ASIAN INFRASTRUCTURE INVESTMENT BANK

ASIAN INFRASTRUCTURE FINANCE 2021

SUSTAINING GLOBAL VALUE CHAINS

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The Asian Infrastructure Finance 2021 is organized as follows: Part I, composed of Chapters 1 to 7, discusses key issues around the theme "Sustaining Global Value Chains".

Part II presents a market update from 2020 to 2021, including country-specific updates. Further data and technical papers will be available online at https://www.aiib.org/en/news-events/media-center/working-papers/index.html

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ABBREVIATIONS

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
bps	basis points
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CAI	EU-China Comprehensive Agreement on Investment
CERE	China-Europe Railway Express
DVA	domestic value added
EU	European Union
FDI	foreign direct investment
GDP	gross domestic product
GVC	global value chain
ICT	information and communication technology
IPA	investment promotion agency
LCU	local content unit
MNE	multinational enterprise
OECD	Organisation for Economic Co-operation and Development
PPP	public-private partnership
R&D	research and development
RCEP	Regional Comprehensive Economic Partnership
SEZ	special economic zone
TEU	twenty-foot equivalent unit
UNCTAD	United Nation Conference on Trade and Development
USD	United States dollar
WTO	World Trade Organization

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KEY DATA SOURCES

ADB Multiregion Input-Output database

UN Comtrade

Eora

IJGlobal

ORBIS Cross-Border Investment

ORBIS Zephyr

Refinitiv

FOREWORD

In early 2020, the sudden emergence of the coronavirus disease (COVID-19) brought first health and then economic shocks of such unprecedented scale and impact that the global community's ability to withstand them has been severely tested. As these shocks hit country after country, virtually all industries and the flow of goods worldwide were disrupted. Borders were closed and many communities went into lockdown. As countries have scrambled to secure supplies of essential medical equipment and vaccines, the impact of disruption to global value chains (GVCs) on normal business and people's lives has never been so acutely felt.

We are far from out of the woods yet as lower-income countries still struggle to secure adequate vaccine supply. We should lose no time in deducing what can be learned from this experience. Policy makers, company executives, investors and other market players are already debating how to improve supply chain resilience post crisis. What should be considered is how participation by emerging economies can be supported and facilitated, so that they are capable of responding to future economic and health shocks. This should be one of the main goals of any major shift in the supply chain ecosystem. We know from experience the impact that supply chain participation can have on lifting people out of poverty. The opportunity before us should not be ignored.

Moving from low engagement to meaningful participation in the supply chain is not as simple as flipping a switch. It can be costly for companies to move their operations between countries. The right infrastructure investments and the right policy and regulatory framework need to be in place to assure the smooth flow of goods. Next, effective cooperation between neighbors that strengthens resilience and does not weaken the nodes in the network must prevail. Taking a regional rather than national approach will bring forth broad benefits for all. The debates must be framed to allow for rational discussion and action. Perceived supply chain vulnerabilities should not become a clarion call for economies to look inward rather than strengthen connections.

If a single country tries to produce essential goods on its own, it will remain fragile. Resilient supply chains require many countries trading with each other, not a rush to relocate manufacturing back to their home countries. The Regional Comprehensive Economic Partnership, for example, is the largest free trade agreement by gross domestic product signed during the COVID-19 pandemic. The agreement was a bright spot in an otherwise difficult 2020. By harmonizing rules of origin, the agreement will allow value chains to be optimized across the region as a single production base while making the best use of each economy's comparative advantage.

This report pays closer attention to the nexus between supply chains and infrastructure development, highlighting the policies and investment needed to improve GVCs post pandemic. At AIIB, where our mission is to invest in the infrastructure for tomorrow, we have explored how GVCs of the future will need to embed green practices and approaches if they are to contribute to global climate goals. The role of digital investments in this journey cannot be ignored either as they are playing an increasingly important role in driving efficiency and modernization in GVCs.

Supply chain resilience is deeply connected to quality infrastructure. A stronger network of connectivity infrastructure strengthens the trading network. A greener and cleaner approach to these investments will help secure our future. By coming together to build connectivity infrastructure and value chains that serve all people, we will be on the road to building back better once the pandemic has come to an end.

Jin Liqun
President and Chair of the Board of Directors
Asian Infrastructure Investment Bank

PREFACE

The reports of the demise of global value chains (GVCs) are greatly exaggerated. Accounting for close to half of total exports and increasing in absolute terms, they continue to be an important lever for emerging and developing economies, not least in Asia, to plug into global processes and innovation. The relative importance of GVCs has more than doubled in these countries over the last quarter century, and while their dramatic expansion has slowed down since the global financial crisis, they continue to expand their footprint and transform economies.

What this report brings out is how critical infrastructure quality and capacity are to the agility and resilience of GVCs. When the coronavirus disease (COVID-19) struck, existing logistics systems managed to quickly shift routings and modes of transport, minimizing the damage and rapidly bringing deliveries and production back to pre-pandemic levels. More fundamentally, we demonstrate the importance of infrastructure-intensive place-based industrial development policies, as illustrated by widely used special economic zones linked up to reliable power networks, multimodal transport and high-quality digital infrastructure. They complement sector-oriented horizontal industrial policies, tackling skill shortages and other constraints in particular sectors.

Undoubtedly, in the wake of the pandemic and faced with increased trade tensions, GVC lead firms are looking at the vulnerability of existing networks, and some have already implemented changes, diversifying suppliers and creating redundancies. Others have invested even more in existing relationships to strengthen their resilience. It is too early to tell which approach will win out, but the fundamental economic forces pushing in the direction of single dedicated relationships should not be underestimated.

A significant challenge to GVCs highlighted by the report is the imperative of the global economy of moving toward net zero carbon. Lead firms will increasingly become responsible for the carbon footprints of their value chains (Scope 3 emissions). If they cannot enforce decarbonization throughout the chains they control, GVCs will no longer be viable. While this is a threat for lead firms and other stakeholders along particular chains, it is also an opportunity for national and global policy makers to make progress on net zero transition across countries and sectors.

Over the longer term, GVCs have most likely been equalizers, providing opportunities for countries, companies and individuals to benefit from technology upgrading and efficiency improvements. We provide evidence from China's experience, in which GVCs have helped lift regions in the country's interior and make them internationally competitive. But there are examples where GVC engagement could reinforce existing inequalities, and the push for decarbonization could lead to further divergence. As we venture along the path to net zero carbon, we must ensure that it is a just and inclusive transition, recognizing countries' different starting points and capacities to benefit from its upsides.

Multilateral development banks (MDBs) have a particular responsibility in facilitating investments, especially in infrastructure, to help countries join GVCs. MDBs can help prepare projects and ensure that any tender process for contracts to implement projects is transparent and fair. Even more important, MDBs can help local and national authorities build capacity to manage the projects and better match the experience of international operators. MDBs can anticipate potential conflicts and ensure that proper procedures are in place to deal with them.

Yet, one set of conflicts existentially challenges GVCs—those associated with growing geopolitical tensions and trade restrictions. They are jeopardizing the foremost lever for many emerging and developing economies to eradicate poverty and achieve prosperity by shifting from investment- to innovation-led growth. Geopolitical frictions are also undermining a main option for making progress on the net zero transition and the broader sustainable development agenda. If the pandemic has shown us anything, it is that multilateralism offers us the best hope for short- and long-term solutions to global emergencies.

Erik Berglof
Chief Economist
Asian Infrastructure Investment Bank

EXECUTIVE SUMMARY

The dramatic expansion of global value chains (GVCs) has slowed since the global financial crisis of the late 2000s, but they continue to enlarge their footprint and transform economies. GVCs are an important lever for developing and emerging economies, not least in Asia, to plug into the global production and innovation ecosystems.

This report examines how Asian economies, to different extents and in different ways, have integrated GVCs into their growth models. We emphasize the role of infrastructure in shaping economies' resilience to shocks and supporting countries in joining GVCs or sustaining their engagement with them. Two case studies—China and India—illustrate how a combination of infrastructure investment and industrial policies have helped previously less developed sectors of their economies attract GVC lead firms. The final chapter looks at the potential role of lead firms in adjusting GVCs to the net zero transition and how Asian economies can attract the firms by offering climate-smart and inclusive production and connectivity.

Value chains are experiencing strains, having to cope with the reopening of economies, demand surge in some instances, and also investment lags in some industries. While acknowledging that the tightly knit structure of GVCs left relatively little slack and has resulted in bottlenecks, GVCs nonetheless have proven highly resilient in the face of the largest peacetime shock since the last century. GVCs' resilience has helped reduce the impact of the pandemic and contributed to the post-pandemic recovery. Resilient infrastructure and flexible logistics were important but so were supportive macroeconomic and fiscal policies in many countries that sustained firms and households through lockdowns and layoffs. Yet, it is too early to say what the medium- and long-term impact will be, as bottlenecks continue to be felt and companies and governments assess the impacts.

The benefit from participation in GVCs is most dramatically felt when countries link to them, transitioning away from exporting commodities and basic intermediate goods and services. The quality of infrastructure, both traditional physical and digital, affects the capacity of economies to capture the gains of new and progressively more sophisticated types of production and upgrading. Some countries have moved upstream and rely less on imported materials, but that is not necessarily the objective. What matters is the acquisition of new capabilities and upgrading of existing ones across different value chains, targeting activities with the greatest potential to improve productivity in a particular economy.

The most dramatic change in GVCs since 2011 has come from China playing a larger part in producing intermediate goods. China's companies have moved upstream and become more productive, but many firms have also moved out of labor-intensive segments of the production chain as wage costs in China have risen. The changes in production patterns have been accompanied by a shift in economic weight from north to south and from coastal areas to inland

cities such as Chongqing and Chengdu. Large investments in high-quality infrastructure, particularly transport, have been important in this remarkable transformation, allowing producers to source, deliver and assemble from many different places. China has become a much more significant user of robots and digital infrastructure, and, with the dramatic expansion of 5G, it is preparing the economy for more GVC engagement.

India has also steadily increased its GVC participation since 1990 but it has come down slightly since the global financial crisis of 2008. The economy relies more on exports of domestic raw materials and intermediate products and less on exports based on imported materials. Since the early 2000s, India has moved downstream by strengthening its backward linkages and shifted toward high-technology exports. Exports have traditionally been concentrated in a few coastal states but, over time, more states have engaged with GVCs. Infrastructure quality, not least the reliability of power supply, is strongly correlated with propensity to export, but so are broader institutional quality measures. An analysis of important ports suggests that investments in hinterland transport would have high returns.

Participation in GVCs is not preordained and depends on government policies. GVCs are infrastructure-intensive production arrangements enabled by targeted place-based and industrial policies in the host countries. For example, many Asian economies have made use of special economic zones, where lead firms can benefit from good access to multiple modes of transport, reliable power supply, preferential tax arrangements and simplified customs procedures. The quality of digital infrastructure has become an increasingly important means of attracting GVC-related investments.

In the medium and long term, GVCs face important challenges from rapid technological development, which affects decisions on where to locate activities and what types of infrastructure are most important for their continued expansion. Increasingly, lead firms are facing pressures regarding their carbon and broader environmental footprint. Add to this the greater attention given to the impact on social and economic inequalities, and lead firms and governments have strong incentives to continue upgrading and transforming value chains.

GVCs, however, provide an opportunity to implement the net zero transition, relying on the lead firms to implement common standards along the value chain. By holding GVC lead firms accountable for the carbon footprint of the entire value chain—the Scope 3 emissions—creditors and shareholders can promote decarbonization across sectors and countries. Given the interest of individual countries in attracting or sustaining engagement with lead firms, there is a potential virtuous cycle of companies seeking to green their supply chains, and countries providing opportunities to do so by offering climate-smart infrastructure. The cycle could stimulate harmonization of standards along value chains and across countries. As companies become increasingly held to account for their emissions and environmental impact, economies that offer greener infrastructure will gain a competitive edge and become attractive to inward investments and GVC activities. Unproductive trade measures around the net zero transition, however, must be avoided. Policy makers would do well to begin tracking carbon emissions embedded in their products, forming and articulating clear transition plans and accelerating the greening of infrastructure and processes to support their industries.

While GVCs have been a leveler for many developing and emerging economies, improving productivity and long-term growth, they also risk leaving countries and groups within countries behind. These divergencies could be further reinforced by efforts to decarbonize production and transport along the chains. In designing policies to attract and sustain engagement with lead firms, policy makers must be aware of the potential distributional consequences: the transition to net zero must be a just transition that encourages equal opportunities and protects individuals and countries from falling behind.

PART 1: SUSTAINING GLOBAL VALUE CHAINS

CHAPTER 1

OVERVIEW

The dispersion of production into multiple locations and economies of different parts of the global value chains (GVCs) has pushed efficiencies to the extreme and allowed previously unimaginable economies of scale and scope. GVCs broadly describe the arrangement of international production sharing, where intermediate products and processes, for different stages of production, are sourced from various economies to produce the final product. Such GVC-related exports have grown to account for about half of total exports. Countries and companies that successfully link to GVCs massively increase their productivity. Everyday products benefit from comparative advantage, low costs, skills and innovation capacities of different economies. GVCs have become such an integral part of our lives that we needed a global shock like the coronavirus disease (COVID-19) to remind us of their imminence, importance and intricacy.

Take the Nintendo Switch, for example. The design combines fixed and portable playsets, which benefits from Japan's innovation ecosystem, manufacturing processes in various economies, including China, Malaysia and Viet Nam, and parts and software from even more locations. The gadget increasingly benefits from third-party developers adding to its game offerings. Interactive gaming is made possible through the internet, connecting families and friends during the pandemic. Like trade in general, the gains from GVCs are spread over space and time in ways that make costs and benefits hard to appreciate and quantify. GVCs have come to represent not only human ingenuity but also cooperation.

1.1 GVCs Have Been Resilient through the Pandemic, yet Fundamental Challenges Remain

Much has been made of the slowdown in growth of participation of many economies in GVCs since the global financial crisis of 2008 (World Bank, 2020d). While more recent data remain incomplete, there is little evidence of overall retrenchment of GVC production. On the contrary, GVCs have been growing along with overall trade, which was expanding quickly until the pandemic.[1] The fundamental economic underpinnings for these arrangements continue to be strong.

[1] The major structural shift, with China increasingly producing intermediate goods, is registered as a decline in participation in GVCs, even though the process has hardly decreased their importance.

COVID-19, the biggest peacetime shock to the global economy, was a major stress test for GVCs. The initial impact was dire, with the effects of work stoppages and lockdowns in China rippling across GVCs, from automobiles to electronics. Yet, GVCs held up and performed remarkably well despite the initial shock. China's containment of COVID-19 is an important part of the resilience, but so are adaption and innovation by companies in China and elsewhere. The swift fiscal and monetary stimuli enacted by policy makers across the world sustained firms and supported demand. Barring the initial shocks, goods and non–travel-related services continue to flow largely unimpeded through the crisis. Multinational companies as well as their suppliers, having invested significantly in global production and benefitted from it, also have incentives to continue with existing arrangements.

The situation does not mean that all is well and that GVCs face no more threats. Early evidence suggests parts of production systems are stressed, reflecting bottlenecks as economies open after the initial shock. Shortages of components for cars, bicycles and computers, among others, were reported during the second half of 2020 and first half of 2021. The occasional port shutdowns and the accident at Suez Canal added to logistical stresses and shipping costs. Some shortages stem from the rapid recovery in some economies in East Asia, North America and Europe.

We continue to witness trade tensions and long-term geopolitical pressures. Although trade tensions between the United States and China garner headlines, trade restrictions by various economies have been rising for some time. The pandemic-related restrictions—for critical supplies, personal protective equipment or vaccines—will continue to be lingering concerns for policy makers. Vaccine production and distribution, for example, underscore the potential for trade disputes. Competition for critical industrial resources could add to trade tensions. Raw materials needed for clean energy production and industrial transformation could become the next source of trade tensions.

Technology changes—such as digitization, automation or artificial intelligence—have begun to change the nature of manufacturing and GVCs, with less demand for cheap labor and more for skills. With greater automation and its potential to allow onshoring, some trade could be displaced. The pandemic laid bare large digital-readiness divides between and within economies. Like roads and ports before it, digital infrastructure and the connectivity it brings are now critical to GVC participation. Technological development is fundamentally changing the competitiveness of different activities. For example, artificial intelligence is replacing some demand for call centers and robotization is competing with locations with low labor costs. Developing economies must cope with these changes or risk being further left behind.

Finally, greenhouse gases of global trade will become an existential and complex issue. GVCs rely on movements of components and final products across large distances, with implications for the climate and local environments. Production has major environmental impacts. Multinational corporations along GVCs are under increasing pressure from civil society and investors to reduce their and their suppliers' carbon footprints.

Yet, companies can be effective only if public policy fully plays its part. GVC sustainability requires greening of production everywhere, not just shifting emissions to developing economies. Trade and logistics infrastructure will have to be consistent with net zero. The targets cannot be achieved by companies fending for themselves. Public infrastructure investments and international coordination will be necessary. If any of these challenges are not met, the world cannot achieve sustainable GVCs. The key risk is that the net zero transition could deepen existing trade or geopolitical fault lines, leading to higher protectionism and harming global production sharing. To prevent this from happening, every effort must be made to ensure that the emerging and developing world has access to technology and finance in their journey to net zero carbon.

1.2 Strengthening Global Supply Chains through Infrastructure

Building on the World Development Report 2020 (World Bank, 2020d) and research of other international financial institutions, this report further analyzes Asia's GVC participation, examines the deep connection with infrastructure development and articulates priorities as the world emerges from the pandemic.

GVCs are embedded in individual countries' growth models and specific technologies. Specialization arising from these production arrangements has opened massive opportunities for developing economies. Instead of having to produce an entire car, a country can focus on a single component, which has radically reduced entry barriers. As economies transit from lower to higher income levels and approach the world technology frontier, the frontier continues to move from technological change, forcing value chains to adapt. Being part of such value chains thus offers rich opportunities to imitate, adapt and eventually innovate to move up the value-added ladder.

The capacity of countries to enjoy the potential positive spillovers from GVCs will depend on the investment climate, the quality of human capital and infrastructure capacity. These arrangements often involve bespoke infrastructure and logistics, but they also operate in a wider infrastructure context. Developing economies have large infrastructure gaps, hampering participation in GVCs. Special economic zones (SEZs) have been effectively used by countries to compensate for weaknesses in overall infrastructure. The zones often compete using access to multiple modes of efficient transport systems and high-speed broadband as competitive advantages.

Understanding the infrastructure requirements of nodes of a specific value chain is important for government authorities and companies as they aspire to enjoy the benefits from integrating into GVCs. Strong physical infrastructure and flexible logistics should help build resilience to external shocks. Leveraging external and in-house research, the key message of the report is that infrastructure quality is a vital determinant of an economy's ability to participate in GVCs. Investment in infrastructure is thus a key pathway to increase participation in GVCs, rejuvenate trade and create a more resilient supply chain for all.

1.3 Rejuvenating Public Policy and International Cooperation

More investment alone, however, is not the answer. Infrastructure must be coordinated with broader industrial policies. Policy makers need to be clear on which sectors and which parts of the value chain to anchor to develop the right supporting infrastructure.

GVCs would benefit from other measures, such as improvement of the foreign direct investment regime, investment promotion, trade policy and the overall business climate. In many instances, policy makers may have to target and attract specific lead firms to anchor certain parts of the value chain.

