-sectional survey data consist of two waves of the surveys: Wave 1 (between 2006 and 2016) and Wave 2 (between 2017 and 2022). Overall, these repeated *World Bank Enterprise Surveys* have gathered data on electricity expenses and the total wage bill among 73,171 firms in 15 2-digit manufacturing and services subsectors in 43 EMDEs, including Bangladesh (2006 and 2022), India (2014 and 2022), and Pakistan (2006 and 2022; annex table 2.1.3.1).

ANNEX TABLE 2.1.3.1 World Bank Enterprise Surveys coverage of South Asia and Other EMDEs

Country	Year	Number of observations
India	2014	9,281
India	2022	9,376
Bangladesh	2007	1,504
Bangladesh	2022	998
Pakistan	2007	935
Pakistan	2022	1,300
Albania	2007	304
Albania	2019	377
Argentina	2006	1,063
Argentina	2017	991
Armenia	2009	374
Armenia	2020	546
Azerbaijan	2009	380
Azerbaijan	2019	225
Belarus	2008	273
Belarus	2018	600
Bolivia	2006	613
Bolivia	2017	364
Bosnia and Herzegovina	2009	361
Bosnia and Herzegovina	2019	362
Ecuador	2006	658
Ecuador	2017	361
Egypt, Arab Rep.	2013	2,897
Egypt, Arab Rep.	2020	3,075
Georgia	2008	373
Georgia	2019	581
Guatemala	2006	522
Guatemala	2017	345
Hungary	2009	291
Hungary	2019	805
Jordan	2013	573
Jordan	2019	601
Kazakhstan	2009	544
Kazakhstan	2019	1,446
Kenya	2007	657
Kenya	2018	1,001
Kyrgyz Republic	2009	235
Kyrgyz Republic	2019	360
Lebanon	2013	561
Lebanon	2019	532
Liberia	2009	150
Liberia	2017	151
Madagascar	2009	445
Madagascar	2022	402
Malaysia	2015	1,000
Malaysia	2019	1,221

ANNEX TABLE 2.1.3.1 *continued*

Country	Year	Number of observations
Moldova	2009	363
Moldova	2019	360
Montenegro	2009	116
Montenegro	2019	150
Morocco	2013	407
Morocco	2019	1,096
Mozambique	2007	479
Mozambique	2018	601
North Macedonia	2009	366
North Macedonia	2019	360
Paraguay	2006	613
Paraguay	2017	364
Romania	2009	541
Romania	2019	814
Russian Federation	2009	1,004
Russian Federation	2019	1,323
Serbia	2009	388
Serbia	2019	361
Sierra Leone	2009	150
Sierra Leone	2017	152
South Africa	2007	937
South Africa	2020	1,097
Tajikistan	2008	360
Tajikistan	2019	352
Timor-Leste	2009	150
Timor-Leste	2021	238
Tunisia	2013	592
Tunisia	2020	615
Turkey	2008	1,152
Turkey	2019	1,663
Ukraine	2008	851
Ukraine	2019	1,337
Uruguay	2006	621
Uruguay	2017	347
Uzbekistan	2008	366
Uzbekistan	2019	1,239
West Bank and Gaza	2013	434
West Bank and Gaza	2019	365
Zambia	2007	484
Zambia	2019	601

Source: World Bank Enterprise Surveys .

Note that the *World Bank Enterprise Surveys* only report total electricity expenses (including expenses on fuel for portable electricity generators). They do not collect data on the consumption of other fuels in firms. Hence, in what follows, energy intensity refers to electricity intensity.

Within- and between-sector energy intensity changes. In order to analyze the within- and between-sector decomposition of energy intensity growth, all the firms were first categorized into one of 15 possible sectors. Countries with fewer than 10 sectors in any of the two waves were dropped.

To decompose aggregate energy intensity into that attributed to changes in energy intensity within sectors and that attributed to changes in the shares of sectors in the economy, energy intensity was first computed at sector level by dividing the aggregate electricity cost of all firms in the sector by their aggregate wage bill, across all countries and years. Survey sampling weights were used when aggregating firm-level costs to their sector-level aggregates.

Let w_s^t be the share of sector s in the total economy wage bill in Wave t and e_s^t be the energy intensity (sector energy to sector wage cost ratio) of sector s in Wave t.

The economy's aggregate energy intensity in Wave t is

$$e_{total}^t = \sum_s w_s^t e_s^t$$

The within-sector component of the change in energy intensity between Wave 1 and Wave 2 is defined as

$$Within^{1,2} = \sum_s \frac{(w_s^2 + w_s^1)(e_s^2 - e_s^1)}{2}$$

That is, it is the sum of the changes in energy intensity in each sector between Waves 1 and 2, each weighted by the mean of the sector weights across the two waves.

Similarly, the between sector component is the sum of the changes in the sector weights across the waves, each weighted by the mean of the sector energy intensities in the waves.

$$Between^{1,2} = \sum_s \frac{(e_s^2 + e_s^1)(w_s^2 - w_s^1)}{2}$$

By construction, the sum of these within and between sector components equals the change in aggregate economy-wide energy intensity between the two waves.

Changes in mean firm-level energy intensity. The within-sector change in mean firm-level energy intensity is computed through firm-level regressions in a dataset that stacks data from Wave 1 and Wave 2 for each South Asian country. Note that the *World Bank Enterprise Surveys* are not a panel at the firm level. For each country, an ordinary least squares regression of log firm-level energy intensity on year t with sector fixed effects is estimated.

$$Log\,(Energy\ Intensity)_{ist} = \alpha + \beta Year_t + \lambda_s + \varepsilon_{ist}$$

Here, i indexes firm, s indexes sector and t indexes the year of the survey. λ_s are sector fixed effect. Hence, β captures the annual percent change in mean firm-level energy intensity within sectors. When estimating the regression for other EMDEs, data from other EMDEs are pooled together and country-sector specific fixed effects are employed. The regression results are shown in annex table 2.1.3.2.

In a robustness analysis, energy intensity is measured as electricity expenditures as percent of total revenue. The regression results of this alternative specification are qualitatively similar to those obtained in the main specification.

2.1.4 Firm-level approaches: India's Annual Survey of Industries

Sample. India's *Annual Survey of Industries* (ASI) includes 519,849 observations covering 156,927 unique firms in 22 manufacturing subsectors during 2001–18. The ASI is a plant (factory)-level dataset that is representative of the formal manufacturing sector at the state and sector level. The ASI panel is an unbalanced panel; that is, the

ANNEX TABLE 2.1.3.2 World Bank Enterprise Surveys: Change in mean firm level energy intensity within sectors

	Dependent variable: Log Energy Intensity			
Variable	India	Pakistan	Bangladesh	Other EMDEs
Year	-0.0856***	-0.00968**	-0.0173***	-0.0192***
	(0.00245)	(0.00397)	(0.00381)	(0.00155)
Constant	-0.811***	-1.548***	-2.031*	-2.962**
	(0.0517)	(0.190)	(1.201)	(1.209)
Observations	17,831	2,204	2,440	47,120
R-squared	0.112	0.061	0.095	0.165
Country specific sector fixed effects	Yes	Yes	Yes	Yes

Source: World Bank staff estimates based on World Bank Enterprise Surveys.
Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. OLS regressions include fixed effects for fifteen 2-digit manufacturing and services subsectors. These sector fixed effects are country specific in the regression shown in column (4), which is estimated on pooled survey data from all EMDEs excluding South Asian countries.

number of firms in the panel in each year varies due to entry, exit and the survey design. The ASI panel is a rotating panel, designed such that except for firms with more than 100 workers, not every firm is tracked every year. On average, each firm appears once every three years. The ASI covers all firms with more than 100 workers each year, while smaller firms are on average revisited once every three years.

Trends in energy intensity. Panel regressions are estimated to identify: (i) the overall change in energy intensity over time; and (ii) the firms' characteristics associated with higher energy intensity change over time. To identify the change in energy intensity over time, a regression with the following specification is estimated:

$$Log\,(Energy\ Intensity)_{it} = \sum \beta_o^t Year_t + \gamma_i + \varepsilon_{it}$$

where $Year_t$ is a dummy variable for year t and γ_i represents firm-level fixed effects to account for firm-specific trends. To identify firms' characteristics associated with higher energy intensity change over time, regressions with the following specification are run:

$$Log\,(energy\,intensity)_{it} = \sum \beta_l^t Year_t * XLow_{it} + \sum \beta_h^t Year_t * XHigh_{it} + \gamma_i + \varepsilon_{it}$$

where $XLow_{it}$ and $XHigh_{it}$ represent a set of firms' characteristics. Three characteristics were considered: firm size, state-level manufacturing growth rate and sector-level initial energy intensity. When considering firm-size, $XLow_{it}$ is a dummy variable for firms with 1–49 employees ("Small firms") and $XHigh_{it}$ is a dummy variable for firms with more than 50 employees ("Large firms"). Similarly, for state-level manufacturing growth rate, $XLow_{it}$ is a dummy variable for being in states with below-median manufacturing value-added growth during 1999–2014 ("Slow-growing states"), and $XHigh_{it}$ is a dummy variable for being in states with above-median manufacturing value-added growth ("Fast-growing states"). Finally, for sector-level initial energy intensity, $XLow_{it}$ is a dummy variable for being from a sector with low initial energy intensity in 2001 and $XHigh_{it}$ is a dummy variable for being from a sector with high initial energy intensity in 2001. Annex table 2.1.4.1 shows the results of these regressions.

Annex table 2.1.4.2 shows the results of similar panel regressions as shown above, but with controls for relative price of electricity and labor included. The empirical specifications are as follows:

ANNEX TABLE 2.1.4.1 India: Within-firm trends in energy intensity

	Log Energy Intensity	Log Energy Intensity	Log Energy Intensity	Log Energy Intensity
Year = 2018	-0.708***			
	(0.00931)			
Slow growing state * Year = 2018		-0.598***		
		(0.0163)		
Fast growing state * Year = 2018		-0.771***		
		(0.0112)		
Firm size < 50 employees* Year = 2018			-0.585***	
			(0.0150)	
Firm size >= 50 employees* Year = 2018			-1.036***	
			(0.0145)	
Low energy intensity * Year = 2018				-0.732***
				(0.0125)
High energy intensity * Year = 2018				-0.685***
				(0.0139)
Observations	519,849	519,849	519,849	519,849
Firm fixed effects	Yes	Yes	Yes	Yes

Source: World Bank staff estimates based on Annual Survey of Industries for India.
Note: Standard errors are clustered at the firm-level and included in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The OLS regressions include dummies for all years between 2001 and 2018. Columns 2-4 also include a full set of year dummy interactions with specific firm characteristics. These coefficients are not displayed for concision. The omitted (baseline) year dummy is 2000.

$$Log(energy\,intensity)_{it} = \sum \beta_l^t Year_t * XLow_{it} + \sum \beta_h^t Year_t * XHigh_{it} + \beta_p * Log\left(\frac{P_{energy}}{P_{labor}}\right) + \gamma_i + \varepsilon_{it}$$

Note that the estimated coefficient of 0.382 on relative price in the table above implies that a 1 percent increase in relative energy price increases relative energy expenditure by 0.38 percent (that is, less than 1 percent). This implies a price elasticity of energy consumption of -0.62.

Annex table 2.1.4.3 shows the results of similar regressions where energy intensity is instead measured as the share of energy expense in total sales. The empirical specifications are as follows:

$$Log\left(\frac{Energy\ Expense}{Total\ Sales}\right)_{it} = \sum \beta_h^t Year_t + \gamma_i + \varepsilon_{it}$$

$$Log\left(\frac{Energy\ Expense}{Total\ Sales}\right)_{it} = \sum \beta_l^t Year_t * XLow_{it} + \sum \beta_h^t Year_t * XHigh_{it} + \gamma_i + \varepsilon_{it}$$

Energy intensity and employment. To examine the relationship between energy intensity and employment in the cross-section of firms, the following OLS regression is estimated on 2018 ASI cross-sectional data:

$$Log(employment)_i = Log(Energy\ Intensity)_i + \lambda_i + \varepsilon_i$$

Here, λ_i are sector dummies.

ANNEX TABLE 2.1.4.2 India: Within-firm trends in energy intensity, controlling for relative prices

	Log Energy Intensity	Log Energy Intensity	Log Energy Intensity	Log Energy Intensity
Year = 2018	-0.368***			
	(0.0104)			
Slow growing state * Year = 2018		-0.283***		
		(0.0167)		
Fast growing state * Year = 2018		-0.416***		
		(0.0120)		
Firm size < 50 employees* Year = 2018			-0.243***	
			(0.0151)	
Firm size >= 50 employees * Year = 2018			-0.744***	
			(0.0146)	
Low energy intensity * Year = 2018				-0.383***
				(0.0130)
High energy intensity * Year = 2018				-0.353***
				(0.0146)
Log (energy price/wage)	0.382***	0.381***	0.397***	0.382***
	(0.00557)	(0.00558)	(0.00556)	(0.00557)
Observations	502,023	502,023	502,023	502,023
Firm fixed effects	Yes	Yes	Yes	Yes

Source: World Bank staff estimates based on Annual Survey of Industries for India.
Note: Standard errors are clustered at the firm-level and included in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The OLS regressions include dummies for all years between 2001 and 2018. Columns 2-4 also include a full set of year dummy interactions with specific firm characteristics. These coefficients are not displayed for concision. The omitted (baseline) year dummy is 2000.

