Investment growth in emerging market and developing economies (EMDEs) is expected to remain below its average rate over the past two decades through the medium term. This subdued outlook follows a decade-long, geographically widespread slowdown in investment growth before the coronavirus disease 2019 (COVID-19) pandemic. An empirical analysis covering 2000-21 finds that periods of strong investment growth during this time frame were associated with strong growth in real output, robust growth in real credit, terms-of-trade improvements, growth in capital inflows, and spurts in reform of the investment climate. Each of these factors has been increasingly supportive of investment growth since the 2007-09 global financial crisis. Weak investment growth is a concern because it dampens potential growth, is associated with weak trade, and makes achieving development and climate-related goals more difficult. Policies to boost investment growth need to be tailored to country circumstances but include comprehensive fiscal and structural reforms, repurposing of expenditure on inefficient subsidies among them. Given EMDEs’ limited fiscal space, the international community will need to significantly increase international cooperation, official financing, and grants and leverage private sector financing for adequate investment to materialize.

Introduction

As the COVID-19 pandemic began in 2020, real investment growth had slowed in EMDEs over much of the previous decade, from nearly 11 percent in 2010 to 3.4 percent in 2019. In EMDEs excluding China, investment growth tumbled more sharply: from 9 percent in 2010 to a mere 0.9 percent in 2019. The slowdown during the 2010s occurred in all EMDE regions, in both commodity-importing and commodity-exporting economies, and in a large share of individual economies.

Advanced economies, by contrast, experienced more sluggish, but also more stable, investment growth, which hovered around its long-term average of 2 percent per year. Investment growth in advanced economies outpaced gross domestic product (GDP) growth during the 2000s and 2010s slightly, except for brief periods after the 2001 slowdown and 2009 recession. In contrast, in EMDEs, investment growth outpaced GDP growth by several percentage points in the 2000s but fell below output growth after 2013.

The pandemic triggered a severe investment contraction in EMDEs excluding China in 2020—a far deeper decline than in the 2009 global recession triggered by the global financial crisis.
EMDEs experienced a broad-based slowdown in investment growth in the period between the 2008-09 global financial crisis and the coronavirus disease 2019 (COVID-19) pandemic in 2020. The pandemic-induced investment contraction in EMDEs excluding China in 2020 was historically large and much sharper than that in advanced economies. The slowdown in investment growth in EMDEs during the 2010s reflected underlying trends in both commodity-exporting and commodity-importing economies and in the three largest EMDEs, especially China.

Financial crisis. EMDEs including China did not avoid an investment contraction in 2020, as they had in 2009 (figure 3.1.A). In advanced economies, however, investment shrunk in 2020 by less than it had in 2009, buttressed by very large fiscal support packages and steep monetary loosening. After a sharp rebound in 2021, investment growth in EMDEs is projected to revert to a pace still below the average during the previous two decades. The medium-term investment growth outlook remains subdued and has been downgraded substantially, along with the GDP growth outlook. This is due to the effects of the Russian Federation’s invasion of Ukraine on commodity markets and supply chains, as well as historically high debt-to-GDP ratios and the sharp tightening of financing conditions as monetary policy responds to rising inflation.
Slowing investment growth is a concern because investment is critical to sustaining long-term growth of potential output and per capita income. Capital accumulation raises labor productivity, the key driver of the long-term growth of real wages and household incomes, through capital deepening—equipping workers with more capital—and incorporation of productivity-enhancing technological advances.

Slowing investment growth has also held back progress toward meeting the Sustainable Development Goals (SDGs) and fulfilling commitments made under the Paris Agreement on climate change. Meeting these goals will require filling substantial unmet infrastructure needs, including growing needs for climate-resilient infrastructure and infrastructure that reduces net emissions of greenhouse gases. Given limited fiscal space in EMDEs, scaling up investment will require additional financing from the international community and the private sector.

Against this backdrop, this chapter addresses four questions:

- How has investment growth evolved over the past decade, and how does the performance of investment during the 2020 global recession compare with that during previous recessions?
- What are the key factors associated with investment growth?
- What are the implications of weak investment growth for development prospects?
- Which policies can help promote investment growth?

Contributions. The chapter makes several contributions to the literature on investment. It presents results of the first study to examine investment growth since the pandemic and Russia’s invasion of Ukraine in a large sample of EMDEs. Additionally, since foreign direct investment (FDI) is a potentially critical source of technology spillovers and financing, this chapter reviews 62 studies since 1990 on the link between FDI, on the one hand, and output and aggregate domestic investment, on the other. The chapter also examines the likely medium- and long-term consequences of the damage to investment in EMDEs from the pandemic and the war in Ukraine, focusing on the effects on productivity, growth in potential output, trade, and the ability to achieve the SDGs and climate-related goals. Finally, the chapter provides recommendations regarding fiscal and structural policies to revive investment growth, including measures to promote private capital mobilization and capitalize on new opportunities created by the pandemic.

Previous studies analyzing investment in EMDEs have tended to be based on pre-global financial crisis data, confined to analysis of the global financial crisis, or focused on specific regions (Anand and Tulin 2014; Bahal, Raissi, and Tulin 2018; Caselli, Pagano, and Schivardi 2003; Cerra et al. 2016; Qureshi, Diaz-Sanchez, and Varoudakis 2015). Firm-level studies include Magud and Sosa (2015) and Li, Magud, and Valencia (2015). Banerjee, Kearns, and Lombardi (2015); IMF (2015); Leboeuf and Fay (2016); and
Ollivaud, Guillemette, and Turner (2016) have explored investment weakness in advanced economies. This study updates and extends two previous studies of investment trends and correlates in a large sample of EMDEs (World Bank 2017, 2019a).

**Main findings.** The chapter presents five main findings. First, compared with that during the years following the global financial crisis, the investment recovery following the COVID-19 pandemic is proceeding more slowly. The slow recovery partly reflects the widespread impact of the pandemic on investment: Investment contracted in nearly three-quarters of EMDEs during the pandemic. The effects of the pandemic and the war in Ukraine are expected to extend the prolonged and broad-based slowdown in investment growth in EMDEs during the 2010s. The slowdown occurred in all regions, in commodity-exporting and commodity-importing economies, and in growth of private and public investment.

Second, empirical analysis in the chapter finds that investment growth in EMDEs over the past two decades has been positively associated with output growth and, to a lesser degree, real credit growth and capital-flow-to-GDP ratios. Improvements in the terms of trade (for energy-exporting EMDEs) and spurts in reform of the investment climate have been associated with strengthening real investment growth. In contrast, in advanced economies, the most important correlate of investment growth over the same period has been output growth, and other factors have covaried less strongly with investment growth than in EMDEs.

Third, investment growth in EMDEs in 2022 remained about 5 percentage points below its 2000-21 average and nearly 0.5 percentage point in EMDEs excluding China. For all EMDEs, projected investment growth through 2024 will be insufficient to return investment to the level suggested by the prepandemic (2010-19) investment trend. Investment weakness of this type dampens long-term output growth and productivity, is associated with weak global trade growth, and makes meeting development and climate goals more challenging.

Fourth, a sustained improvement in investment growth in EMDEs will require the use of policy tools and international financial support, with appropriate prescriptions dependent on country circumstances. Macroeconomic policy can support investment in EMDEs in a variety of ways, preserving macroeconomic stability being just one of those ways. Even with constrained fiscal space, reallocating expenditures, freeing resources by moving away from distorting subsidies, improving the effectiveness of public investment, strengthening revenue collection, and engaging the private sector to cofinance infrastructure and other investment projects can boost spending on public investment. Structural policies will also play a key role in creating conditions conducive to attracting investment. Institutional reforms could address a range of impediments and inefficiencies, such as high business start-up costs, weak property rights, inefficient labor and product market policies, weak corporate governance, costly trade regulation, and shallow financial sectors. Setting appropriate, predictable rules governing investment, including investment in public-private partnerships, will also be important.
Fifth, a review of the literature since 1990 finds mixed evidence on the relationship between FDI and output growth but a mostly positive relationship between FDI and domestic investment. That said, several country characteristics, time period specifics, and features of FDI have influenced the relationships between FDI and output growth and FDI and investment. Greenfield investment in upstream and export-intensive, nonprimary sectors has tended to be more conducive to growth and investment. FDI has also tended to raise growth and investment more in countries with better institutions, more skilled labor forces, greater financial development, and higher trade openness.

Data and definitions. In this chapter, “investment” refers to real gross fixed-capital formation, including both private and public investment. “Gross fixed capital formation” includes produced tangible assets (for example, buildings, machinery, and equipment) and intangible assets (for example, computer software, mineral exploration, entertainment, and original writing or art) used for more than one year in the production of goods and services. Investment growth is calculated, using countries’ real annual investment at average 2010-19 prices and constant 2019 U.S. dollars as weights, for 69 EMDEs and 35 advanced economies (table 3C.1). These economies have represented about 97 percent of global GDP since the mid-2000s. Investment cannot be decomposed into type of use, such as buildings, transport equipment, and information and communications technology equipment, because of limited comparable data for EMDEs. Lack of data availability also prevents a separate econometric exploration of private and public investment.

Trends and fluctuations in investment growth

After reaching historic highs in the lead-up to the global financial crisis, global investment growth slowed substantially in the 2010s, largely reflecting weakening investment growth in EMDEs, where this weakening was widespread. In each year between 2012 and 2020, investment growth was well below the pre-global financial crisis (2000-08) average in more than half of EMDEs. The slowdown during the 2010s occurred in both commodity-exporting and commodity-importing EMDEs, in all EMDE regions, and in each of the three largest EMDEs. This slowdown in EMDE investment growth in the decade before the pandemic happened alongside comparatively stable—albeit more sluggish—investment growth in advanced economies, occurred in most EMDEs, and involved slowdowns in both private and public components. Although investment growth in EMDEs remained above that in advanced economies, the difference in investment growth rates, especially in the second half of the decade, was much smaller than in the 2000s.

The investment contraction in EMDEs excluding China in 2020, the first year of the COVID-19 pandemic, was historically large and far deeper even than that during the global recession in 2009. The outlook for investment growth in EMDEs is weak and has been downgraded as a result of legacies of the pandemic and spillovers from the war in Ukraine, although the full effects of these events on investment remain unclear.
Prepandemic slowdown

Several key features of investment growth in EMDEs during the prepandemic decade are evident. Investment growth in EMDEs fell from nearly 11 percent in 2010 to 3.4 percent in 2019. In EMDEs excluding China, investment growth tumbled more sharply: from 9 percent in 2010 to a mere 0.9 percent in 2019 (figures 3.1.A and 3.1.B). The slowdown during the 2010s occurred in both commodity-exporting and commodity-importing EMDEs and in all EMDE regions (figure 3.1.C; Vashakmadze et al. 2018). Slowing investment growth in China made a large contribution to the aggregate EMDE slowdown (figure 3.1.D). Private and public investment also grew at a slower pace in the 2010s than in the previous decade (figures 3.2.A and 3.2.B).

The slowdown in investment growth reflected both international and domestic factors. For commodity-exporting EMDEs, a steep drop in oil and metal prices between mid-2014 and early 2016 and the associated deterioration in the terms of trade were key factors. In China, investment growth slowed following a domestic policy shift in 2010 toward more reliance on consumption and less reliance on investment and exports. Weak economic growth in advanced economies and high corporate leverage also generated investment-dampening spillovers to EMDEs during this period (Banerjee, Hofmann, and Mehrotra 2020).

A moderate uptick in EMDE investment growth in 2016-18 reflected, in part, a pickup in the growth of global manufacturing output and trade (World Bank 2019a). A

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1 Stocker et al. (2018); Vashakmadze et al. (2018); and World Bank (2017) discuss these issues. Several large commodity-exporting economies—including Brazil, the largest of these economies—experienced severe recessions during the commodity price collapse.
rebound in oil and metal prices in 2017-18, which encouraged capital expenditures in the commodity-dependent regions of Latin America and the Caribbean (LAC) and Sub-Saharan Africa (SSA), further supported the recovery. Public borrowing from China to finance infrastructure projects under the Belt and Road Initiative supported investment in countries in several regions, predominantly in East Asia and Pacific (EAP), Europe and Central Asia (ECA), and South Asia (SAR) (Council on Foreign Relations 2022; World Bank 2019a; chapter 4).

Collapse and rebound during the COVID-19 pandemic

The COVID-19 pandemic disrupted business operations and caused a spike in uncertainty. This resulted in a sharp contraction in aggregate investment in EMDEs, marking a departure from the previous global recession in 2009, when EMDEs avoided such a contraction (figure 3.3.A). EMDEs excluding China suffered an especially sharp investment contraction, of more than 8 percent—a deeper decline than in 2009. China
was a notable exception, thanks to a large fiscal stimulus equivalent to about 6.5 percent of GDP (IMF 2021).

In EMDEs excluding China, investment shrank by about 2 percentage points more in 2020 than in the 2009 global recession, despite easier financial conditions and the provision of sizable fiscal stimulus in many large EMDEs (figures 3.3.B and 3.3.C). A key difference between the 2009 and 2020 decline in EMDE investment growth was the number of affected EMDEs. About 70 percent of EMDEs experienced an investment contraction in 2020, compared with 55 percent in 2009 (figure 3.3.D). Latin America and the Caribbean and South Asia had the sharpest investment contraction in 2020 among regions; output declined the most in these two regions as well (chapter 4). Yet while more EMDEs experienced a recession in 2020 than in 2009, in the median EMDE recession, investment declined less severely in 2020 than in 2009, and the subsequent rebound was more pronounced (figure 3.4.A). The terms-of-trade shock associated with the 2020 global recession, however, severely affected EMDE commodity exporters. The median EMDE commodity exporter saw a sharper decline in investment in 2020 than in 2009, with a shallower recovery (figure 3.4.B).

Investment in advanced economies also shrank in 2020, by 3.4 percent; however, this was far less than the 10.5 percent plunge in 2009. Massive fiscal and monetary stimulus dampened the investment contraction in 2020, unlike that in the aftermath of the 2009
financial crisis, and the disruptions in financial markets and in access to finance were much smaller. By the end of 2021, investment in advanced economies had already exceeded projections made just prior to the pandemic, in January 2020. Investment recovered more quickly in advanced economies after 2020 than after other global recessions during the past two decades.