GVC development may require special spatial considerations and support. For example, many developing economies may face fiscal or institutional constraints on developing infrastructure across the board. SEZs become a way to improve physical and digital infrastructure in a defined area with special institutional support to anchor GVCs. Policy makers sometimes face a tradeoff: place SEZs in more developed regions to maximize efficiency or in less developed regions as a place-based policy to jump-start development? In any case, good connectivity infrastructure is important to ensuring that SEZs function well while ameliorating potential spatial inequalities. China, for example, has greatly expanded inland infrastructure and connectivity to catch up with the coastal regions. The report discusses the policy framework in greater detail.

The difficult year that was 2020 had some bright spots. The Regional Comprehensive Economic Partnership (RCEP) was signed. It forms the largest free trade area by gross domestic product (GDP) size and spans high-, middle- and low-income economies. The RCEP is the first agreement of its kind that has brought together the three large manufacturing hubs in Asia—China, Japan and the Republic of Korea. Such trade agreements are conducive for GVC participation, but RCEP does not tackle the issues that are most important for sustaining and further developing such production arrangements. Increasingly, GVCs are about services and information and regulation and standards, which require deeper and more ambitious agreements, more in the spirit of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP).[2]

[2] The CPTPP was signed by 11 countries on March 8, 2018 in Santiago, Chile. The United Kingdom (UK) applied for membership on Feb. 1, 2021, and on June 2 the CPTPP Commission agreed to formally commence accession negotiations with the UK government.

On the less positive side, the pandemic has amplified geopolitical tensions. The increasing importance of GVCs, particularly for emerging and developing economies, and their potential vulnerability to geopolitical disruptions increase the stakes. The tensions are jeopardizing the main levers for many emerging and developing economies to eradicate poverty and achieve prosperity by shifting from investment- to innovation-led growth. The geopolitical frictions are undermining an important option for making progress on the net zero transition and the broader sustainable development agenda.

1.4 Sustaining Global Value Chains into the Future

Decarbonization will have to cover all activities along the value chain. Most of the carbon footprint comes from production, but transport and logistics contribute. Digitization holds obvious promise to improve productivity and resilience, as well as to reduce the carbon footprint such as through more efficient use of resources and routing efficiency. Yet, digitization alone cannot solve the fundamental challenges. Net zero carbon emissions require a systemic rethink of how GVCs are organized and managed. They will not be sustainable if the challenges are not met.

Five shifts are key:

1. All forms of production will have to transit toward net zero emission, which will involve the massive scale-up of energy production from renewable energy sources and away from fossil fuels. Beyond energy production, each industry will need its own transition to curb emissions, specific to its technology and economics.
2. To achieve much-needed peak-load balancing of electricity demand, manage intermittency and overcome imbalances in renewable energy supply and demand across geographies, cross-border transmission and grid integration must improve substantially. Infrastructure will eventually need to support the hydrogen fuel trade to overcome the constraints of electricity transmission and to allow long-distance energy trade.
3. Moving certain energy-intensive industries to locations with green comparative advantage would be optimal. For example, future steel production could be located where renewable energy is abundant, provided the locations are well-connected through adequate infrastructure.
4. Transport and logistics underpinning GVCs must move toward net zero with the use of renewable energy or biofuels. Green and high-quality infrastructure investments are clearly needed to realize the shifts.
5. International governance around carbon emissions and trade and regulations (including in financial markets) must be continuously improved, and lead firms must play a greater role in decarbonizing production along the supply chain and improving data transparency.

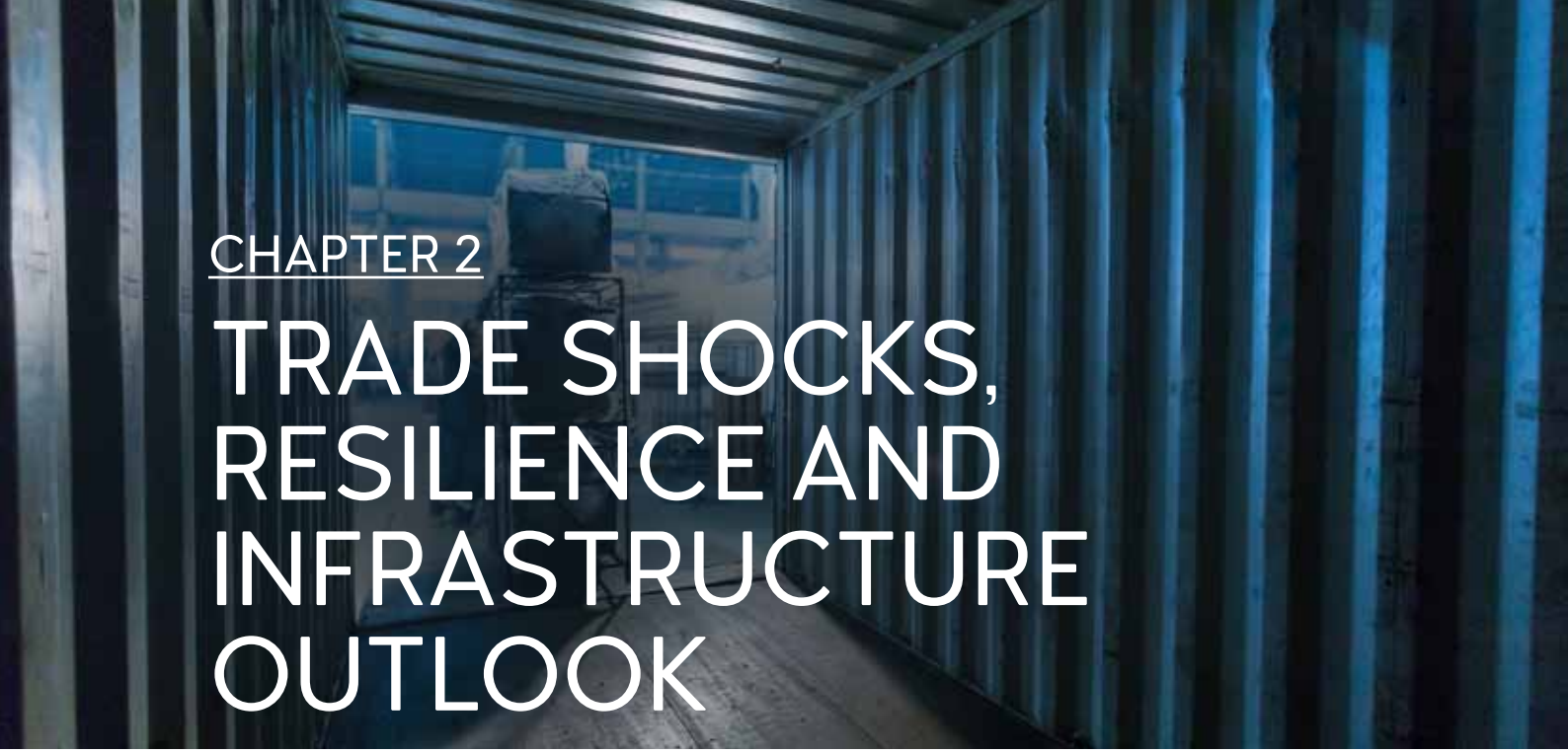
A key feature of GVCs is the presence of lead firms able to exercise governance over geographically dispersed activities across jurisdictions. The firms' ability has helped transform GVCs into today's hyper-efficient production and logistics operations. An important element in the transformation has been the imposition of product and process standards at different stages of the value chain. Corporate governance exercised by lead firms can help sustain GVCs into the future by implementing the net zero transition throughout the value chains they control.

Lead firms have increasingly strong incentives to exercise corporate governance as financial regulators are beginning to assess the exposure of the lead firms' lenders, mainly commercial banks, to climate risks in their lending and investment portfolios. Shareholders and creditors, particularly institutional investors, are becoming more and more attentive to the carbon footprints of their investee companies as pressure from public authorities and civil society organizations increases. Lead firms can become important levers for decarbonization.

Many companies are already decarbonizing, for example, by directly installing solar photovoltaics for their own production, entering into corporate power purchase agreements with renewable energy suppliers or obtaining carbon offsets. Many companies subscribe to principles of Scope 3 emissions, monitoring and disclosing their carbon footprints along the whole supply chain. Investors are beginning to demand that companies disclose much more on their environment, social and governance measures.

1.5 Conclusion

GVCs have generated tremendous benefits for the global economy. Transiting to GVCs that have net zero emissions by the 2050s will be a major endeavor, and no less than the future of global trade is at stake. Countries with public policies that support infrastructure investment, industrial development and net zero transition will improve their competitive advantage and attract GVCs. Infrastructure for tomorrow, invested today, will be key to the evolving development story.



CHAPTER 2

TRADE SHOCKS, RESILIENCE AND INFRASTRUCTURE OUTLOOK

The COVID-19 pandemic has shocked global trade with production disruptions, border closures, record-high uncertainty and hugely volatile consumer demand. Trade and trade infrastructure came under severe strain but ultimately proved resilient in the pandemic's aftermath. The implications for the post-pandemic configuration of value chains and connectivity infrastructure are still being played out.

2.1 International Trade Showed Remarkable Resilience

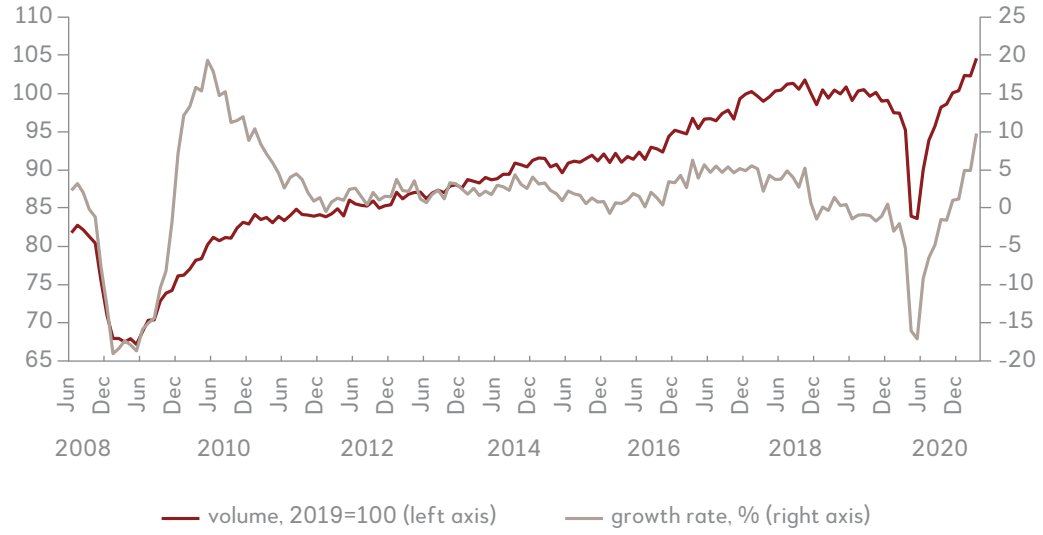
In April 2020, the World Trade Organization (WTO) projected that global trade would contract by as much as 32 percent in 2020 (WTO, 2020). The volume of international merchandise trade plunged by over 15 percent immediately following the announcement of the global pandemic (Figure 1).[3] However, trade flows recovered quickly, and recovery continued despite a resurgence of the virus in the fourth quarter of 2020 and in early 2021. By the end of 2020, global trade volume had exceeded pre-pandemic levels, having increased 1.3 percent year-on-year (5.5 percent in value terms).

Trade of different products was affected differently. About half of the initial collapse in trade can be attributed to intermediate goods, typically traded inside GVCs, which were impacted by the lockdown in China. In subsequent months, however, intermediate goods became the largest contributor to the rebound thanks to the supply networks' resilience.

The value of fuel and mining trade declined sharply because of lower prices and lower demand for travel. Trade in vehicles fell by more than 50 percent in the first quarter of 2020 as supply disruptions halted production lines, while demand fell under lockdown conditions. However, automotive purchases have been recovering since. Trade in agricultural products defied initial food security worries and has performed remarkably well—a testimony to the resilience of food value chains, automation in agriculture and successful prioritization. Among product lines, trade in medical goods, particularly personal protective equipment, and in computers and other information and communication technology (ICT) equipment, increased, reflecting the need for medical supplies and digital connectivity during the pandemic (Figure 2).

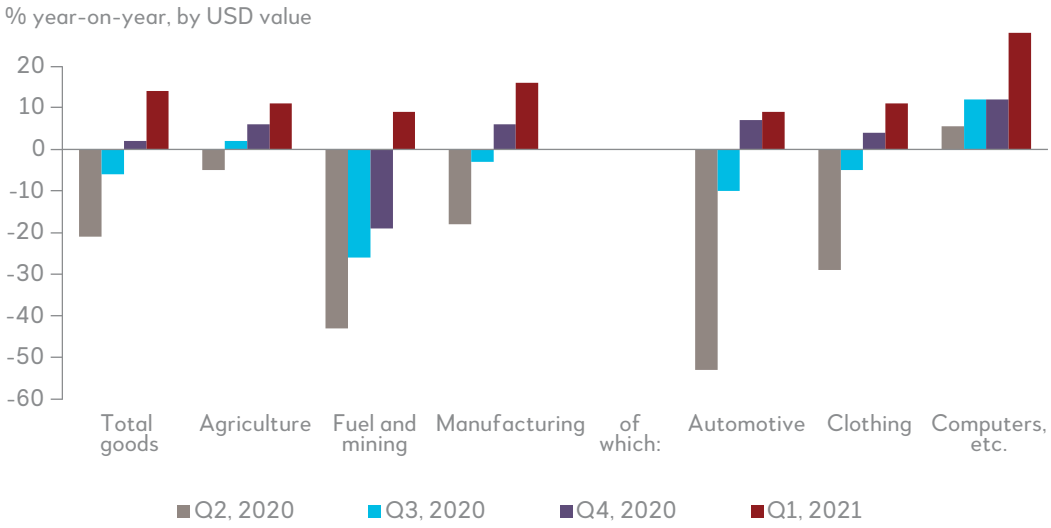
[3] Data for this section come from World Bank (2021), CPB World Trade Monitor (2021) and WTO (2021a,b,c).

Figure 1: Volume of World Merchandise Trade



Data source: CPB World Trade Monitor (2021).

Figure 2: World Merchandise Trade Growth

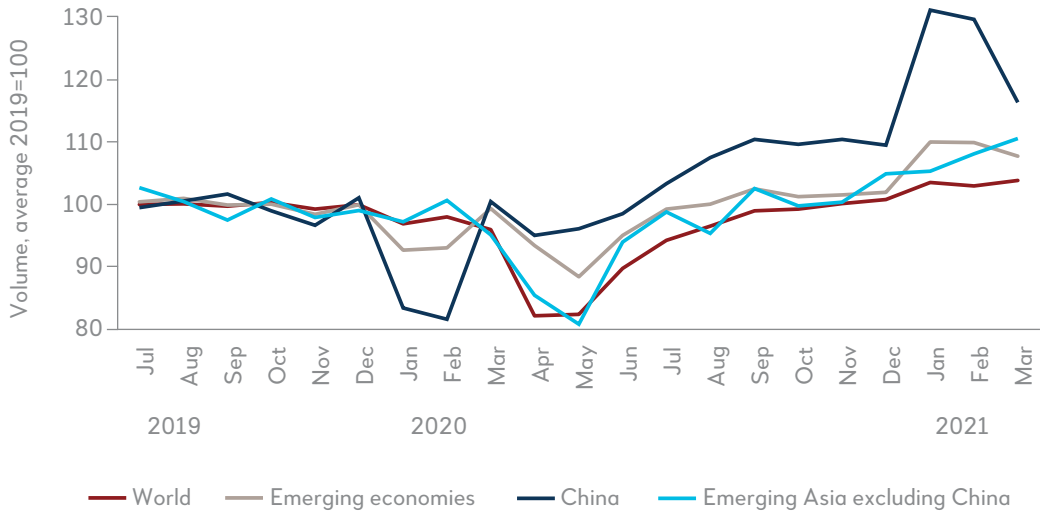


Data source: World Trade Organization (2021a).

China was key to the recovery. Having controlled the pandemic internally, China was well-positioned to close supply chain gaps. Exports started recovering in March 2020 and by the end of the year were up more than 10 percent year-on-year and continued performing strongly into 2021. Export recovery in the Association of Southeast Asian Nations (ASEAN) and other Asian emerging economies was also robust (Figure 3).[4] By the end of 2020, all regions were on a path to recovery from low levels, with Latin America somewhat lagging.

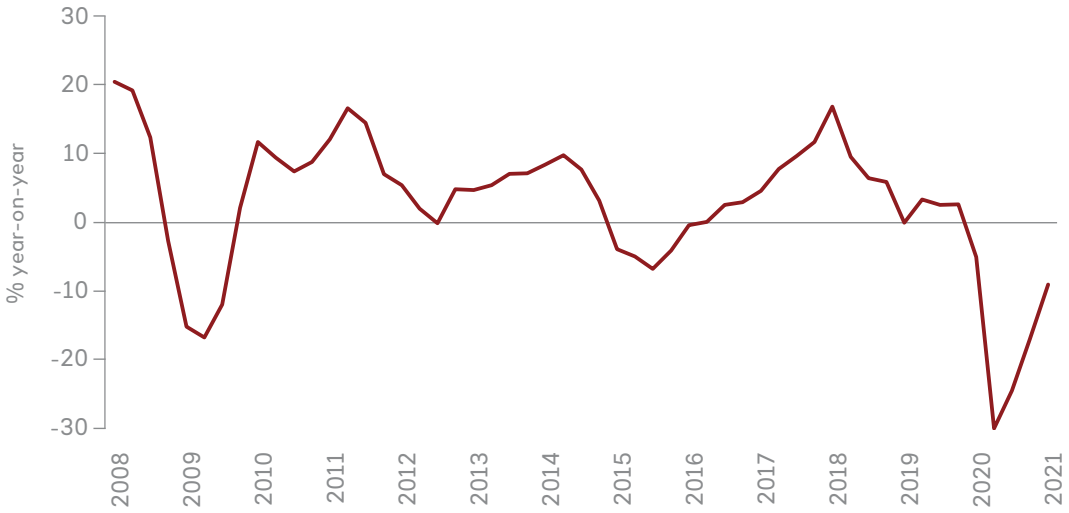
[4] In some Asian countries where the textile and clothing sector has been an important driver, cancellations and postponement of orders led initially to a 50 percent or more decline in exports (World Bank, 2021). Fortunately, demand for apparel started to recover relatively quickly.

Figure 3: Merchandise Export by Region



Data source: CPB World Trade Monitor (2021).

Figure 4: Growth of Trade in Services

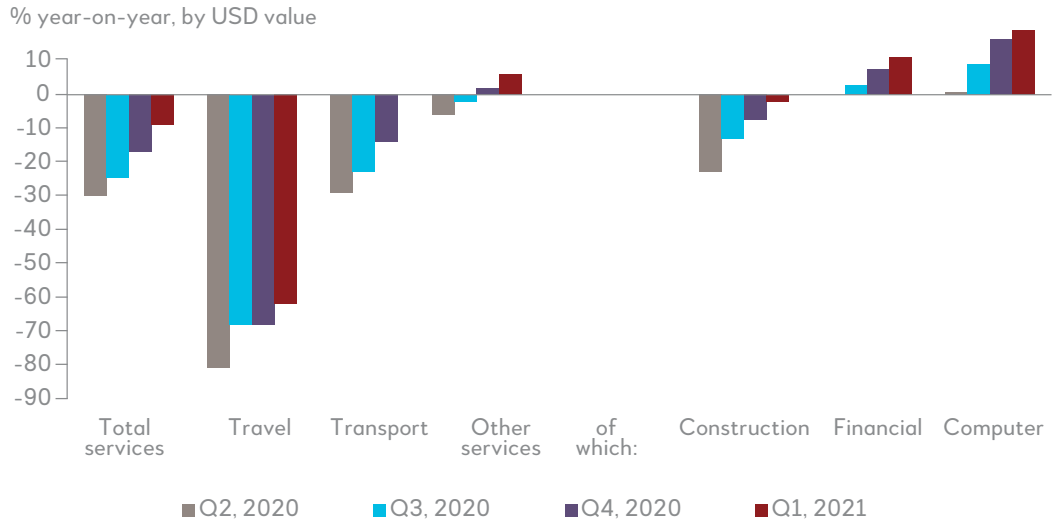


Data source: World Trade Organization (2021b, c).