To examine the relationship between changes in energy intensity and employment within firms over time, the following firm fixed effects OLS regression is estimated on the ASI panel:

$$Log(employment)_{it} = Log(Energy\ Intensity)_i + \gamma_i + \varepsilon_i$$

The results are shown in annex table 2.1.4.4.

2.1.5 World Bank Firm-level Adoption of Technology Surveys

Sample. In 2022, the World Bank's *Firm Adoption of Technology* (FAT) Surveys Wave 2 surveyed 10,090 firms in seven EMDEs, including 1,936 firms in Bangladesh and 1.455 firms in India, about their technology use, as well as other firm characteristics. The FAT surveys in South Asia are representative of formal sector firms in select manufacturing and services subsectors including apparel, food processing, pharmaceuticals, leather goods, bricks, iron and steel, cement, a residual category comprising all other manufacturing subsectors, wholesale and retail, land transport, and health. The surveys are stratified by location (cities in the case of Bangladesh), firm size and subsector. Estimates of average rates of technology adoption use survey sampling weights.

Regression specification. The following OLS regression is estimated to examine the association between energy-efficient technology adoption and firms' characteristics.

$$Energy\,Technology\ Index_i = \alpha + \sum \beta_1^s \cdot Size_i^s + \sum \beta_2^s \cdot Age_i^a + \sum \beta_3^s \cdot Management_t^m + \sum \beta_3 \cdot Multinational + \beta_5 \cdot Finance + \beta_6 \cdot Subsidy + \beta_7 \cdot GBF + \mu_i + \pi_i + \varepsilon_i$$

Here, *Energy Technology Index*$_i$ is an index

ANNEX TABLE 2.1.4.3 India: Within-firm trends in energy intensity, measuring energy intensity in percent of total sales

VARIABLES	Log Energy Expenditure/ Sales	Log Energy Expenditure/ Sales	Log Energy Expenditure/ Sales	Log Energy Expenditure/ Sales
Year = 2018	-0.313***			
	(0.0110)			
Slow growing state * Year = 2018		-0.277***		
		(0.0184)		
Fast growing state * Year = 2018		-0.331***		
		(0.0138)		
Firm size < 50 employees * Year = 2018			-0.319***	
			(0.0174)	
Firm size >= 50 employees* Year = 2018			-0.449***	
			(0.0171)	
Low energy intensity * Year = 2018				-0.327***
				(0.0155)
High energy intensity * Year = 2018				-0.298***
				(0.0158)
Observations	520,336	520,336	520,336	520,336
Firm fixed effects	Yes	Yes	Yes	Yes

Source: World Bank staff estimates based on Annual Survey of Industries for India.
Note: Standard errors are clustered at the firm-level and included in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The OLS regressions include dummies for all years between 2001 and 2018. Columns 2-4 also include a full set of year dummy interactions with specific firm characteristics. These coefficients are not displayed for concision. The omitted (baseline) year dummy is 2000.

ANNEX TABLE 2.1.4.4 India: Employment and energy intensity

	(1) Log Employment 2018	(2) Log Employment 2018	(3) Log Employment 2001-18
Log energy intensity	-0.169***	-0.164***	-0.215***
	(0.00594)	(0.00676)	(0.00324)
Observations	36,006	36,006	519,849
Sector fixed effects	No	Yes	No
Firm fixed effects	No	No	Yes

Source: World Bank staff estimates based on Annual Survey of Industries for India.
Note: The first two columns present results for cross-sectional OLS regressions for firms in 2018 while the last column presents the results from a firm-level OLS panel regression of firms from 2001-18. Robust standard errors are included in parentheses for the first two columns while standard errors clustered at the firm level are included within parentheses in the last column. *** p<0.01, ** p<0.05, * p<0.1.

ANNEX TABLE 2.1.5.1 Average energy efficient technology usage rates: Country details

(Percent of firms)

	Energy Star	EE lighting	VAV HVAC system	Programmable thermostats	IoT enabled systems
Bangladesh	59.5	76.3	6.2	1.4	1.1
Brazil	43.4	90.7	69.3	35.1	15.8
Cambodia	2.4	31.7	0.5	1.1	1
Chile	39.7	50.3	23.4	14.1	4.9
Ethiopia	14.3	20	1	0	0
Georgia	10.2	45.8	37.1	10.9	4
India	70	90.9	39	6.7	5

Source: World Bank Firm Level Adoption of Technology Surveys.
Note: Energy Star refers to a U.S. government-backed program for measuring energy efficiency. "VAV HVAC" refers to variable air volume heating, ventilation, and air conditioning systems. "IoT" refers to Internet of Things-enabled systems to control premises temperature, lighting system, and/or refrigeration units.

measuring the level of energy- efficient technology in firm i, constructed as the sum of dummies for each energy-efficient technology listed in annex table 2.1.5.1. $Size_i^s$ includes the set of firm size groups (20–99 and 100+ employees), Age_i^a is the set of firm age groups (6–10, 11–15, and 16+), $Management_i$ represents the set of management related variables (Managers with BA or above, Managers with experience in multinational firms, Having formal incentive for workers, following 1–2 KPI, and following 3+ KPI), *Multinational* is an indicator for firms having business with multinational firms. *Finance* is an indicator for firms that needed to borrow money but could not borrow, *Subsidy* is an indicator for firms that benefited from government program/subsidy, and is an index for the adoption of general business function technology. The specifications also include industry (μ_i) and region (π_i) fixed effects. The estimation results are presented in annex table 2.1.5.2. The main specification, which is the foundation of the discussion in the chapter, is in column 5. It shows that there is a statistically significant association between energy-efficient technology adoption and firm size, manager education and KPI monitoring. Having business links with multinational firms and having benefited from government programs are not significantly associated with technology adoption.

Use of generators. The association between power outages and the use of generators is estimated with the following probit regression:

$$P(Y_i = 1 \mid outage_i, X_i) = \Phi(\alpha + \beta.outage_i + \gamma.X_i)$$

Here, Y_i is a dummy for whether the firm uses a generator, *outage* is a dummy indicating whether the firm experienced a power outage in the past month. X_i is a set of firm attributes: sector, size and firm age. The regression is estimated on the India FAT sample and on a pooled sample containing all seven EMDE countries. It cannot be estimated separately for Bangladesh owing to the absence of variation in power outages in that survey (that is, all firms in Bangladesh sample report facing a power outage in the past month). Annex table 2.1.5.3 reports the marginal estimated probabilities.

2.1.6 Bangladesh Randomized Control Trial

Study sample. A randomized control trial (RCT) is being conducted among 504 small and medium firms in leather goods and footwear manufacturing in Bangladesh since 2022 (Chaurey et al. 2023). The RCT measures the impact on informational interventions on the adoption of servo motors, a new energy-efficient alternative to the traditional clutch motors used in sewing machines in leather goods, footwear and garment firms. The baseline survey was conducted in 2022, and a midline survey conducted in March–May 2023. A final, endline survey will be conducted to measure the effects nine months after the intervention, from September-November 2023. The report is based on the interim analysis of the baseline and midline

ANNEX TABLE 2.1.5.2 Correlates of energy efficient technology adoption index

	Technology adoption index	Technology adoption index	Technology adoption index	Technology adoption index	Technology adoption index
Employment 20-99	0.127**	0.133**	0.163**	0.166**	0.218***
	(0.0643)	(0.0637)	(0.0688)	(0.0686)	(0.0700)
Employment 100+	0.0159	0.0636	0.0795	0.0994	0.387***
	(0.0667)	(0.0659)	(0.0801)	(0.0789)	(0.0966)
Age 6-10		0.101	0.0191	0.00713	-0.0472
		(0.113)	(0.108)	(0.107)	(0.100)
Age 11-15		0.167	0.0175	-0.000759	-0.0353
		(0.109)	(0.106)	(0.105)	(0.0990)
Age 16+		0.403***	0.131	0.109	0.0463
		(0.105)	(0.102)	(0.102)	(0.0959)
Manager with BA degree or above			0.358***	0.360***	0.281***
			(0.0628)	(0.0630)	(0.0665)
Business with multinational firm			0.0133	-0.00476	-0.0211
			(0.0882)	(0.0904)	(0.0884)
CEO/manager has experience in multinational firm			-0.0221	-0.0158	-0.00179
			(0.0780)	(0.0793)	(0.0765)
Firm needed to borrow money but could not			0.0885	0.0876	0.0521
			(0.0659)	(0.0665)	(0.0670)
Formal incentives for workers			0.280***	0.263***	0.0193
			(0.0786)	(0.0792)	(0.0836)
Uses 1-2 key performance indicators			0.443***	0.419***	0.174**
			(0.0641)	(0.0633)	(0.0730)
Uses 3+ key performance indicators			0.434***	0.412***	0.134
			(0.0852)	(0.0847)	(0.0908)
Benefited from government program or subsidy			-0.109	-0.0943	-0.0712
			(0.0841)	(0.0833)	(0.0836)
Exporter				-0.0819	
				(0.0735)	
Sector, region fixed effects	No	No	No	No	Yes
Dependent variable mean			1.777		
Observations	3,391	3,384	2,436	2,434	2,436
R-squared	0.003	0.023	0.157	0.161	0.214

Source: World Bank staff estimates based on World Bank Firm Level Adoption of Technology (FAT) Surveys Wave 2 for Bangladesh and India.
Note: Robust standard errors are included in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Charts depict coefficient estimates with 95% confidence intervals from OLS regressions of Energy Efficient Technology Index on firm attributes including sector and region dummies. The index (range 0-6) is the sum of dummies for whether the firm uses energy efficient lighting, Energy Star rated equipment, Variable Air Volume HVAC systems, programmable thermostats, and Internet of Things enabled systems to control temperature, lighting, or refrigeration.
The sample for the regression is the FAT Survey Wave 2 pooled dataset for Bangladesh and India. N = 2436. "Size 20-99" and "Size 100+" are dummies for firm employment size; the omitted size dummy is "Employment below 20 workers." "Manager with BA degree or above" is a dummy for manager education. "Formal incentives for workers" is a dummy indicating the use of formal incentive schemes for workers by the firm. "Uses 1-2 key performance indicators" and "Uses 3+ key performance indicators" are dummies indicating the number of Key Performance Indicator (KPIs) monitored by the firm; the omitted KPI dummy is "Firm does not monitor any KPI".

ANNEX TABLE 2.1.5.3 Power outages and generator use

	Generator Use	Generator Use
Power outage (=1)	0.161***	0.155***
	(0.0368)	(0.0238)
Size and age controls	Y	Y
Sector dummies	Y	Y
Country fixed effects		Y
Sample	India	All EMDEs
Observations	1444	9243

Source: World Bank staff estimates based on World Bank Firm Level Adoption of Technology Surveys.

Note: Robust standard errors are included in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the estimated marginal effect of power outages on the probability of owning/sharing a generator, resulting from a firm-level Probit regression of generator use on a dummy for whether firm faced a power outage in the past month, controlling for sector, size and firm age. Column (1) is estimated on India survey data. Column (2) is estimated on Bangladesh, Brazil, Cambodia, Chile, Ethiopia, Georgia, and India, and includes country fixed effects in addition to the other controls.

surveys discussed in Chaurey et al. (2023). The details of the RCT intervention are discussed below.

The intervention. The RCT has provided information about the servo motors in varying intensities to the managers of the study firms. It has elicited managers' beliefs about cost savings from the servo motors through a belief elicitation procedure, and elicited managers' willingness to pay for the servo motors using a Becker-DeGroot-Marschak (BDM) procedure. In the BDM procedure, the firm's manager is asked to state the maximum price at which they would be willing to purchase the servo motor. They have the opportunity to purchase the motor at a randomly drawn price if that price is lower than their stated maximum willingness to pay for the motor. There are three treatment arms and one control arm. In all four arms, the RCT is tracking the evolution of managers' beliefs about cost savings from the servo motors and their willingness to pay for them. The arms differ in the extent of information provided about the servo motors and in the distribution from which prices are drawn in the BDM procedure. All three treatment arms are shown a video explaining the energy saving benefits of servo motors. For the control and first two treatment arms, the RCT draw prices from a right -skewed distribution; almost no firms purchase the servo motor at this price. For the third treatment arm, the RCT draws prices from a left-skewed distribution; almost all firms purchase the servo motor at this (very low) price. The arms are the following:

- Control (labelled C): right-skewed distribution, no video
- Video only (labelled T1a): right-skewed distribution, plus detailed information about the servo motor using a video on a tablet device
- Video + meter (labelled T1b): right-skewed distribution plus video from T1a plus smart electricity meter on one machine with a clutch motor
- Motor + video + motor + 2 meters (labelled T2): left-skewed distribution plus video from T1a plus two smart electricity meters, one on a clutch motor machine and one on the machine with the new servo motor.