Macroeconomic backdrop

Investment grew more slowly in EMDEs in the decade before the pandemic in the context of a worsening global macroeconomic environment. Slower output growth, lower commodity prices, lower and more volatile capital inflows to EMDEs, higher economic and geopolitical uncertainty, and a substantial buildup of public and private debt characterized the global economy in 2010-19, compared with that in 2002-07 (Kose and Ohnsorge 2020).

Weak activity. Investment tends to respond, and respond more than proportionately, to economic activity, a phenomenon dubbed the “accelerator effect” (Shapiro, Blanchard, and Lovell 1986). EMDE per capita output growth slowed sharply in the decade following the global financial crisis, from 7.5 percent in 2010 to 3.9 percent in 2019. There was a roughly parallel growth slowdown in EMDEs excluding China—from 5 percent in 2010 to 1.6 percent in 2019. To the extent that the slowing of growth in EMDEs was more structural than cyclical or transitory, sluggish investment growth can also be expected to persist (Didier et al. 2015; World Bank 2022d). The sources of the slowdown in output growth varied across EMDEs, but they included lower commodity prices, spillovers from weak growth in major economies, weakening productivity growth, tightening financial conditions, and a maturing of supply chains that slowed global trade growth. A decline of 1 percentage point in U.S. or euro area output growth has been found to reduce aggregate EMDE investment growth by more than 2 percentage points (World Bank 2017).

In China, growth slowed gradually as the economy rebalanced from investment- and export-driven growth in manufacturing to consumption-driven growth in services. This transition reduced commodity demand and prices, with adverse spillovers to commodity-exporting EMDEs (Huidrom et al. 2020; World Bank 2016a). A decline of 1 percentage point in China’s output growth has been estimated to slow output growth in commodity-exporting EMDEs by about 1 percentage point after one year, with associated effects on investment growth (World Bank 2017).

In advanced economies, output growth in the decade after the global financial crisis was generally weaker than in the decade before, despite unprecedented monetary policy stimulus and easy financing conditions. A recession in 2012-13 followed the euro area crisis. Rising trade tensions, as well, hindered euro area growth prospects near the end of the decade (World Bank 2019b).

Adverse terms-of-trade shocks. Almost two-thirds of EMDEs rely on exports of energy, metal, or agricultural commodities. Most commodity prices (in U.S. dollar terms) fell sharply from their early-2011 peaks, with metal and energy prices plunging by
more than 40 percent to troughs in 2016, followed by moderate recoveries in the following three years (figure 3.5.A). Surging U.S. oil production and a shift in Organization of the Petroleum Exporters policy in mid-2014 triggered an oil price plunge during 2014-16 that caused widespread disruptions in oil-exporting countries. By the end of 2019, energy prices were 21 percent below their 2010 levels, industrial metal prices 19 percent below, and agricultural commodity prices 13 percent below. As a result, the terms of trade of commodity exporters deteriorated by about 6 percent between 2011 and 2019 and those of oil exporters by 27 percent. EMDEs with lower growth in terms of trade experienced lower investment growth during 2000-21 (figure 3.5.B).

Rapid growth in private sector credit and debt overhang. After rising during most of the 2000s, annual growth of real credit to the private sector (from domestic and foreign financial institutions) in EMDEs began to retreat during the 2008-09 global financial crisis and subsequently slowed further, from 11.5 percent in 2011 to a trough of 4.8 percent in 2016, before stabilizing at about 6 percent in 2019-21 (figure 3.6.A). Credit grew highly unevenly, on average, in 2011-19 across EMDEs, however, with some countries experiencing credit surges despite overall downward trends. In contrast to what took place during the three decades before the global financial crisis, when investment surges accompanied 40 percent of credit booms or followed them within one or two years, credit booms since 2010 have been unusually “investment-less.” Investment surges have accompanied or followed virtually none of the credit booms in EMDEs since the global financial crisis (box 3.1). In several EMDEs, rapid credit
FIGURE 3.6 Credit growth, debt, and investment growth

Since 2011, weakening investment growth in EMDEs has been accompanied by slowing real credit growth to the private sector. EMDEs with slower credit growth experienced lower investment growth over 2000-21. Private sector debt has risen steadily, relative to GDP, in EMDEs over the past two decades. EMDEs with larger private-debt-to-GDP ratios experienced slower investment growth during 2000-21.


Note: EMDEs = emerging market and developing economies; GDP = gross domestic product.
A. “Private credit” refers to real annual credit growth to the private sector. Lines show weighted averages using countries’ real annual investment in constant U.S. dollars as weights. Sample includes 69 EMDEs and 35 advanced economies. Last observation is 2021.
B. “Private debt” refers to domestic credit to the private sector as a percent of GDP. Sample includes 71 EMDEs. Last observation is 2021.
C. Sample includes 69 EMDEs.
D. Sample includes 68 EMDEs.

Despite slowing credit growth since the global financial crisis, the ratio of outstanding credit to GDP has risen steadily (figure 3.6.B). In the median EMDE, private credit as a share of GDP rose by 20 percentage points of GDP from 2000 to 2021, and it rose by 27 percentage points in commodity-importing EMDEs. About four in ten EMDEs had private-credit-to-GDP ratios exceeding 60 percent in 2021, up from one in ten in 2000. High leverage can lead to financial stress, restrict future access to credit, and divert resources from productive investment (Banerjee and Duflo 2005; World Bank 2022i).
CHAPTER 3  FALLING LONG-TERM GROWTH PROSPECTS

BOX 3.1 Investment-less credit booms

Credit to the private sector has at times risen sharply in some emerging market and developing economies (EMDEs). But these credit booms have been unusually “investment-less.” Investment surges of the kind that were common in earlier episodes have accompanied virtually none of the credit booms in EMDEs since 2010. In 2020, private credit surged in 13 EMDEs, supporting private consumption during the pandemic, while investment fell notably below trend. Lower output growth once the credit booms have unwound has tended to follow the absence of investment surges during credit booms.

Introduction

Over the past decade, credit to the nonfinancial private sector from domestic and foreign lenders has risen rapidly in several EMDEs, while investment growth has slowed. In the past, credit booms have often financed rapid investment growth, with investment subsequently stalling. Against this background, this box addresses three questions:

• How has total investment, including both private and public investment, evolved during credit booms and deleveraging episodes in EMDEs?
• How often have investment booms accompanied credit booms?
• How has output growth evolved during credit booms and deleveraging episodes?

The results indicate that while investment often rose sharply in EMDEs during previous credit booms, this has not been the case for credit booms since 2010. In particular, investment surges accompanied none of the 2020 credit booms. This pattern is cause for concern because in the past, when investment surges did not accompany credit booms and those credit booms unwound, output growth has tended to slow more.

Data and definitions

Credit to the nonfinancial private sector consists of claims—including loans and debt securities—on households and nonfinancial corporations by the domestic financial system as well as external creditors. Annual credit data are available for 14 EMDEs for 1980-99 and 55 EMDEs for 2000-21. In this box, data for the broadest definition of credit are sourced from the Bank for International Settlements for 14 EMDEs from 1980 to 2021: Argentina, Brazil, China, Hungary, India, Indonesia, Malaysia, Mexico, Poland, the Russian Federation, Saudi Arabia, South Africa, Thailand, and Türkiye. For other EMDEs, in which credit from the domestic banking system remains the main source of credit

Note: This box was prepared by Shu Yu.
CHAPTER 3

FALLING LONG-TERM GROWTH PROSPECTS

BOX 3.1 Investment-less credit booms (continued)

(Ohnsorge and Yu 2016), the box uses annual data on claims by banks on the private sector, sourced from the IMF’s *International Financial Statistics*, to proxy credit to the nonfinancial private sector. This increases the sample by another 41 EMDEs, mainly from 2000 onward: Azerbaijan, Bahrain, Bangladesh, Bolivia, Botswana, Bulgaria, Chile, Colombia, Costa Rica, Côte d’Ivoire, Croatia, the Arab Republic of Egypt, Gabon, Georgia, Ghana, Guatemala, Honduras, Jamaica, Jordan, Kazakhstan, Kenya, Kuwait, Mauritius, Mongolia, Namibia, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, the Philippines, Qatar, Senegal, Serbia, Sri Lanka, Tunisia, Ukraine, Uruguay, República Bolivariana de Venezuela, and Zambia.

A credit boom is defined here as an episode during which the ratio of private sector credit to gross domestic product (GDP) is more than 1.65 standard deviations above its Hodrick-Prescott-filtered trend (that is, within the 90 percent confidence interval) in at least one year (Ohnsorge and Yu 2016; World Bank 2016b). An episode starts when the credit-to-GDP ratio first exceeds one standard deviation and ends when the ratio begins to fall. Conversely, a deleveraging episode is defined as an episode during which the ratio of private sector credit to GDP is more than 1.65 standard deviations below trend in at least one year. The deleveraging episode starts when the credit-to-GDP ratio first drops more than one standard deviation below trend and ends when the ratio begins to climb.

The box studies credit booms and deleveraging episodes within a seven-year event window that covers their peak or trough years ($t=0$), the three prior years, and the three subsequent years. In the sample used here, there have been 65 credit booms and 32 deleveraging episodes in 55 EMDEs. A typical credit boom lasts about 2 years, while an average deleveraging episode lasts about 2.5 years.

Investment behavior during credit booms and deleveraging episodes

Credit booms have typically been associated with rising investment. During the median credit boom over the past two to three decades, real investment grew by 1 percentage point of GDP above its long-term (Hodrick-Prescott-filtered) trend until the peak of the credit boom (figure B3.1.1.A). In one-quarter of previous credit booms, the real-investment-to-GDP ratio dropped about 3.5 percentage points below its long-term (Hodrick-Prescott-filtered) trend during the two years after the peak. Investment swung sharply in the most pronounced credit boom and bust episodes. For example, during the Asian financial crisis of the late 1990s, investment contracted by an average of 35 percent in Indonesia, Malaysia, the Philippines, and Thailand in 1998 and expanded by 16 percent in 2000.


**BOX 3.1 Investment-less credit booms (continued)**

**FIGURE B3.1.1 Investment and consumption growth during credit booms and deleveraging episodes**

In the median credit boom in EMDEs, investment grew by about 1 percentage point of GDP more than its long-term trend until the credit boom peaked. Investment dropped below its long-term trend by about 1 percentage point of GDP before deleveraging episodes reached their troughs. Growth in private consumption increases slightly during a credit boom.

**A. Investment around credit booms**

![Graph showing investment growth around credit booms](image)

**B. Investment around deleveraging episodes**

![Graph showing investment growth around deleveraging episodes](image)

**C. Consumption around credit booms**

![Graph showing consumption growth around credit booms](image)

**D. Consumption around deleveraging episodes**

![Graph showing consumption growth around deleveraging episodes](image)

Sources: World Bank, World Development Indicators database.

Note: Red lines show sample medians of the cyclical component of investment in percent of GDP (derived using a Hodrick-Prescott filter); blue lines show the corresponding upper and lower quartiles. Shaded areas indicate credit booms. A credit boom is defined as an episode during which the cyclical component of the ratio of nonfinancial private sector credit to GDP (derived using a Hodrick-Prescott filter) is more than 1.65 standard deviations above trend in at least one year. The episode starts when the cyclical component first exceeds one standard deviation above trend. It ends in a peak year (year 0) when the ratio of nonfinancial private sector credit to GDP declines in the following year. A deleveraging episode is defined as an episode during which the cyclical component of the ratio of nonfinancial private sector credit to GDP (derived using a Hodrick-Prescott filter) is more than 1.65 standard deviations below trend in at least one year. The episode starts when the cyclical component first falls below one standard deviation. It ends in a trough year (year 0) when the ratio of nonfinancial private sector credit to GDP increases in the following year. To address the endpoint problem of a Hodrick-Prescott filter, the data set is expanded by setting the data for 2022-24 to be equal to the data in 2021 (2020 if data for 2021 are unavailable). The sample is for available data over 1980-2021 for 55 EMDEs.

EMDEs = emerging market and developing economies; GDP = gross domestic product.

A. The orange dashed line is the median of the six EMDEs (China, Indonesia, Malaysia, Mongolia, the Philippines, and Thailand) that were affected by the 1997-98 Asian financial crisis (1997 is t = 0). The yellow dashed line for 2017-21 (where t = 0 for year 2020) shows the sample median for the corresponding period.

B. The yellow dashed line for 2017-21 (where t = 0 for year 2020) shows the sample median for the corresponding period.
Similarly, investment growth slowed during deleveraging episodes. Real investment dropped below its long-term trend by about 2 percentage points of GDP during the last three years of the median deleveraging episode (figure B3.1.1.B). After the trough of a typical deleveraging episode, real investment growth bounced back and, within three years, rose to near or slightly above its long-term trend.

Credit and investment booms together

Although investment growth tends to rise during credit booms, not all credit booms are associated with investment booms. For instance, Mendoza and Terrones (2012) document a coincidence between investment booms and credit booms in EMDEs between 1960 and 2010 of about 34 percent (26 percentage points lower than the coincidence in advanced economies). The moderate coincidence of credit booms and investment booms may reflect credit booms that mainly fueled consumption (Elekdag and Wu 2013; Mendoza and Terrones 2012). In one-quarter of past credit booms, consumption rose above its Hodrick-Prescott-filtered trend by 3 percentage points of GDP during the peak of the boom (figure B3.1.1.C). Consumption on average fell below trend by about 1 percentage point of GDP in the median deleveraging episode (figure B3.1.1.D).

Following former studies, this box defines an investment surge, in parallel with the way it defines credit booms, as an episode during which the investment-to-GDP ratio is at least one standard deviation higher (compared with 1.65 standard deviations higher for investment booms) than its Hodrick-Prescott-filtered trend. Similarly, an investment slowdown is defined as an episode in which the investment-to-GDP ratio is at least one standard deviation below its Hodrick-Prescott-filtered trend.¹

Investment surges in advanced economies are found to have occurred more often with credit booms than in EMDEs, and the rise in investment was more rapid. In EMDEs, investment surges or booms around the peak year accompanied about one-third of credit booms (figure B3.1.2.A). More than 65 percent of investment surges that coincided with credit booms during the peak year qualified as investment booms in advanced economies, but only 56 percent of such investment surges turned out to be investment booms in EMDEs.