Unlike merchandise, trade in services has recovered more slowly. Starting in April 2020, global trade in services declined sharply, by 30 percent, and at the end of 2020 it was still 17 percent lower than in the previous year (Figure 4). Unsurprisingly, services that require physical presence or face-to-face interaction to deliver, notably travel, transport and construction, were affected the most.

Travel has been impacted by border closures, with a sharp drop of about 80 percent (Figure 5). Business travel was replaced by teleconferencing, while international tourism practically disappeared. In March 2021, international tourist arrivals were still about 85 percent lower than pre-pandemic levels (World Tourism Dashboard, 2021). Asia has seen the largest decline, at 95 percent, because of strict policies and the highest percentage of border closures. Even in Europe, however, where most borders quickly reopened, tourism has not resumed in any meaningful way. As of mid-2021, travel remained depressed amid hesitant border reopening, uneven vaccine rollout and new outbreaks.

Figure 5: Growth of Trade in Services by Sector



Data source: World Trade Organization (2021b, c).

Trade in transport services also declined sharply, by about 30 percent. International passenger transport has suffered the most, while freight has recovered quickly, in parallel with the resurgence of merchandise trade. Construction services declined by about 25 percent because of difficulties getting local or foreign workers back on sites.

Conversely, trade in services that do not require physical interaction held on well. "Other services" (excluding transport, travel and the like) declined initially by less than 10 percent and, by the third quarter of 2020, had virtually recovered to pre-pandemic levels. Insurance, financial services, intellectual property payments, telecommunications and ICT have barely recorded any decline. They are often supplied remotely, may require little interaction and can be delivered in a "work-from-home" mode.

Robust performance of international trade derived from the underlying resilience of demand and supply. Global demand has been supported by swift and sizeable fiscal and monetary responses, particularly in advanced economies. Discretionary stimulus put in place in 2020 came to almost USD14 trillion globally in lifeline support to households and businesses. Resilient disposable incomes allowed consumption to continue and supported trade as soon as countries started to ease restrictions from mid-2020. On the supply side, the pandemic stressed but did not damage manufacturing capacity. Instrumental in this resilience was China's and other Asian manufacturing hubs' success in sufficiently containing the virus so that factories could reopen quickly and plug back into GVCs. For example, by March 2020, China's industrial production was already back to 2019 levels. Elsewhere, factories remained open, in principle and at least partially, so global manufacturing supply started to recover from June 2020.

2.2 Trade Infrastructure Was Severely Strained but Resilient and Adaptive

Shipping lines, ports, air cargo, rail and other logistics and trade infrastructure came under severe strain during the pandemic.

First, lockdowns threatened the very functioning of logistics lines. Stoppages at facilities and workers on quarantine crippled operations. In response, countries designated logistics as a key sector exempted from some COVID-19–related restrictions, stepped up interagency coordination or simplified customs processes, particularly for essential and emergency goods. Many players accelerated the adoption of digital technologies (UNCTAD, 2020b). Logistics operators contributed by adapting to the new situation, including sanitary restrictions. These measures helped keep trade flowing.

Second, pent-up demand was released after the initial lockdowns eased in mid-2020. Supported by trillions of dollars in government stimulus, consumers in developed countries, unable to spend on services such as vacations or entertainment, turned to e-commerce to buy goods.[5] Businesses added their share by restocking vigorously, having depleted inventories during the early pandemic lockdowns, which led to a surge in demand for manufactured goods, particularly from Asia, and then to a scramble for shipping capacity.

The bust and the subsequent boom, amid continuing intermittent capacity closures, have led to historically high imbalances and bottlenecks in multiple parts of the system. Disruptions cascaded down the value chains and logistics lines, throwing the normally fine-tuned system off balance.

2.2.1 Maritime and Port Infrastructure

Uninterrupted port operation and shipping are instrumental in keeping world trade flowing. A COVID-19 outbreak at a port can take the facility down, with a knock-on effect on the whole network. Maritime infrastructure quickly came under strain. COVID-19 meant lockdowns and acute labor shortages, leading to congestion and backlogs. Cargo remained uncollected or undelivered and ships needed to skip ports.[6] Toward the end of 2020, the surge in demand made matters worse. For example, during the pre-Christmas rush, demand for cargo capacity had grown so much and supply had been stretched so thin that container ships were laden to the brink.[7] Even then, vessels had to sit for several days anchored off the West Coast of the United States (US), unable to unload cargo because of port congestion.

Unexpected container imbalances at various locations became a major bottleneck. Demand for containers in exporting countries of Asia had grown faster than the return of empty containers from importing countries in Europe and North America. The containers' return was delayed by lockdowns in the destination countries, logjams in distribution centers and shortage of drivers or port workers. Lack of empty containers meant that goods could not be shipped.

For a system used to running on schedule, the bottlenecks meant havoc and long delays. Shipping reliability, as measured by the share of vessels arriving at their destination on time, declined from 75 percent in mid-2020 to below 40 percent in the first half of 2021—equivalent to as much as 8-12 percent of global container shipping capacity lost to vessel delays (Sea-Intelligence, 2021a,b). Advance time to book shipping and delivery times have increased to record levels.

Predictably, the demand surge amid supply constraints has led to steep price hikes. At the turn of 2021, the average price globally to ship a 40-foot container was about USD4,500—triple the normal level (Figure 6). Further to that, prices in 2021 doubled by midyear, to above USD9,000.[8] To outside observers, however, the maritime and port sector appeared resilient. According to the World Bank (2021), deployed container ship capacity began to recover in May 2020 and exceeded pre-pandemic levels by mid-summer (Figure 7). Port operators gradually adapted to the new situation. Despite sanitary and other operational constraints, vessel turnaround times inside ports do not seem to have increased significantly (World Bank 2021).

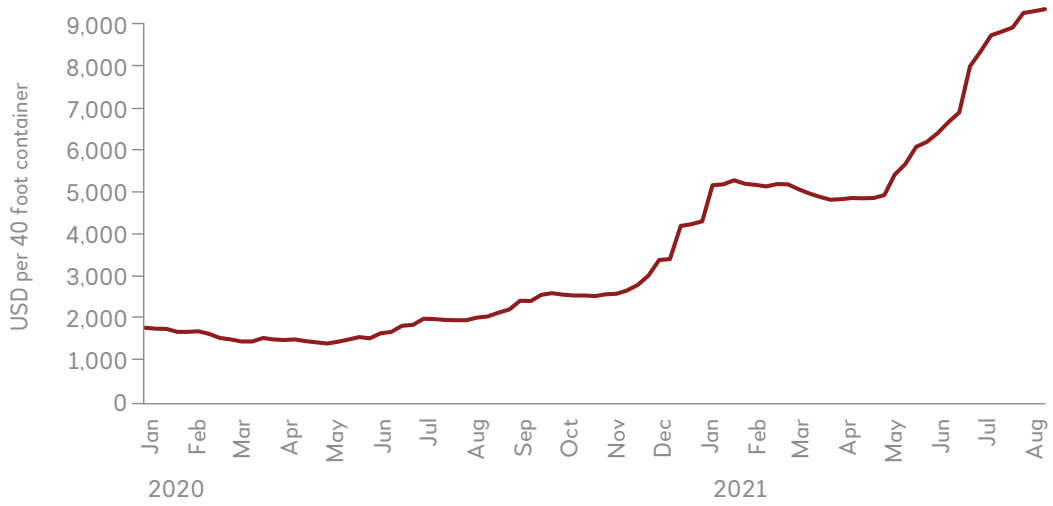
[5] According to the United States (US) Census Bureau, e-commerce sales in the US grew by more than 30 percent in 2020.

[6] Some 100,000 twenty-foot equivalent units (TEUs) remained uncollected from container freight stations near Jawaharlal Nehru port at the end of April 2020, and about 50,000 TEUs remained uncleared at Chennai port (UNCTAD, 2020a). In June 2021, after a month-long outbreak in the port of Yantian, some 160,000 containers were waiting to be picked up (Wall Street Journal, 2021b).

[7] As a likely side effect, in just the two months at the turn of 2021, some 3,000 containers were reportedly lost at sea in rough weather as ships were rushing to transport their loads, compared with the annual average of 1,382 containers (Wall Street Journal, 2021a).

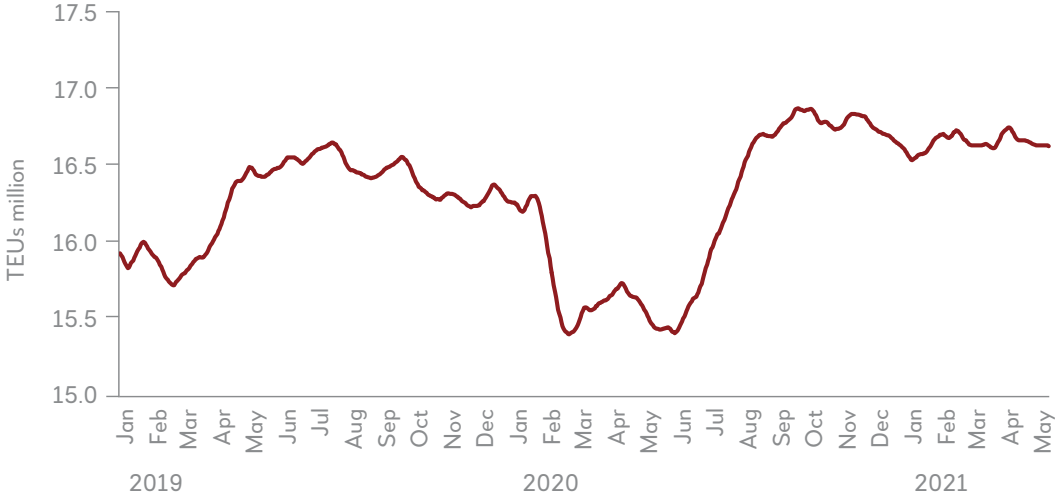
[8] These prices apply on the margin to last-minute shipping orders. Most customers have longer-term agreements and pay much lower average prices.

Figure 6: World Container Index



Data source: Drewry World Container Index.

Figure 7: Global Trade Carrying Capacity



TEU = twenty-foot equivalent unit.

Data source: World Bank (2021).

By the fourth quarter of 2020, global port turnover, as measured by container throughput, reached then exceeded previous years' levels (Figure 8), with maritime routes in East Asia and North America posting the fastest recovery. Neither did the pandemic result in any significant loss of global shipping connectivity. The average number of connections from an average port to other ports (as measured by the number of origin-destination pairs in the shipping networks) declined by less than 10 percent by May 2020, compared with 2019 levels (World Bank, 2021). Global trade kept flowing.

2.2.2 Airborne Trade

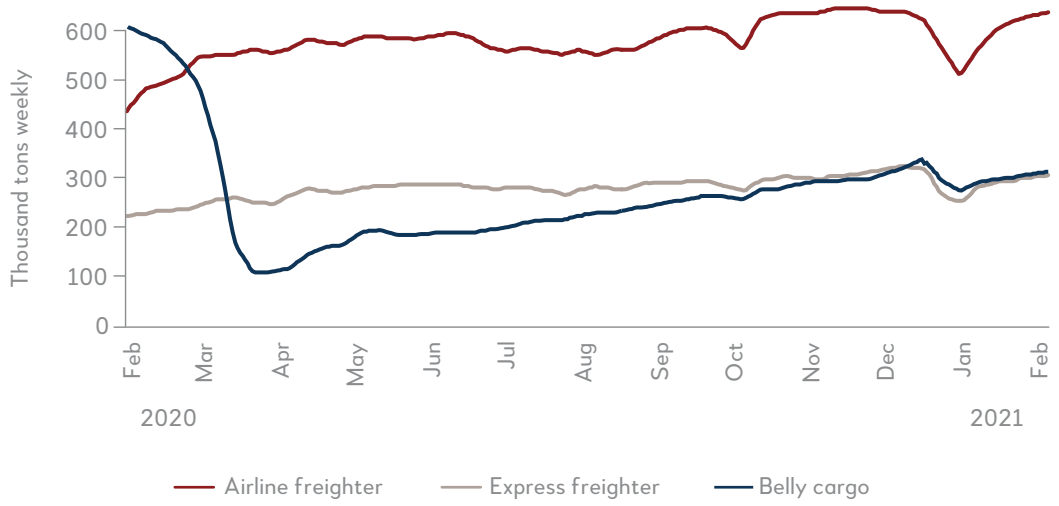
COVID-19 presented a major challenge to the air cargo industry. Although carrying only a fraction of the tonnage that maritime shipping does, air cargo is an important segment of the GVC infrastructure as it transports goods that are critical, high value or time sensitive. Almost 90 percent of air cargo is international. With border closures, the collapse in international travel and the grounding of the global fleet of passenger aircrafts, the industry lost about half its capacity almost instantly (Figure 9).[9]

[9] One reason is that some 60 percent of all air cargo is normally carried in cargo holds of passenger planes, the so-called "belly cargo."

Figure 8: Global Container Port Throughput Index

Data source: Drewry Global Container Port Throughput Index.

Figure 9: International Air Cargo Capacity

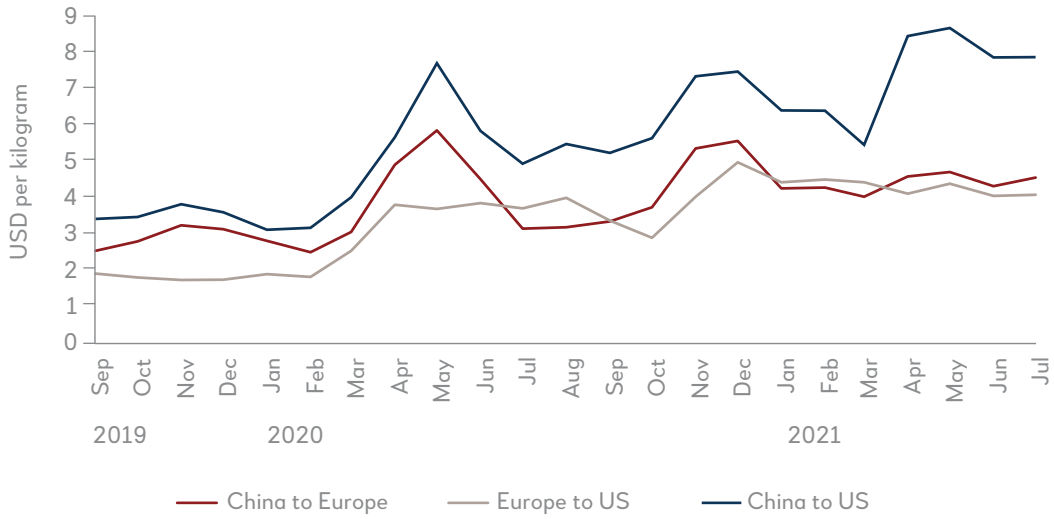


Data source: Accenture (2021).

At the same time, demand did not decline to the same extent because of the need to transport large amounts of personal protective equipment, increasing demand for electronic products or the diversion of some critical industrial components from sea to air. Operators have been responding dynamically to the challenge, trying to restore capacity by adding dedicated freighter planes, extending aircraft utilization rates and repurposing passenger aircraft to carry cargo (The Loadstar, 2020). Airlines were loading more goods on planes: the load factor on international routes at the end of 2020 was 65.3 percent, a 12.3 percentage point increase year-on-year.[10] Despite these efforts, demand exceeded supply and prices have soared, particularly for goods from China going to the US. Air cargo prices peaked at several times normal levels and remained elevated as of mid-2021 (Figure 10).

[10] Given significant trade imbalances on many routes and seasonality, average load factors above 60-70 percent may indicate that aircrafts are reaching their maximum load on one of the legs, depending on the route.

Figure 10: Air Freight Prices



US = United States, USD = United States dollar.

Data source: Aircargo News Baltic Exchange Air Freight Index.

Despite perturbances, air cargo performance has been robust. By the end of 2020, international air cargo had virtually recovered and, by April 2021, the volume of cargo transported, measured by cargo tonne-kilometers, was some 12 percent higher than in 2019, despite significant reduction in capacity (IATA, 2021a). Given the midyear dip, the growth rate for the whole of 2020 was minus 11.8 percent. The recovery has been led by trade routes out of Asia, driven by booming demand in the US and Europe for manufactured goods. However, all regions have either already recovered or almost recovered, except for Latin America, which has been lagging (minus 20 percent growth in 2020 and continued weakness in 2021).

2.2.3 Rail and Other Infrastructure

High rates for ocean freight, capacity constraints, bottlenecks at ports and long delays have sent shippers scrambling for alternative modes of transportation, particularly rail. A record 12,400 freight trains were operated from China to Europe during 2020, 50 percent more than dispatched in 2019. The trains moved some 1.1 million twenty-foot equivalent units (TEUs), an increase of 56 percent year-on-year. The high double-digit growth continues into 2021 (Xinhua, 2021a,b). Problems experienced in sea and air transport cascaded into rail; prices doubled toward the end of 2020 and have stayed high into 2021. Container shortages became an increasingly binding constraint, while congestion and delays have been plaguing major hubs (JOC, 2021; JOC, 2020; The Loadstar, 2021). With emerging capacity constraints on rail, demand for road transport from China to Europe has also increased.

2.3 Outlook and Infrastructure Remain Uncertain

Well into the second year of the pandemic, the stresses on logistics lines, supply chains and trade infrastructure continue. The situation may be temporary and the system, given its demonstrated capacity to adapt, may soon return to something resembling normalcy. The potential for recurring COVID-19 outbreaks, however, poses a great risk in the near and medium term. With uneven vaccine rollout, new variants and the prospect of COVID-19 becoming endemic, such risk is substantial, and parametric changes to the system may not be sufficient to mitigate it. In other words, it may now be less prudent than previously for a trader or a producer to assume they will—as reliably as before—be able to get hold of required goods or inputs sourced from faraway.

These challenges add to a host of other preexisting problems, among them trade tensions and creeping protectionism. Even before the pandemic, they had led to the escalation of tariffs, antagonistic rhetoric between major global trade partners and calls for reshoring or diversification of supply chains. All are worrying because trade restrictions are amplified along GVCs as products must cross borders multiple times, leading to large inefficiencies (Blanchard, 2019). Many harmful trade measures were imposed at the beginning of the pandemic, notably on critical medical supplies, food and later, vaccines. Fortunately, many of the measures were rolled back as countries exercised a degree of self-restraint, which has prevented worse outcomes (WTO, 2021d). Still, many issues have hibernated rather than been resolved.