Approach. A number of methodologies was applied. Heterogeneity in firms' willingness to pay at baseline is examined in a linear regression of firms' reported willingness to pay for servo motors on firm characteristics. The change in firms' willingness to pay after the intervention is derived from a linear regression of the willingness to pay on a dummy variable for the midline variable and firm dummies. Spillovers are derived from a probit regression of technology adoption among control group firms on the number of treated firms within a limited geographic distance (Chaurey et al. 2023).

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CHAPTER 3

Stranded jobs? The energy transition in South Asia's labor markets

Chapter 3. Stranded jobs? The energy transition in South Asia's labor markets

The transition away from fossil fuels in South Asia will have significant labor market impacts, which could leave many workers stranded in lower-wage jobs in declining industries. In all South Asian countries except India, pollution-intensive jobs outnumber green jobs and account for 6–11 percent of all jobs; only in India do green jobs outnumber—and then only slightly—pollution-intensive jobs, which account for 9 percent of all jobs. Pollution-intensive jobs are concentrated among lower-skilled and informal workers, whereas green jobs tend to be held by higher-skilled, better-paid, and formal-sector workers. Experience from past major economic transformations, especially in resource sectors, suggests that the transition from fossil fuels will have large effects on the structure of employment and earnings, with lasting losses for some workers, and will cause significant internal worker migration. A wide range of policies will be needed to facilitate the necessary adjustment in labor markets while protecting vulnerable workers. These include: the provision of better access to high-quality education and training, finance, and markets; measures to facilitate labor mobility; and strengthening social safety nets.

Introduction

The widespread adoption of more energy-efficient and green technologies, and cutbacks in highly polluting activities, are likely to have significant effects in South Asia's labor markets. Workers could be stranded in lower-wage jobs in declining industries, or when assets like land and capital are no longer productive and labor is not mobile. This chapter examines the important role of labor market policies in supporting South Asia's energy transition, while also promoting the region's broader development objectives.

South Asia is a major source of GHG emissions, accounting for almost 10 percent of global emissions in 2021—more than twice its 4 percent share of global GDP (figure 3.1). As part of the 2015 Paris Agreement, several South Asian countries have committed to cuts in emissions or emissions intensity.

A significant focus of the region's efforts under the Paris Agreement is to increase the share of renewables in electricity generation. India is on track to produce 50 percent of its energy from renewables by 2030 (Birol and Kant 2022). In Bhutan and Nepal, hydroelectric energy already accounts for almost all power generation, and capacity is being enlarged, allowing both countries to export electricity to India (Asian Development Bank 2013; IEA 2021a; IRENA 2022a, 2022b; World Bank Group 2022a).

The region has strong potential for solar and wind power generation (figure 3.2). Nearly 60 percent of its area has solar exposure of at least 3.5 kWh/kWp with low seasonality, and about half of its area has wind speeds of greater than 5 meters per second (World Bank et al. 2023a). Solar-powered electricity generation in the region has grown rapidly: between 2015 and 2022, it grew by 20 percent in Bangladesh, 40 percent in the Maldives, and almost 70 percent in Nepal and Sri Lanka (figure 3.3; Ember 2022).

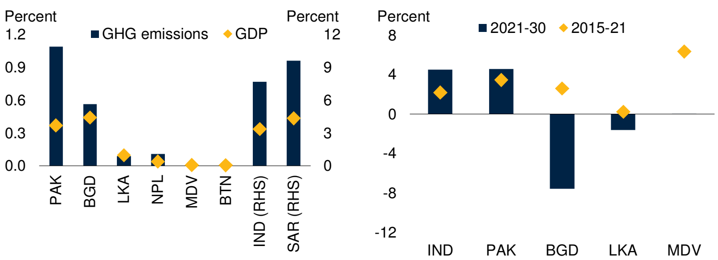
Policy makers in South Asia have started to gear policies explicitly to supporting the green transition. For example, India's 2023–24 budget has been dubbed a "Green Budget" for including green growth as one of its seven goals, with sizable investments in renewable energy and energy-saving technologies. Sri Lanka's government has prepared a *Natural Adaptation Plan and National Environment Action Plan* and is formulating a *Climate Change Act* and a new *Environment Act*. Bangladesh's *National Solar Energy Road Map 2021–2044* and Pakistan's *Alternative and Renewable Energy (ARE) Policy 2019* outlined renewable energy targets to be achieved by increasing solar and wind capacity (World Bank Group 2022b; 2022c).

Note: This chapter was prepared by Margaret Triyana.

FIGURE 3.1 South Asia: GHG emissions and policy commitments

South Asia's recent share of global GHG emissions has been more than twice its share in global GDP. The commitments under the Paris Agreement of several South Asian countries imply a slowdown in their emissions growth between 2021 and 2030.

A. Share of global GHG emissions and global GDP, 2021 **B. GHG emissions growth implied by commitments**

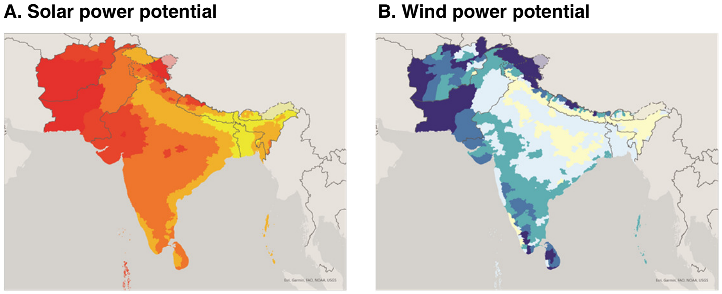


Sources: Climatewatch.org; EDGARv7.0_GHG database; European Commission; World Development Indicators; World Bank.
Note: BGD = Bangladesh; IND = India ; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan, SAR = South Asia Region.
A. Chart shows South Asian countries' shares of global GHG emissions compared with their shares in global nominal GDP in U.S. dollars in 2021.
B. Since different countries have defined their commitments in different ways, the chart shows estimated emissions growth based on the latest available nationally determined contributions plans as recorded by Climatewatch.org. For India, which has a target for the decline in emissions intensity but not for emissions growth, the emissions growth shown assumes that the targeted cut in emissions intensity is achieved.

FIGURE 3.2 Renewable energy potential in South Asia

South Asia has high potential for solar power generation, and parts of the region also have high potential for wind power generation.

A. Solar power potential **B. Wind power potential**



Source: ESMAP.
Note: Charts show South Asia's solar and wind energy potential. Solar radiation is based on the median radiation for the district. Solar suitability is based on a cutoff of 3.5 kWh/kWp. Wind speed is based on the 90th percentile wind speed in the district. Wind suitability is based on a cutoff of 5 m/s. A darker color indicates greater solar (A) or wind (B) power potential.

Large-scale investment in green technologies is already underway in South Asia. India and Pakistan already count among the five EMDEs with the largest public investment in renewable energy (IRENA 2023). The region is also investing heavily in electricity networks and battery storage (IEA 2021b). These investments are taking place in the context of a favorable outlook for investment in the region as a whole: over the next 10 years, consensus forecasters expect South Asia to be the EMDE region with the strongest investment growth.

South Asia's energy transition will have significant consequences for its labor markets. Already the number of jobs in the region related to the production of renewable energy is almost as high as in the United States, although far lower than in China. Most of the region's renewable energy jobs are in India's and Pakistan's hydropower sectors, but there is significant potential for employment growth in the region's wind and solar energy sectors. Indeed, Bangladesh and India are already among the world's top five countries in terms of employment in solar energy, and India is among the world's top 10 countries in terms of employment in wind energy (IRENA 2022c).

Policies relating to labor markets can help smooth the energy transition as it gains traction, by facilitating the mobility of workers, improving worker skills, providing social safety nets that reduce the long-term scarring of job losses, and developing well-coordinated regional economic programs. India, for example, launched the *Skill Council for Green Jobs* in 2015 to prepare its labor market for the green transition.

In addition to reducing GHG emissions, the region's energy transition has the potential to raise labor productivity and incomes significantly. Currently, South Asia, along with Sub-Saharan Africa, has the lowest labor productivity among EMDE regions, and it also has the highest share of informal employment, in part due to a sizable agricultural sector in employment and economic activity (chapter 1, figure 3.4). Agricultural workers are at particular risk of being stranded in low-productivity jobs since their assets and skills tend to be tied to land. The major investments in sectors like power, industrial, and services sectors to achieve the transition away from fossil fuels may raise growth, as well as the level of labor productivity, by encouraging more firms and workers to operate in the formal sector (chapter 2).

While the energy transition from fossil fuels will have wider-ranging consequences, this chapter focuses on the implications for *workers*. It discusses the following questions.

- What are the labor market implications of a shift from pollution-intensive industries?
- What was the labor market impact of past major structural transformations around the world?
- What are the policy implications?

Contributions to the literature

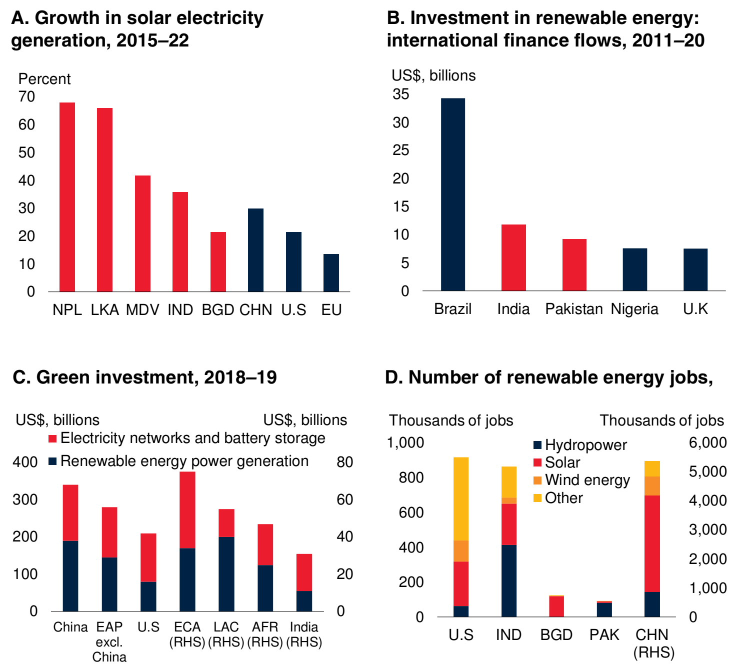
Individual aspects of the challenges arising from the green transition have been explored in detail in World Bank *Country Climate and Development Reports* for Bangladesh, Nepal, and Pakistan. This chapter, for the first time, examines together the associated labor market policy challenges faced by South Asia's economies. It makes several additional contributions to the literature.

First, this chapter provides a first assessment of the share of South Asia's workers that are most likely to be affected by the energy transition—favorably or unfavorably. Research has shown that shifts from pollution-intensive to green jobs have been net job-increasing in the EU (Bali Swain, Karimu, and Gråd 2022), Japan (Kuriyama and Abe 2021), Switzerland (Füllemann et al. 2020), the United States (Garrett-Peltier 2017), and a sample of 11 advanced economies, one advanced-economy region, and the Middle East and North Africa (Meyer and Sommer 2014). Another study for the United States has shown that tighter environmental regulation has not been associated with changes in aggregate employment but with higher demand for green skills, especially technical and engineering ones (Vona et al. 2015, 2018). Data limitations mean that comprehensive exercises such as these cannot be conducted for South Asia. That said, this chapter informs the debate by quantifying for the first time the shares of workers employed in green and pollution-intensive jobs in South Asia in a manner that allows comparisons across countries.

Second, the chapter is the first study to describe the characteristics of workers in green and pollution-intensive jobs in South Asia. The existing literature is sparse and based on data for advanced economies. U.S. workers in green jobs appear, on average, to be better-educated and more experienced, and to have higher cognitive and social skills than other U.S. workers (Consoli et al. 2016). In a broad sample of advanced economies and EMDEs, workers in green jobs also appear to be higher-skilled, more urban, and better-paid (IMF 2022). In the United Kingdom and the United States, some green jobs have been associated with greater engineering skills (Curtis

FIGURE 3.3 Economic activity

Solar electricity generation is increasing rapidly in South Asia. India and Pakistan are among the five EMDEs with the largest public investments in renewable energy.



Sources: Ember; ESMAP; IEA; ILO; IRENA.