After the global financial crisis, the coincidence between credit booms and investment surges during the peak year of a credit boom dropped significantly (figure B3.1.2.B). Half of the EMDEs in a credit boom were also experiencing an investment surge in 2007, and two-thirds in 2008. However, from 2010 onward,

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¹. The results are similar when investment growth, instead of the investment-to-GDP ratio, is used.
there were very few instances of simultaneous credit booms and investment surges, except in 2015. As the number of EMDEs in a credit boom increased from two in 2010 to seven in 2015, the number of EMDEs in investment surges dropped from nine to six. In the years prior to the pandemic, the number of credit booms subsided, before rising again in 2020.

For the 13 countries experiencing credit booms in 2020 (Botswana, Brazil, Chile, Georgia, Honduras, Jamaica, Panama, Peru, the Philippines, Qatar, Saudi Arabia, Türkiye, and República Bolivariana de Venezuela), consumption as a share of GDP was about in line with the median during past credit boom episodes, while investment as a share of GDP was lower than in previous credit episodes (figure B3.1.1.A). Credit booms in 2020 seemed to support consumption during the pandemic rather than fueling investment surges as in some of the former credit booms (such as that during the 1997-98 Asian financial crisis).

b. The six countries are Ghana, Côte d'Ivoire, Namibia, Oman, Saudi Arabia, and Zambia. Data on investment growth do not support the identification of Saudi Arabia.
In general, output has expanded during credit booms, but by less than investment (Mendoza and Terrones 2012). On average, over the whole sample period from 1980 to 2020, in the year before the median credit boom peaked, output increased by about 2.5 percent above trend in the median country in cases in which there was an investment surge. However, in cases in which there was no investment surge, output was slightly lower than trend (figure B3.1.3.A). As credit booms unwound from their peaks, output dropped below trend by about 1 percent over two years in the absence of investment surges. However, when there were investment surges, output was slightly above trend. That a credit boom without an investment surge disrupts output more than a credit boom with an investment surge may reflect the absence of a boost to potential output from capital accumulation that an investment surge could provide. In countries that experienced credit booms in 2020, output peaked at nearly 8 percent above trend in the year before the peak of the credit boom, much higher than in past credit booms, before falling to 2 percent below trend in the peak year of the credit boom.

Subdued and volatile capital inflows. While FDI inflows to EMDEs have risen substantially over time, their growth has slowed since 2010, partly on account of weak activity in advanced economies. Growth of non-FDI inflows has shown more resilience and volatility, reflecting investors’ search for higher yields amid low interest rates in advanced economies, a shift from bank to nonbank flows, and increased interest from institutional investors (Cole et al. 2020; McQuade and Schmitz 2016). The global financial crisis led to a significant decrease in the average interest cost of outstanding government debt in advanced economies. In contrast, the average interest cost of outstanding government debt in EMDEs barely decreased, owing to persistently high risk premiums and increased reliance on international borrowing, particularly in foreign currency and on nonconcessional terms (United Nations Inter-Agency Task Force on Financing for Development 2022). Nevertheless, compared with the period leading up to the global financial crisis (2000-07), there were twice as many sudden stop events in EMDEs in the years prior to the COVID-19 pandemic (2011-19). During sudden stops, non-FDI inflows tend to decline much more sharply and for longer than FDI flows (Eichengreen, Gupta, and Masetti 2018).

The literature has produced mixed findings on the link between FDI and investment (box 3.2). Although there is evidence that FDI has a positive relationship with economic growth and investment, mainly in countries with well-developed financial markets, the
literature has not found a consistent and significantly positive effect (Alfaro et al. 2004; OECD 2015). One possible explanation for the mixed evidence is that FDI crowds out domestic investment (Farla, de Crombrugghe, and Verspagen 2016).

Heightened uncertainty. Policy uncertainty increased in many EMDEs after the global financial crisis, owing to a variety of factors, including geopolitical tensions in Eastern Europe, security challenges and conflicts in the Middle East, and acute domestic political tensions in several EMDEs. While uncertainty clearly has negative effects on investment and output growth, the scale of those effects depends on the context. Studies have shown that the effects have been more pronounced in countries that have a lower tolerance for uncertainty or where uncertainty interacts with other constraints such as access to credit (Carrière-Swallow and Céspedes 2013; Hofstede 2001; Inklaar and Yang 2012).

Empirical analysis of investment growth

A panel regression analysis is used here to formalize the role of macroeconomic factors in driving investment weakness. Investment growth is estimated for 57 EMDEs covering 2000-21 as the dependent variable in a system generalized method of moments panel regression, similar to the approach in Nabar and Joyce (2009). Growth in real output, the terms of trade, and real private credit; the capital-flow-to-GDP ratio; and a dummy variable for large improvements in the investment climate proxy drivers of investment growth, such as the marginal return to capital and risk-adjusted cost of capital.

Correlates of EMDE investment growth

Real annual investment growth in EMDEs is found to be positively associated with real output growth, real credit growth, improvements in the terms of trade, increasing capital-flow-to-GDP ratios, and spurts in reform of the investment climate (annex 3A; tables 3C.2 and 3C.3). These results are consistent with those of other studies that find a wide number of the drivers of investment growth (G20 2016; IMF 2015; Libman, Montecino, and Razmi 2019). Other studies have also found corporate borrowing to be an important driver of investment growth (for example, Garcia-Escribano and Han 2015). The finding of positive links among institutional quality, financial development, and investment growth is also in line with previous work (Lim 2014). While reform spurts have a large and highly statistically significant coefficient, these events do not explain much of the variation in EMDE investment growth during 2000-21. On average, there were 0.8 investment profile reform spurts in the sample per year, and the majority of these occurred before 2010.

For advanced economies, which did not experience a slowdown in investment growth
during the decade prior to the pandemic, output growth is the most important covariate of the explained yearly variation in investment growth during 2000-21. Other factors, such as real credit growth and the ratio of capital flows to GDP, are much less correlated with investment growth, while still significant.\textsuperscript{2} Compared with that in EMDEs, investment growth in advanced economies is slightly more correlated with terms of trade and less correlated with capital flows and real credit growth.

Using the results of the main regression for EMDEs to predict the contribution of the explanatory variables to investment growth shows that between 2000 and 2021, investment growth in EMDEs was primarily correlated with real output growth,
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FIGURE 3.8 Outlook for investment growth

Investment growth in EMDEs is projected to be below its 2000-21 average rate in 2023 and 2024. The war in Ukraine adds to downside risks relating to the pandemic and could further hold back investment growth.

followed by real credit growth (figure 3.7.A). Declining capital-flow-to-GDP ratios contributed negatively to investment growth in commodity importers in multiple years after 2011, while energy-exporting EMDEs experienced particularly low credit growth after 2015 (figures 3.7.C and 3.7.D).

Terms of trade made a more volatile contribution and comoved strongly with investment growth in energy-exporting EMDEs, particularly during periods of falling or rising oil prices in 2015-16, 2017-18, 2020, and 2021 (Stocker et al. 2018). The negative shock to the terms of trade of energy-commodity exporters may be viewed as having lowered investment growth by reducing the expected return to capital in the exporting sector (Bleaney and Greenaway 2001). In contrast, improving terms of trade did not significantly offset the factors that slowed investment growth in commodity importers, in part because the improvement was less pronounced than the deterioration experienced by commodity exporters.

In 2020-21, the output growth collapse and rebound generated even larger swings in investment growth. In energy exporters, swings in the same direction in the terms of trade amplified the swings in investment growth. Low real credit growth did not compensate for the collapse in output in 2020 and then held back the recovery in 2021 in both commodity exporters and importers alike.

Investment prospects

After a robust rebound in 2021, investment growth is projected to average 3.5 percent per year in EMDEs, and 4.1 percent in EMDEs excluding China, in 2022-24, below
the long-term (2000-21) average rates for both country groups (figure 3.8.A). Commodity-exporting EMDEs are projected to have lower investment growth rates than tourism-reliant EMDEs (figure 3.8.B). Investment growth is projected to be below the individual-country trend of the past 20 years for about three-fifths of EMDEs in 2023 and 2024.

Following the global financial crisis, EMDEs excluding China returned to the investment level implied by the precrisis trend within two years (figure 3.9.A). China contributed materially to the recovery of investment in EMDEs, helping to raise investment above the level suggested by the precrisis trend by 2010 (figure 3.9.B). However, following the 2020 global recession, projected investment growth through 2024 in all EMDEs will be insufficient to return investment to the level suggested by the prepandemic trend from 2010 to 2019 (the period between the highly disruptive 2009 and 2020 global recessions). This is partly due to the weakness of investment recovery in China (figure 3.9.C). Investment in EMDEs excluding China is projected to return to its prepandemic trend by 2024, with the recovery after the global recession in 2020 taking two years longer than after the global financial crisis (figure 3.9.D).

The weak outlook for investment reflects several factors and may deteriorate further if the global economy tips into recession (Guénette, Kose, and Sugawara 2022). Uncertainties about the postpandemic economic landscape, the war in Ukraine, and elevated inflation and borrowing costs may discourage investment for some time. Tighter financial conditions are limiting the fiscal support governments can provide to stimulate public investment (World Bank 2023). At the same time, the legacy of high corporate debt, at the highest level in decades in EMDEs, may constrain investment growth after the pandemic (Caballero and Simsek 2020; Stiglitz 2020). In China, investment growth is projected to remain well below the average of the past two decades: Regulatory curbs on the property and financial sectors and continuing mobility restrictions related to the pandemic will both be restraining factors, in an environment of slower economic growth.

The globally synchronous nature of monetary (and fiscal) policy, while necessary to contain inflation and preserve creditworthiness, may compound the effects of tightening, creating potentially adverse consequences for investment. The empirical analysis in this chapter finds that slowing GDP growth and slowing credit growth are both associated with slower investment growth. Other empirical studies have found similar results. For example, in a study of a large sample of firms in 13 EMDEs, Borensztein and Ye (2018) find that while higher debt-service capacity is correlated with higher investment growth, when a firm’s debt burden rises above a certain threshold, debt restrains investment.⁴

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⁴As described in annex 3A, the regression analysis in this chapter tested for nonlinear effects of credit growth and credit-to-GDP thresholds. The results were not significant at the aggregate country level.
On the bright side, there is evidence that investment in digital technologies and sectoral reallocation has boosted productivity, at least in advanced economies, although it remains to be seen how long-lasting these improvements will be (Criscuolo et al. 2021). Negative factors in major advanced economies appear to have outweighed these improvements’ positive effects on total factor productivity (TFP) in the first year of the pandemic (Bloom et al. 2020).

**Implications of weak investment growth**

Weakening investment growth has lasting implications for global trade as well as for long-term output growth and EMDEs’ ability to reach development and climate-related goals. The slowing of capital accumulation in EMDEs, and consequently of
Inflows of foreign direct investment (FDI) to emerging market and developing economies (EMDEs) have trended downward since the turn of the century, raising concern about negative macroeconomic implications. With that in mind, this box reviews the literature on FDI. Covering research since 1990, a literature survey concludes that there are mixed results on the correlation between FDI and investment as well as that between FDI and growth in EMDEs. Although the literature lacks consensus, there is broad agreement that initial conditions in host countries can be important for linking FDI to domestic investment and growth.

Introduction

Inflows of FDI to EMDEs as a share of gross domestic product (GDP) have slowed over the past decade (figures B3.2.1.A and B3.2.1.B). The decline was broad-based, affecting commodity-exporting and commodity-importing EMDEs, and four of the six EMDE regions (figures B3.2.1.C and B3.2.1.D).

Several reasons have been proposed for the decline, including the maturation of global value chains and tightening FDI regulations. In the 2010s, global value chain formation stagnated after two decades of rapid expansion (Qiang, Liu, and Steenbergen 2021). In addition, in the midst of the global financial crisis, a number of countries imposed restrictions on FDI after many years of FDI liberalization around the world (Sauvant 2009). During the coronavirus disease 2019 (COVID-19) pandemic, both advanced economies and EMDEs raised barriers to FDI, although EMDEs introduced an even larger number of measures to lower such barriers (figure B3.2.1.E). Over the past decade, barriers to FDI have generally been higher in EMDEs than in advanced economies, regardless of the sector receiving the FDI (figure B3.2.1.F). If geopolitical tensions intensify and lead to a further retrenchment in global value chains, it is possible that many EMDEs will face a prolonged period of FDI weakness.

Slowing FDI inflows, FDI restrictions, and frequent changes to them raise concerns about the effects on aggregate investment and output growth in these economies. Slowing FDI may also impede productivity-enhancing collateral benefits (Kose et al. 2009). With more FDI, countries may benefit from pressure for stable macroeconomic policies, financial development, and stronger institutions. However, the strength of the relationship between FDI and investment or growth remains a long-standing matter of debate, with mixed findings in the literature.

Note: This box was prepared by Hayley Pallan.

a. China-U.S. trade tensions since 2018 appear not to have led to a considerable decline in FDI in China yet, largely because of the presence of global value chains in capital-intensive industries (Blanchard et al. 2021).
Figure B3.2.1: Trends in FDI since 2000

FDI inflows as a share of GDP have declined in the past decade. The slowdown has been broad-based, occurring in EMDEs and advanced economies, in commodity exporters and importers, and in most regions. FDI policies tend to be more restrictive in EMDEs than advanced economies. Since 2020, barriers to FDI have increased in both groups of countries, although FDI restrictions have simultaneously eased in EMDEs.

A. FDI inflows

B. FDI inflows, by decade

C. FDI inflows to EMDEs, by commodity-exporting status

D. FDI inflows to EMDEs, by region

E. FDI barriers and easing measures, 2020-22

F. FDI Regulatory Restrictions Index, by sector, 2010-20

Sources: Organisation for Economic Co-operation and Development, FDI Regulatory Restrictiveness Index; United Nations Conference on Trade and Development; World Bank; World Bank FDI Entry and Screening Tracker.