The uncertainty over the configuration of post-pandemic global supply chains is, therefore, considerable and could not only have major ramifications on trade infrastructure but also give rise to opportunities for developing economies in the post-crisis world. For example, onshoring of activities back to developed economies could lead to less trade between the North and the South, and, therefore, less demand for connectivity infrastructure. Opportunities for developing economies could, therefore, be reduced (Faber, 2020). However, diversification could involve relocation of manufacturing into more countries, increasing regional trade and boosting participation in GVCs, thus presenting opportunities for all.

Not surprisingly, recent evidence confirms that investors are taking a wait-and-see approach. Closed financing volume for infrastructure projects declined in 2020, with projects cancelled or delayed to 2021. Out of the large construction projects tracked, some 2,000 were cancelled in Asia, double the number in 2019.[11] Half were in roads and power infrastructure. Cancellations increased by as much as USD200 billion, which is not surprising given that infrastructure operators have been hit by lower-than-expected demand. Some sectors have been affected more than others, particularly aviation, where prospects for fast and decisive recovery are highly uncertain, impacting airport projects (Box A).

Looking at emerging and developing economies, greenfield announcements fell by almost half, and new announced international project finance deals, which are often associated with investment in infrastructure, fell by 14 percent (UNCTAD, 2021b).[12]

[11] Asian Infrastructure Investment Bank (AIIB) staff calculations based on the Global Data database.

[12] This is consistent with the World Bank foreign direct investment pulse survey (World Bank, 2020c), administered among local affiliates of multinational enterprises (MNEs) in the fourth quarter of 2020. The results suggested that MNEs were delaying, scaling back or cancelling investment plans. About half the affiliates surveyed reported that COVID-19 adversely impacted investment.

Box A: Airport and Aviation Are Facing Difficulties. Can the Industry Recover?

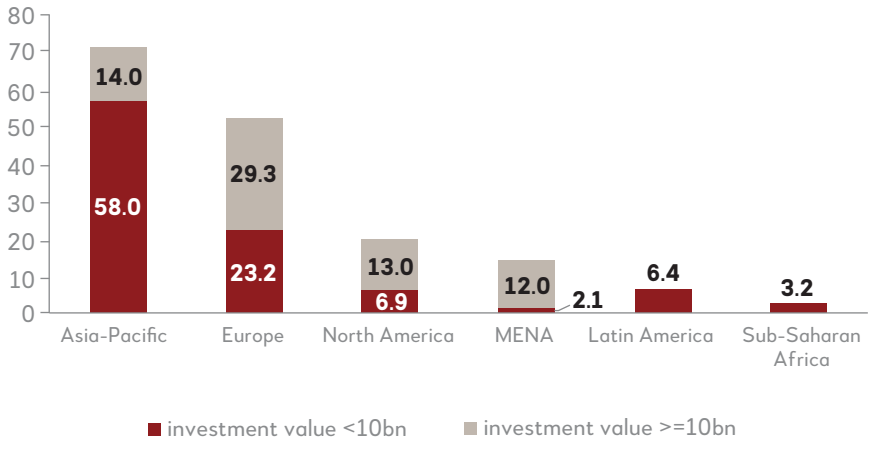
The aviation industry plays a critical role in spurring economic growth. The industry (including airport operators, airlines, airport-based positions and the civil aerospace industry) supports 87.7 million jobs around the world. Aviation is the backbone of tourism, which generates more than 10 percent of the world's gross domestic product and creates one in 10 jobs worldwide. Aviation enables not only the mobility of goods, capital and people but also ideas and technology.

The passenger airline industry has most significantly been affected by the coronavirus disease (COVID-19) pandemic. Some airlines slumped to the biggest losses in their history. Revenue passenger-kilometers fell by 69.7 percent year-on-year worldwide in 2020, by far the sharpest decline on record (IATA, 2021b).

Airports are, therefore, the hardest-hit infrastructure segment and are expected to take many years to recover. Extension of travel restrictions and lockdowns and new consumer habits developed during the pandemic are likely to prolong the downturn and delay recovery. Governments around the world have provided immediate support to mitigate the impacts of the COVID-19 crisis.

Investors face difficulties obtaining funding for airport infrastructure projects. More than USD15 billion worth of investment is at risk of delay. The crisis has impacted existing investment projects. While some airport infrastructure projects are scheduled to continue, others will inevitably be delayed for years. As of March 2021, the sum of announced airport infrastructure projects exceeded USD168 billion globally. The projects are all around the world, but primarily in Asia and Europe (Figure A.1). Of 145 announced projects, 13, worth about USD15 billion and accounting for around 10 percent of total airport investment, are in countries whose ratings are below investment grade.

Figure A.1: Announced Airport Infrastructure Projects by Region (USD billion)



Note: "Announced" means at "financing" or "prefinancing" stage.

AIIB = Asian Infrastructure Investment Bank, MENA = Middle East and North Africa.

Data source: IJGlobal with AIIB staff calculations.

Airports' credit quality tends to be significantly more resilient than airlines' but is still fragile. As airports have more diverse revenue streams and some benefit from the domestic travel market, they have been cushioned from the plunge in numbers of international passengers. Nevertheless, the world's biggest airports could face downgrades should international traffic fail to recover in a meaningful way.

Despite a sharp decline in global demand and travel restrictions, mega airport infrastructure projects are still in the pipeline. Many governments have already spent millions in bailout packages to stimulate the economy. In challenging times like these, it is not easy to access finance for the projects. However, with continued government support and low interest rates, there will be attractive opportunities to support selected airport assets for long-term recovery.

CHAPTER 3

PARTICIPATION IN GLOBAL VALUE CHAINS AND INFRASTRUCTURE DEVELOPMENT

While advanced economies have traditionally dominated GVC exports, developing countries, led by China, have been capturing a bigger share over the last two decades. Greater participation in GVCs has the potential to play a pivotal role in the development paradigm of countries by providing them access to better skills, improved technology and a bigger market. The extent to which a country can benefit from participation in GVCs depends critically on its ability to move to higher value-added tasks within the value chain. There is no one-size-fits-all model for upgrading, and evidence suggests that countries have approached it in diverse ways. Notwithstanding the path of upgrading, infrastructure is decisive in increasing GVC participation, although infrastructure requirements will depend on the sector and value chain activity. This chapter highlights the close nexus between infrastructure development and participation in GVCs and the potential of both to rejuvenate economic development through trade.

3.1 Expansion of GVC Participation Slowed Down across Most Economies

The expansion of GVC participation has slowed down since the global financial crisis in most countries (Figure 11), although measures differ, and data are still incomplete.

Participation in GVCs can be characterized as follows:

1. Producing and exporting intermediate goods that meet domestic demand of trade partners, which is captured by domestic value added (DVA) of exports;[13]
2. Producing and exporting intermediate goods that are then further embedded in exports of trade partners, which are captured by indirect value added (DVX), also known as forward linkages and
3. Importing intermediate goods, then embedding them into exports, which are captured by foreign value added (FVA), also known as backward linkages.

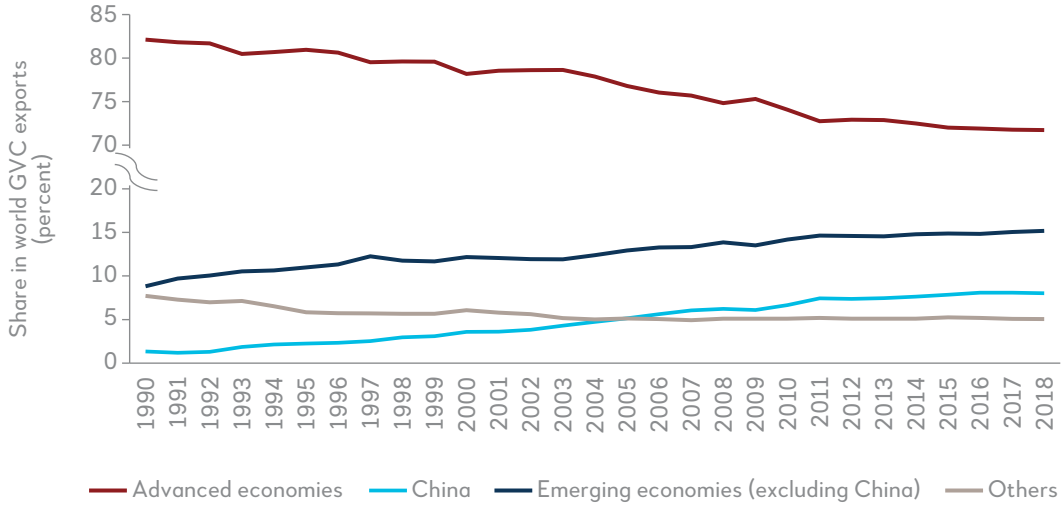
[13] Some economists consider GVC participation to occur only when intermediates cross borders more than once, underscoring the chain nature of production. DVA, therefore, is sometimes excluded from the definition. But the wider definition of GVC participation includes DVA of intermediates, even if they cross the border only once. Although definitions and, hence, statistics might differ, there is some consensus that the growth of GVC participation has slowed down since 2011.

Figure 11: Global Value Chain Participation Rate

AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Eora database and AIIB staff calculations. The GVC participation rate is the sum of foreign value-added embedded in exports and domestic value add embedded in exports of another economy as a ratio of total exports. This will be elaborated in subsequent chapters.

Figure 12: Shifting Patterns of Global Value Chain Exports

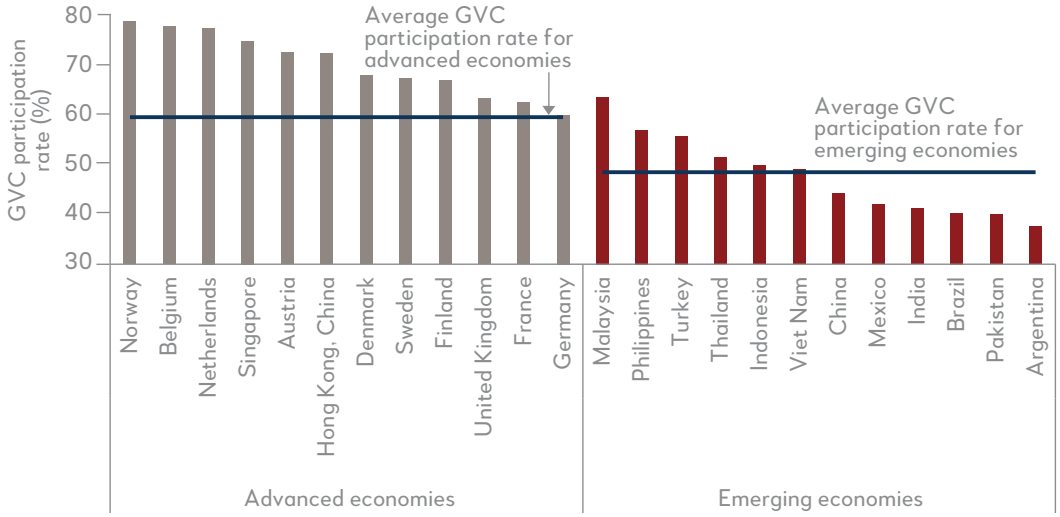


AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Eora database and AIIB staff calculations.

In 2018, advanced economies accounted for about 72 percent of GVC exports, slightly down from 78 percent in 2000 (Figure 12) but still higher than their proportionate share of global GDP (60 percent) or exports (64 percent). Although emerging economies' share in GVC exports increased from 14.6 percent in 2000 to 21.0 percent in 2018, much of it was driven by China, whose share more than doubled from 3.6 percent to 8.0 percent. Many developing economies continue to see relatively low participation in GVCs (Figure 13).

Figure 13: Global Value Chain Participation of Select Economies, 2018



AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Eora database and AIIB staff calculations.

3.2 Different Strategies Are Possible for GVC Participation and Economic Growth

Why does the slowdown in the growth of GVC participation matter? While countries differ significantly in GVC growth and innovation experience, the positive impact of GVC participation on development is well-established. A key advantage of a GVC is that it allows developing economies to insert themselves into parts of the value chain (e.g., car parts), as opposed to the whole, thereby offering more realistic pathways to development, benefiting domestic firms and workers.

Estimates show that a 1 percent increase in GVC participation boosts per capita income by more than 1 percent (World Bank, 2020d) or more than five times the equivalent gain from increasing participation in standard trade. The growth benefits are most dramatically felt when countries link to GVCs, transitioning from exporting commodities to exporting basic intermediate goods and services. There is no unique one-size-fits-all strategy and economies adopt different strategies (Table 1). While GVC participation matters considerably for growth, it goes beyond simple engagement. For GVCs to drive development, countries must be able to capture the gains through new, progressively more sophisticated types of participation and upgrading.

Take, for instance, upstream or downstream positioning. An intuitive way of looking at it involves determining whether a country supplies more intermediates to others or uses more intermediates from others (Koopman, Wang, and Wei, 2014).[14] Economies are considered more upstream if their intermediates are used intensively in partner countries' exports (Aslam, Novta, and Rodrigues-Bastos, 2017). Regardless of where a country or region sits in terms of backward or forward integration, there will be growth opportunities.

Over the last two decades, there has been some repositioning of countries in GVCs. The advanced economies have moved downstream during this period, while emerging economies, led by China, have moved upstream (Figure 14). In China, upgrading coincided with moving upstream and relying on fewer imported intermediates (Kee and Tang, 2016). However, it has not always been the case in other countries and should not necessarily be the target.

[14] Upstreamness of an economy is calculated as $\ln\left(1+\frac{DVX}{Gross\ Exports}\right) - \ln\left(1+\frac{FVA}{Gross\ Exports}\right)$, (Koopman, Wang, and Wei, 2014). Note that this differs from measures of sector upstreamness, (Antràs, Chor, Fally, and Hillberry, 2012).

Table 1: Different Models of Global Value Chain Participation and Economic Growth: Some Stylized Facts

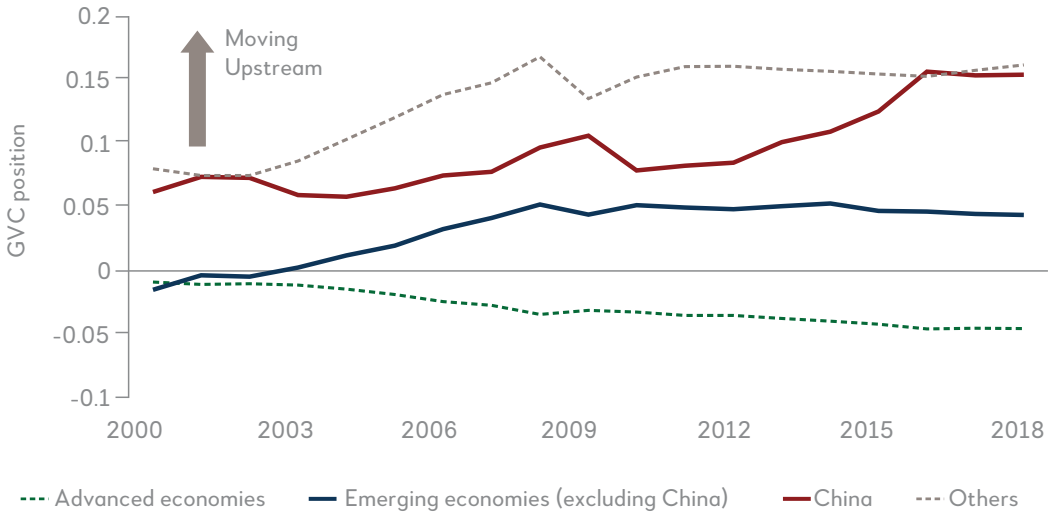
Country	GVC Position	Productivity	Innovation	Role of Foreign Subsidiaries in Trade	Sourcing Structure of Foreign Affiliates
China	Balanced	Medium	High	High	Domestic firms
India	Balanced	Low	Low	Low	Abroad
Philippines	Balanced	Low	Low	High	Abroad but within the region
Hong Kong, China	High backward linkages	High	High	High	Domestic firms
Republic of Korea				Low	
Singapore				High	
Malaysia	High backward linkages	Medium	Low	High	Abroad but within the region
Thailand		Low			
Viet Nam					
Indonesia	High(er) forward linkages	Medium low	Low	Medium	Abroad
Brunei Darussalam	High forward linkages	Mixed-high for natural resources	Low/Medium for Russia	Low	Diversified
Kazakhstan					
Russia					
Saudi Arabia					

GVC = global value chain, OECD = Organisation for Economic Co-operation and Development, PCT = Patent Cooperation Treaty, US = United States, WIPO = World Intellectual Property Organization.

Notes: GVC position is based on (a) share of foreign value-added in total exports (backward linkages) and (b) domestic value-added embodied in exports of intermediates that are reexported to third countries, expressed as a ratio of gross exports (forward linkages). No data on foreign affiliates' activities are available for Brunei Darussalam and Kazakhstan.

Sources: OECD Analytical AMNE Database and the inter-country input-output tables for the role of foreign subsidiaries and their sourcing structure, which are based on the percentage of exports and imports in manufacturing industries accounted for by foreign affiliates and on the percentage of intermediate inputs in manufacturing industries sourced by foreign affiliates subdivided by geography. OECD (2015) for both indicators. World Bank National Accounts data for productivity and innovation, based on gross domestic product per capita in current US dollars. WIPO Patent Report: Statistics on Worldwide Patent Activity for PCT patent applications per capita.

Figure 14: Global Value Chain Position—Upstream or Downstream



AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Note: Covers countries that accounted for more than 1 percent of GVC exports in 2018.

Data source: Eora database and AIIB staff calculations.

Acquiring new capabilities and upgrading them are what matters. In India, the relatively highly integrated semiconductor microchip and pharmaceutical GVCs might see higher value-added potential in functional upgrading (increasing skill content of tasks) by increasing tasks in design or research and development upstream. Opportunities exist, however, for more downstream activities, given India's lower labor costs. India's automobile GVCs might find value added upstream (like Indonesia) or downstream (like Thailand).

Different degrees of participation and positioning in GVCs correlate differently with domestic productivity, innovation and economic growth, depending on how they are translated into domestic upgrading in tasks that workers and firms pursue in the global division of labor (Boffa, Kumritz, Santoni, Taglioni, and Winkler, 2016). The types of infrastructure needed will vary depending on the position, model of integration and type of GVC. A variety of factors shape the link between infrastructure and the capability of countries to participate in or upgrade to higher value-added and more sophisticated GVCs (Kummritz, Taglioni, and Winkler, 2017).

The infrastructure requirement for such upgrading will vary depending on the sector and value chain activity. For example, high value-added preproduction activities such as design, research and development and brand building require infrastructure investment that facilitates face-to-face knowledge exchange in different (likely urban) areas. In contrast, postproduction activities such as after-sales service and marketing, which are also high value-added activities, might require information and communication technology (ICT) infrastructure for engaging with customers and improving logistics. In production, different types of infrastructure development will be appropriate for different stages in different regions. For example, good institutions provide a comparative advantage if an area is in the later stages of the production process. In contrast, the availability of electricity and transport infrastructure is what provides an advantage in the early stages of production.

Participation or positioning in GVCs is not preordained and depends on a wide range of factors, which can be shaped by the right set of policies. The factors include cost and skill of domestic workers; availability of natural resources; foreign investment fostering linkages with parent firms; trade policies comprising tariff rates, trade facilitation and custom procedures; domestic market size and distance from major GVC hubs; infrastructure and logistics performance; and institution quality. The report discusses the overall policy support framework in detail in Chapter 6.