Note: AFR = Africa; BGD = Bangladesh; CHN = China; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EU = European Union; IND = India; LAC = Latin America and the Caribbean; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan; UK= United Kingdom; U.S. = United States.

A. Change in solar energy production between 2015 and 2022 for Bangladesh, India, the Maldives, Nepal, Sri Lanka, and selected comparators. Energy production measured in terawatt hours.

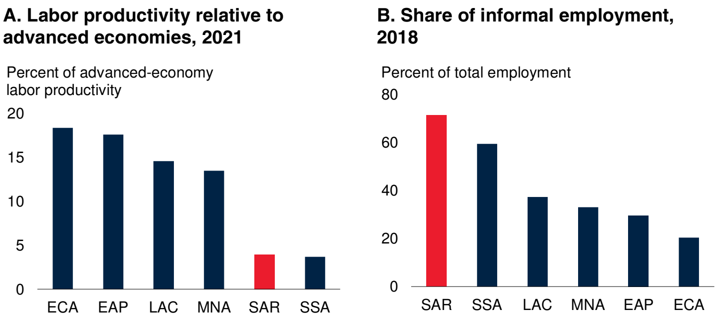
B. Renewable energy finance flows by technology, donor, financial instrument and financial institution/agency in the five largest EMDE recipients between 2011 and 2020.

C. Investment in green technologies, 2018–19. Investment in India is average annual investments over the period 2016–20. Investment for the power sector includes refurbishments, upgrades, new builds and replacements for all fuels, and technologies for on-grid, mini-grid, and off-grid generation. Additionally, they include investment in transmission, distribution, and battery storage.

D. Number of direct and indirect renewable energy jobs, by energy type. Direct jobs are those created by core activities within the renewable energy industry. Indirect jobs supply or support the renewable energy industry, such as the provision of materials or positions in government ministries (IRENA 2012). Data are primarily from 2021. Other renewable category includes biogas, concentrating solar-thermal power, geothermal, liquid biofuels, municipal and industrial waste, solid biomass, tide, wave, and ocean energy. EMDE average includes Angola; Argentina; Brazil; China; Egypt, Arab Rep.; Indonesia; Iran, Islamic Rep.; Mexico; Nigeria; Poland; the Russian Federation; South Africa, and Thailand.

FIGURE 3.4 Labor productivity and informal employment

South Asia, alongside Sub-Saharan Africa, is the EMDE region with the lowest labor productivity; it also has the highest share of informal employment.



Sources: Haver Analytics; World Bank; Yu and Ohnsorge (2021).

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa.

A. Working-age population-weighted averages. Labor productivity is defined as nominal U.S. dollar GDP relative to working-age population (aged 15–64 years).

B. Working-age population-weighted averages. Share of informal employment is proxied by the share of self-employment in total employment.

and Marinescu 2022; Sofroniou and Anderson 2021). This chapter confirms some of these results in the South Asian context.

Third, this chapter draws upon historical experience with sector-specific booms and busts, as well as major economic transformations in China and India. It synthesizes the findings of a large literature on resource booms in the first meta regression analysis of this literature. This analysis summarizes quantitatively 43 studies that estimate the labor market effects of major resource booms and busts in more than 50 countries from 2004. The chapter also conducts the first review of research on the labor market impacts of China's and India's economic transformations in the 1990s.

Main findings

This chapter sets out the following main findings.

First, in all South Asian countries except India, pollution-intensive jobs outnumbered green jobs, with pollution-intensive jobs accounting for 6–11 percent of all jobs. In India, pollution-intensive jobs accounted for 9 percent of all jobs, below the 11 percent accounted for by green jobs. The vast majority of jobs are classified as "pollution-neutral"—neither green nor pollution-intensive.

Second, workers in pollution-intensive jobs were concentrated in the manufacturing and construction sectors. Almost 50 percent of workers in pollution-intensive jobs were in low-skilled occupations in textile and garment-related processing, food processing, and painting and wood treatment. On average, they were significantly less educated and more often informally employed than other workers. Their informal employment arrangements and lack of education were reflected in lower average wages.

Third, green jobs were more dispersed, both across sectors of production and geographically. Although manufacturing was the largest employer of workers in green jobs, it accounted for only one -third of green jobs, compared with one-half of pollution-intensive jobs. Across the region, there were only four states where green jobs accounted for more than 10 percent of employment—half the number of states where pollution-intensive jobs accounted for more than 10 percent of employment. Workers in green jobs were significantly better educated and less frequently informally employed than other workers and, on average, their wages were 7 percent higher even after controlling for their higher education and formal employment arrangements.

Fourth, the experience of higher-income countries with energy sector booms and busts, and the major economic transformations in China and India in the 1990s, suggest that the green transition may have labor market effects that go well beyond changes in the shares of green and pollution-intensive jobs. Some regions may be able to leverage the green transition into employment and earnings increases in both green and non-green jobs, with overall increases in employment and income. Other regions may suffer lasting negative labor market effects, including employment and earnings losses that leave some workers stranded in low-productivity activities, which may even carry over into future generations.

Fifth, policies that can smooth the labor market transition and create jobs for all will be crucial to managing these long-term risks. Policies that have proven useful elsewhere include measures that facilitate labor mobility—both geographically and across occupations—into more productive employment, support for the upgrading of worker skills, well-designed social safety nets, and well-coordinated region-specific economic and labor market programs.

Labor market effects of the energy transition

Labor force surveys provide a window into the nature of the jobs most likely to be affected by the energy transition—green and pollution-intensive jobs—and into the characteristics of the workers in those jobs.

Green and pollution-intensive jobs

Green and pollution-intensive jobs are defined on the basis of occupational classifications. The vast majority of jobs are "pollution-neutral"—neither particularly green nor particularly pollution-intensive. "Green" jobs are defined as occupations that include at least some environmentally friendly tasks, such as those related to renewable energy or environmental protection or activities such as repair or recycling (Granata and Posadas 2022). "Pollution-intensive" jobs are defined as occupations that are most common in the most polluting industries and include occupations such as textile and garment trades workers and machinery mechanics (Vona et al. 2018). Annex 3.1 defines green and pollution-intensive jobs in detail. Data are available from labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).

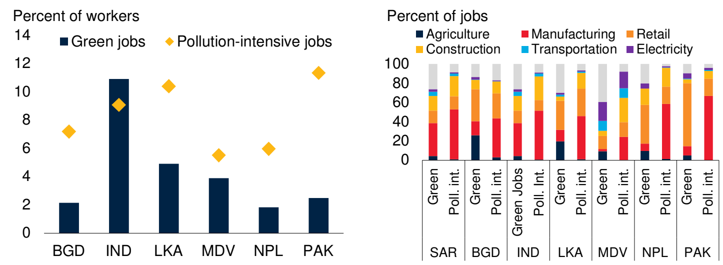
In the six South Asian economies with available data, 2–11 percent of workers were employed in green jobs (figure 3.5; annex table 3.1.2). The range was narrower for pollution-intensive jobs, at 6–11 percent. In all countries except India, pollution-intensive jobs outnumbered green jobs. In India, which accounts for 70 percent of the region's labor force, workers in pollution-intensive jobs accounted for about 9 percent of all jobs, and workers in green jobs for about 11 percent.

Pollution-intensive jobs were highly concentrated in manufacturing, which accounted for about one-

FIGURE 3.5 Green and pollution-intensive jobs in South Asia

In most South Asian countries, pollution-intensive jobs outnumber green jobs. About one-half of pollution-intensive jobs are in manufacturing whereas green jobs are more widely dispersed across sectors.

A. Share of green jobs and pollution-intensive jobs / **B. Distribution of green jobs and pollution-intensive jobs**



Sources: National statistical offices; World Bank.

Note: BGD = Bangladesh; IND = India ; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan. Green jobs are those in occupations that have some environmentally friendly tasks, such as recycling. Pollution-intensive jobs are those that are most common in industries with above-median pollution intensity, such as machinery mechanic, as defined in annex 3.1. Labor force surveys are available for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).

B. All other sectors include: mining and quarrying; financial services and insurance; health and social work, education, public administration and defense; compulsory social security; other community, social, and personal services.

half of them, with about one-sixth in construction. Green jobs were more dispersed: only one-third of workers in green jobs were in manufacturing, the single largest green-job sector, with construction and retail trade accounting for a little more than one-tenth each. Despite the large share of employment in agriculture, only about 4 percent of green jobs and 1 percent of pollution-intensive jobs are in agriculture.

Pollution-intensive jobs were also more geographically concentrated than green jobs. Pollution-intensive jobs accounted for 10 percent or more of employment in two states or union territories in India, which also had above-average poverty; three provinces in Pakistan; and three provinces in Sri Lanka (figure 3.6). Green jobs were more dispersed: across the whole region, there were only four states with a share of green jobs above 10 percent, all of them being in India, with two also heavily reliant on pollution-intensive jobs.

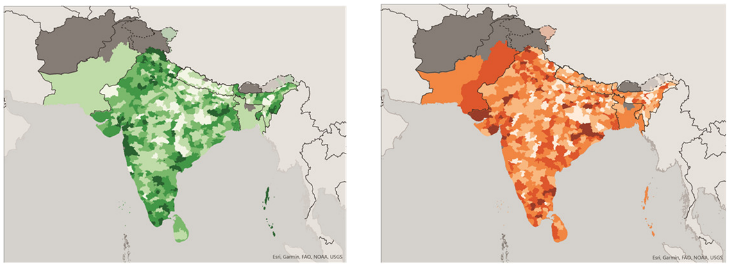
Characteristics of workers in green jobs

Workers in green jobs differed systematically from other workers. A probit regression is used to

FIGURE 3.6 Regional distribution of jobs in South Asia

Workers in pollution-intensive jobs are concentrated in a few states and districts, while workers in green jobs are more geographically dispersed.

A. Share of green jobs **B. Share of pollution-intensive jobs**

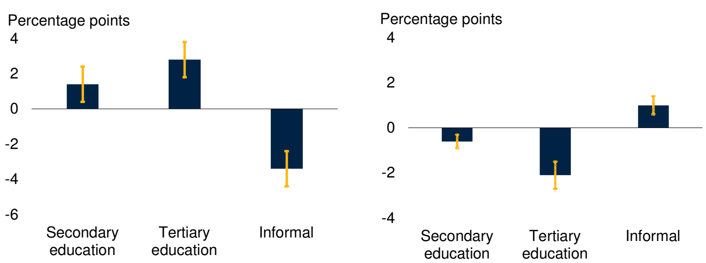


Sources: National statistical offices; World Bank.
Note: Green jobs are those in occupations that have some environmentally friendly tasks. Pollution-intensive jobs are those that are most common in industries with above-median pollution intensity as defined in annex 3.1. Labor force surveys are available for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019). A darker color indicates a higher share of local workers employed in green (A) or pollution-intensive (B) jobs.

FIGURE 3.7 Green and pollution-intensive jobs in South Asia: Worker characteristics

Across the region, workers in pollution-intensive jobs are systematically less educated and more often informally employed. Workers in green jobs are systematically better-educated and less often informally employed.

A. Marginal probability of working in a green job relative to the average job **B. Marginal probability of working in a pollution-intensive job relative to the average job**



Sources: National statistical offices; World Bank.
Note: Green jobs are those in occupations with a positive share of environmentally friendly tasks, such as recycling. Pollution-intensive jobs are those that are most common in industries with above-median pollution intensity, such as machinery mechanic as defined in annex 3.1. Labor force surveys are available for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).
A.B. Marginal probabilities as estimated in probit regressions of a dummy variable of being employed in a green job (A) or polluting job (B), conditional on being in an urban location, having completed secondary or tertiary education, being aged 24–54 or 55 or older, and being informally employed (annex tables 3.1.3 and 3.1.4). The regressions control for industry and subnational entity dummies.

estimate the probability of being in a green job conditional on education level (completion of primary, secondary, and tertiary schooling), age, urban location, and informal employment, controlling for subnational and industry fixed effects (annex table 3.1.3). The data are again drawn from labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).

In the region as a whole, highly-educated workers were more likely to be employed in green jobs (figure 3.7). In India and Sri Lanka, workers who had completed secondary or tertiary schooling were more likely to be employed in green jobs; but in Bangladesh and Pakistan, the opposite was the case. The difference appears to reflect, in part, differences in the skill requirements for the most common green jobs in Bangladesh and Pakistan compared with other countries: more than three-quarters of green jobs in Bangladesh and Pakistan were mid-skilled, compared with fewer than two-thirds of green jobs in the other countries in the region and fewer than half of green jobs in India.

On average in the region, workers in informal employment were less likely than workers in formal employment to be employed in green jobs. However, this was not the case in the Maldives or Sri Lanka, the two countries with the smallest informal sectors in the region, or Nepal.