Note: “FDI” is net FDI inflows as percent of GDP. EAP = East Asia and Pacific; ECA = Europe and Central Asia; EMDEs = emerging market and developing economies; FDI = foreign direct investment; GDP = gross domestic product; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa.

A. Last observation is 2021.

A.-D. Sample includes 36 advanced economies and 139 EMDEs. Bars show GDP-weighted annual averages of FDI during 2000-10 and 2011-21 (B-D).

E.F. Panel E shows number of barriers to entry of FDI and number of policies easing entry of FDI during 2020-22 for 24 advanced economies and 22 EMDEs. Bars in panel F show averages during 2010-20 for 32 advanced economies and 51 EMDEs. The indexes range from 0 (no restrictions) to 1 (complete restrictions).
Correlations between FDI inflows and investment and FDI inflows and output growth were weak, less than 0.3 and 0.1, respectively, during 1970-2020, with variation depending on the time period and country characteristics (figures B3.2.2 and B3.2.3). These correlations are somewhat lower in countries with better-developed financial systems, possibly because financial development affords greater consumption smoothing. And conversely, the correlations are somewhat larger in countries with high trade openness, better institutions, or a more skilled labor force, suggesting complementarities between these factors and FDI that can amplify growth dividends.

Against this backdrop, this box surveys prior empirical studies on FDI to address two questions:

- What is the link between FDI and investment?
- What is the link between FDI and output growth?

The box documents that the literature has found mixed evidence on the relationship between FDI and output growth but a mostly positive relationship between FDI and investment. FDI has tended to raise growth and investment
Macroeconomic implications of foreign direct investment in EMDEs (continued)

FDI has generally had stronger correlations with both investment and output growth in EMDEs with lower financial development, higher trade openness, better human capital, and stronger institutions.

Note: “FDI” is net FDI inflows as percent of GDP. EMDEs = emerging market and developing economies; FDI = foreign direct investment; GDP = gross domestic product.

A.B. Bars show the pooled correlation between FDI and gross fixed-capital formation and between FDI and growth in GDP per capita for countries with high (greater than the 75th percentile; blue bars) and low (lower than the 25th percentile; red bars) levels of financial development or levels of trade openness. Financial development is measured as private credit as share of GDP. “Trade” refers to trade as a share of GDP. Differences between country groups are not statistically significant.

C.D. Bars show the pooled correlation between FDI and gross fixed-capital formation and between FDI and growth in GDP per capita for countries with high (blue bars) and low (red bars) levels of human capital or institutions. For human capital, “high” refers to pupil-to-teacher ratio less than the 25th percentile, and “low” refers to pupil-to-teacher ratio greater than the 75th percentile. For institutions, “high” refers to countries above the median, and “low” refers to countries below the median, of the Investment Profile Index in the PRS Group’s International Country Risk Guide. Differences between country groups are not statistically significant.

more in countries with better institutions, more skilled labor forces, and greater financial development and openness and when FDI has been directed at manufacturing rather than the primary sector or services.

The remainder of the box reviews 62 studies of FDI, of which 25 pertain to investment and 37 to output growth, covering up to 150 countries and using data
These studies have been selected based on two criteria: They include EMDEs in the empirical analysis, and they focus on the macroeconomic implications of FDI received in host economies. More than 80 percent of the studies are cross-country, and more than 65 percent of these cross-country studies use exclusively EMDE samples.

Findings of the literature on FDI and investment

The majority of the studies (60 percent) find a positive, statistically significant correlation between FDI and investment, sometimes called “crowding in” (figure B3.2.4.A; Ang 2009a; Kamaly 2014). This correlation is generally found regardless of whether the empirical analysis includes data prior to 1990. However, studies that include data after 2009 generally find mixed results.

Another 30 percent of studies on FDI and investment find mixed effects, and only 2 each find a negative effect or no effect. Mixed effects are recorded in the survey if a study finds a combination of positive, negative, or no effects. One of the studies finding no effect is based on subnational data for China; the other uses a predominantly Latin American and Caribbean country sample between the 1970s and 2000s. The two studies finding outright negative effects employ generalized method of moments techniques to avoid endogeneity or seek to identify long-run relationships, in contrast to other studies that rely mostly on ordinary least-squares regressions (Eregha 2012; Morrissey and Udomkerd-mongkol 2012).

The strength of the relationship between FDI and investment, which is mostly positive, depends on country characteristics, initial conditions, and types of FDI (figure B3.2.4.B). Initial conditions important for investment include financial development and institutions in the host economy.

- **Financial development.** The positive link between FDI inflows and domestic investment is stronger when countries have higher levels of financial development (Jude 2019). FDI may have served as a catalyst for economic activity when domestic firms have had access to sufficient financing to invest in expansions. On the other hand, low financial development may have hindered investment. In contrast, in the two decades after the collapse of the Soviet Union, financial development appears to have been associated with a weaker correlation between FDI and investment in Europe and Central Asia (Mileva 2008).

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b. A separate strand of research on outward FDI finds that by investing abroad, home country firms may benefit from greater and more diversified growth opportunities (Arndt, Buch, and Schnitzer 2010; Desai, Fritz Foley, and Hines 2009; Hejazi and Pauly 2003; Herzer and Schrooten 2008).
Institutions. The positive relationship between FDI and investment is found to be stronger in countries with better institutions (as measured by the World Bank’s Country Policy and Institutional Assessments) or competitiveness (Mody and Murshid 2005; Nguyen 2021). Political stability is shown to dampen the negative relationship between FDI and domestic investment (Morrissey and Udomkerdmongkol 2012).

Sectors and linkages. FDI is associated with more investment when it occurs in the manufacturing sector, is directed to sectors that mainly source inputs domestically, or occurs in sectors that are export oriented (Amighini, McMillan, and Sanfilippo 2017; Ha, Holmes, and Tran 2022). These types of FDI may encourage investment through foreign firms purchasing domestic inputs, selling domestic firms cheaper inputs, or helping local firms integrate
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The evidence on the relationship between FDI and output growth has been mixed, with a positive relationship identified more often in samples starting after 1990 than in samples covering earlier years (figure B3.2.5.A). Among those studies reviewed, only one used long-term cointegration methods for a pre-1990 sample; it identified a statistically significant negative relationship between FDI and output growth in 44 EMDEs between 1970 and 2005 (Herzer 2012). The broader mixed findings may reflect reverse causality running from growth to FDI, third factors driving both FDI and growth, or heterogeneity across time periods and country samples. Several studies have attempted to disentangle the direction of causality and control for a comprehensive set of other factors.

As in the literature on FDI and investment, the strength of the relationship between FDI and output growth depends on initial conditions in host countries and on types of FDI (figure B3.2.5.B). These initial conditions include country characteristics such as financial development, quality of institutions, human capital, and the extent of integration with the global economy.

**Financial development.** The association between FDI and output growth is stronger in countries with more developed financial systems, in part because domestic firms in those countries are able to finance expansions that allow them to supply multinationals (Alfaro et al. 2004; Azman-Saini, Law, and Ahmadi 2010; Bengoa and Sanchez-Robles 2003; Hermes and Lensink

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c. This is consistent with findings from a review of the literature before the global financial crisis (Kose et al. 2009).
Since the financial and capital account liberalizations of the 1990s, however, the link between financial development and growth has weakened (Benetrix, Pallan, and Panizza 2022). This weakening may reflect threshold effects in the rapid financial system growth that followed these liberalizations. For example, there appears to be a private-credit-to-GDP threshold above which FDI and growth no longer have a positive relationship, possibly because of an increased incidence of financial crises (Osei and Kim 2020).

- **Human capital.** FDI and output growth have a stronger positive link in countries with higher-skilled workforces, possibly because these countries are better equipped to absorb the productivity-enhancing new technology that

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**BOX 3.2** Macroeconomic implications of foreign direct investment in EMDEs (continued)

**FIGURE B3.2.5** Summary of empirical studies of FDI and growth in EMDEs

The literature mostly finds a mixed relationship between FDI and output growth, especially when using samples starting before the 1990s. The strength of the relationship between FDI and growth depends on country characteristics and the features of FDI.

**A. Findings on the relationship between FDI and output growth**

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<tr>
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<td>Positive</td>
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<tr>
<td>Negative</td>
<td>25</td>
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<tr>
<td>Mixed</td>
<td>25</td>
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<td>None</td>
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**B. Studies on FDI and output growth that account for initial conditions and type of FDI**

**Sources:** World Bank, based on 37 studies: Alfaro (2003); Alfaro and Charlton (2013); Alfaro et al. (2004); Alguacil, Cuadros, and Orts (2011); Ali and Asgher (2016); Ang (2009b); Aykut and Sayek (2007); Azman-Saini, Law, and Ahmad (2010); Balasubramanyam, Salisu, and Sapsford (1996); Benetrix, Pallan, and Panizza (2022); Bengoa and Sanchez-Robles (2003); Blanchard et al. (2016); Borensztein, De Gregorio, and Lee (1998); Busse and Groizard (2008); Carkovic and Levine (2005); Chakraborty and Nunnenkamp (2008); Choe (2003); Chowdhury and Mavrotas (2006); Cipollina et al. (2012); De Melo (1999); Driffield and Jones (2013); Gao (2004); Hansen and Rand (2006); Harms and Ménon (2018); Hermes and Linsink (2003); Herzer (2012); Kohpaiboon (2003); Lee and Chang (2009); Luu (2016); Makki and Somwaru (2004); Mehic, Silajdzic, and Babic-Hodovic (2013); Nair-Reichert and Weinhold (2001); Osei and Kim (2020); Prasad, Rajan, and Subramanian (2007); Romer (1993); Wang (2009); and Wang and Wong (2011).

*Note:* EMDEs = emerging market and developing economies; FDI = foreign direct investment.

A. First bar shows share of studies that find statistically significant positive, negative, mixed, or missing relationships between FDI and growth. Remaining sets of two bars show shares of studies if they are restricted based on the start date of their empirical analysis (before and after 1990) and the end date of their empirical analysis (before and after 2009).

B. Bars show share of studies on FDI and growth that find a statistically significant role for specific initial conditions, as shown along the x-axis. "Sectors and linkages" refers to different effects of FDI on growth depending on the sector of FDI (that is, manufacturing or services). "Type" refers to different effects of FDI on growth depending on whether FDI is greenfield or mergers and acquisitions.
Institutions. Strong institutions, as measured by indexes of business regulation and freedom from government intervention, are associated with a stronger positive link between FDI and output growth or a dampened negative link (Alguacil, Cuadros, and Orts 2011; Driffield and Jones 2013; Herzer 2012). Conversely, excessive regulation is associated with a weaker link between FDI and output growth (Busse and Groizard 2008).

Trade. Trade openness and global integration are associated with a stronger link between FDI and output growth (Balasubramanyam, Salisu, and Sapsford 1996; Kohpaiboon 2003; Makki and Somwaru 2004). However, in countries that rely heavily on primary sector exports, FDI and growth are found to be negatively correlated (Herzer 2012).

Sectors and linkages. FDI in the manufacturing sector is found to be positively correlated with output growth, while FDI in other sectors has no significant correlation, or even a negative correlation (Ali and Asgher 2016; Aykut and Sayek 2007; Chakraborty and Nunnenkamp 2008; Wang 2009). FDI in high-tech, capital-intensive, and high-skill industries is associated with high output growth (Alfaro and Charlton 2013; Cipollina et al. 2012). Conversely, FDI in the primary sector, which tends to have few linkages to other domestic sectors, is not associated with greater output growth (Alfaro 2003).

Type. Greenfield FDI is found to have a positive effect on output growth (Harms and Méon 2018), while mergers and acquisitions are associated with lower output growth (Luu 2016).

Conclusion

As summarized here, in a review of 62 studies, the literature has found mixed evidence on the relationship between FDI and output growth, but there is mostly a positive relationship between FDI and investment. That said, several country
Characteristics, time period specifics, and features of FDI have influenced the relationships between FDI and output growth and FDI and investment. Greenfield investment in upstream and export-intensive, non-primary sectors tends to be more conducive to growth and investment. FDI has also tended to raise growth and investment more in countries with better institutions, more skilled labor forces, greater financial development, and trade openness.

Policies can aim to encourage types of FDI or, more broadly, to improve the country-level conditions that make FDI enhance growth more. These policies include, for example, efforts to invest in education for a higher-skilled workforce capable of absorbing new technologies. Limiting trade restrictions can help countries attract, and benefit from, FDI related to global value chains, as EMDE country segments of global value chains typically produce inputs that are used in other parts of the production process or goods for sale elsewhere, which need to be exported to final consumers. Countries can also support financial development to attract FDI. In the long run, improving institutions and ensuring political stability can help generate growth- and investment-enhancing FDI inflows. Furthermore, investment promotion agencies have been found to have a positive effect on attracting FDI to targeted sectors (Harding and Javorcik 2011).

Technological progress embedded in investment, implies slowing productivity growth and potential output, with adverse implications for EMDEs’ ability to catch up with advanced-economy per capita incomes.

**Slower global trade growth.** Investment tends to be more import intensive than other components of demand, particularly through trade in capital goods. Weakening investment growth, therefore, contributed to the slowdown of trade before the pandemic (figures 3.10.A and 3.10.B; Bobasu et al. 2020; IMF 2016; World Bank 2015c). Capital goods imports by EMDEs tend to embody efficiency-enhancing technology transfers (Alfaro and Hammel 2007). Hence, the slowdown in such transfers may also have contributed to slowing EMDE productivity growth. A pullback in cross-border investment by multinational companies, which accounts for one-third of global trade, further accompanied the global investment weakness (Lakatos and Ohnsorge 2017). This slowdown occurred at the same time as, and may have been partly due to, the implementation by several countries of additional regulatory measures and nontariff barriers, such as restrictions on FDI and limitations on foreign purchases in public procurement (chapter 6).