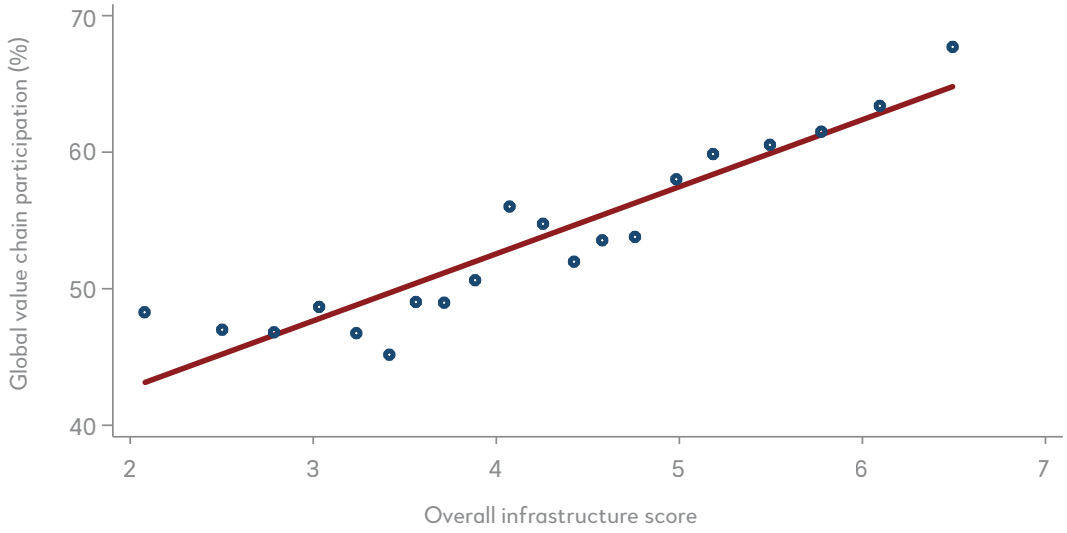
3.3 GVC Participation Is Correlated with Infrastructure Development

A major factor driving geographic fragmentation of the production chain under GVCs is varying production costs across countries, which allow firms to break up the production process and produce each component at the cheapest location. But the quality of power, logistics and transport infrastructure determine whether geographic dispersion is economically feasible. While different types of infrastructure are more important to certain GVC activities, the prevalence of a certain level of aggregate infrastructure matters.

Across countries' cross-sectional data, there is a clear correlation between infrastructure quality and GVC participation (Figure 15). GVC participation seems to take off when countries achieve a minimal standard of infrastructure quality, as suggested by the kink in the diagram (between scores 3 and 4 on the X-axis). The relationship is expected to be mutually reinforcing, i.e., infrastructure improvements are likely to induce better GVC participation of firms by alleviating key structural bottlenecks but, equally possible, in regions with growing GVC participation, infrastructure investments can be productive.

Electricity is key. Poor-quality power disrupts production in various ways and raises its cost, with impact along the whole value chain. Unsurprisingly, there is a strong positive association between quality of power and GVC participation (Figure 16 c). Power outages dissuade firms from entering the export market and reduce the average propensity to export (measured as the ratio of export sales to overall sales), based on evidence from a large sample of firms in the World Bank Enterprise Survey database (Box B). The development of information and communication infrastructure reduces coordination costs while allowing the transfer of product-specific knowledge across economies. Unsurprisingly, countries with better infrastructure have higher GVC participation.

Figure 15: Binscatter Correlation between Infrastructure Quality and Global Value Chain Participation Across Countries



AIIB = Asian Infrastructure Investment Bank.

Data source: Eora database, World Economic Forum, and AIIB staff calculations.

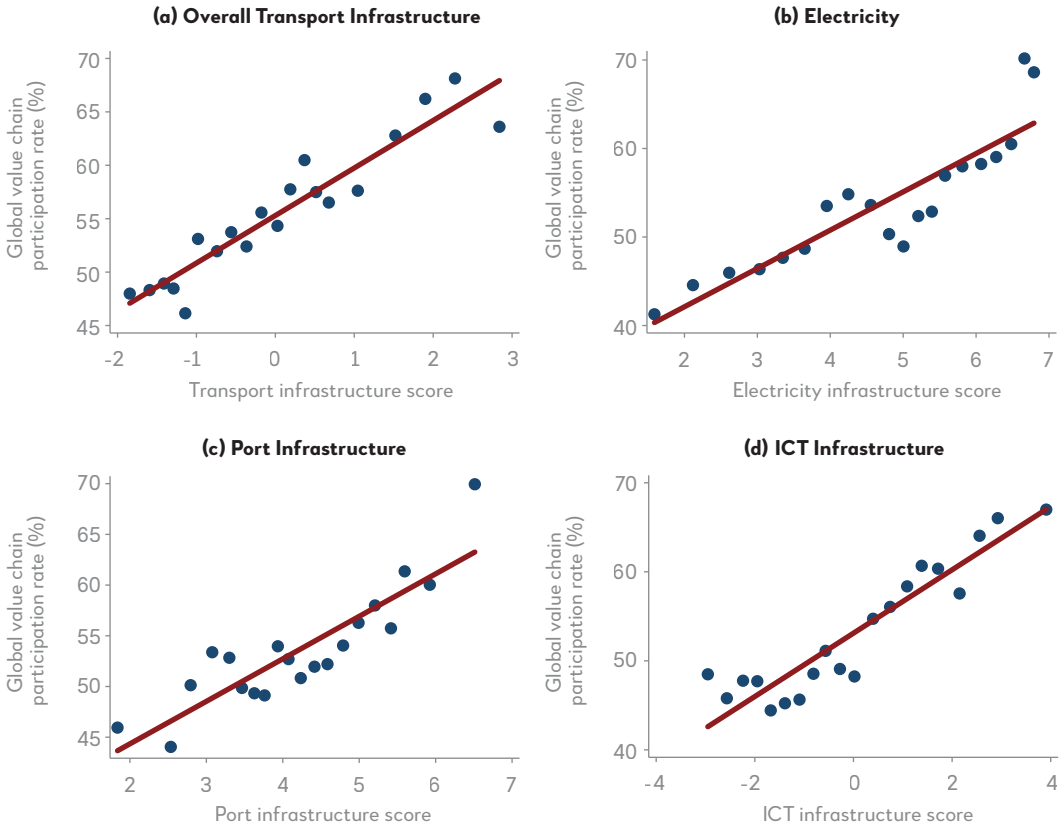
Time and cost overruns because of weak transport infrastructure inhibit a country's participation in GVCs, given the need to move intermediate goods across multiple centers of production in different countries rapidly, reliably and at reasonable cost. Delays caused by infrastructure or bureaucracy raise the cost of integrating into value chains (Lanz and Piermartini, 2018). The close linkage between quality of transport infrastructure and GVC participation is evident from Figure 16 a. With nearly 70 percent, by value, carried by maritime transport, port infrastructure and customs procedures are important to a country's GVC participation (Bottasso, Conti, Porto, Ferrari, and Tei, 2018). A ship's dwell time at a port reflects the amount of time that cargo or ships spend within the port. High dwell time introduces uncertainties in the supply of goods, which impede GVC exports as the manufacturing supply chain is tightly controlled with just-in-time inventory systems.

There is a positive correlation between port infrastructure and GVC participation (Figure 16 c). Improvement in port infrastructure investment across a number of states in Brazil from 2009 to 2012 had a strong impact on trade flows, greater for exports than for imports. Maritime infrastructure investment realized over the sample period is expected to have raised exports by 14 percent and imports by 11 percent (Bottasso, Conti, Porto, Ferrari, and Tei, 2018).

Improving inland road and rail networks allows firms to source domestic inputs required for GVC exports in a timely manner at a reasonable cost. Thus, a well-developed rail and road network eases connectivity between ports and production centers and reduces costs and time overruns (Box C). Poor infrastructure and high transport costs impede participation in GVCs, particularly for downstream industries (Antras and de Gortari, 2020).

In addition to supporting GVC participation, infrastructure plays a vital role in upgrading to more sophisticated products in existing value chains or moving into new supply chains with higher value-added share. Absence of appropriate infrastructure can lead to firms missing out on gains of upgrading, as exemplified by the contrasting experience of Ghana and Cameroon in the cocoa value chain (Kaplinsky and Morris, 2016). In Ghana, the government initiated a strategic industrial policy platform focusing on developing human capital and infrastructure. The lead firms responded by relocating processing facilities and buying activities within Ghana, thereby securing supplies and gaining greater flexibility to meet global manufacturers' specifications. In Cameroon, however, the lack of a supportive policy resulted in the country engaging in thin DVA export of raw cocoa beans.

Figure 16: Binscatter Correlation between Global Value Chain Participation and Various Infrastructure Quality Measures

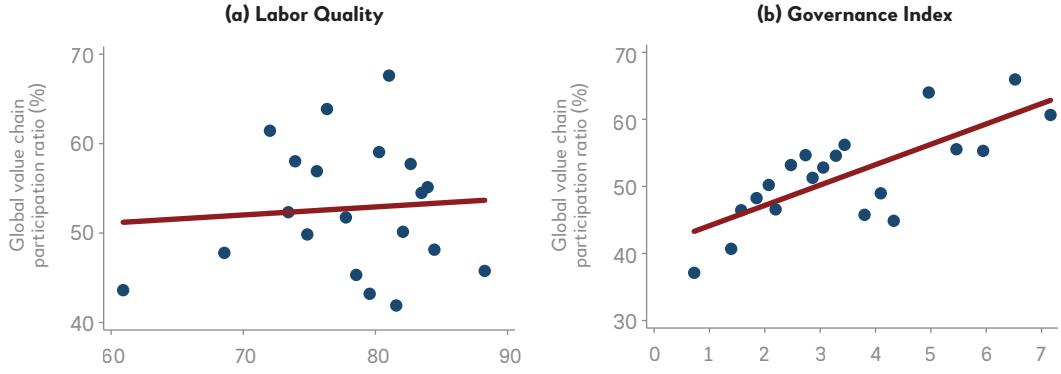


AIIB = Asian Infrastructure Investment Bank, ICT = information and communication technology.

Note: The transport infrastructure index is computed based on the first principal component of the quality of roads and railways, while the ICT infrastructure index is calculated using the first principal component of per capita broadband subscribers, per capita fixed telephone line, international internet bandwidth, per capita mobile broadband subscribers, per capita mobile telephone subscribers and percentage of population using the internet.

Data source: Eora database, World Economic Forum and AIIB staff calculations.

Figure 17: Binscatter Correlation between Global Value Chain Participation and Institutional Quality



AIIB = Asian Infrastructure Investment Bank.

[a] Labor quality is proxied by the percentage of the labor force with an advanced degree. Governance is derived from principal component analysis of governance indicators from the World Economic Forum Global Competitiveness Index.

Data source: Eora database, World Economic Forum, World Bank and AIIB staff calculations.

Another example is the upgrading program in Colombia led by a multinational enterprise, which saw only 40 percent of the regions taking up the opportunity. Those that did enjoyed increased surplus along the value chain, with farmers in the regions reaping half the benefit (Macchiavello and Miquel-Florensa, 2019). The differential impact may be caused by some regions lacking hard infrastructure such as transport to benefit from the program or inhibiting soft infrastructure such as institutions, e.g., engagement with Federación de Cafeteros, a para-statal body in charge of sector policies.

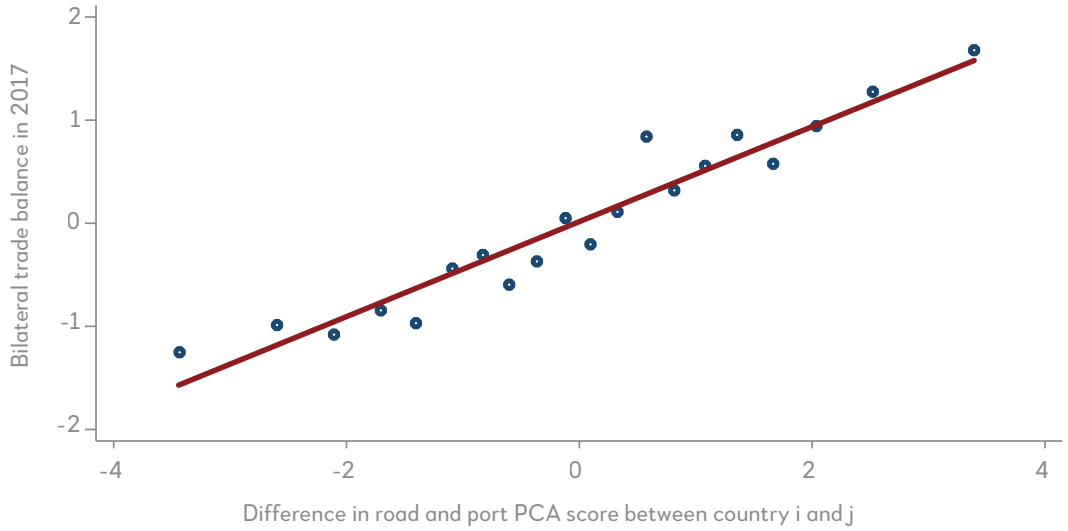
Without a major push to improve connectivity infrastructure (between and within countries, e.g., rural-urban linkages), economies will have difficulty entering GVCs even from the downstream. Analysis by the Asian Infrastructure Investment Bank (AIIB) shows that trade liberalization (Thia and Lopez, 2020), if not accompanied by improvement in infrastructure, could even lead to worse trade outcomes for developing economies (Figure 18).

The quality of transport connectivity is particularly critical for high-technology industries. Using the country-by-country trade flow matrix, it is possible to compute the trade centrality of an economy, i.e., the importance of the economy in the trade network as determined by the size of trade flow through the economy and the size and importance of its connecting trade partners. An economy that has a large trade flow in a sector and is well-connected to other important nodes is deemed more central. For less complex goods, there is no obvious correlation between the centrality of economies and the quality of transport infrastructure. But for complex products, the correlation between trade centrality and transport infrastructure is much higher (Figure 19), highlighting the criticality of transport infrastructure for economies upgrading to more complex products.

3.4 Inadequate ICT Infrastructure Will Become a Major Constraint

The pandemic has made apparent the importance of digital transformation. Digital technology is changing how production shop floors operate. Advanced robotics, artificial intelligence, cloud computing, the Internet of Things (IoT), data capture and analytics and digital fabrication are creating highly automated and optimized production. A similar transformation is taking place in the supply chain (World Bank, 2019).

Figure 18: Bilateral Trade Balance and Infrastructure Quality Difference

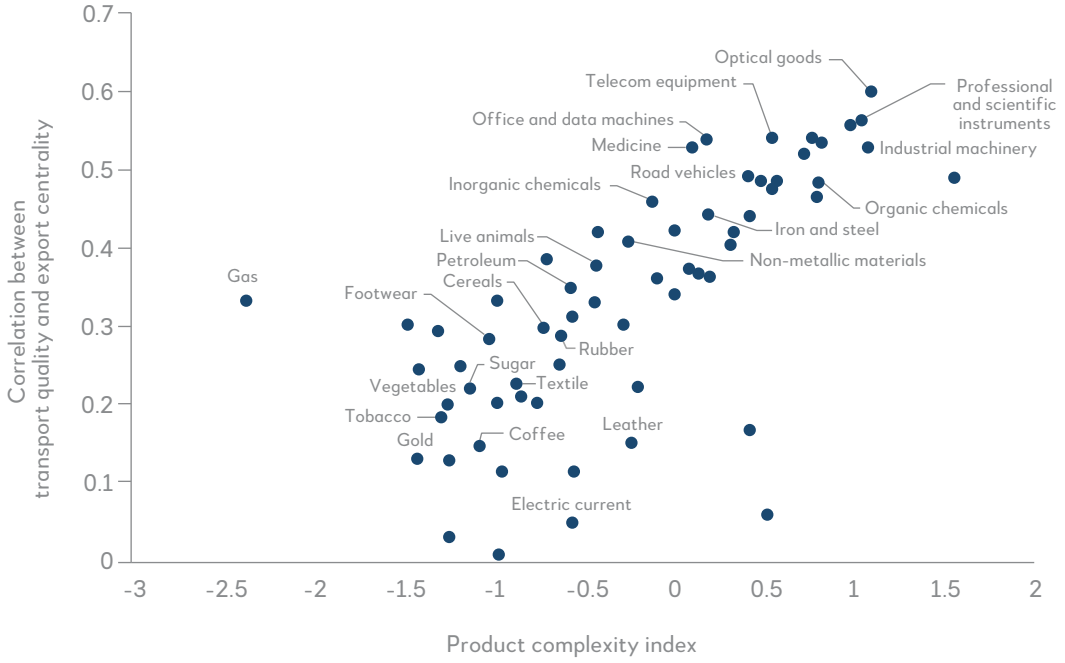


AIIB = Asian Infrastructure Investment Bank, PCA = Principal component analysis.

Note: The figure shows a binscatter plot of bilateral differences in exports (in logs), thereby giving the bilateral trade balance (Y-axis) against the bilateral infrastructure quality difference, which is computed using the principal component road and port infrastructure scores from the World Economic Forum (X-axis). The figure shows that at the country-pair level, bilateral trade balance is positively correlated with a higher infrastructure score.

Data source: Eora database, World Economic Forum, and AIIB staff calculations.

Figure 19: Export Product Complexity and Correlation between Transport Infrastructure and Centrality



AIIB = Asian Infrastructure Investment Bank.

Note: For each product, the cross-country centrality scores (based on eigenvector centrality) are computed and correlated with transport infrastructure quality. The figure presents the summary of the underlying correlations (between centrality scores and infrastructure quality for all the sectors), across products of various complexity.

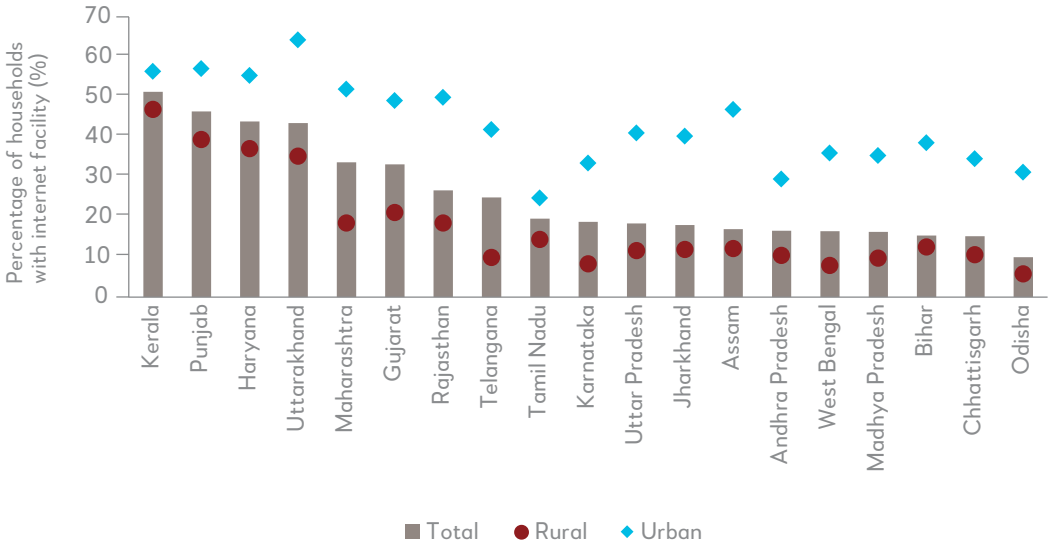
Data sources: World Economic Forum Transport Quality index, Atlas of Economic Complexity Product Complexity Index and AIIB staff calculations of product-level trade centrality.