In all countries other than the Maldives, wages were higher for workers in green jobs than other workers. In South Asia as a whole, the average wage in green jobs was 31 percent higher than in non-green jobs (figure 3.8; annex tables 3.1.5 and 3.1.6). Much of this wage differential reflected worker characteristics. But even after controlling for worker, industry, and location characteristics, workers in green jobs received 7 percent higher wages than their peers in non-green jobs. This is similar to evidence from a study of mostly advanced economies where a skill premium of almost 7 percent was found for workers in green jobs (IMF 2022).

Pakistan and the Maldives were exceptions, where workers in green jobs did not receive significantly higher wages than other workers with similar characteristics. This, in part, reflected differences in the most common green jobs, in particular a greater prevalence of mid-skilled green jobs in Pakistan and of green jobs in low-wage construction in the Maldives. In Pakistan, considerably more green jobs were mid-skilled—

about 80 percent of them—than in South Asia as a whole, where the proportion was 43 percent. In the Maldives, the share of green jobs in typically lower-wage construction was double the share of green jobs in typically higher-wage manufacturing, whereas the reverse was true in South Asia overall.

Characteristics of workers in pollution-intensive jobs

Workers in pollution-intensive jobs also differed systematically from their peers in non-pollution-intensive jobs. Workers with secondary or tertiary education were less likely, and informal workers more likely, to be in pollution-intensive jobs (annex table 3.1.4).

Workers in pollution-intensive jobs, on average, received almost 10 percent lower wages than the average worker in the region. In India, this raw wage differential reflected worker, industry, and location characteristics. In most other South Asian countries, wages in pollution-intensive jobs were 2–11 percent lower than average wages even after controlling for worker characteristics, industry, and location. In Bangladesh, however, workers in pollution-intensive jobs received higher wages than their peers with similar characteristics, in part because the share of high-skilled workers in pollution-intensive jobs is about twice the region's average.

Lessons from past structural transformations

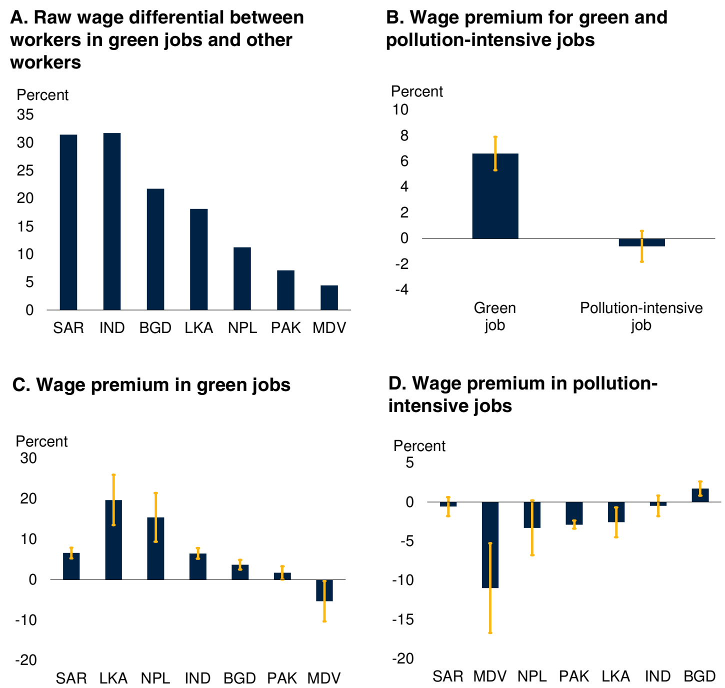
The energy transition is likely to involve considerable structural transformations of the region's economies. Such structural transformations have occurred in other countries and at other times. A sizable literature has examined these past experiences, and there are policy lessons to be drawn.

Resource booms and busts

As the energy transition proceeds, different parts of South Asia will undergo employment expansions or contractions, depending on the speed with which they adopt green technologies and practices and exit pollution-intensive activities. Structural shifts in agriculture and resource sectors have caused comparable transformations in the past. While agriculture remains an important sector in the region, its share of green and pollution-intensive jobs is relatively small. The growth in renewable energy may be more similar to the experience of the resource sectors, which indicates that the labor market consequences of the energy transition may reach well beyond the directly affected sectors.

FIGURE 3.8 Green and pollution-intensive jobs in South Asia: Wage premiums and discounts

On average, workers in green jobs receive significantly higher wages than other workers whereas those in pollution-intensive jobs receive lower wages. In part, this reflects worker characteristics, but even controlling for these, in most South Asian countries, workers in green jobs earn a wage premium.



Sources: National statistical offices; World Bank.

Note: SAR = South Asia Region; BGD = Bangladesh; IND = India ; LKA = Sri Lanka; MDV = Maldives; NPL = Nepal; PAK = Pakistan.

Green jobs are those in occupations with a positive share of environmentally friendly tasks, such as recycling. Pollution-intensive jobs are those that are most common in industries with above-median pollution intensity, such as machinery mechanic as defined in annex 3.1. Labor force surveys are available for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).

A. Wage differential is the difference in the average wages between workers in green jobs and other workers.

B.C.D. A Mincer regression estimates the rate of returns to being in a green and pollution-intensive job, dubbed "wage premium." The analysis entails regressing log earnings on dummy variables for being employed in a green job or pollution-intensive jobs conditional on being in an urban location, having completed secondary or tertiary education, and being aged 24– 54 or 55 or older, potential experience, and being informally employed (annex table 3.1.5). The regressions control for industry and subnational entity dummies.

The labor market effects of resource booms and busts have been most extensively studied for five advanced economies (Australia, Canada, Spain, the United Kingdom, and the United States), three EMDEs in Latin America (Brazil, Chile, and Peru), two EMDEs in Europe and Central Asia (Kazakhstan and the Russia Federation), and 29 EMDEs in Sub-Saharan Africa. The effects of these resource booms and busts have parallels to the likely effects on labor markets of the green transition.

That said, there are also important differences. In particular, the green transition is likely to be associated with a shift from lower-skilled to higher -skilled jobs, whereas past resource booms have often been associated with shifts in the opposite direction. Therefore, the following review of the evidence on resource booms and busts is complemented with a review of the literature on two broader structural transformations: those following India's liberalization of international trade and domestic regulations that began in 1991, and China's market-based reforms of the 1990s.

Literature sources

To identify the labor market effects of resource booms and busts, a comprehensive literature review is conducted. The studies summarized in Aragón, Chuhan-Pole, and Land (2015) and Marchand and Weber (2018) form a starting point for the analysis, supplemented by more recent studies. The analysis began with a total of 43 studies published in peer-reviewed journals, working papers, and policy publications (annex tables 3.2.1 and 3.2.2). Most of these studies (28 of the 43 studies) examine developments in the United States, with others analyzing developments in Canada (one study), and economies in East Asia and the Pacific (four studies), Europe and Central Asia (four studies), Latin America (eight studies), the Middle East and North Africa (three studies), South Asia (three studies), and Sub-Saharan Africa (30 studies). Together, these studies cover more than 50 countries from 2004 onward. Some of these studies examined resource booms at the country level, others at the subnational level. After standardizing the results and restricting them to subnational resource booms and busts, the meta regression analysis is based on data from 23 studies on employment (53 estimates), 27 studies on earnings (70 estimates), and 13 studies on spillovers to non-resource sectors (65 estimates).

A meta regression analysis is conducted on these studies to estimate the average effect of resource booms and busts on the local labor market. The meta regression combines and contrasts multiple studies on resource booms and busts to capture the methodological diversity in such studies. The main outcomes of interest are the percent changes in total employment and earnings. Earnings measures vary widely in these studies and include earnings per worker, family earnings, wage and salary income, GDP per capita, total wages, annual pay, household income, median income, median earnings, and per capita expenditure. The meta regression analysis assumes that all these measures are suitable proxies for average earnings. The analysis also examines employment spillovers to non-resource sectors. While the results are indicative of indirect effects, the meta regression analysis cannot distinguish the channels behind the observed spillovers.

Subnational regions with rapid growth in green jobs: Past resource booms

The parts of South Asia with rapid growth in green jobs are likely to witness similar benefits and challenges to those experienced by countries or subnational regions that experienced resource booms in the past. Their experience suggests significant employment and earnings gains, with favorable spillovers to non-resource sectors.

In almost all studies of resource booms around the world, total employment rose and, in most cases, average earnings rose too. Brazil's offshore oil boom in the 1980s was an exception because it provided limited employment for residents in regions closest to the oil fields. On average, subnational resource booms were associated with a statistically significant 5 percent increase in employment in the local labor market directly affected by the booms and a 0.5 percent increase in earnings (figure 3.9).

The employment gains were virtually universal across all studies. For earnings gains, the majority of estimates showed increases. About 30 percent of the estimates in studies that reported earnings declines typically referred to areas with high resource dependence and a rapid expansion of low -skilled jobs. These studies generally present evidence consistent with "Dutch disease"—a decline in non-resource sectors that accompanies a resource boom in a resource-reliant economy. Since green jobs tend to be higher-skilled, the experience of this subset of studies may be of limited relevance to the energy transition.

Studies of resource booms have often shown that additional jobs in the resource sector created additional non-resource-sector jobs, which attracted workers from regions not directly affected by the boom. With the exception of Brazil's offshore oil boom, resource booms were accompanied by increases in the working-age population. The meta regression analysis suggests that the average subnational resource boom was associated with a small, but statistically significant, increase in non-resource-sector employment, with about 0.2 additional jobs created during the boom (annex tables 3.2.2 and 3.2.3). All sectors (in both goods and services production) experienced statistically significant increases in employment.

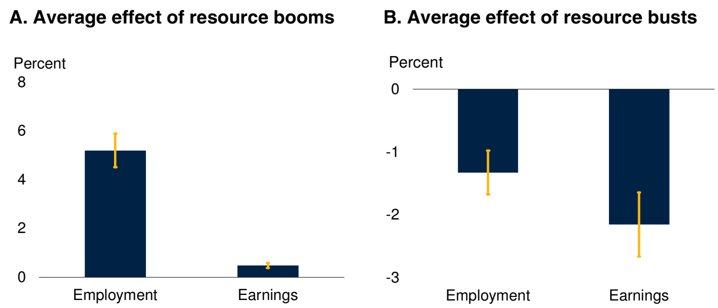
Subnational regions reliant on pollution-intensive employment: Past resource busts

Local economic busts, such as those that may occur in some subnational regions that currently rely heavily on pollution-intensive jobs, have been shown to cause lasting scarring. The literature on resource busts suggests significant aggregate employment and earnings declines. However, there is wide heterogeneity in spillovers to the non -resource sector.

In many past resource busts, total employment and average earnings declined in the affected regions and remained depressed for many years. This was the case for regions affected by the decline of U.S. manufacturing due to globalization (Autor, Dorn, and Hanson 2021); the U.S. oil and gas bust in the 1980s (Jacobsen and Parker 2016); the decline of the U.S. coal industry in the 1980s and 2010s (Hanson 2023); and the 2012–15 coal bust in China (Zhang 2023).[1] After such resource busts, household finances deteriorated significantly not only for directly affected households but also more broadly in the affected regions (Blonz, Tran, and Troland 2023).

FIGURE 3.9 Meta regression of the effects of resource booms and busts on employment and earnings

Employment and earnings systematically increased during resource booms and fell during resource busts



Sources: Calculations based on Marchand and Weber (2018), Aragón, Chuhan-Pole, and Land (2015), and related studies in annex 3.2.
Note: Estimates are based on random effects meta regressions. Each study's effect size is standardized to percentage changes. Log changes are interpreted as percentage changes. Employment measure is total employment in the labor market considered by each study. Earnings include earnings per worker, family earnings, wage and salary income, GDP per capita, total wages, annual pay, household income, median income, median earnings, and per capita expenditure.

On average, subnational resource busts were associated with a 1 percent, statistically significant, decline in total employment. The decrease in employment was not reversed (Krause 2022). On average, resource busts were associated with 2 percent earnings losses—well in excess of the 0.5 percent earnings gain during resource booms. If the energy transition generates similarly outsized earnings losses for workers in pollution-intensive jobs, it will tend to increase inequality in several South Asian countries where these workers' earnings are already below-average.

The spillovers to non-resource sectors varied widely because they had different degrees of

[1] In Canada, by contrast, there was no significant decline in employment around oil busts in the 1980s (Marchand 2012). In Spain, large plant closures led to less-than-proportionate declines in local employment (Jofre-Monseny, Sánchez-Vidal, and Viladecans-Marsal 2018); and a less-than-proportionate decline was also seen in the U.K. regions affected by coal mine closures (Beatty, Fothergill, and Powell 2007).

complementarity with the resource sector. In some cases, subnational resource busts were associated with job losses of up to 10 percent in all other sectors.