Global trade also propagates a pickup or slowdown in investment growth across countries (chapter 6; Freund 2016). Trade can facilitate more efficient allocation of capital goods, in turn improving overall productivity and rates of return on capital, thus...
encouraging investment (Mutreja, Ravikumar, and Sposi 2014). For example, the marginal product of capital does not vary much between low- and high-income countries, and EMDEs with high relative prices of investment goods compared with consumption prices, will tend to have lower real investment rates (Caselli and Feyrer 2007; Hsieh and Klenow 2003). Countries engaged in deepening trade integration have seen the prices of investment goods fall relative to the prices of consumption goods, especially between 2005 and 2011, thus boosting investment rates (Lian et al. 2019). Indeed, trade openness has been found to be positively correlated with capital accumulation (Alvarez 2017; Sposi, Yi, and Zhang 2019; Wacziarg and Welch 2008).

The deep global recession of 2020, together with pandemic-related lockdowns, led to a collapse of global trade in 2020. Continuing supply and shipping bottlenecks, weak demand, and continued pandemic-related mobility clampdowns in some countries hampered the subsequent recovery in trade. The war in Ukraine has further slowed global trade growth by disrupting commodity markets, logistics networks, and supply chains (Ruta 2022).

**Slower growth in potential output.** The prospect that investment growth will remain weak in the medium term raises fundamental concerns about the economic health of EMDEs and about meeting the infrastructure needs of expanding and urbanizing populations in many EMDEs. Before the COVID-19 pandemic, growth in potential output—the level of growth achievable at full capacity utilization and full employment—had already slowed in EMDEs (Kilic Celik, Kose, and Ohnsorge 2020; World Bank 2018). Projected low investment growth in the medium term will further weaken growth in potential output through 2030. This will result in capital accumulation contributing, on average, 0.6 percentage point a year less to EMDE
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FIGURE 3.11 Growth of investment, productivity, and potential output

EMDEs with low investment growth also tend to have low TFP growth. Fluctuations in TFP growth in EMDEs between 2000 and 2020 mirror fluctuations in investment growth. Slowing investment and TFP growth have lowered potential growth in EMDEs, especially in commodity-importing EMDEs, among which China has an outsized weight.

potential growth in 2022-30 than in 2011-19. However, filling needs for investment in physical capital could partially offset the projected slowdown in potential growth during 2022-30 (chapter 1; figure 3.11.A; World Bank 2021a).

Weaker investment growth leads to weaker growth in potential output by lowering TFP growth. In contrast, increased investment often involves the adoption of productivity-enhancing technologies, in the investment goods sector itself, among other places (Colecchia and Schreyer 2002; Hsieh and Klenow 2007; OECD 2016a). Weaker investment and TFP growth can also be a symptom of market distortions that subsidize investment by less productive firms (Restuccia and Rogerson 2008). Alongside slowing

Sources: Dieppe (2021); Haver Analytics; International Labour Organization; Penn World Table; UN, World Population Prospects; World Bank.
Note: EMDEs = emerging market and developing economies; TFP = total factor productivity.
A. Growth in potential output is based on production function estimates. Sample includes 53 EMDEs.
B.C. Total factor productivity is derived from labor productivity (output per worker) by adjusting for human capital and capital deepening; see Dieppe (2021). “Investment” refers to gross fixed-capital formation. Investment growth and TFP growth are calculated using countries’ real annual investment in constant U.S. dollars as weights. Sample includes 69 EMDEs.
D. Bars show group medians; vertical lines show interquartile ranges. “Low” and “high” indicate years when annual investment growth was in the bottom and top third of the distribution, respectively, during 2000-20. Difference in medians between “high” and “low” subsamples is significant at the 1 percent level. Sample includes 69 EMDEs.
investment growth, TFP growth in EMDEs slowed in the decade prior to the pandemic to 1.2 percent per year in 2010-19, on average, from 2.3 percent per year in 2000-08 (figures 3.11.B and 3.11.C). EMDEs with low investment growth tend to also have low TFP growth (figure 3.11.D). TFP growth slowed in EMDEs despite evidence of somewhat faster cross-country absorption of technologies from countries at the productivity frontier (Comin and Ferrer 2013; Moelders 2016). Along with investment growth, TFP growth in EMDEs is projected to remain weak during the next decade (chapter 5). Slower labor productivity growth—the key driver of long-term growth in real wages and household incomes—would also reflect weak TFP growth (Blanchard and Katz 1999; Feldstein 2008).

The pandemic generated another major hit to productivity. If the impacts of the pandemic on the accumulation of physical and human capital and slowing TFP growth are taken into account, growth in potential output in EMDEs is estimated to drop to about 4 percent per year in 2022-30, from an estimated 5.1 percent per year in 2011-19 (chapter 5).

**Slower progress toward the SDGs and climate goals.** Achieving the SDGs and climate-related goals requires increasing investment in EMDEs. Raising infrastructure investment is especially important, following several years of subdued growth in public investment in infrastructure in EMDEs before the pandemic (Foster, Rana, and Gorgulu 2022; Vorisek and Yu 2020). Meeting commitments for reducing emissions of greenhouse gases, advancing the transition to clean energy, and capping the rise in temperature are expected to require an investment in infrastructure and other adaptations of several trillion U.S. dollars per year (table 3C.5; Black et al. 2022; IEA 2021a, 2021b; IPCC 2022; Songwe, Stern, and Bhattacharya 2022). For a partial set of EMDEs, building resilience to climate change and putting these economies on track to reduce emissions by 70 percent by 2050 is estimated to require investment of 1 to 10 percent of GDP annually between 2022-30, with higher investment needed in low-income countries (LICs) (figure 3.12.A; World Bank 2022a). Similarly, LICs will need a much larger increase in spending (relative to GDP) to achieve the SDGs than will the average EMDE (Gaspar et al. 2019). Closing investment gaps will require substantial additional financing from the global community and the private sector.

Achieving the SDGs related to infrastructure (electricity, transport, water supply and sanitation) and infrastructure-related climate change preparation (flood protection, irrigation) in low- and middle-income countries will necessitate average investment of $1.5-$2.7 trillion per year (4.5-8.2 percent of these countries’ combined annual GDP) during 2015-30. This investment will mostly be needed for transport and electricity (Rozenberg and Fay 2019), depending on policy choices and the quality and quantity of...
infrastructure services, with variance across regions (figure 3.12.B). The estimate of 4.5 percent of GDP anticipates investment in renewable energy; transport and land use planning that results in denser cities and less expensive, more reliable public transport and development of reliable railway systems for freight; and deployment of decentralized technologies such as minigrids and water purification systems in rural areas. Gaps in investment relative to the levels needed to reach the health-related SDGs also remain substantial (Stenberg et al. 2017; UNCTAD 2014).

Likewise, investment in education is vital to achieving schooling-related SDGs, closing education achievement gaps created by the pandemic, and supporting long-term income growth (Barro 2013; Psacharopoulos et al. 2021).

Investment in infrastructure has multiple potential benefits. For one, it appears to be

\[4,5\]

\[Psacharopoulos et al. (2021) estimate that lifetime losses in incomes from school closures during the COVID-19 pandemic will amount to 0.8 percent of global GDP per year over the next 45 years. Barro (2013) finds that one additional year of male upper-level schooling can raise GDP growth by 1.2 percentage points per year. Jones (2003) theoretically shows how educational attainment can be interpreted as an investment rate.

Calderón and Servén (2014) review multiple channels through which infrastructure investment affects the poor; Ferreira (1995) and Getachew (2010) discuss the role of public investment in infrastructure and Medeiros, Ribeiro, and do Amaral (2021) the role of infrastructure investment; and Maliszewska and van der Mensbrugghe (2019) examine the role of infrastructure investment in lowering trade costs and generating opportunities for the poor.
inversely correlated with income inequality in EMDEs. Infrastructure investment can lower income inequality and poverty through direct channels, for example, by employing members of low-income households or providing services at lower cost and better quality, or indirect ones, for example, by lowering trade costs in stimulating economic growth. Investment in climate-related resilience and adaptation, as well as mitigation, is central to eliminating extreme poverty and achieving the SDGs. Such investment is perhaps most crucial in low-income and high-poverty countries, which are particularly vulnerable to the impact of climate change and increasingly frequent adverse weather events on agriculture, energy generation and usage, and water availability (World Bank 2022a). Green infrastructure and the adoption of environmentally sustainable technologies can support faster growth in the long term, while also mitigating climate change (OECD 2020; Strand and Toman 2010). Improving and expanding access to infrastructure can enhance productivity (Bizimana et al. 2021; Calderón, Moral-Benito, and Servén 2015; Perez-Sebastian and Steinbuks 2017). Public investment in infrastructure has also been found to create jobs, especially in LICs (Moszoro 2021).

**Policies to promote investment growth**

EMDEs have substantial investment needs—to bolster resilience to climate change, smooth the transition away from growth driven by natural resources, improve social conditions, and support long-term growth of output and per capita income. The urgent need to ramp up investment in EMDEs is clear. The challenges demand a multi-pronged strategy featuring a variety of fiscal and structural measures to boost growth in public and private investment, with the specific priorities differing according to country circumstances.

Fiscal and structural policy, especially over the medium and long term, can make a substantial dent in filling large investment needs in EMDEs. Multilateral institutions will also clearly need to assist EMDEs in financing their investment needs. Yet constrained fiscal space and the limited resources of multilateral development banks mean that the private capital mobilization has become vital to filling investment needs (Bhattacharya and Stern 2021; United Nations Inter-Agency Task Force on Financing for Development 2019; World Bank 2022f).

It is critical to design policies that can stimulate investment with lasting benefits while discouraging opportunistic behavior and to focus on high-quality investment projects (G20 2019). Successfully leveraging private sector capital to boost investment requires a set of policies to balance the risks, costs, and returns of investment projects, as well as overcoming common obstacles to private investment, such as poor business conditions, insufficient project pipelines, and underdeveloped domestic capital markets.

Two areas with strong growth potential are investment in digital capabilities and the transition to clean energy. The pandemic created new opportunities for the adoption of digital infrastructure in commerce and governance, while energy market volatility due to
Russia’s invasion of Ukraine and an increasingly urgent need to meet climate goals have made the development of clean, renewable, and affordable energy sources a priority.

The pandemic also underscored the need for investing in health and education. Healthier individuals are more productive, better at creating and adapting to new technologies, and inclined to invest more in education (Aghion, Howitt, and Murtin 2011). They also have a longer life expectancy and are likely to save more, which feeds back into investment (Zhang, Zhang, and Lee 2003). Investing in education is necessary not only to make up for the effect of lost schooling on future earnings, but also to explore how new approaches to learning and digitalization can reduce inequality in education in EMDEs, provided the appropriate underlying conditions, including the necessary infrastructure, are in place (Bashir et al. 2021; Muñoz-Najar et al. 2021; Wilichowski et al. 2021). In the long term, investment in education is needed to spur research and development and ultimately, innovation.

**Fiscal policy**

Countries can pay for public investment in infrastructure, education, and public health systems in several ways. First, they can raise funding through government borrowing, in particular through countercyclical fiscal stimulus programs during economic downturns, among other possible avenues. The extended low-interest-rate environment in the decade or more before 2022 offered an opportunity for many governments to borrow for investment projects, with limited risks to long-term fiscal sustainability (OECD 2016b). With debt burdens now at historically high levels and financing costs rising with global interest rates, however, EMDEs have limited capacity for expansionary fiscal policy financed through increased borrowing. Countries that are in or near debt distress can focus on fiscal sustainability in the short term to free fiscal resources for investment while taking care to protect spending on essential health, education and other social programs (Glassman, Keller, and Smitham 2023; World Bank 2022i).

Second, countries can increase revenues or cut other expenditures to finance increases in public investment. Strengthening tax administrations, broadening tax bases, or raising tax rates could increase revenues. Revenue-to-GDP ratios are particularly low in South Asia and Sub-Saharan Africa (World Bank 2015b, 2016b). Even without tax rate increases, efforts to remove exemptions, tighten tax administration, and broaden tax bases could yield revenue gains that increase resources to finance public investment projects. Measures that have proven successful in the past include the adoption of digital payments, taxpayer and property registration, and monitoring compliance (Okunogbe and Santoro 2021).

Less productive expenditures and those that are less clearly aligned with policy priorities could also be reallocated toward growth-enhancing investment. For example, eliminating distortive agriculture and fossil fuel subsidies would free sizable funds for investment in renewable energy, health, education, and targeted social safety net programs, even in fiscally constrained EMDEs (World Bank 2022c). Similarly, identifying inefficient spending on high-cost medicines and other health expenditures...
for which lower-cost alternatives are available could offer large gains in spending efficiency (Glassman, Keller, and Smitham 2023). For commodity-exporting economies, well-implemented fiscal rules and stabilization funds would allow governments to use windfall gains earned when commodity prices are high to smooth government investment and expenditures during economic downturns or when commodity prices are low. Procyclical fiscal policy in commodity-exporting countries has been found to worsen the depth of economic downturns (World Bank 2022d). Countercyclical fiscal rules need to also take into account spending on health, education, and aspects of social safety nets, which are often discretionary even in countries that have implemented fiscal rules (Glassman, Keller, and Smitham 2023).

Third, within an existing envelope of public spending on investment, it may be possible to improve spending efficiency and increase the benefits to growth (Buffie et al. 2012). For example, medium-term budget frameworks can improve spending predictability, while greater transparency of expenditures and independent spending evaluations can generate incentives to improve efficiency. Better coordination among different levels of government can reduce duplication and inconsistencies (Mandl, Dierx, and Ilzkovitz 2008; St. Aubyn et al. 2009). Limiting contractual and institutional risks related to public-private partnerships in infrastructure can reduce contingent liabilities, while careful monitoring of state-owned enterprises can limit the need to inject fiscal resources into these companies (Dappe et al. 2022; Dappe, Melecky, and Turkgulu 2022). Some countries also have capacity to improve budget execution of planned public investment (World Bank 2022b).