Technologies such as digital platforms for e-commerce, digital payments, automated document processing and IoT reduce coordination and matching costs, bringing about high levels of logistics efficiency. An analysis covering over 9,000 firms in India shows that digital competence helps firms upgrade to more sophisticated product lines that capture higher value added in GVCs (Banga, 2019).

While the COVID-19 pandemic accelerated digital adoption, it also highlighted large heterogeneity within countries. As more activities move online, billions of people and businesses that lack broadband access to the internet are at risk of being left behind. For example, in the United States, 29 percent of adults with household incomes below USD30,000 a year do not own a smartphone, while 44 percent of adults do not have access to broadband services and 46 percent do not have access to a traditional computer (Anderson and Kumar, 2019). In contrast, the technologies are ubiquitous among adults in households earning more than USD100,000 a year. In Australia, the digital divide is large between the lowest- and highest-income quintile households, between older and younger people, and between those employed and those outside the workforce. The gaps increased from 2014 to 2018 (Barraket, et al., 2018).

Effective ICT is critical for GVC participation (World Bank, 2019). Regional disparities hamper GVC participation and contribute to within-country inequalities. In India, for instance, the proportion of households that can access internet ranges from more than 50 percent in Kerala to less than 10 percent in Odisha (Government of India, 2020a). The divergence between rural and urban populations is large, by more than 30 percentage points in Assam, Maharashtra, Telangana and Rajasthan. Regional disparities are evident, with less than 45 percent of households in regions such as Guba-Khachmaz, Sheki-Zagatala, Yukhary-Garabagh and Ganja-Gazakh having access to fixed broadband internet compared with more than 70 percent in Absheron and Nakhchivan (Asian Development Bank, 2019).

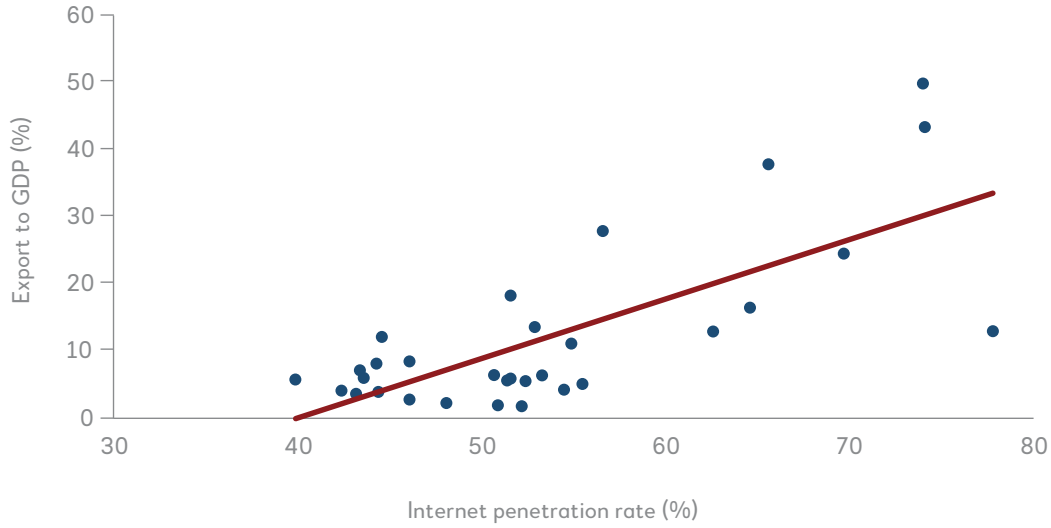
Figure 20: Household Access to Internet Facility across Selected States in India



Note: Total, rural and urban shares are calculated as a percentage of number of households.

Data source: National Statistical Office, India.

Figure 21: Scatter Plot of Internet Penetration and Exports among Cities in China, 2016



GDP = gross domestic product.

Data sources: China Internet Network Information Center, General Administration of Customs, National Bureau of Statistics of China.

Indian states that have better digital connectivity also export more. In the case of 15 states with the highest export volume, those with a higher ICT readiness index score from the State Investment Potential Index 2018, a proxy for digital connectivity, generally have higher exports-to-gross state domestic product ratios.[15]

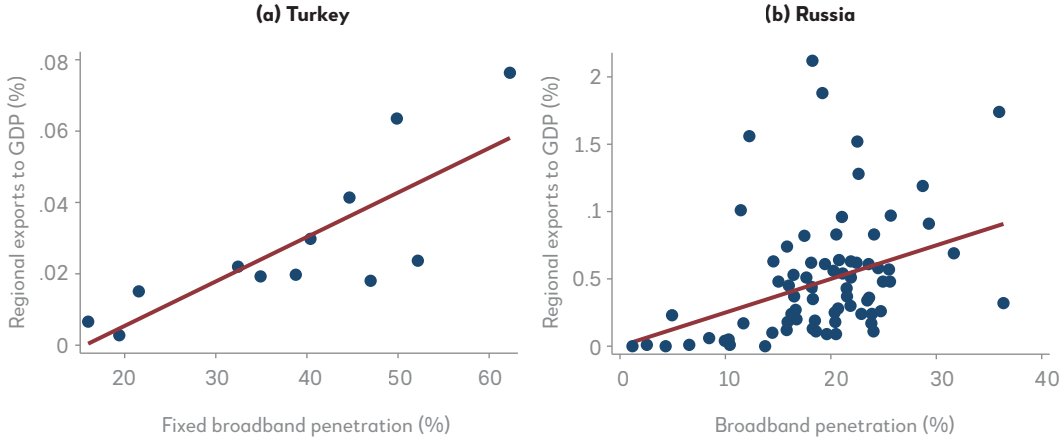
Even in China, where infrastructure is a source of comparative strength, regional differences are wide. Cities that have better internet coverage have higher exporting intensities (Figure 21). Provinces with higher digital connectivity, proxied by the number of web domains registered, have higher exports-to-GDP ratios. The association

[15] States that have ICT-readiness scores higher than 60 export the equivalent of more than 20 percent of their gross domestic product. As ICT-readiness scores are based on preparedness of firms to employ ICT in their day-to-day work, and states with higher ICT usage may have more efficient logistics processes (Rodriguez-Crespo and Martínez-Zarzoso, 2019), the states made products that were more competitive in the external market. ICT usage could have boosted e-sales for manufacturing firms and services (Kotnik and Hagsten, 2018).

between higher digital connectivity and higher export participation is stronger for Fujian, Shanghai and Guangdong.[16] Having web domains, therefore, could have allowed businesses in China to communicate better with their clients.

The trends are similar in Turkey and Russia. In general, regions with higher broadband penetration export more. Much like electricity, roads and ports before, digital connectivity will be a key determinant of GVC participation in the future.

Figure 22: Scatter Plots of Broadband Penetration and Exports in Turkey and Russia



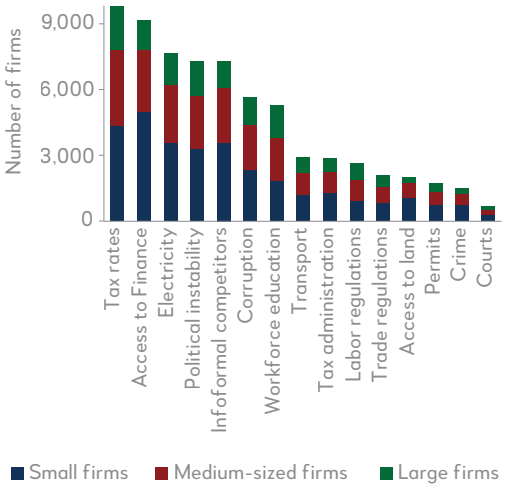
Data sources: CEIC, CNNIC, TurkSTAT.

[16] High internet usage can impact trade by decreasing information friction, thereby reducing trade costs (Fernandes, Mattoo, and Nguyenc, 2017).

Box B: Firm-Level Linkages between Power Outages and Export Performance

Much of the focus on the impact of infrastructure on global value chain (GVC) participation and export propensity is on the aggregate country level. However, it is an individual firm in a country that exports, and the country analysis can sometimes mask a great degree of heterogeneity that firms experience within a country (Sen Gupta and Singh, 2021). This assessment uses the World Bank Enterprise Survey, covering a cross section of 106 countries from 2012 to 2019 to evaluate the relationship between power outages and export performance. Access to electricity is the most important infrastructure bottleneck (third most important overall) affecting the firm's operations (Figure B.1). However, there are important regional differences. In East Asia and the Pacific, transport infrastructure is the major bottleneck, while in South Asia and Sub-Saharan Africa, electricity infrastructure is the dominant obstacle. In India, more than 15.3 percent of the surveyed firms found electricity to be the most important bottleneck, compared with only 3.0 percent of firms that reported transport as an obstacle. In contrast, in China, 7.7 percent of the firms identified transport as the major bottleneck, compared with 4.9 percent citing electricity (Figure B.2).

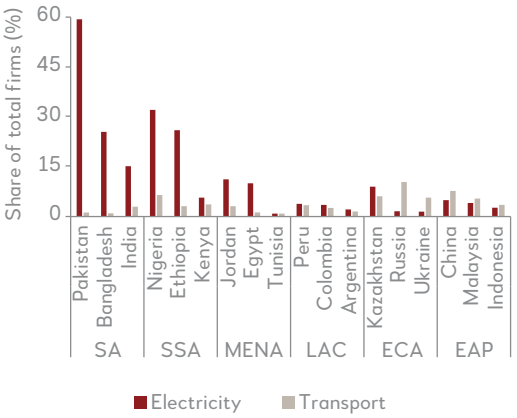
Figure B.1: Biggest Obstacle Affecting Operations



AIIB = Asian Infrastructure Investment Bank.

Data source: World Bank Enterprise Survey and AIIB staff calculations.

Figure B.2: Share of Firms Identifying Infrastructure as an Obstacle



AIIB = Asian Infrastructure Investment Bank, EAP = East Asia and the Pacific, ECA = Europe and Central Asia, LAC = Latin America and Caribbean, MENA = Middle East and North Africa, SA = South Asia, SSA = Sub-Saharan Africa.

Data source: World Bank Enterprise Survey and AIIB staff calculations.

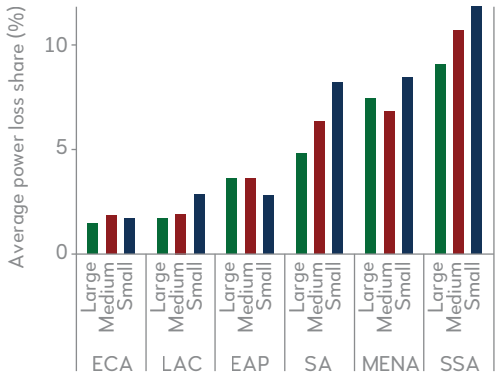
Power outages have a detrimental impact on firms' operations by raising costs, lowering productivity and reducing output. On average, firms in South Asia, Sub-Saharan Africa and the Middle East and North Africa experience more than 70 hours of power outage a month, while firms in Europe and Central Asia, Latin America and Caribbean and East Asia and the Pacific experience less than 14 hours (Figure B.3). Power outages are directly related to losses suffered by firms. Firms in regions with high power outage lose nearly 9.0 percent of the output, nearly four times the losses of firms in regions with low power outage. While losses are similar across different firm sizes in regions with low power outage, in regions with high power outages, small firms take the biggest hit. They are unable to arrange for alternate power sources such as captive diesel gensets and end up losing more than 10 percent of their output.

An econometric model assesses the marginal impact of power outage on firms' decision to enter the export market, controlling for other determinants identified in the trade literature as influencing exports. Firms facing power outage have up to 13 percent lower chances of getting into the export market (Figure B.4). Firms with access to foreign technology, foreign input, finance and research and development, and having foreign ownership and exhibiting higher productivity, have a better chance of entering the export market.

continued on next page

Box B: *continued*

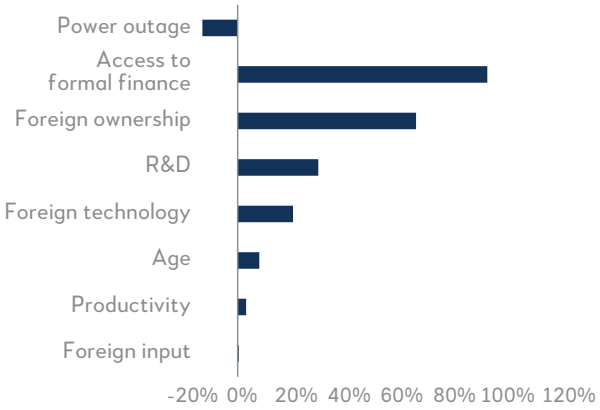
Figure B.3: Losses Caused by Power Outages



AIIB = Asian Infrastructure Investment Bank, EAP = East Asia and the Pacific, ECA = Europe and Central Asia, LAC = Latin America and Caribbean, MENA = Middle East and North Africa, SA = South Asia, SSA = Sub-Saharan Africa.

Data source: World Bank Enterprise Survey and AIIB staff calculations.

Figure B.4: Factors Affecting Firms' Decision to Export



AIIB = Asian Infrastructure Investment Bank, R&D = research and development.

Note: The impacts are based on probit regressions with instrumental variables. The dependent variable is the firms' presence in the export market. Only the statistically significant impacts have been shown.

Data source: World Bank Enterprise Survey and AIIB staff calculations.

Apart from dissuading firms from entering the export market, power outage negatively impacts their average export propensity (the ratio of export sales to overall sales). By increasing the cost of production by relying on more expensive sources of alternate power, disrupting the assembly line and delaying production and creating products that may not be up to international standards, power outage is likely to hurt export margins of firms and reduce their export propensity. These factors are even more important in GVCs, which are dependent on the production of various parts and components to international standards on time at a reasonable cost.

CHAPTER 4

A CHANGING CHINA ECONOMY AND GLOBAL VALUE CHAINS

China has been increasing its share of GVC trade, particularly for intermediate goods, and is now a key manufacturing and trade node in the global economy (Figure 23). This chapter shows that the rise of China's GVC participation is enabled by infrastructure development and foreign direct investment (FDI). China's economy is in a stage of fundamental transformation with moving up the value-added ladder in many industries and a shift out of labor-intensive activities. The economic weight has shifted from north to south, and some inland provinces and cities have emerged as important hubs for high-technology industry and trade. Again, infrastructure has played a critical role in these shifts. China's changing role in GVCs and its maturing as an economy will present opportunities for further regional development.

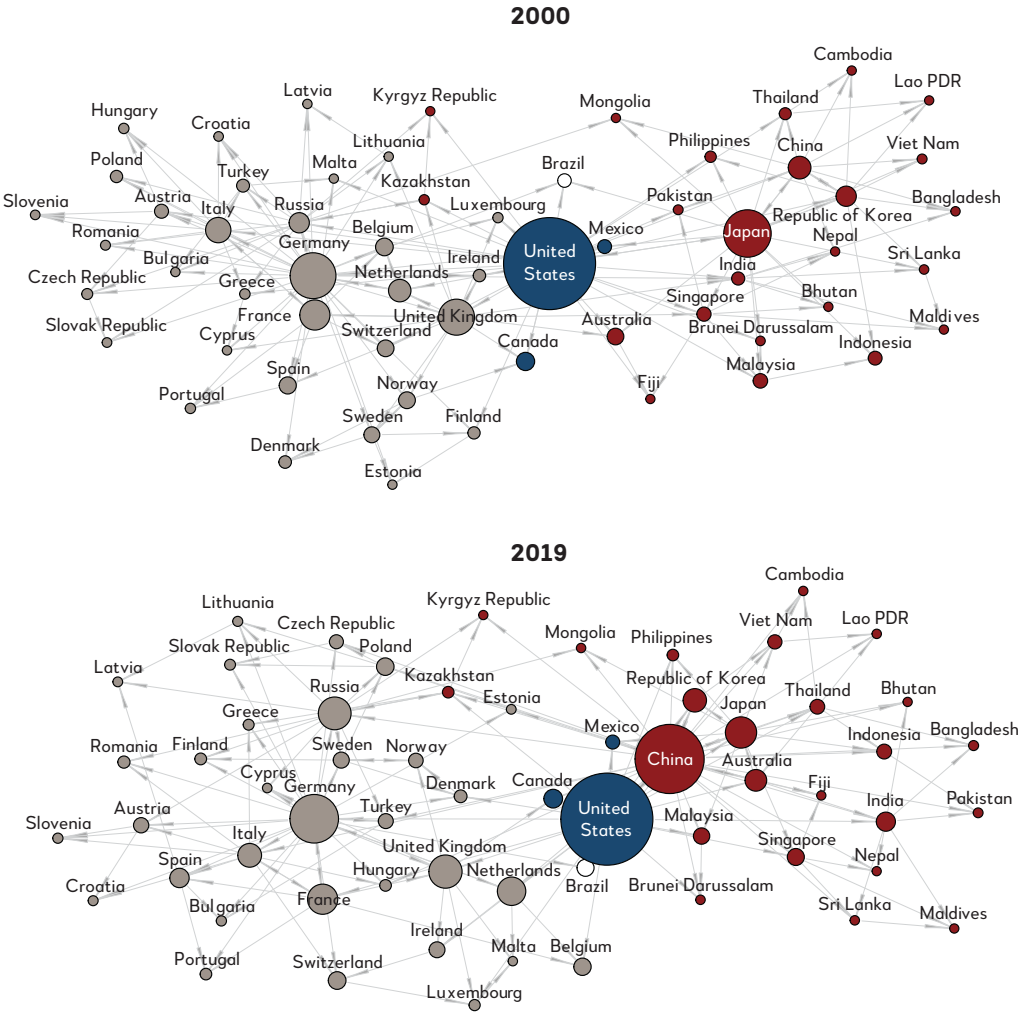
4.1 China Is Moving toward Higher Value-Added GVCs

Over the past two decades, China has become deeply integrated into GVCs (Figure 23). China's production linkages with other Asian economies strengthened significantly from 2000 to 2019 across a range of high- and low-technology goods. For example, from 2000 to 2019, GVC networks of textile production and electrical and optical equipment underwent remarkable changes. Supply centers in textile networks were more dispersed in 2000. By 2019, they had become more concentrated in China. China has also played a more and more important role in providing intermediate goods in the high-technology sector of electrical and optical equipment to the world.

China's GVC participation rate (GVC exports as a share of total exports) has increased from 37.9 percent in 2000 to 44.6 percent in 2019. The modest aggregate change masks a deeper structural one. China's forward participation rate rose from 22.6 percent to 31.7 percent, while the backward participation rate decreased from 15.3 percent to 12.9 percent. The changes imply that China is moving toward a more upstream position in GVCs, in line with the transition to becoming a global supply hub in GVC networks. Among China's GVC exports, the contribution of high-technology manufacturing increased significantly from forward and backward perspectives, while the share of low-technology sectors fell, more so on the backward side (Figure 24). The change in sector structure is a sign of its upgrading. Service sectors (e.g., transport and finance) expedited China's integration into GVCs but their shares did not change much from 2000 to 2019.

Labor-intensive assembly of final goods used to be China's mainstay but is now gradually being transferred to other Asian economies such as Cambodia and Viet Nam, in low-technology sectors (e.g., textiles and textile products) and high-technology ones (e.g., computers, electronic and optical products).

Figure 23: Supply Hubs of Global Value Chains (All Sectors)



Lao PDR = Lao People's Democratic Republic.

Notes: 1. A circle's size denotes the magnitude of the global value chain (GVC) export from the perspective of forward linkages. The lines represent the three most important bilateral supply linkages. For example, if country A accounts for the largest share of foreign value added embedded in country B's GVC export, then there will be a linkage from A to B.