Affected regions may see an exodus of their most productive workers (Marchand 2012). Significant out-migration, especially of younger workers, was seen in the U.S. and U.K. regions most affected by the coal industry decline of the 1980s (Beatty, Fothergill, and Powell 2007; Hanson 2023), although not in the Chinese regions most affected by the coal industry bust of 2012–15 (Zhang 2023) or in the Spanish regions affected by large plant closures (Jofre-Monseny, Sánchez-Vidal, and Viladecans-Marsal 2018).

Many displaced workers may never find another job, never migrate, and never return to their pre-boom earnings. This was the case for many workers affected by the decline of U.S. manufacturing in the 1990s and early 2000s (Autor, Dorn, and Hanson 2013; Autor et al. 2014); the decline of the U.S. coal industry in the 1980s (Hanson 2023); and the U.S. oil bust (Jacobsen, Parker, and Winikoff 2023). Various welfare payments rose significantly in resource busts and remained statistically significantly larger long afterwards (Black, McKinnish, and Sanders 2003; Hanson 2023).

Large-scale economic transformations

The experience of major economic transformation, such as the market-based economic reforms in China, including state-owned enterprise reforms, in the 1990s, and the trade liberalization and deregulation in India that started in 1991, points to possible consequences of the green transition for employment and earnings in South Asia.

China. China's reforms in the 1990s relaxed price controls and allowed the operation of private enterprises, including through the privatization of state-owned enterprises. In general, China's state-owned enterprises have been characterized by lower labor productivity and greater job stability than private enterprises (Cheng and Ng 2023; Li and Yamada 2015). The privatizations changed the composition of employment but their impact on aggregate employment remains an open question. Major state-owned enterprise restructuring was associated with either insignificant aggregate employment changes or employment gains, at least among firms that underwent outright ownership changes (Boubakri and Cosset 1998; Gong, Maioli, and Görg 2007; Sun and Tong 2003). Privatization, specifically, was associated with higher employment (Cosset and Boubakri 2002; Sun and Tong 2003) but lower employment growth in privatized firms, pointing to slower job transitions (Gong, Maioli, and Görg 2007).

India. India's economic liberalization included reductions in import tariffs, the deregulation of markets, and reductions in taxes. There were no statistically significant employment contractions in the import-competing industries most affected by these reforms, but there was a clear decline in wages (Banga 2005; Epifani 2003; Topalova 2010). The presence of FDI in an industry was associated with higher wages (Banga 2005) while higher rates of import protection were associated with lower wages (Kumar and Mishra 2008). The wage-elasticity of labor demand increased after the reforms (Hasan, Mitra, and Ramaswamy 2007), pointing to faster job transitions for workers. Separately, delicensing was associated with an increase in the number of factories, promising increased economic activity and job creation (Aghion et al. 2008).

Policy implications

The experience of past sectoral transformations suggests that regions with rapid green jobs growth are likely to benefit from employment and income gains, while regions with declining pollution-intensive activities may suffer lasting employment and income losses. The characteristics of workers in pollution-intensive jobs suggest that job and income losses may be concentrated among lower-paid, lower-educated workers.

Efforts to accelerate overall job creation and to help the most affected workers and regions adjust are, therefore, a priority. Measures to improved access to finance and high-quality education and training, to facilitate the mobility of workers, as well as a robust social safety net, can support workers in their transition out of declining pollution-intensive industries into neutral jobs. Regional policies can help shore up economic activity in the most adversely affected regions. Each of these policies needs to be carefully designed and coordinated across different levels of government to avoid fiscally costly interventions that do not improve aggregate employment or productivity and incomes.

Job creation. Broader job creation, fueled by stronger growth, could help absorb the workers in pollution-intensive jobs at risk of being stranded during the energy transition (chapter 1). The employment opportunities created by the energy transition itself may not offer promising prospects to workers in pollution-intensive jobs because of the high-skill bias of green jobs. On average, workers in green jobs are higher skilled: 30 percent of green workers are high-skilled, while only 15 percent of non-green workers and 4 percent of pollution-intensive workers are high-skilled. At least initially, the green transition is likely to constitute a skill-biased shift in the composition of jobs. Faster output growth and, with it, more vigorous job creation is needed to absorb workers who are currently in pollution-intensive jobs, especially into pollution-neutral jobs. Indeed, evidence for India suggest that, over time, gains in energy efficiency have been accompanied by job creation (chapter 2).

Skills upgrading. Retraining programs for workers can facilitate their redeployment. However, evidence on the success of such active labor market programs is mixed, both for advanced economies (Crépon and Van Den Berg 2016) and EMDEs (McKenzie 2017). Any retraining or reskilling program should be designed and implemented in close consultation with employers (Christiaensen and Ferré 2020).

Robust social safety net. A robust social safety net can prevent the lasting scarring that often occurs after adverse economic shocks. When well-designed, it can also encourage the risk-taking by workers often needed for gains in productivity. Although challenging to implement, the social benefits system needs to be adaptable to rapidly changing circumstances, have large coverage, and be efficiently administered (World Bank 2022a). Social protection programs implemented before negative shocks occur can serve as automatic stabilizers of the economy and, during crises, they can be modified to meet specific objectives. Such programs can aim for income protection or job protection, the choice partly depending on the structure of the labor market. In South Asia, where few workers are permanently employed full-time in the formal sector, income-based, means-tested social protection schemes may be needed to protect vulnerable workers. A robust social safety net can also allow policy makers to ease labor regulations, which may allow workers to move to productive firms and more productive employment. Broad income support programs are likely to be less distortionary and more effective at protecting vulnerable groups than job protection schemes during the labor market shifts that are likely to accompany the green transition.

Facilitating internal worker migration. Connecting workers with jobs, including through mobile job platforms, may help encourage labor mobility and improve skill matching and employment prospects (Lobao et al. 2021; Ruppert Bulmer et al. 2021). South Asia already accounts for 9 percent of the world's international migration but, considering the size of the region's population, cross-border migration within South Asia is relatively limited (World Bank 2023b). Migration, both internal and cross-border, including agriculture workers who may be stranded due to land, toward higher-productivity employment, could be encouraged by lowering the cost of migration, broadening the portability of social security benefits (such as in India's One-Nation-One-Ration-Card scheme), and expanding access to remittance services (World Bank 2022b).

Subnational policies. The energy transition will have different effects across subnational labor markets and may therefore require changes in fiscal transfers to ensure continued and well-targeted public service delivery. In most South Asian countries (except Bangladesh and Sri Lanka), subnational government spending, relative to GDP, is above the average level in other EMDEs. In India, targeted intragovernmental transfers for specific purposes have been found to improve service delivery and subnational outcomes (World Bank 2019). This suggests that well-coordinated programs, including programs financed by fiscal transfers, to stimulate economic activity in specific districts and provinces may help them adjust to the structural transformation away from fossil fuels. The most effective subnational policies have been found to be those that were well -coordinated between different levels of government (Lobao et al. 2021; Oei, Brauers, and Herpich 2020). To facilitate the adjustment process in the hardest-hit districts and provinces, subnational policies could aim to develop the institutional capacity to catalyze private investment and expand infrastructure to connect to markets.

- *Infrastructure*. Subnational policies that promote specific investments to improve the region's infrastructure and productive capacity can promote economic activity. For the U.S. regions that suffered from the decline of the coal industry, for example, investment in transport infrastructure was associated with permanent increases in employment (Hanson 2023). In declining German coal mining regions, too, investment in infrastructure and education reduced adjustment costs (Oei, Brauers, and Herpich 2020). A case study from Canada's Just Transition Fund also found that a combination of training, income support, and investments in infrastructure helped absorb coal workers in Alberta in the short term (Parkland Institute 2019).

- *Institutional capacity*. Strong local institutional capacity can secure resources needed for the transition. Evidence from the closure of U.S. coal mines suggests that strong institutional capacity was key to a successful transition to a post-coal economy. This allowed local city councils to access grants, turn nearby universities into incubators, develop commuter or tourism economies near population centers, and design effective reskilling and job placement programs (Ruppert Bulmer et al. 2021).

ANNEX 3.1. Methodology: Quantifying green and pollution-Intensive jobs

Sample. The sample includes 332,128 workers for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019). District level data is available for India (648 districts), the Maldives (18 districts), Nepal (74 districts), and Sri Lanka (25 districts). Division level data is available for Bangladesh (7 divisions) and province level data for Pakistan (4 provinces). The data are restricted to employed male workers between the ages 15 and 64. Both pollution-intensive and green jobs employ few women and the selection into labor force participation for women is beyond the scope of this chapter. Variables and data sources are shown in annex table 3.1.1.

Definitions. Green jobs are those in occupations with a positive share of environmentally friendly tasks, as defined in Granata and Posadas (2022). A green job indicator takes the value one if the occupation has at least one environmentally friendly task. Environmentally friendly tasks include repairs, environmental management, recycling and forest management. Examples of green occupations include: bicycle repairer; forestry workers; refuse sorters; farming, forestry, and fisheries advisers; civil engineers; and environmental and occupational health inspectors. Examples of green occupations in agriculture include aquaculture workers and agricultural and forestry production managers. A pollution-intensive occupation is defined as in the most common occupations (at the 6-digit SOC level) in the five percent of 4-digit NAICS industries that have the highest emissions of pollutants per worker, as defined in appendix C of Vona et al. (2018). Polluting industries are a set of 62 4-digit North American Industry Classification System (NAICS) industries that are in the 95th percentile of pollution intensity for at least three pollutants among CO, VOC, NOx, SO2, PM10, PM2.5, lead, and CO2. Pollution-intensive occupations are then defined as those 6-digit Standard Occupational Classification (SOC) occupations with a 7 times higher probability of working in

ANNEX TABLE 3.1.1 Sample description

Variable	Definition/description
Occupation	Occupations follow the ILO's ISCO-08 4-digit coding for Bangladesh, Sri Lanka, the Maldives, Nepal, and Pakistan and ILO's ISCO-88 3-digit coding for India (International Labour Organization 2008). Green job and pollution-intensive job indicators are created based on occupation.
Industry	Industry includes 1. agriculture (reference group); 2. manufacturing; 3. mining and quarrying; 4. electricity, gas, steam and air condition supply; 5. construction; 6. wholesale and retail trade; 7. transportation and storage; 8. financial services and insurance; 9. health and social work, education, public administration and defense; compulsory social security; other community, social and personal services. Data for Nepal includes an adjustment to agriculture.
Education	Education is categorized into less than primary, primary, secondary (which combines lower- and upper-secondary) and tertiary (which includes post-secondary).
Potential experience	Inferred from age and level of education minus 6, the assumed start of primary education.
Urban	India includes urban location of work. For all other countries, urban residence is assumed to be urban location of work. Data for the Maldives assume Malé Atoll, which includes the capital, Malé, to be urban.
Informality	Informal indicator is created based on self-employment, casual work pattern, informal salary payments, social security, and business registration. The informality indicator is missing for 2 to 10 percent of the sample.
Monthly earnings	Monthly cash earnings of an employee in *main* job. Main refers to the work that an individual spent most of the time on in the past week or month. If same number of hours used in more than one work, this considers the one where they earn the most money.
PPP adjustment	PPP conversion factors for GDP taken for the corresponding country and survey year. Raw monthly earnings divided by PPP conversion factor.

Note : Labor force surveys for Bangladesh (2015), India (2018), Nepal (2017), Pakistan (2018), and Sri Lanka (2019). The Maldives (2019) Household Income and Expenditure Survey is used since there is no separate labor force survey. District-level data are available for India (648 districts), the Maldives (18 districts), Nepal (74 districts), and Sri Lanka (25 districts). Division -level data are available for Bangladesh (seven divisions) and province level data for Pakistan (four provinces). The data are restricted to employed male workers between the ages 15 and 64. The definition of agricultural work was adjusted between the preceding labor force survey and the 2018 labor force survey. To account for this change, the definition of agricultural work was adjusted to count all those individuals who spent at least 4 hours a month on subsistence agriculture activities, following the methodology employed in the 2020 *Nepal Jobs Diagnostic*.

polluting sectors than in any other job.[2] These occupations are collapsed to the 3-digit SOC occupations using the share of employment in the 3-digit occupation as follows:

$$X_r = \frac{\sum_{i=1}^{n} w_i \times x_i}{\sum_{i=1}^{n} w_i}$$

where X_i is the occupation at the 6-digit level, w_i is the share of employment of 6-digit occupation i in 3-digit occupation r, and X_r is the occupation variable at the 3-digit level. The 3-digit SOC occupations are then mapped to the ILO's 3-digit ISCO occupations. The mapping to the ISCO occupations effectively collapses the SOC occupation-level data, which generates a measure of pollution intensity between 0 and 1. In this analysis, for comparability to the binary nature of

[2] Vona et al. (2018) used this threshold to ensure the inclusion of certain occupations that are associated with high emissions.

the green job definition, a pollution-intensive job indicator takes the value one if the occupation's pollution intensity is above the median. Annex table 3.1.2 shows the share of workers in green and in pollution-intensive jobs in the main sectors. Examples of pollution-intensive jobs include: machinery mechanics and fitters; tailors, dressmakers, furriers and hatters; painters, building structure cleaners; food processing and related trades workers; and textile, garment and related trades workers. In agriculture, such jobs include butchers, fishmongers and related food preparers and food processing and related trades workers.