Engaging the private sector to cofinance infrastructure and other investment projects can limit the use of fiscal resources and diversify risks. EMDEs can also boost private capital mobilization through the use of syndicated loans, guarantees, and instruments for enhancing credit and managing disaster risk. Multilateral institutions have been engaged in offering all of these products to EMDEs in recent years, easing the challenges borrowers in these counties face when seeking financing from investors (World Bank 2022f, 2022h). Although private investors require adequate returns to compensate them for the risk they take on, they can improve the efficiency of infrastructure investment by contributing necessary skills and operational experience.

For EMDEs, boosting public investment can have large benefits in terms of output, because multipliers tend to be large (Izquierdo et al. 2019). Few studies estimate the fiscal multipliers for infrastructure investment in EMDEs, but the existing literature suggests that investment in green and digital infrastructure may have high multipliers (Vagliasindi and Gorgulu 2021). With the right conditions, public investment can boost private investment. Falling trade barriers and privatization efforts increase the likelihood public investment will have a positive effect on private investment, especially if the stock of infrastructure is low and access to credit is not constrained (Bahal, Raissi, and Tulin 2018; Erden and Holcombe 2005).

Fiscal policy can also support private investment indirectly. Prospects for growth of demand and output play a major role in private investment decisions. To the extent that
a growth slowdown in EMDEs is cyclical, countercyclical fiscal stimulus can help raise private investment during and after a downturn, assuming there is policy space (Cerra, Hakamada, and Lama 2021; Huidrom, Kose, and Ohnsorge 2016). However, expansionary fiscal policy can also crowd out private investment, thereby hindering economic growth. If increased government borrowing, through the pressure it puts on credit markets or through reactions of the central bank, leads to increases in interest rates and appreciation of the domestic currency, the cost of financing will increase and reduce a country’s international competitiveness. For example, high levels of public investment in China after the global financial crisis initially boosted economic growth but also saddled cities with large amounts of public government debt (Huang, Pagano, and Panizza 2020). This increase in local public debt tightened financial conditions and lowered private investment by local manufacturing firms. Conversely, reducing fiscal deficits can, in some circumstances, boost private investment (Essl et al. 2019).

Monetary policy also has a role in supporting the growth of private investment, primarily by establishing an environment of low and stable inflation over the medium term, which will foster confidence in macroeconomic stability (World Bank 2022e). Monetary policy can also play a countercyclical role through its management of interest rates and credit growth. This can support investment growth when activity is weak and inflation is low, while also restraining investment when the economy is overheating.

**Structural policy**

Structural reforms of many types can reduce constraints to investment and ultimately boost investment growth. The empirical results in this chapter suggest that spurts in
reform of the investment climate and higher real credit growth have been associated with stronger investment growth (annex 3A). This positive impact is also apparent in a panel regression of investment growth on large spurts and setbacks in investment climate reforms among 60 EMDEs during 1984-2022 (figure 3.13.A). Reform spurts are associated with significantly higher investment growth—by about 6 percentage points, on average. Reform setbacks have a more mixed impact (figure 3.13.B; annex 3B).

Reforms that improve the business and regulatory climate can enable investment that increases the willingness of investors to extend long-term financing to domestic firms, thus reducing rollover risks and, if financing is put toward infrastructure or research and development, yielding returns over decades. Business environment reforms can also amplify the positive effects of investment, such as less informality and more job creation. Informal firms are both less productive and less capital intensive than formal firms (IMF 2019; Ohnsorge and Yu 2021). Structural reforms that encourage entry of informal firms into the formal sector can therefore raise investment and growth in potential output, particularly in countries where informal firms are prevalent. Reducing business start-up costs has been linked to higher profitability of incumbent firms and greater investment in information and communications technology. Stronger property rights can encourage business and real estate investment. Labor and product market reforms that increase firm profitability can encourage investment. In countries where access to finance is constrained, measures to promote financial deepening could boost investment, although risk indicators must be monitored to avoid financial instability (Kiyotaki and Moore 2005; Sahay et al. 2015).

Addressing climate change and building a resilient and reliable energy infrastructure requires structural reforms that encourage private investment participation and lower barriers of access for the private sector. Many EMDEs need governance and institutional reforms to improve and unify the often-fragmented regulatory and institutional environment, including regional cooperation in, for example, electricity trade. Unpredictable regulatory and policy risk is one reason capital costs two to three times more for solar energy producers in EMDEs (excluding China) than in advanced economies (IEA 2022).

EMDEs have made significant progress in establishing robust policy frameworks for renewable energy and energy efficiency since 2010, but the gap between their regulatory frameworks and those of advanced economies is still large, especially in the case of LICs (ESMAP 2020). Medium-term policy targets and development plans can lower the policy uncertainty holding back private investment (World Bank 2022i). For energy-importing EMDEs, Russia’s invasion of Ukraine has underscored the energy security benefits of relying on a diversified mix of energy inputs, transitioning to clean sources of

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8 For the linkages between reform measures and investment growth, see Andrews, Criscuolo, and Gal (2015); Calcagnini, Ferrando, and Giombini (2015); Corcoran and Gillanders (2015); Field (2005); Munemo (2014); Reinikka and Svensson (2002); Schivardi and Viviano (2011); and Wacziarg and Welch (2008).
energy, and improving the energy efficiency of buildings and production processes (World Bank 2022g).

Setting appropriate, predictable rules relating to investment decisions can boost investment and help countries avoid potential pitfalls. Using firm-level data, Gutierrez and Philippin (2017) find that when firms invest less than would be expected based on their market performance, corporate governance and industry concentration explain two-thirds of this shortfall. Improvements in the planning and allocation of investment and in the implementation of public investment management systems, including reforms that resolve problems of asymmetric information and moral hazard, can enhance the benefits of infrastructure investment. This can be achieved, for example, through the establishment of a sound legal and institutional setting, robust appraisal systems, and effective procurement and monitoring systems (Gardner and Henry 2021; Kim, Fallov, and Groom 2020). For EMDEs in which public-private partnerships for infrastructure investment are common, a robust governance structure for such partnerships can limit fiscal risks and avoid opportunistic renegotiations (Dappe, Melecky, and Turkogulu 2022; Engel, Fischer, and Galeotic 2020). A robust regulatory framework for public-private partnerships is especially critical in LICs, where related reforms are lagging (World Bank 2020b).

Developing digital and technological infrastructure can be an important driver of investment growth. Policies to stimulate private and public investment include closing the gap in rural access to broadband networks, aligning regulations with international standards, implementing regulation that encourages competition, ensuring price affordability for consumers, and educating the workforce in skills relevant to information and communications technology (OECD and IDB 2016). Between 2003 and 2018, new high-speed undersea internet connections to Africa, in the presence of a reliable electricity supply, increased FDI flows into the technology and financial sectors of African countries and expanded the size of investment projects in those countries (Mensah and Traore 2022). In Nigeria, the expansion of mobile broadband internet led to an increase of consumption by covered households, lowered poverty rates, and raised labor market participation (Bahia et al. 2020). Multilateral institutions have a role to play in assisting EMDEs in developing a pipeline of projects of interest to investors.

In many EMDEs, underdeveloped and illiquid domestic financial markets limit investment, especially for small- and medium-sized firms (World Bank 2015a). Compared with those in advanced economies, banks extend less credit to the private sector as a share of GDP in EMDEs. This access gap to credit is largest for loans with long maturities (United Nations Inter-Agency Task Force on Financing for Development 2022). Development of domestic capital markets in EMDEs encompasses not only improving financial institutions, but also developing private markets for equity and debt. Policies to expand financial intermediation and access to credit include lowering information asymmetries (for example, on the creditworthiness of debtors), building the legal infrastructure for contract enforcement to lower collateral requirements, providing partial credit guarantees to intermediaries to mitigate specific
risks and market failures, developing a digital infrastructure to lower market access costs for firms and small financial institutions, and establishing disclosure rules for asset allocation and investment decisions (United Nations Inter-Agency Task Force on Financing for Development 2022; World Bank 2022f).

Local currency equity and debt markets facilitate the entry of institutional investors, such as pension funds and private equity firms, which have a higher risk tolerance, and allow firms to access financing in EMDEs with less-developed financial intermediation infrastructures (United Nations Inter-Agency Task Force on Financing for Development 2022). Multilateral development banks can support development of these markets through the use of innovative products such as catastrophe bonds as well as blue and green bonds and provision of liquidity in local currency in the most illiquid capital markets, as well as assistance and advice to governments on building the necessary regulatory and institutional frameworks (World Bank 2015a, 2022f). Risk indicators must be monitored to avert financial instability as domestic capital markets are developed, however (Kiyotaki and Moore 2005; Sahay et al. 2015).

Trade-related reforms, such as simplifying border procedures, eliminating unnecessary duties, and improving trade-related transport infrastructure, could help increase trade flows, with associated benefits for investment (chapter 6; Breton, Ferrantino, and Maliszewska 2022). Lowering uncertainty related to at-the-border trade costs and committing to current or reduced tariff levels, as well as lowering other nontariff barriers, will decrease trade costs and encourage investment. High-quality and well-maintained infrastructure, such as ports and airports, should accompany these reforms (World Bank 2021b). In some EMDEs, lower barriers to cross-border trade finance would help close trade finance gaps and support trade growth (IFC and WTO 2022).

Membership in trade and integration agreements, such as the African Continental Free Trade Area, solidifies reforms, which should benefit a country’s investment climate, particularly if such agreements boost integration into global value chains and help lower the cost of tradable investment goods (machinery and equipment), for which EMDEs still face significantly higher costs than advanced economies (Lian et al. 2019). These reforms should include standardization of inspection and labeling requirements, which add significant costs to trade even if tariffs are low (Moïsé and Le Bris 2013). Lower trade barriers can integrate participating economies into regional and global value chains, while investment, intellectual-property rights, and competition protocols aim to increase cross-border investments (Echandi, Maliszewska, and Steenbergen 2022; World Bank 2020a).

In the long term, many commodity-exporting EMDEs need to diversify their economies so that terms-of-trade shocks are less likely to have an impact on investment decisions. They can accomplish such diversification by, for instance, moving production up the value chain or building infrastructure that promotes the growth of activity outside the natural resource sector. EMDEs will also increasingly need to develop policies to offset the investment-dampening effects of population aging (Aksoy et al. 2019; Zhang, Zhang, and Lee 2003).
Conclusion

Investment growth slowed during the decade prior to the pandemic. On an aggregate level, investment collapsed more in EMDEs in 2020 (including or excluding China) than in the global recession in 2009, and the return to the prerecession trend is expected to take longer. The slowdown of investment growth in EMDEs during the decade prior to the pandemic and the subdued prospects for investment growth in the medium term can be observed, to varying degrees, in all EMDE regions. Chapter 4 explores investment trends and policies needed to boost investment in each of the six EMDE regions.

The empirical analysis in this chapter finds that strong growth in real output, robust growth in real credit, improvements in terms of trade, growth in capital inflows as a share of GDP, and spurts in reform of the investment environment are associated with strengthening real investment growth. For advanced economies, where investment growth was much lower than in EMDEs during the 2010s but also more stable, output growth is found to be the most important correlate of investment growth during 2000-21.

At a time when investment growth is projected to be sluggish in most EMDEs, fiscal space for expansion of public investment is limited, and borrowing conditions are much tighter than during the long period of easy credit in the decade prior to the pandemic. Policymakers will need to identify innovative ways to fill unmet investment needs. Meeting climate goals and SDG targets and supporting long-term growth requires sound fiscal policies, including debt sustainability, as well as targeted investment and reforms.

The sequencing and implementation of these reforms should reflect country-specific circumstances. For example, in countries under acute fiscal stress, the priority may be improving spending efficiency in public investment. In countries with anemic private investment, the priority may be business climate reforms, including robust competition policy, to foster private investment. In countries with large foreign direct investment, the priority may be to improve human capital to ensure that such foreign direct investment enhances growth.

Needed fiscal policies will include those increasing spending efficiency, implementing countercyclical fiscal rules, and strengthening tax administration and revenue collection. Additional financing from the international community and the private sector will need to complement fiscal policy to boost investment. Structural reforms such as lowering tariffs and nontariff barriers to trade, improving the business climate, and putting in place predictable rules such as governance structures that enable public-private partnerships will be needed to crowd in private investment. Public and private investment can both play important roles in boosting long-term growth prospects by supporting productive sectors or expanding infrastructure (including digital, transportation, and electricity infrastructure), improving health sector outcomes, and improving and expanding education. The impact of school closures during the pandemic makes the need for investment in education particularly significant.
Future research on investment could focus on several areas. One is to identify the policies most likely to boost growth in public and private investment and thereby the growth of output and per capita incomes. Promising research questions relate to the relative effectiveness of various institutional reforms in raising investment growth, as well as the quantitative benefits of investments in infrastructure and information and communications technology (Libman, Montecino, and Razmi 2019; Mensah and Traore 2022). Public investment in infrastructure has been found to stimulate structural transformation and productivity (Perez-Sebastian and Steinbuks 2017).

Human development is strongly correlated with income per capita and economic growth. Countries with higher income levels tend to have not only a larger share of workers in the formal sector, where wages are typically higher than in the informal sector, but also a larger share of jobs that provide health care benefits, job stability, and good working conditions (Hovhannisyan et al. 2022). These job quality attributes improve access to health care, allow households to send their children to school, and minimize their chance of experiencing catastrophic expenditures. Yet within countries, there is often large heterogeneity in the quality of jobs across sectors of the economy (ILO 2008, 2013; OECD 2015). Identifying sectors and structural reforms that increase investment opportunities with the highest likelihood of providing good-quality jobs will help close education and health gaps to achieve the SDGs.

Another underdeveloped area of research is understanding the role of intangible investment (for example, intellectual property) in driving growth and productivity.
ANNEX 3A Determinants of investment growth: Empirical framework

Framework. Investment decisions are based on the expected marginal return of capital and the risk-adjusted cost of financing the investment. While public investment decisions may also involve other considerations, private investment accounts for the majority of investment in emerging market and developing economies (EMDEs), about three-quarters of total gross fixed-capital formation.