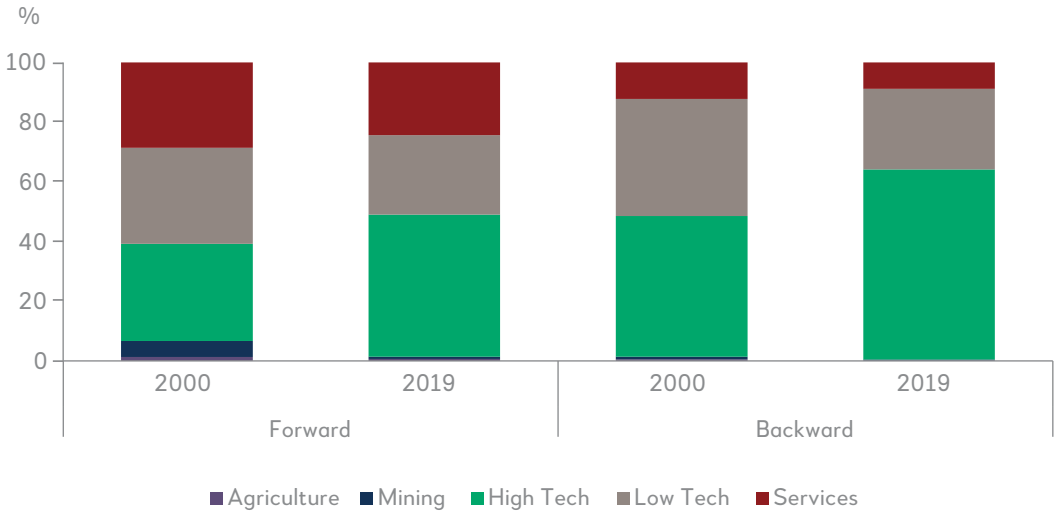
2. The measures of GVC exports and GVC participation rates follow the methodology in Chapter 3. The network analysis of GVCs follows the methodology of Meng, Xiao, Ye and Li (2019) and Global Value Chain Development Report 2019.

Data sources: Asian Development Bank Multiregional Input-Output database and Asian Infrastructure Investment Bank staff calculations.

The trend was already under way before the recent trade tensions. For computer, electronic and optical products, for example, Viet Nam's imports of intermediates from China and exports of final goods to the world expanded at the same time, suggesting that some assembly activities had been moved from China to Viet Nam. A similar trend emerged in Cambodia's textile sector, especially after the global financial crisis of 2008 (Figure 25).

Labor cost in China is a key driving force. In recent years, China's unit labor costs in manufacturing have grown much faster than those in the other supply hubs of GVCs (Germany, Japan and the United States) and in other developing economies such as India and Mexico (Figure 26), which is a natural consequence of growth in China. Firm-level empirical evidence shows that the increase in minimum wages in China can explain about 32 percent of the growth in outward FDI from China during 2001-2012 (Fan, Lin, and Tang, 2018).

Figure 24: Sector Contributions to China's Global Value Chain Export

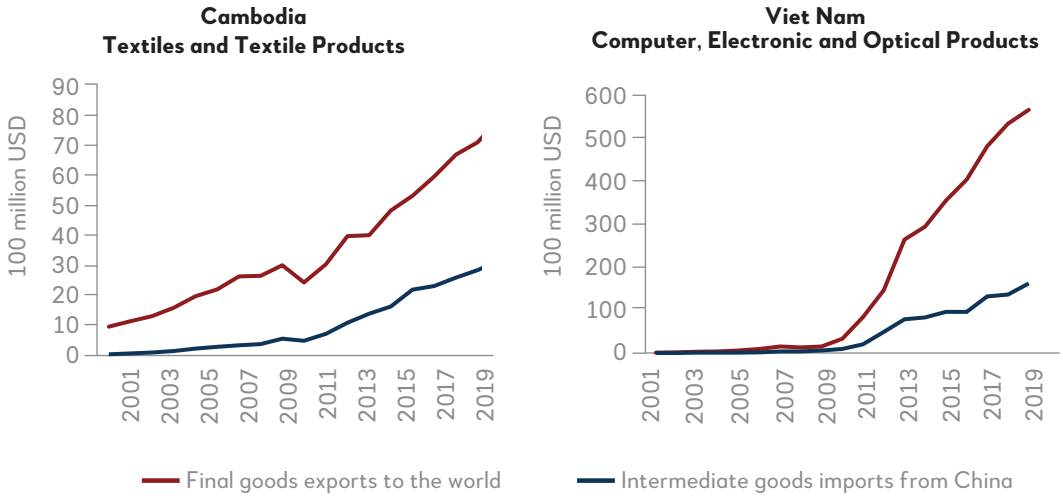


AIIB = Asian Infrastructure Investment Bank.

Note: High- and low-technology manufacturing sectors are based on Organisation for Economic Co-operation and Development classifications.

Data source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

Figure 25: Intermediates Imports from China and Final Goods Exports to the World

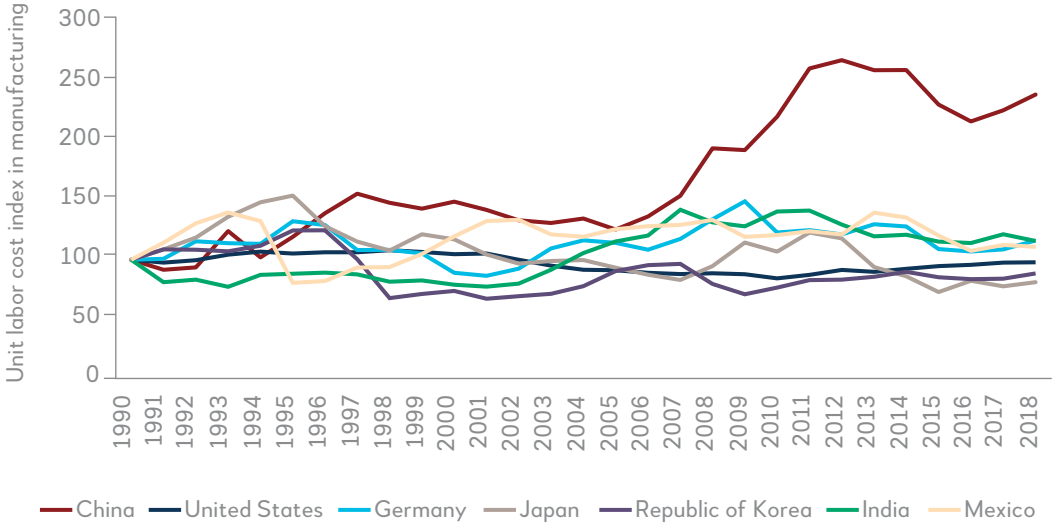


ISIC = United Nations International Standard Industrial Classification of All Economic Activities, USD = United States dollar.

Data source: Organisation for Economic Co-operation and Development Bilateral Trade in Goods by Industry and End-Use (BTDIxE), ISIC Rev.4.

China increased its share of DVA in gross exports. China's DVA share in exports increased by 2.7 percentage points over 2000-2019, while most other GVC participants saw theirs decrease (Figure 27). In exports of electrical and optical equipment, for example, China's DVA share rose from 75.3 percent to 80.5 percent, and the absolute value of DVA content increased by 12 times. Viet Nam's DVA share dropped from 44.9 percent to 40.4 percent, but the value of DVA surged by 60 times, which largely promoted local employment and economic growth (Figure 28).

Figure 26: Unit Labor Cost Index in Manufacturing, Selected Economies

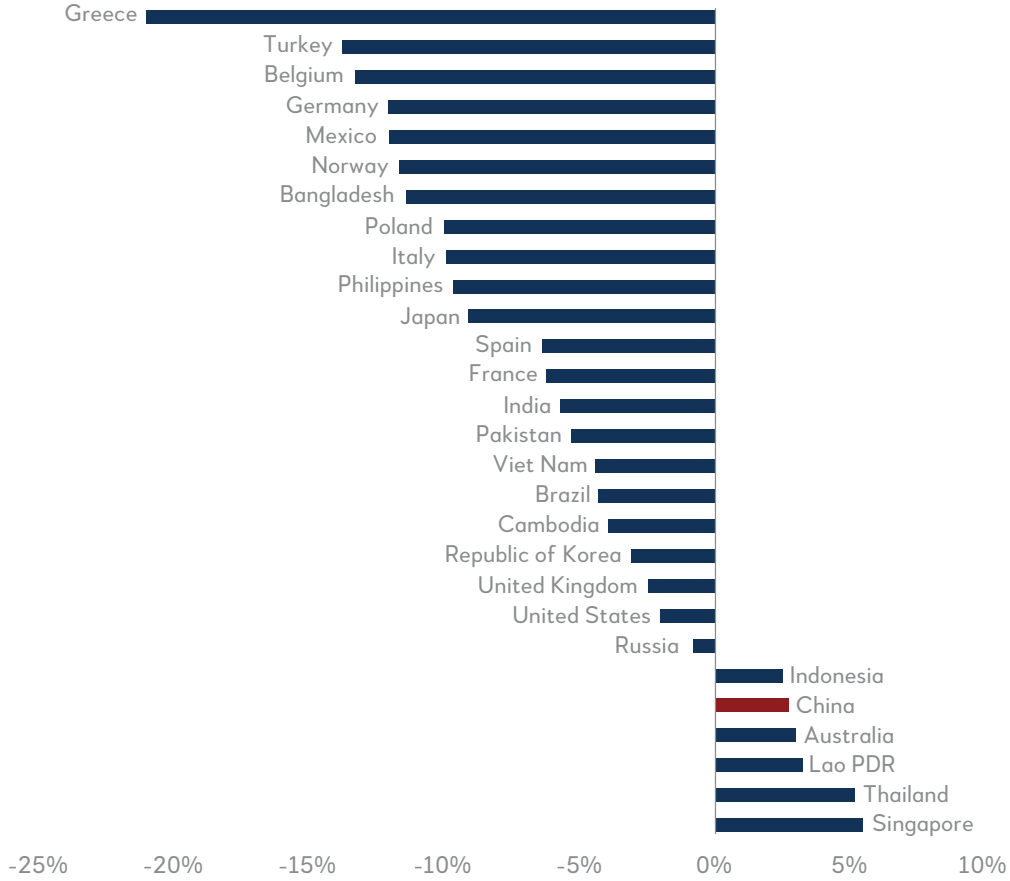


USD = United States dollar.

Note: Unit labor cost index is labor cost per unit of real value added (USD), 1990 = 100.

Data source: The Conference Board International Labour Comparisons Program.

Figure 27: Changes in Domestic Value-Added Share of Economies' Exports, 2000-2019, Selected Economies



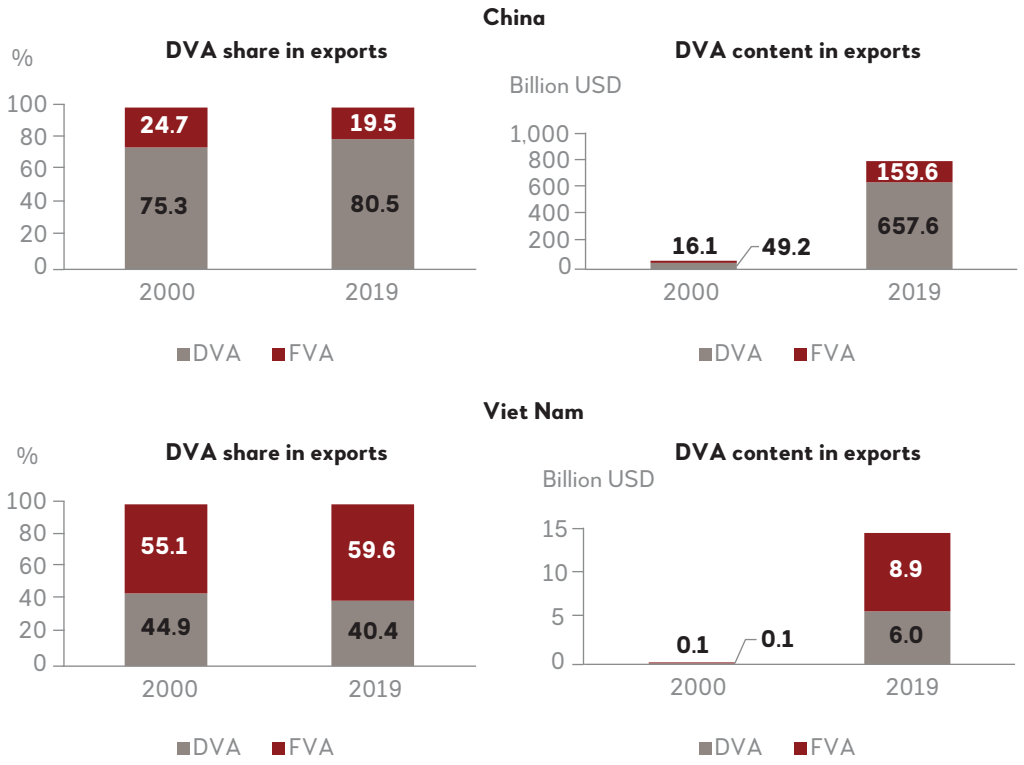
AIIB = Asian Infrastructure Investment Bank, Lao PDR = Lao People's Democratic Republic.

Data Source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

Two main forces drive the increase in DVA share of China's exports. One is the development of the domestic intermediate input sector fueled by China's trade and FDI liberalization after 2000. Increasing FDI inflows and lowering input tariffs have motivated China's producers of intermediates to improve product varieties and quality, stimulating downstream firms to substitute domestic for imported inputs (Kee and Tang, 2016). Another factor is China's structural change in types of exports (Brandt and Morrow, 2017). Incentivized by upgrading policies, the share of processing trade in China's total trade decreased from more than 50 percent in 2000 to 25 percent in 2019.[17]

The COVID-19 outbreak has hit GVCs and impacted GVC participation of countries, including China. China's exports fell dramatically in February 2020, when COVID-19 cases peaked in China. After the domestic situation was under control in March 2020, China's exports started to recover and final goods exports recovered significantly faster than intermediate exports, driven by demand for COVID-19 medical supplies mostly and, to a lesser extent, ICT final goods (home office equipment) (Figure 29).[18] The effects of COVID-19 are transmitted via GVCs.

Figure 28: Domestic Value-Added Shares and Value in Exports (Electrical and Optical Equipment)



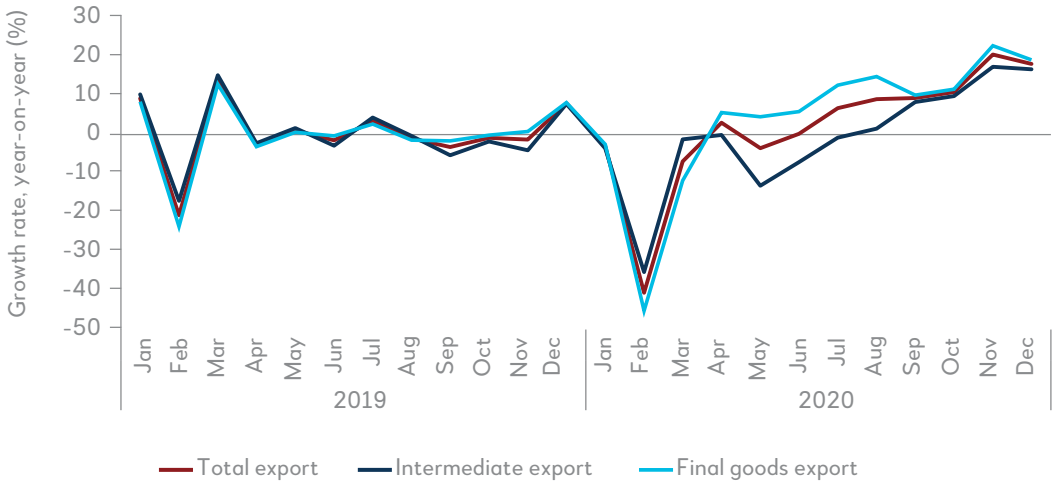
AIIB = Asian Infrastructure Investment Bank, DVA = domestic value added, FVA = foreign value added, USD = United States dollar.

Data sources: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

[17] Processing trade refers to export activities that rely mainly on imported materials and parts and on the export of finished goods after processing or assembly work. Processing trade activities often have low value added.

[18] From April to December 2020, the average monthly growth rate of China's exports of COVID-19 medical supplies was 196 percent and that of ICT final goods 14 percent. The data are from China's customs and the definition of COVID-19 medical supplies is from the World Customs Organization and the World Health Organization HS Classification Reference for COVID-19 Medical Supplies, Second Edition.

Figure 29: China's Monthly Export Growth



AIIB = Asian Infrastructure Investment Bank.

Data source: China's customs data and AIIB staff calculations.

A recent study found that the number of new jobs dropped by 31 percent in China because of the pandemic, with 20 percent lost because of domestic outbreaks and 11 percent because of global production linkages (Fang, Ge, Huang, and Li, 2020).

4.2 Infrastructure Development Expedited a Spatially Inclusive Internationalization Process

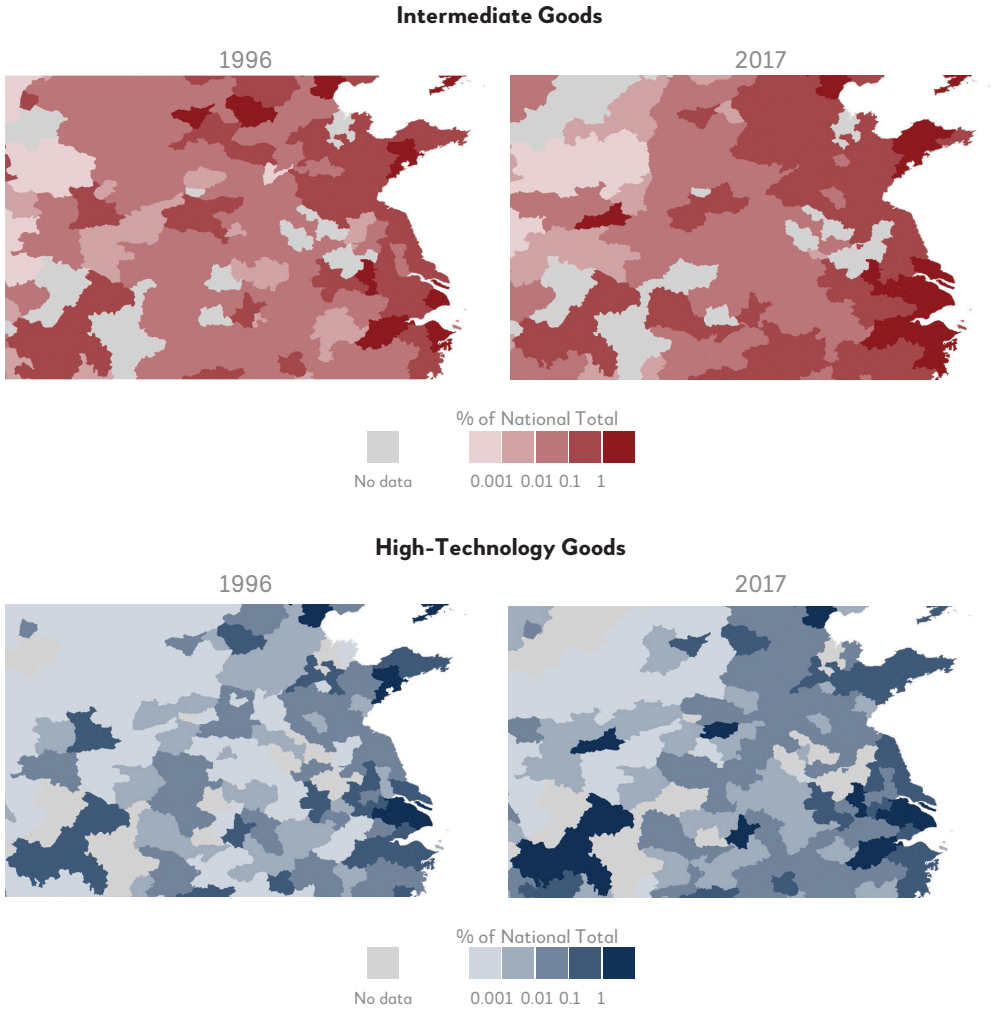
Domestically, GVC activities used to be heavily concentrated in China's coastal areas, which have easy access to various types of transport infrastructure and a better business environment. The Pearl and Yangtze river deltas are still home to major manufacturing hubs for exports of intermediate and final goods, but the landscape has begun to change. City trade data show that GVC participation has spread more evenly to the hubs' neighboring areas.[19] More non-coastal cities, such as those in or near Guangdong, Shandong and Jiangsu provinces, are exporting a much higher share of intermediates than in 1996 (Figure 30).