Regression: worker characteristics. Probit regressions are estimated for the probability of a worker being employed in a green job or in a pollution-intensive job, conditional on worker characteristics:

$$p_{i,j} = \Phi(\beta_1 E_j^{secondary} + \beta_2 E_j^{tertiary} + \beta_3 Age_j^{24\text{-}54} + \beta_4 Age_j^{55+} + \beta_5 urban_j + \beta_6 informal_j)$$

where $p_{i,j}$ is a dummy variable if worker j is employed in a job of type i (either green or non-green); $E_j^{secondary}$ and $E_j^{tertiary}$ are dummy variables for worker j having completed secondary or tertiary schooling, respectively; $Age_j^{24\text{-}54}$ and Age_j^{55+} are dummy variables for worker j being aged 24-54 years or 55 and more years, respectively; $urban_j$ is residence in an urban location by worker j[3], and $informal_j$, a dummy variable for worker j being informally employed. Industry and subnational regional fixed effects are included. A similar probit regression is estimated where $p_{i,j}$ is a dummy variable if worker j is employed in a pollution-intensive job or non-pollution-intensive job. Worker characteristics of green jobs are based on the set of jobs that are green at the moment. However, given the early stages of the green transition, there is a possibility that the characteristics of workers who hold green jobs may be systematically different in the future. Annex table 3.1.3 shows the estimated marginal probability of being employed in a green job and annex table 3.1.4 shows the estimated marginal probability of being employed in a pollution-intensive job.

Regression: wage premium. To estimate the wage premium, a variant of the same regression is estimated in a linear regression of log earnings:

$$\log earnings_{i,j} = \delta_g Green_j + \delta_p PollutionIntensive_j + \beta_1 E_j^{secondary} + \beta_2 E_j^{tertiary} + \beta_3 Age_j^{24\text{-}54} + \beta_4 Age_j^{55+} + \beta_5 urban_j + \beta_6 informal_j + \beta_6 exp_j + \beta_7 exp_j^2$$

where exp_j is the potential experience of worker j, i.e., their age minus the typical age at which their education level is achieved, and the quadratic term of potential experience. This chapter assumes formal education begins at age 6. Industry and subnational regional fixed effects are included. Annex table 3.1.5 shows the coefficient estimates. Annex table 3.1.6 shows the Blinder-Oaxaca decomposition, into explained and unexplained components, of the difference between average wages in a green or pollution-intensive job and the country- or region-wide average wage (Blinder 1973; Oaxaca 1973).

Both regressions—for the probability of being employed in a green or pollution-intensive job and for the wage premium—are estimated both as a pooled regression of all labor force surveys with subnational regional fixed effects and separately for each country. Survey weights are used in all estimations. Pooled regression reweights each country's sample by the share of the labor force in the region.[4]

[3] Almost all surveys include urban residence instead of location of employment (annex table 3.1.1).

[4] Using the original survey weight in the pooled regression yields qualitatively similar results.

ANNEX TABLE 3.1.2 Share of workers in green and pollution-intensive jobs in the main sectors

		Agriculture; forestry & fishing	Manufacturing	Electricity, gas, steam and air condition supply	Construction	Wholesale and retail trade	Transportation and storage	Other
South Asia	Green	4	34	3	15	13	4	26
	Pollution-intensive	1	52	1	21	14	3	9
Bangladesh	Green	26	14	3	10	33	1	14
	Pollution-intensive	3	41	1	12	26	0	17
India	Green	4	34	3	15	13	4	26
	Pollution-intensive	1	51	1	25	11	3	9
Maldives	Green	9	2	20	5	14	10	40
	Pollution-intensive	0	24	17	25	15	10	8
Nepal	Green	9	8	5	17	40	0	20
	Pollution-intensive	1	57	1	19	18	0	2
Pakistan	Green	5	10	6	4	66	1	10
	Pollution-intensive	0	67	2	8	18	1	4
Sri Lanka	Green	20	12	2	4	30	2	30
	Pollution-intensive	1	45	1	17	28	1	7

Sources: Labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).
Note: The data are restricted to employed male workers between the ages 15 and 64. Other includes mining and quarrying; financial services and insurance; health and social work, education, public administration and defense; compulsory social security; other community, social and personal services.

ANNEX TABLE 3.1.3. The marginal probability of being employed in a green job

	Region	Bangladesh	India	Maldives	Nepal	Pakistan	Sri Lanka
Level of education: below primary	-0.003	0.000	-0.003	0.020***	0.001	-0.004**	0.01
	(0.006)	(0.003)	(0.006)	(0.008)	(0.005)	(0.001)	(0.012)
Level of education: secondary	0.014***	0.000	0.015***	-0.007	0.002	-0.009***	0.002
	(0.004)	(0.002)	(0.005)	(0.005)	(0.004)	(0.002)	(0.004)
Level of education: tertiary	0.028***	-0.005***	0.030***	-0.005	0.010**	-0.008***	0.024***
	(0.007)	(0.002)	(0.007)	(0.005)	(0.005)	(0.003)	(0.009)
Age: 25–54	-0.014**	-0.007***	-0.014**	0.003	-0.007	-0.014***	0.000
	(0.006)	(0.001)	(0.006)	(0.005)	(0.004)	(0.002)	(0.004)
Age: 55–64	-0.023***	-0.016***	-0.023***	-0.020***	-0.011*	-0.020***	-0.013***
	(0.008)	(0.004)	(0.009)	(0.007)	(0.006)	(0.003)	(0.005)
Urban	0.041***	0.003**	0.044***	0.000	0.004	0.005**	0.010***
	(0.005)	(0.002)	(0.006)	(0.001)	(0.003)	(0.002)	(0.003)
Informality	-0.034***	-0.011***	-0.037***	-0.007	-0.006	-0.020***	0.002
	(0.006)	(0.001)	(0.006)	(0.007)	(0.005)	(0.003)	(0.004)
No. of observations	227,434	89,932	65,269	5,591	10,218	40,096	15,590
Share of pollution-intensive jobs	0.06	0.03	0.17	0.04	0.02	0.03	0.04

Sources: Labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).
Note: The data are restricted to employed male workers between the ages 15 and 64. Industry and subnational region fixed effects included, standard errors in parentheses, clustered at the subnational region level. * p<0.10, ** p<0.05, *** p<0.01.

ANNEX TABLE 3.1.4 The marginal probability of being employed in a pollution-intensive job

	Region	Bangladesh	India	Maldives	Nepal	Pakistan	Sri Lanka
Level of education: below primary	-0.006	-0.022***	-0.005	-0.009	-0.002	-0.026***	-0.044**
	(0.004)	(0.005)	(0.005)	(0.010)	(0.003)	(0.005)	(0.018)
Level of education: secondary	-0.006**	-0.009***	-0.006**	0.005	-0.005	-0.009	0.007
	(0.003)	(0.002)	(0.003)	(0.006)	(0.003)	(0.009)	(0.006)
Level of education: tertiary	-0.021***	-0.067***	-0.020***	-0.013***	-0.005	-0.089***	-0.096***
	(0.006)	(0.002)	(0.006)	(0.005)	(0.005)	(0.016)	(0.022)
Age: 25–54	-0.016***	-0.005**	-0.016***	0.011**	0.001	-0.017***	-0.007
	(0.003)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)
Age: 55–64	-0.029***	-0.019***	-0.029***	0.008	-0.008*	-0.032***	-0.025***
	(0.005)	(0.003)	(0.006)	(0.011)	(0.005)	(0.009)	(0.009)
Urban	0.021***	0.003	0.021***	0.001	0.005*	0.031***	0.011
	(0.003)	(0.005)	(0.003)	(0.002)	(0.003)	(0.002)	(0.007)
Informality	0.010**	0.015***	0.008*	-0.002	0.004**	0.048***	0.016***
	(0.004)	(0.006)	(0.005)	(0.003)	(0.002)	(0.005)	(0.005)
No. of observations	226,755	90,197	62,161	5,551	12,725	40,096	15,632
Share of pollution-intensive jobs	0.09	0.09	0.12	0.06	0.06	0.15	0.11

Sources: Labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).

Note: The data are restricted to employed male workers between the ages 15 and 64. Industry and subnational region fixed effects included, standard errors in parentheses, clustered at the subnational region level. * p<0.10, ** p<0.05, *** p<0.01.

ANNEX TABLE 3.1.5 Earnings in green and pollution-intensive jobs

	Region	Bangladesh	India	Maldives	Nepal	Pakistan	Sri Lanka
Green job	0.066***	0.037**	0.065***	-0.053	0.154**	0.017	0.197***
	(0.013)	(0.012)	(0.013)	(0.050)	(0.060)	(0.016)	(0.062)
Above-median pollution intensity	-0.006	0.017*	-0.005	-0.110*	-0.033	-0.029**	-0.026
	(0.012)	(0.009)	(0.013)	(0.057)	(0.035)	(0.005)	(0.019)
Informality	-0.418***	-0.119***	-0.422***	-0.264***	0.073***	-0.458***	-0.128***
	(0.022)	(0.006)	(0.023)	(0.029)	(0.025)	(0.060)	(0.027)
Level of education: below primary	-0.104***	-0.060**	-0.104***	-0.168	-0.086***	-0.056***	0.035
	(0.012)	(0.017)	(0.012)	(0.122)	(0.031)	(0.002)	(0.045)
Level of education: secondary	0.186***	0.136***	0.186***	0.221***	0.281***	0.178***	0.110***
	(0.009)	(0.011)	(0.009)	(0.026)	(0.029)	(0.024)	(0.018)
Level of education: tertiary	0.671***	0.598***	0.673***	0.623***	0.627***	0.618***	0.953***
	(0.022)	(0.072)	(0.023)	(0.043)	(0.031)	(0.038)	(0.039)
Age: 25–54	-0.033**	-0.068***	-0.032**	0.054*	-0.019	0.009	0.102***
	(0.015)	(0.008)	(0.015)	(0.026)	(0.036)	(0.011)	(0.024)
Age: 55–64	0.044*	-0.017	0.047**	-0.026	0.023	0.085**	0.143**
	(0.023)	(0.024)	(0.024)	(0.042)	(0.062)	(0.024)	(0.067)
Urban residence	0.136***	0.062***	0.136***	0.000	0.049**	0.178***	0.041
	(0.014)	(0.007)	(0.014)	(.)	(0.024)	(0.014)	(0.035)
Potential experience	0.040***	0.024***	0.040***	0.038***	0.038***	0.035***	0.030***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
Potential experience (squared)	-0.001***	-0.000***	-0.001***	-0.001***	-0.001***	-0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No. of observations	141,512	42,476	66,594	4,695	4,738	14,508	8,501
Monthly earnings in cash (PPP mean)	647.47	658.12	638.32	1226.30	621.72	552.17	689.03

Sources: Labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).
Note: The data are restricted to employed male workers between the ages 15 and 64. Industry and subnational region fixed effects included, standard errors in parentheses, clustered at the subnational region level. * p<0.10, ** p<0.05, *** p<0.01.

ANNEX TABLE 3.1.6 Decomposition of earnings differential between workers in green jobs and the average worker

	Region	Bangladesh	India	Maldives	Nepal	Pakistan	Sri Lanka
Overall							
Green workers	6.361***	6.544***	6.361***	7.058***	6.439***	6.166***	6.446***
	(0.032)	(0.028)	(0.025)	(0.174)	(0.059)	(0.072)	(0.050)
Non-green workers	6.047***	6.327***	6.044***	7.014***	6.328***	6.095***	6.265***
	(0.017)	(0.037)	(0.018)	(0.145)	(0.019)	(0.040)	(0.050)
Difference	0.314***	0.217***	0.317***	0.044	0.112*	0.071**	0.181***
	(0.026)	(0.032)	(0.020)	(0.039)	(0.060)	(0.036)	(0.049)
Explained	0.207***	0.130***	0.213***	0.082	0.037	0.010	0.005
	(0.025)	(0.028)	(0.020)	(0.058)	(0.065)	(0.044)	(0.034)
Unexplained	0.107***	0.088***	0.104***	-0.039	0.074	0.061***	0.176***
	(0.028)	(0.013)	(0.019)	(0.043)	(0.059)	(0.021)	(0.048)
No. of observations	142,853	43,347	66,671	4,956	4,797	14,508	8,574

Sources: Labor force surveys for Bangladesh (2015), India (2018), the Maldives (2019), Nepal (2017), Pakistan (2018), and Sri Lanka (2019).
Note: The data are restricted to employed male workers between the ages 15 and 64. Explained component comes from education, age, urban residence, potential experience, and informality. Industry and subnational region fixed effects included, standard errors in parentheses, clustered at the subnational region level. * p<0.10, ** p<0.05, *** p<0.01.