Therefore, investment is modeled in this chapter as the level of investment $I$ chosen such that the marginal return on capital ($MPK$) equals the cost of capital, which is the sum of the risk-adjusted real interest rate $r$ and the rate of depreciation of capital $\delta$, absent binding constraints:

$$MPK = r + \delta.$$

As a result, $I$ also depends on the determinants of the marginal product of capital—especially total factor productivity $TFP$ and the existing stock of capital $K$. Since investment decisions are about the expected future returns to capital, the cost of capital also includes a risk premium $\pi$:

$$I = I(TFP, K, r, \pi, \delta).$$

A higher cost of capital—whether due to higher risk premiums or higher risk-free real interest rates—would reduce investment, whereas higher productivity, lower depreciation, or a low capital stock would raise it.

To proxy these factors, the regression includes growth in real output, terms of trade, and real credit; change in capital flows as a percent of gross domestic product (GDP); and a dummy for spurts in investment reform. As exports are included in GDP, output growth also captures trade growth beyond its impact through terms of trade.

Data sources. Real investment growth is calculated from real gross fixed-capital formation taken primarily from Haver Analytics and, for countries or years not available in Haver Analytics, from the World Bank’s World Development Indicators or Global Economic Prospects for 2021. Real output growth is taken from the Global Economic Prospects. Real credit growth to the private sector and the credit-to-GDP ratio in the robustness section are taken from the Bank for International Settlements and supplemented with data from the International Monetary Fund’s International Financial Statistics. Credit growth proxies both depth of the financial sector as well as the cost of financing investment, since data on comparable financing costs for a sufficiently large number of countries over the past two decades is not available. Terms of trade are from the World Development Indicators and, for 2021, from the Global Economic Prospects. Capital flows are calculated using data on the sum of foreign direct investment, portfolio flows, and changes in external bank liabilities from the International Financial Statistics. Missing data for all three flow variables are imputed by taking the average of the values for adjacent years. This imputation is limited to at most two consecutive missing observations per economy. Reform spurts are calculated using the Investment Profile...
Index taken from the PRS Group’s *International Country Risk Guide*. Reform spurts are defined as a two-year increase in the index above two times the standard deviation of the country-specific index. The data set includes a panel of 57 EMDEs and 31 advanced economies and covers the period from 1999 to 2021. The regression starts in 2000 and allows for lagged variables.

**Methodology.** The analysis estimates the correlates of investment growth in 57 EMDEs for the period 2000-21 in a system generalized method of moments framework, with the third to sixth lag used to instrument the differenced equation and second lags for the level equation. Generalized method of moments instruments of this type are used for growth in output, real credit, capital flows, and terms of trade. The econometric framework is similar to that of Nabar and Joyce (2009). However, the focus in this chapter is on investment growth—a critical component of overall output growth (ultimately, the source of rising living standards)—rather than changes in the investment-to-GDP ratio, which would capture only changes in investment growth relative to output growth. Use of investment growth is in line with recent studies on advanced economies and individual EMDEs.9 Table 3C.2 shows the results. The sample is unweighted to avoid a small number of EMDEs dominating the results (China and India, for example, account for a large share of total EMDE investment). Lastly, the terms-of-trade, real-credit-growth, and capital-flow variables exclude the top and bottom 1 percent of observations in the entire sample to deal with outliers. Standard errors are clustered at the country level.

**Robustness.** Table 3C.3 details a range of robustness checks. The regressions are robust to using ordinary least squares with fixed effects instead of system generalized method of moments (to account for the initial level of capital, for example). Further, when capital flows are divided into their components, the change in flows of foreign direct investment is not significant, but the changes in portfolio and bank flows are. The credit-to-GDP ratio is not significant once China is excluded from the sample, and credit growth does not exhibit nonlinear behavior. The regression is also robust to adding advanced economies to the sample (excluding Ireland, Malta, and Singapore, as these countries are large outliers in regard to capital flows). Further robustness checks in the system generalized method of moments specification include controlling for various institutional-quality variables from the *International Country Risk Guide* and time fixed effects, as well as the relative price of capital from Penn World Table 10. These additional variables are not significant, while the main results are generally robust. Only the coefficient on terms of trade becomes nonsignificant when global trend variables are included. The subsamples of commodity-importing EMDEs and commodity-exporting EMDEs are too small to generate significant results.

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ANNEX 3B  Investment growth and reforms

Values in figure 3.13 are based on a panel data regression in which the dependent variable is real investment growth. A spurt (setback) is defined as a two-year increase (decrease) above (below) two times the country-specific standard deviation of the Investment Profile Index, a component of the International Country Risk Guide, published by the PRS Group. The sample spans 60 EMDEs over 1984-2022. Overall, there are 44 reform spurt events and 10 reform setback events.

In the regression, $t$ denotes the end of a two-year spurt and $s$ the end of a two-year setback. The coefficients are dummy variables for spurts and setbacks over the $[t-3, t+2]$ or $[s-3, s+2]$ window around these episodes (table 3C.4). In figure 3.13, “reform” at time $t$ refers to the two-year change from $t-2$ to $t$. All coefficients show the investment growth differential of economies during an episode compared with those that experienced neither improvements nor setbacks. All estimates include time fixed effects to control for global common shocks and country fixed effects to control for time-invariant heterogeneity at the country level.
### ANNEX 3C Tables

**TABLE 3C.1 Economies in the investment sample**

<table>
<thead>
<tr>
<th>Emerging market and developing economies (EMDEs)</th>
<th>Latin America and the Caribbean</th>
<th>South Asia</th>
<th>Advanced economies</th>
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<tbody>
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<td><strong>East Asia and Pacific</strong></td>
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<td>Cambodia *</td>
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<td>Brazil</td>
<td>Sub-Saharan Africa</td>
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<td>Slovenia</td>
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<td><strong>Sub-Saharan Africa</strong></td>
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<td>Burkina Faso</td>
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<td>United States</td>
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<tr>
<td>Mauritius *</td>
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<td>Nigeria</td>
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<td>Senegal</td>
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<tr>
<td>South Africa</td>
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<td></td>
</tr>
<tr>
<td>Uganda</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** World Bank.

**Note:** Indicates an emerging market and developing economy (EMDE) commodity importer. Each EMDE is classified as a commodity importer or commodity exporter. An economy is defined as a commodity exporter when, on average in 2017-19, either (1) total commodity exports accounted for 30 percent or more of its total exports or (2) exports of any single commodity accounted for 20 percent or more of its total exports. Economies for which these thresholds were met as a result of reexports are excluded. When data are not available, judgment has been used. This taxonomy results in the classification of some well-diversified economies as importers, even if they are exporters of certain commodities (for example, Mexico).
### TABLE 3C.2 Correlates of investment growth

<table>
<thead>
<tr>
<th>Dependent variable: Real investment growth (percent)</th>
<th>(1) EMDEs</th>
<th>(2) Advanced economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP growth (percent)</td>
<td>1.807***</td>
<td>1.699***</td>
</tr>
<tr>
<td></td>
<td>(13.66)</td>
<td>(16.85)</td>
</tr>
<tr>
<td>Real credit growth (percent)</td>
<td>0.132***</td>
<td>0.060**</td>
</tr>
<tr>
<td></td>
<td>(3.22)</td>
<td>(2.25)</td>
</tr>
<tr>
<td>Growth in terms of trade (percent)</td>
<td>0.095*</td>
<td>0.127***</td>
</tr>
<tr>
<td></td>
<td>(1.95)</td>
<td>(3.07)</td>
</tr>
<tr>
<td>Spurt in reform of investment climate</td>
<td>6.970*</td>
<td>0.638</td>
</tr>
<tr>
<td></td>
<td>(1.78)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>Change in capital flows (percent of GDP)</td>
<td>0.218**</td>
<td>0.060***</td>
</tr>
<tr>
<td></td>
<td>(2.15)</td>
<td>(3.42)</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.854***</td>
<td>-1.231***</td>
</tr>
<tr>
<td></td>
<td>(-5.30)</td>
<td>(-5.95)</td>
</tr>
<tr>
<td>Number of observations</td>
<td>1,024</td>
<td>625</td>
</tr>
<tr>
<td>Number of economies</td>
<td>57</td>
<td>31</td>
</tr>
</tbody>
</table>


Note: Table presents results of a panel system generalized method of moments regression for 57 emerging market and developing economies (EMDEs) and 31 advanced economies during 2000-21. Column (1) shows results for the baseline regression for EMDEs. Column (2) shows results for the regression for advanced economies (excluding Ireland, Malta, and Singapore, as these countries are large outliers for capital flows). Real gross domestic product (GDP) growth, real credit growth, and growth in terms of trade, as well as changes in capital flows, are treated as endogenous. Standard errors are clustered at the country level. t-statistics are in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.
### TABLE 3C.3 Correlates of robustness of investment growth

<table>
<thead>
<tr>
<th>Dependent variable: Real investment growth (percent)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMDEs excl. China</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Split capital flows</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Credit-to-GDP ratio excl. China</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real credit growth squared</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal credit growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real GDP growth (percent)</td>
<td>1.839***</td>
<td>1.840***</td>
<td>1.979***</td>
<td>1.855***</td>
<td>1.854***</td>
<td>1.743***</td>
</tr>
<tr>
<td></td>
<td>(14.04)</td>
<td>(12.73)</td>
<td>(17.58)</td>
<td>(14.06)</td>
<td>(13.85)</td>
<td>(19.29)</td>
</tr>
<tr>
<td>Real credit growth (percent)</td>
<td>0.132***</td>
<td>0.148***</td>
<td>0.102</td>
<td></td>
<td>0.102***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.28)</td>
<td>(3.32)</td>
<td>(1.60)</td>
<td></td>
<td>(3.16)</td>
<td></td>
</tr>
<tr>
<td>Growth in terms of trade (percent)</td>
<td>0.084*</td>
<td>0.092*</td>
<td>0.116**</td>
<td>0.084*</td>
<td>0.086*</td>
<td>0.091*</td>
</tr>
<tr>
<td></td>
<td>(1.75)</td>
<td>(1.78)</td>
<td>(2.25)</td>
<td>(1.87)</td>
<td>(1.75)</td>
<td>(1.85)</td>
</tr>
<tr>
<td>Spurt in reform of investment climate</td>
<td>7.834*</td>
<td>3.165*</td>
<td>8.173**</td>
<td>6.384*</td>
<td>7.701*</td>
<td>4.375*</td>
</tr>
<tr>
<td></td>
<td>(1.87)</td>
<td>(1.83)</td>
<td>(2.01)</td>
<td>(1.82)</td>
<td>(1.99)</td>
<td>(1.80)</td>
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<tr>
<td>Change in capital flows (percent of GDP)</td>
<td>0.219**</td>
<td>0.195**</td>
<td>0.226**</td>
<td>0.203**</td>
<td>0.132***</td>
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<tr>
<td></td>
<td>(2.16)</td>
<td>(2.05)</td>
<td>(2.14)</td>
<td>(2.17)</td>
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<td>(3.55)</td>
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<tr>
<td>Change in FDI flows (percent of GDP)</td>
<td>0.102</td>
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<tr>
<td></td>
<td>(0.91)</td>
<td></td>
<td></td>
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<tr>
<td>Change in portfolio flows (percent of GDP)</td>
<td>0.343**</td>
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<td></td>
<td>(2.60)</td>
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<tr>
<td>Change in net liabilities of financial corporations (percent of GDP)</td>
<td>0.076***</td>
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<tr>
<td></td>
<td>(2.90)</td>
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<tr>
<td>Change in credit-to-GDP ratio (percent of GDP)</td>
<td>0.123</td>
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<td></td>
<td>(1.38)</td>
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<td></td>
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<tr>
<td>Real credit growth squared</td>
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<tr>
<td></td>
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<td>(-0.20)</td>
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</tr>
<tr>
<td>Nominal credit growth</td>
<td></td>
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<td></td>
<td></td>
<td>0.089**</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>(2.32)</td>
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<tr>
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<td>(-5.34)</td>
<td>(-5.79)</td>
<td>(-4.72)</td>
<td>(-5.46)</td>
<td>(-5.23)</td>
<td>(-6.15)</td>
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<td>Number of economies</td>
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<td>56</td>
<td>57</td>
<td>57</td>
<td>88</td>
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</tbody>
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Note: Table presents results of a panel regression for 56-57 emerging market and developing economies (EMDEs) and 31 advanced economies during 2000-21. Number of economies varies based on data availability. Columns (1) to (5) show results of variations of the system generalized method of moments regression in column (1) of table 3C.2. Column (1) excludes China from the sample. Column (2) separates capital flows into the three components. Column (3) replaces real credit growth with the change in the credit-to-GDP ratio, excluding China. Column (4) tests for nonlinearity of real credit growth. Column (5) replaces real credit growth with nominal credit growth. Column (6) estimates the baseline for a global sample of 31 advanced economies (the sample excludes Ireland, Malta, and Singapore, as these economies are large outliers for capital flows) and 57 EMDEs. All additional control variables in columns (1) to (5) are assumed to be endogenous. Standard errors are clustered at the country level. t-statistics are in parentheses. FDI = foreign direct investment; GDP = gross domestic product.