ANNEX 3.2. Methodology: Meta regressions

Sample. The initial screening included 43 studies summarized in Aragón, Chuhan-Pole, Cust and Poelhekke (2015), Land (2015), and Marchand and Weber (2018) supplemented with recent studies. The systematic reviews are updated by including studies conducted between 2015 to the present, including working papers. Studies are included in the analysis if they estimate a resource boom or bust on the labor market, focusing on employment, earnings, and spillovers to non-resource sectors. Employment is defined as total employment in the labor market considered by each study. Earnings are measured in various ways, including earnings per worker, family earnings, wage and salary income, GDP per capita, total wages, annual pay, household income, median income, median earnings, and per capita expenditure. Spillovers to non-resource sectors are measured in terms of employment in all other sectors, manufacturing, transport, construction, education and health, government, retail, accommodation, other services, agriculture, and all services. Some sectors may contract and expand along with the resource sector while the converse may be true for others.

Studies must have standard errors or confidence intervals to be included in the meta regression analysis. If the estimated effect is not reported as a percent change, for consistent comparison, the estimates are standardized as the percent change in the outcome relative to the mean of the comparison group or sample mean. Estimates in logarithms are interpreted as percent changes. Studies for spillovers during booms are standardized to the number of jobs created, while those during busts are standardized to the percent change of employment or earnings in non-resource sectors. Estimates that cannot be standardized are excluded from the analysis. This approach results in 33 studies whose estimates are included in the regression analysis. The description of the studies is shown in annex table 3.2.1 and the list of studies is shown in annex table 3.2.2.

Meta regression. The meta-analysis regression uses a random effects model, weighted by the inverse of the variance so that more weight will be given to results that are more precisely estimated (Fabregas, Kremer, and Schilbach 2019; Fabregas et al. 2019). For each experiment, the observed treatment effect is given by:

$$\hat{T}_j = \theta_j + e_j\,,$$

where θ_j is the true effect for study j and e_j is the within study error, where $e_j \sim N(0,\sigma_j)$, and σ_j is the sampling variation in estimating θ_j. The technique assumes that $\theta_j = \mu + \delta_j$ and $\delta_j \sim N(0,\tau^2)$, where τ^2 is the between-study variance, estimated by the DerSimonan and Laird method (DerSimonian and Laird 1986). The estimated μ is given by:

$$\hat{\mu} = \frac{\sum w_j T_j}{\sum w_j}$$

where w_j is study-specific weight given by the inverse of the variance, which is given by:

$$w_j = \frac{1}{(\hat{\tau}^2 + \hat{\sigma}_j^2)},$$

If the article includes several estimated effects, the intent-to-treat parameter is the preferred estimate (Croke et al. 2016). The intent to treat parameter is the estimated effect of a resource boom or bust on the labor market outcomes of interest. Ideally, the parameters in the meta-regression would come from randomized trials, which are considered the gold standard for program evaluation, but such studies do not exist in this context, hence quasi-experimental studies are included in this analysis. Meta regression results showing the average effect size for each outcome of interest during resource booms and busts are shown in annex table 3.2.3.

ANNEX TABLE 3.2.1 Sample description

Panel A. Description of screened and analyzed studies

	Number of studies screened	Number of studies Included in analysis
Total	43	33
Region/Country		
Canada	1	1
United States	28	24
Latin America and the Caribbean	6	2
Europe and Central Asia	3	1
East Asia and the Pacific	4	2
South Asia	2	1
Sub-Saharan Africa	4	1
Outcomes (not mutually exclusive)		
Employment	27	23
Earnings	29	27
Non-resource sector spillover	14	13
Method (not mutually exclusive)		
Difference-in-differences	16	14
Instrumental variable	12	10
Fixed effects	6	4
Other	10	8

Panel B. Description of analyzed estimates

	Number of studies	Number of estimates
Outcomes (not mutually exclusive)		
Employment	23	53
Earnings	27	70
Spillover	13	65

Sources: Aragón, Chuhan-Pole, and Land (2015; Marchand and Weber (2018), and related studies.
Note: Other quantitative methods include propensity score matching and time series analysis. Employment is total employment in the labor market considered by each study. Earnings include earnings per worker, family earnings, wage and salary income, GDP per capita, total wages, annual pay, household income, median income, median earnings, and per capita expenditure. Spillovers to non-resource sectors include all other sectors, manufacturing, transport, construction, education and health, government, retail, accommodation, other services, agriculture, and all services. Some papers analyzed more than one country or region, therefore, the counts of papers by region are not mutually exclusive.

ANNEX TABLE 3.2.2 Studies of the effects of natural resource booms and busts on the labor market

Reference	Region/Country	Boom or Bust	Outcome(s)
Agerton et al. (2017)	United States	Boom	Employment
Allcott and Keniston (2014)	United States	Boom	Earnings, employment, spillover
Aragón and Rud (2013)	Latin America and the Caribbean	Boom	Employment, spillover
Aragón, Rud, and Toews (2018)	Europe and Central Asia	Bust	Earnings
Asher and Novosad (2014)	South Asia	Boom	Employment, spillover
Atienza, Lufin, and Soto (2021)	Latin America and the Caribbean	Boom	Sector linkages
Bartik et al. (2019)	United States	Boom	Earnings, employment
Baum and Benshaul-Tolonen (2019)	Sub-Saharan Africa	Boom	Employment
Bazillier and Girard (2020)	Sub-Saharan Africa	Boom	Earnings
Betz et al. (2015)	United States	Both	Earnings, spillover
Black, McKinnish, and Sanders (2005)	United States	Both	Employment, spillover
Brown (2014)	United States	Boom	Earnings, employment
Brown (2015)	United States	Boom	Employment
Caselli and Michaels (2013)	Latin America and the Caribbean	Boom	Earnings
Douglas and Walker (2017)	United States	Boom	Earnings
Fetzer (2014)	United States	Boom	Earnings, employment, spillover
Feyrer, Mansur, and Sacerdote (2017)	United States	Boom	Earnings, employment
Fleming and Measham (2015)	East Asia and Pacific	Boom	Earnings, employment
Gradstein and Klemp (2020)	Latin America and the Caribbean	Boom	Earnings
Haggerty et al. (2014)	United States	Boom	Earnings
Jacobsen (2018)	United States	Boom	Earnings, employment
Jacobsen and Parker (2016)	United States	Both	Earnings, employment
James and Aadland (2011)	United States	Boom	Earnings
James (2015)	United States	Boom	Earnings
James and James (2011)	United States	Boom	None (education)
Komarek (2016)	United States	Boom	Earnings, employment, spillover
Kotsadam and Tolonen (2016)	Sub-Saharan Africa	Both	Employment
Krause (2023)	United States	Bust	Earnings, employment, spillover
Lee (2015)	United States	Boom	Earnings, employment
Loayza, Mier y Teran, and Rigolini (2013)	Latin America and the Caribbean	Boom	Earnings
Maniloff and Mastromonaco (2017)	United States	Boom	Earnings, employment
Marchand (2012)	Canada	Both	Earnings, employment
Markandya et al. (2016)	Europe and Central Asia	Boom	Employment
Michaels (2011)	United States	Boom	Earnings
Munasib and Rickman (2015)	United States	Boom	Employment, spillover
Papyrakis and Gerlagh (2004)	United States	Boom	Earnings

ANNEX TABLE 3.2.2 *continued*

Reference	Region/Country	Boom or Bust	Outcome(s)
Paredes, Komarek, and Loveridge (2015)	United States	Boom	Earnings, employment
Pelzl and Poelhekke (2021)	East Asia and Pacific	Boom	Earnings, employment
von der Goltz and Barnwal (2019)	Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa	Boom	Wealth
Weber (2012)	United States	Boom	Earnings
Weber (2014)	United States	Boom	Earnings, employment
Weinstein (2014)	United States	Boom	Earnings, employment
Wrenn, Kelsey, and Jaenicke (2015)	United States	Boom	Employment
Zuo and Jack (2016)	East Asia and Pacific countries	Boom	Earnings

Note: Some papers cover multiple countries and multiple regions. The East Asia and Pacific countries included in the papers screened are: Australia, Cambodia, China, Indonesia, and the Philippines. The Latin America and Caribbean countries included are: Bolivia, Brazil, Chile, Colombia, Dominican Republic, Guyana, Haiti, and Peru. The South Asian countries included are: Bangladesh, India, and Nepal. The Sub-Saharan Africa countries included are: Angola; Benin; Burkina Faso; Burundi; Cameroon; Central African Republic; Congo, Dem. Rep.; Cote d'Ivoire; Ethiopia; Ghana; Guinea; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; Swaziland; Tanzania; Togo; Uganda; Zambia; and Zimbabwe. The Middle East and North African countries are: Egypt, Arab Rep.; Jordan; and Morocco. The Europe and Central Asia countries/regions included are Albania, the European Union, Moldova, and the United Kingdom.

ANNEX TABLE 3.2.3 Meta regression results

	Boom: employment	Boom: earnings	Boom: spillovers to manufacturing, transport, and construction	Boom: spillovers to retail and services	Boom: spillovers to all non-resource sectors	Bust: employment	Bust: earnings	Bust: spillovers to all non-resource sectors
Overall effect size	5.194	0.480	0.200	0.207	0.166	-1.325	-2.151	0.003
	(0.692)	(0.105)	(0.079)	(0.092)	(0.046)	(0.349)	(0.508)	(0.007)
No. of estimates	31	51	18	16	51	14	18	25

Note: Estimated effects are based on random effects meta regressions for each outcome of interest. Standard errors in parentheses. Each study's effect size is standardized to percentage changes. Log changes are interpreted as percentage changes. Employment is total employment in the labor market considered by each study (columns 1, 6). Earnings (columns 2, 7) include earnings per worker, family earnings, wage and salary income, GDP per capita, total wages, annual pay, household income, median income, median earnings, and per capita expenditure. Spillovers to non-resource sectors include all other sectors, manufacturing, transport, construction, education and health, government, retail, accommodation, other services, agriculture, and all services. Number of estimates refers to the number of individual results included in the meta regression to compute the overall effect size. Spillovers in columns 3-5 are the number of jobs created in non-resource sectors, spillovers in column 8 are standardized to the percentage of jobs created in non-resource sectors.

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What determines domestic market yields?	Spring 2022, Box 2.1
Remittances and the effects on poverty and inequality	Fall 2021, Box 1.3
What does a model based on macro trends predict about remittance growth in 2020, and what does it miss?	Spring 2021, Box 1.2
Public banks: A cursed blessing	Spring 2020, Chapter 3
Have public banks hindered subsequent financial development?	Spring 2020, Box 3.1
Does the broad public branch network translate into more credit for development targets in Bangladesh?	Spring 2020, Box 3.2
In Asia, more public banks are associated with lower interest rate margins	Spring 2020, Box 3.3
Reducing government ownership has had positive effects in other countries	Spring 2020, Box 3.5
Measurement and significance of remittances	Spring 2019, Box 4
Hidden debt: Solutions to avert the next financial crisis in South Asia	South Asia Development Matters, June 2021
Labor markets	
The informal foreign exchange market and capital controls: A South Asian tale	Spring 2023, Spotlight
Affirmative action policies in South Asia	Spring 2023, Box 3.4
(Mis)Measuring migration	Fall 2022, Box 3.1
Intraregional migration in South Asia	Fall 2022, Box 3.2

Note: The *South Asia Development Update* was called *South Asia Economic Focus* through April 2023.

South Asia is expected to grow faster than any other emerging market and developing economy (EMDE) region in 2024–25. However, for all countries, this will represent a slowdown from pre-pandemic averages. Several potential adverse events could derail this outlook, including risks related to fragile fiscal positions. Government debt in South Asia averaged 86 percent of GDP in 2022, above that of any other EMDE region. In some countries, outright defaults have short-circuited growth, while in others, increasing domestic borrowing by governments has driven up interest rates and diverted credit away from the private sector. Elections could add to spending pressures. An urgent policy priority for the region is, therefore, to manage and reduce fiscal risks.

Over the longer term, the policy priority is to accelerate growth and job creation in a sustainable manner. The energy transition, away from fossil fuels toward sustainable sources of energy, presents an opportunity for the region to lift productivity, cut pollution, reduce its reliance on fuel imports, and create jobs. South Asia's energy intensity of output is twice the global average and the region lags in the adoption of advanced energy-efficient technologies. Even fiscally constrained governments can take action to support the energy transition with market-based regulations, information campaigns, broader access to finance, and reliable public power grids. With about 9 percent of the region's workers employed in pollution-intensive activities, and these workers less educated and more often informally employed than the average worker, the energy transition will create challenging labor market shifts. This calls for measures to boost job creation and facilitate worker mobility, geographically and across sectors.

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