***p < 0.01, **p < 0.05, *p < 0.1.
### TABLE 3C.4 Investment growth around spurts and setbacks in reform of the investment climate

<table>
<thead>
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<th></th>
<th>Dependent variable: Real investment growth (percent)</th>
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<td>$t - 3$</td>
<td>-2.460</td>
</tr>
<tr>
<td></td>
<td>(3.752)</td>
</tr>
<tr>
<td>$t - 2$</td>
<td>0.385</td>
</tr>
<tr>
<td></td>
<td>(2.501)</td>
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<tr>
<td>$t - 1$</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>(2.550)</td>
</tr>
<tr>
<td><strong>Period $t$ of reform spurt</strong></td>
<td>5.577**</td>
</tr>
<tr>
<td></td>
<td>(2.815)</td>
</tr>
<tr>
<td>$t + 1$</td>
<td>3.417</td>
</tr>
<tr>
<td></td>
<td>(2.320)</td>
</tr>
<tr>
<td>$t + 2$</td>
<td>-0.393</td>
</tr>
<tr>
<td></td>
<td>(1.403)</td>
</tr>
<tr>
<td>$s - 3$</td>
<td>-4.395</td>
</tr>
<tr>
<td></td>
<td>(2.772)</td>
</tr>
<tr>
<td>$s - 2$</td>
<td>-1.163</td>
</tr>
<tr>
<td></td>
<td>(2.592)</td>
</tr>
<tr>
<td>$s - 1$</td>
<td>-8.891**</td>
</tr>
<tr>
<td></td>
<td>(4.129)</td>
</tr>
<tr>
<td><strong>Period $s$ of reform setback</strong></td>
<td>-7.323</td>
</tr>
<tr>
<td></td>
<td>(5.137)</td>
</tr>
<tr>
<td>$s + 1$</td>
<td>-6.490**</td>
</tr>
<tr>
<td></td>
<td>(3.108)</td>
</tr>
<tr>
<td>$s + 2$</td>
<td>-0.098</td>
</tr>
<tr>
<td></td>
<td>(5.438)</td>
</tr>
<tr>
<td><strong>Number of observations</strong></td>
<td>1,854</td>
</tr>
</tbody>
</table>

Note: The regression includes time and country fixed effects. $t$ indicates the period of a significant reform spurt and $s$ the period of a significant reform setback, as defined in annex 3B. Robust standard errors are in parentheses.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.***
## TABLE 3C.5 Estimates of climate-related investment needs

<table>
<thead>
<tr>
<th>Author(s) and year</th>
<th>Climate target</th>
<th>Concept (total vs. additional need)</th>
<th>Investment need or gap (nominal amount)</th>
<th>Investment need or gap (percent of GDP)</th>
<th>Time coverage</th>
<th>Country coverage</th>
<th>Sectors or adaptations covered</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black et al. (2022)</td>
<td>Cap temperature increase at 2 degrees Celsius (°C)</td>
<td>Total need</td>
<td>$0.5 trillion per year</td>
<td>0.4 percent of GDP per year or 0.7 percent for high-income countries and 0.3 percent for low-income countries</td>
<td>2021-30</td>
<td>Global</td>
<td>“Cleaner technologies”</td>
<td>Computable general equilibrium (CGE) and a sector-based “assessment tool”</td>
</tr>
<tr>
<td>Citi (2022)</td>
<td>Net-zero emissions</td>
<td>Total need</td>
<td>$2.6 trillion per year during 2021-25; $3.8 trillion per year during 2026-30</td>
<td>2.6 percent of GDP per year during 2021-25; 3.3 percent of GDP during 2026-30</td>
<td>2021-30</td>
<td>Global</td>
<td>International Energy Agency (IEA) Net Zero Emissions by 2050 Scenario modeling by United Nations Framework Convention on Climate Change Race to Zero Campaign with support from Vivid Economics, Citi Global Perspectives &amp; Solutions</td>
<td></td>
</tr>
<tr>
<td>Hallegatte et al. (2018)</td>
<td>Implicitly, the nationally determined contributions (NDCs) under the Paris Agreement</td>
<td>Total need</td>
<td>$115 billion per year</td>
<td>0.1 percent of GDP per year</td>
<td>2020-30</td>
<td>Global</td>
<td>Accounting exercise: Global estimate is derived based on per capita costs of adaptation for 50 countries for which NDC data are available, with the assumption that NDCs reflect actual needs</td>
<td></td>
</tr>
<tr>
<td>IEA (2021b)</td>
<td>Investment needed to limit global warming to 1.5°C</td>
<td>Total and additional need</td>
<td>Total need of $4 trillion (2020 dollars) per year; additional need (gap) of about $3 trillion (2020 dollars) per year</td>
<td>Total need of 4 percent of GDP per year; additional need (gap) of 3 percent of GDP</td>
<td>2020-30</td>
<td>Global</td>
<td>Clean electricity; decarbonization in buildings, industry, transport; low-emission fuel production</td>
<td>IEA World Energy Model simulations</td>
</tr>
<tr>
<td>IEA (2022)</td>
<td>World on track for net-zero emissions (consistent with 1.5°C) by 2050</td>
<td>Total need</td>
<td>$4.8 trillion (2021 dollars) per year</td>
<td>4 percent of GDP per year</td>
<td>2021-30</td>
<td>Global</td>
<td>Fuels, electricity, infrastructure, end-use adaptations (efficiency, electrification, renewables)</td>
<td>IEA GEC Model</td>
</tr>
</tbody>
</table>
## TABLE 3C.5 Estimates of climate-related investment needs (continued)

<table>
<thead>
<tr>
<th>Author(s) and year</th>
<th>Climate target</th>
<th>Concept (total vs. additional need)</th>
<th>Investment need or gap (nominal amount)</th>
<th>Investment need or gap (percent of GDP)</th>
<th>Time coverage</th>
<th>Country coverage</th>
<th>Sectors or adaptations covered</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCC (2022)</td>
<td>Limit global warming to 1.5°C or 2°C</td>
<td>Total need</td>
<td>$2.3 trillion (2015 dollars) per year to meet the 1.5°C goal; $1.7 trillion (2015 dollars) per year to meet the 2°C goal</td>
<td>1.2 percent of GDP per year</td>
<td>2023-52</td>
<td>Global</td>
<td>Infrastructure, energy</td>
<td>Multimodel framework with multiple simulations</td>
</tr>
<tr>
<td>IRENA (2022)</td>
<td>Limit global warming to 1.5°C</td>
<td>Total need</td>
<td>$5.7 trillion per year</td>
<td>5.3 percent of GDP per year</td>
<td>2021-30</td>
<td>Global</td>
<td>Infrastructure, energy</td>
<td>International Renewable Energy Agency macroeconometric model</td>
</tr>
<tr>
<td>McCollum et al. (2018)</td>
<td>Implementation of NDCs by all countries by 2030</td>
<td>Additional need</td>
<td>$130 billion (2015 dollars) per year</td>
<td>0.1 percent of GDP per year</td>
<td>2015-30</td>
<td>Global</td>
<td>Energy</td>
<td>Six energy and integrated assessment models: AIM/CGE, IMAGE, MESSAGEix-GLOBIOM, POLES, REMIND-MagPIE, and WITCH-GLOBIOM</td>
</tr>
<tr>
<td></td>
<td>2°C target</td>
<td>Additional need</td>
<td>$320 billion (2015 dollars) per year</td>
<td>0.4 percent of GDP per year</td>
<td>2015-30</td>
<td>Global</td>
<td>Energy</td>
<td>Six energy and integrated assessment models: AIM/CGE, IMAGE, MESSAGEix-GLOBIOM, POLES, REMIND-MagPIE, and WITCH-GLOBIOM</td>
</tr>
<tr>
<td></td>
<td>1.5°C target</td>
<td>Additional need</td>
<td>$480 billion (2015 dollars) per year</td>
<td>0.5 percent of GDP per year</td>
<td>2015-30</td>
<td>Global</td>
<td>Energy</td>
<td>Six energy and integrated assessment models: AIM/CGE, IMAGE, MESSAGEix-GLOBIOM, POLES, REMIND-MagPIE, and WITCH-GLOBIOM</td>
</tr>
</tbody>
</table>
TABLE 3C.5 Estimates of climate-related investment needs (continued)

<table>
<thead>
<tr>
<th>Author(s) and year</th>
<th>Climate target</th>
<th>Concept (total vs. additional need)</th>
<th>Investment need or gap (nominal amount)</th>
<th>Investment need or gap (percent of GDP)</th>
<th>Time coverage</th>
<th>Country coverage</th>
<th>Sectors or adaptations covered</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>McKinsey Global Institute (2022)</strong></td>
<td>Transition to net-zero emissions by 2050</td>
<td>Total and additional need</td>
<td>Total need of $9.2 trillion per year; additional need (gap) of $3.5 trillion per year</td>
<td>Total need of 6.8 percent of GDP per year; additional need (gap) of 2.6 percent of GDP per year</td>
<td>2021-50</td>
<td>Global</td>
<td>Infrastructure, energy</td>
<td>Net-zero emissions 2050 scenario defined by the Network for Greening the Financial System (NGFS) and the NGFS current policies scenario as a counterfactual in the REMIND-MAgPIE model</td>
</tr>
<tr>
<td><strong>OECD (2017)</strong></td>
<td>66 percent probability of staying below 2°C temperature increase</td>
<td>Total need</td>
<td>$6.9 trillion (2015 dollars) per year</td>
<td>7.5 percent of GDP per year</td>
<td>2016-30</td>
<td>Global</td>
<td>Energy supply and demand, transport, water and sanitation, telecommunications</td>
<td></td>
</tr>
<tr>
<td><strong>Paulson Institute, The Nature Conservancy, and Cornell Atkinson Center for Sustainability (2020)</strong></td>
<td>Halt decline in biodiversity by 2030</td>
<td>Total and additional need</td>
<td>Total need of $722-$967 billion per year; additional need (gap, or “biodiversity financing gap”) of $598-$824 billion per year</td>
<td>Total need of 0.7-1.0 percent of GDP per year; additional need (gap) of 0.6-0.8 percent of GDP per year</td>
<td>2019-30</td>
<td>Global</td>
<td>Biodiversity</td>
<td>Accounting exercise</td>
</tr>
<tr>
<td><strong>Rockefeller Foundation and Boston Consulting Group (2022)</strong></td>
<td>Net-zero emissions</td>
<td>Total need</td>
<td>$3.4 trillion per year during 2020-25; $4.1 trillion per year during 2026-30</td>
<td>3.7 percent of GDP per year during 2020-25; 3.8 percent of GDP per year during 2026-30</td>
<td>2020-30</td>
<td>Global</td>
<td></td>
<td>Extrapolations based on IEA net-zero emissions scenario</td>
</tr>
<tr>
<td><strong>UNEP (2022)</strong></td>
<td>Limit temperature increase to 1.5°C or 2°C</td>
<td>Total need</td>
<td>$11 trillion ($379 billion per year) for 1.5°C scenario; $9.5 trillion ($328 billion per year) for 2°C scenario</td>
<td></td>
<td>2022-50</td>
<td>Global</td>
<td>MAgPIE version 4.1, developed by Vivid Economics, and off-model analysis</td>
<td></td>
</tr>
<tr>
<td>Author(s) and year</td>
<td>Climate target</td>
<td>Concept (total vs. additional need)</td>
<td>Investment need or gap (nominal amount)</td>
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</tr>
<tr>
<td>Baarsch et al. (2015)</td>
<td>Limit temperature increase to 2°C</td>
<td>Total need $0.2 trillion (2012 dollars) per year</td>
<td>0.7 percent of GDP per year</td>
<td>Through 2030</td>
<td>Middle- and low-income countries, excluding China</td>
<td>Adaptation and resilience</td>
<td>Integrated assessment model (Regional Dynamic Integrated Model of Climate and the Economy, AD-RICE2012)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limit temperature increase to 2°C</td>
<td>Total need $0.5 trillion (2012 dollars) per year</td>
<td>0.6 percent of GDP per year</td>
<td>Through 2050</td>
<td>Middle- and low-income countries, excluding China</td>
<td>Adaptation and resilience</td>
<td>Integrated assessment model (AD-RICE2012)</td>
<td></td>
</tr>
<tr>
<td>IEA (2021a)</td>
<td>Net-zero emissions by 2050</td>
<td>Total need $1.4 trillion per year</td>
<td>2.1 percent of GDP per year</td>
<td>2026-30</td>
<td>EMDEs, excluding China</td>
<td>Electricity, end-use energy efficiency (buildings, transport), and renewables</td>
<td>Scenario analysis (methodology unclear)</td>
<td></td>
</tr>
<tr>
<td>Markandya and González-Eguino (2019)</td>
<td>High-damage and low-damage scenarios</td>
<td>Total need $29-$411 billion by 2030 (lower and upper bounds reflect low-damage/high-discount-rate and high-damage/low-discount-rate scenarios)</td>
<td>0.1-1.3 percent of GDP per year</td>
<td>Through 2030</td>
<td>Developing countries</td>
<td>Integrated assessment model</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High-damage and low-damage scenarios</td>
<td>Total need $71 billion-$1.09 trillion by 2050 (lower and upper bounds reflect low-damage/high-discount-rate and high-damage/low-discount-rate scenarios)</td>
<td>0.1-1.5 percent of GDP per year</td>
<td>Through 2050</td>
<td>Developing countries</td>
<td>Integrated assessment model</td>
<td></td>
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</tr>
</tbody>
</table>
### TABLE 3C.5 Estimates of climate-related investment needs (continued)

<table>
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<tr>
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<th>Investment need or gap (nominal amount)</th>
<th>Investment need or gap (percent of GDP)</th>
<th>Time coverage</th>
<th>Country coverage</th>
<th>Sectors or adaptations covered</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narain, Margulis, and Essam (2011)</td>
<td>Adaptation to limit temperature increase to 2°C</td>
<td>Total need</td>
<td>$70-$98 billion per year (2005 US$)</td>
<td>0.2-0.3 percent of GDP per year</td>
<td>2010-50</td>
<td>Developing countries</td>
<td>Infrastructure, coastal zones, water supply, agriculture, fisheries, forests and ecosystems, human health, extreme weather</td>
<td>Accounting exercises benchmarked against goals, CGE models</td>
</tr>
<tr>
<td>Rozenberg and Fay (2019)</td>
<td>Limit temperature increase to 2°C and fill investment needs</td>
<td>Total need</td>
<td>$640 billion-$2.7 trillion per year (2015 dollars)</td>
<td>2.0-8.2 percent of GDP per year</td>
<td>2015-30</td>
<td>Developing countries</td>
<td>Energy, transport, water and sanitation, irrigation, flood protection</td>
<td>Accounting exercises benchmarked against goals, CGE models</td>
</tr>
<tr>
<td>World Bank (2022a)</td>
<td>Resilient and low-carbon pathway</td>
<td>Need of 8 percent of GDP in low-income countries; 5.1 percent of GDP in lower-middle-income countries; 1.1 percent of GDP in upper-middle-income countries</td>
<td>2022-30</td>
<td>24 developing countries</td>
<td>Infrastructure, transport, energy/electricity, water and sanitation, urban, landscape, and industry</td>
<td>Scenario analysis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


References