The trend is also evident in the high-technology sector. From 1996 to 2017, the share of exports of high-technology goods from inland areas largely increased, although coastal cities still played an important role. Two notable examples are Chengdu and Chongqing, which together accounted for about 8.3 percent of China's high-technology exports in 2017, compared with only 0.6 percent in 1996 (Figure 31). The rise of Chengdu and Chongqing as China's high-technology manufacturing hubs started in 2011, when the first China-Europe Railway Express (CERE) started operations in Chongqing. CERE connects the city and surrounding areas to major European Union (EU) economies directly by train, significantly reducing trade distance between China and Europe (Yang, Sun, and Lee, 2020). Most products transported via CERE are high value added, such as electronics. For example, Acer and Foxconn's factories in Chongqing and many other cities with access to CERE have been switching to rail to export their electronics to Europe (State Council, 2018). The share of trade transported by rail from Chongqing and Chengdu increased from one to seven percent from 2010 to 2017, while the national average of trade by rail stayed at one percent (Japan External Trade Organization, 2019).

Since its debut in Chongqing, CERE has been linking other cities in central and western China, further boosting inland China's cross-border transport.

[19] City here refers to the prefecture (*dijishi* 地级市), which is one level lower than the province.

Figure 30: Prefecture Share of National Exports



AIIB = Asian Infrastructure Investment Bank.

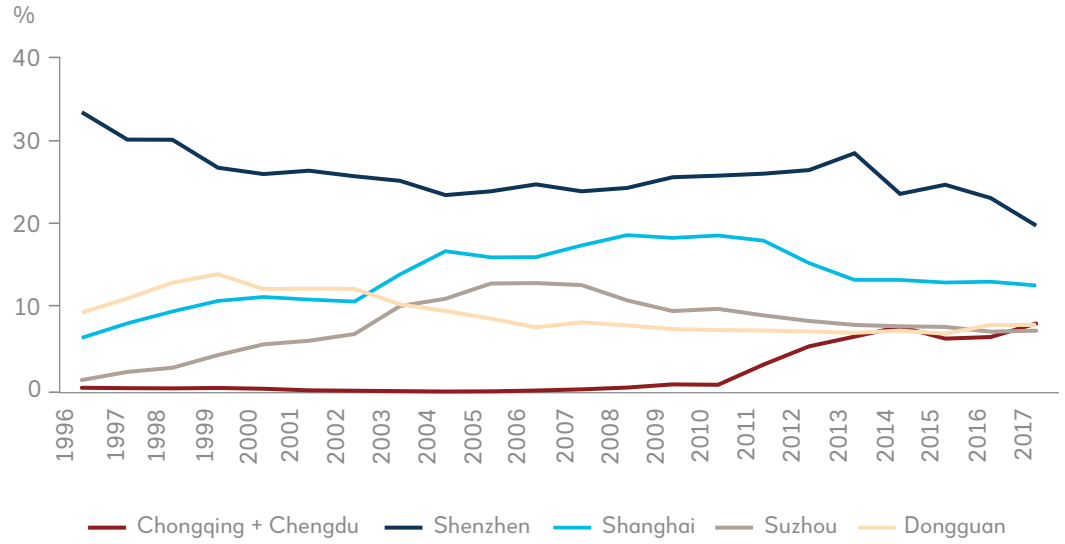
Note: Darker colors denote a higher share of exports in the national total. The maps are generated by ArcGIS software.

Data source: China's customs data and AIIB staff calculations.

During the COVID-19 pandemic in 2020, cargo volume transported by CERE increased by 50 percent more than in 2019, as many firms struggled to find sea and air transport (Caixin, 2021). Even countries outside the EU and China are showing increasing interest in CERE. For example, Nippon Express, one of Japan's leading logistics companies, announced it would double its freight services via CERE in 2020 (Nikkei Asia Review, 2020). In December 2020, a Japanese company shipped its products made in Nagoya to Wuhan, then transported them to Germany via CERE (Xinhua, 2020a). With the EU-China Comprehensive Agreement on Investment (CAI) starting in 2021, high value-added trade via CERE will likely increase further.

Although CERE is a rising alternative mode of transport between China and Europe, trade via rail is smaller than sea-borne trade in volume and diversity of goods. More data and research are needed to precisely evaluate the impact of CERE. Nevertheless, the story of CERE is not so much about rail taking over other modes of transport in China-Europe trade. Rather, CERE has shown the potential of diversified transport connectivity in China, which not only contributed to the resilience of the global supply chain, especially during disruptions in sea and air cargo during the COVID-19 pandemic, but provided trade opportunities for inland China and reduced regional disparities.

Figure 31: Share of High-Technology Exports, Selected Cities



AIIB = Asian Infrastructure Investment Bank.

Data source: China's customs data and AIIB staff calculations.

4.3 GVC Success Requires Several Enabling Factors, including Infrastructure and Openness to Foreign Direct Investment

Several factors contribute to China's rising role in GVCs and changes in domestic distribution of GVC participation:

1. Rapid expansion and upgrading of modern infrastructure networks. Highway construction from 2000 to 2006, for example, increased domestic value chain participation (Yang G. , 2018). The expanded transport system eases reallocation of resources and decentralizes economic activities (Baum-Snow, Brandt, Henderson, Turner, and Zhang, 2017), contributing to more spatially inclusive growth in China. The national highway system promoted cities' productivity growth and sectoral reallocation between cities (Yang, 2018) and, therefore, increased cities' competitiveness in trade and GVCs.

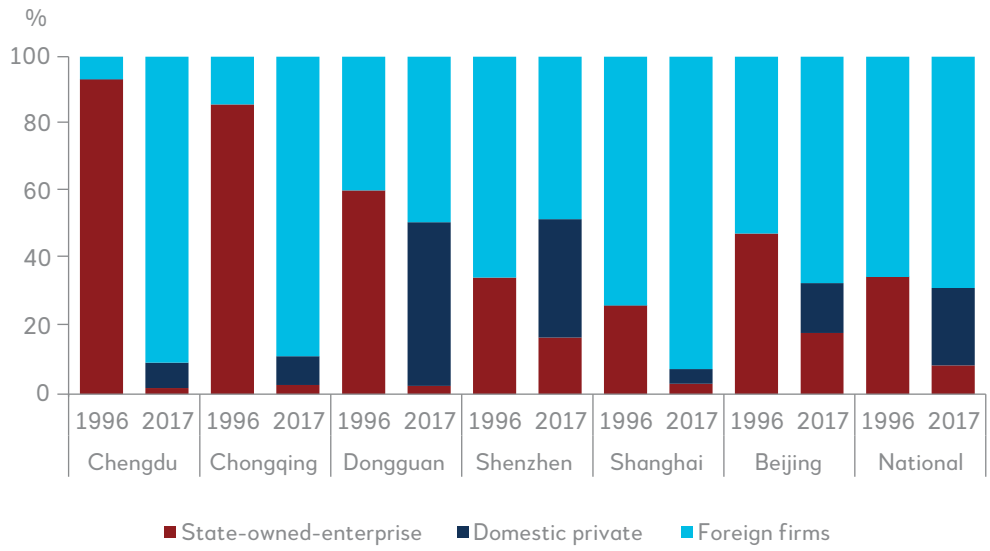
In general, more technologically sophisticated products require more efficient infrastructure as they need to source from, deliver to and be assembled in different places. Globally, a country's transport quality is positively associated with its importance to global trade networks, but the association is much stronger for high-technology products such as industrial machinery and optical goods (Figure 19). The trend is consistent with the evidence on domestic transport infrastructure and exports. Cities with a higher export share of high-technology products are in places with the densest network of all types of road.[20]

2. FDI inflows to China.[21] Foreign-owned enterprises have been bringing technological spillover effects to China (Wei and Liu, 2006; Long, Hale, and Miura, 2014; Cheung and Lin, 2004; Li and Tanna, 2017) and contribute directly to the production and export of high-technology products, accelerating the country's integration into high-technology manufacturing GVCs. In Chengdu and Chongqing, for example, more than 90 percent of high-technology goods were exported by foreign firms, higher than the national average of 69 percent in 2017 (Figure 32).

[20] Author's calculation using the Global Road Inventory Project (GRIP) and customs data. The calculation includes highways and primary, secondary and tertiary roads covered by GRIP databases.

[21] China replaced the United States as the biggest FDI destination country for the first time in 2020 (UNCTAD, 2021a).

Figure 32: Exporters of High-Technology Products by Ownership



AIIB = Asian Infrastructure Investment Bank.

Data source: China's customs data and AIIB staff calculations.

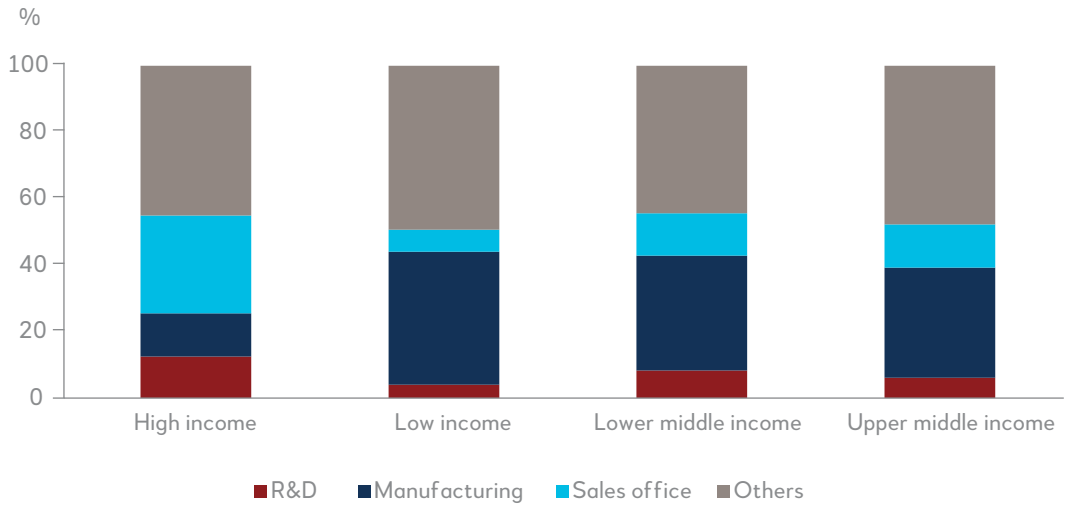
Over the past few years, despite uncertainties in trade, China has continued to remove restrictions on FDI entry and to improve other aspects (e.g., investor protection and national treatment before and after entry) of foreign investment regulations, especially in sectors deemed strategically important to advance technological development. China signed the Regional Comprehensive Economic Partnership (RCEP) and the CAI. Under RCEP, China pledged to pare back the negative list for non-service sectors and transform the regulatory approach from a positive to a negative list for service sectors within six years after the enforcement of RCEP. Under the CAI, China committed higher-level openness to EU firms by shortening the negative list for all sectors. Some digital sectors, such as telecommunications and cloud and computer services, are included in areas opened up between China and the EU.

3. Outward FDI from China to the world. Outward FDI not only strengthens technological cooperation between China and other countries (e.g., investing in research and development [R&D] or R&D centers) but also promotes specialization and efficiency by making full use of countries' factor endowments and comparative advantages in various production tasks. Thus, China's outward FDI helps countries more deeply integrate into GVCs. The GVC engagement of destination countries, especially local firms in upstream and downstream sectors of developing countries, is improved through diverse channels such as resource reallocation and knowledge spillovers (Crescenzi and Limodio, 2021), which may further strengthen China's role in GVCs.

More than half of China's outward greenfield FDI projects went to high-income countries from 2013 to 2021, with Germany (13 percent) and the United States (11 percent) as the top-two destination economies. India was the third-biggest destination economy. One distinct trend is that, compared with investments in low- and middle-income countries, China's FDI in high-income countries has a higher share in sales and R&D-related projects and a much lower share in manufacturing (Figure 33). Almost all R&D centers' investments in high-income countries are in automobiles, communications and industrial machinery.

4. Improvement of soft infrastructure, institutional support and other GVC facilitation policies. For example, China initiated the Single Window reform in 2016, enabled information sharing between 25 ministries, covered all ports and provided one-stop services to firms (UNCTAD, 2019b). By 2019, overall customs clearance time was cut by half from 2017 (China Daily, 2019). China also reduced charges on imports and exports. Since April 2019, cargo port fees have been lowered by 15 percent and port facility security fees by 20 percent.

Figure 33: China's Outward Greenfield Foreign Direct Investment, 2013-2021



R&D = research and development.

Note: Greenfield foreign direct investment is measured by the number of projects in the destination market. Income group definition follows the World Bank methodology. Projects from Hong Kong, China and Macao, China are included. R&D includes training and software development centers. Data were collected on Aug. 13, 2021.

Data source: ORBIS cross-border investment database.

Some place-based policies, such as special economic zones (SEZs), have driven China's integration into GVCs. In general, China's SEZs increase FDI inflows, promote local employment and productivity and achieve agglomeration economies (Wang, 2013; Lu, Wang, and Zhu, 2019), which facilitate trade and GVC activities (Chapter 6).

4.4 China Is Planning for GVC Integration in the Digital Future

China's working-age population (15-64) has been shrinking in absolute size and as a share of the total population since 2010.[22] Facing this challenge, China's future integration into GVCs will rely on technological advances, which include more automation in manufacturing and the underlying digital infrastructure that powers such digital transformation.

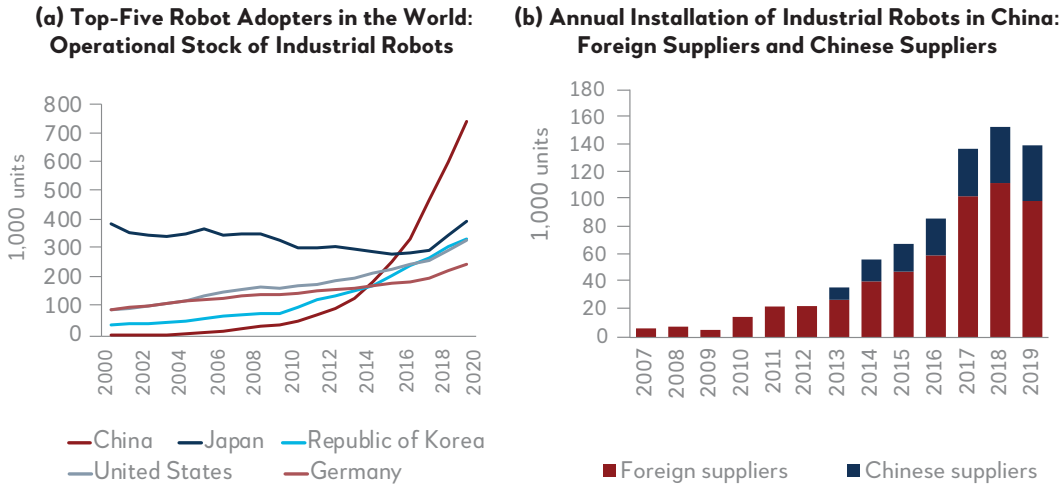
4.4.1 Robotics: Preparing for the Aging Population

The labor shortage and rapidly rising labor costs have motivated manufacturers to adopt industrial robots to replace labor for some labor-intensive production tasks. The government has encouraged the production and use of industrial robots. Against this backdrop, China has had the largest operational stock of industrial robots in the world—mostly in the automotive and electronics industries—since 2016 (Figure 34). Since China is a major producer of cars and electronics and its global share keeps increasing, it will become a more significant user of robots (Cheng, Jia, Li, and Li, 2019).

China could use robots in GVCs, especially for high-technology products. A few points emerge. First, China still relies on imported robots or robotic technology, with 71 percent of newly installed robots shipped in from foreign suppliers.

[22] The share of China's working-age population in total population peaked in 2010 at 74.5 percent, then declined to 70.6 percent in 2019. The absolute size of China's working-age population peaked in 2013 at 1,005.8 million, then decreased to 989.1 million in 2019.

Figure 34: Industrial Robots in China



Data sources: Cheng, Jia, Li and Li (2019); Executive Summary of World Robotics Industrial Robots 2007-2020 by International Federation of Robotics (2020).

Second, the use of robots can help China keep its edge in GVCs, even for labor-intensive industries, and slow down potential reshoring. The increase in robot-powered productivity, however, may also increase output, presenting more opportunities for other parts of GVCs.[23] The full effects of robotics on GVCs are only starting to play out and will be a key topic for research.

4.4.2 Accelerating Deployment of Digital Infrastructure

Further integration into GVCs will be impacted by industrial digital transformation, which involves more automation and optimization of the entire production lifecycle. The Organisation for Economic Co-operation and Development (OECD) lists three fundamental underlying technologies essential to the success of industrial digital transformation: big data, cloud computing and IoT (OECD, 2017). To embed them in manufacturing at scale, new types of digital infrastructure, such as 5G towers and data centers, will be needed, as all the technologies rely heavily on massive data collection, analysis and transmission. In 2018, China started formalizing national strategies to build new infrastructure (Government of China, 2018), and one important pillar is digital infrastructure, including 5G towers and data centers. The COVID-19 pandemic gave China the opportunity to enable the process as supply chains have been disrupted and businesses worldwide have become more digitalized.

By the end of 2020, official data suggested that more than 710,000 5G towers had been deployed around the country, 600,000 of them built in 2020 since the COVID-19 outbreak (Xinhua, 2020b). The near-term goal is to cover all prefectures with 5G network. Guangzhou has the most 5G towers (more than 48,000 deployed), followed by other metropolitan cities such as Shenzhen, Shanghai and Beijing (Figure 35). Two outstanding examples in inland China are Chongqing (44,000+) and Changsha (31,000+), which have close to the number of 5G towers in the "Big Four" tier-one cities.[24] Text mining of reports of local prefecture governments about their 5G tower plans suggests that the main objectives are related to keywords, including "industrial development," "smart or intelligent" and "innovation and integration."[25] They all directly correspond to China's digital

[23] Robots increase firms' productivity and expand their production scale, and the productivity effect of robots would likely outweigh potential labor displacement in the long term (Graetz and Michaels, 2018; Aghion, Bunel, and Jaravel, 2020; Acemoglu, Lelarge, and Restrepo, 2020).

[24] Beijing, Shanghai, Guangzhou and Shenzhen.

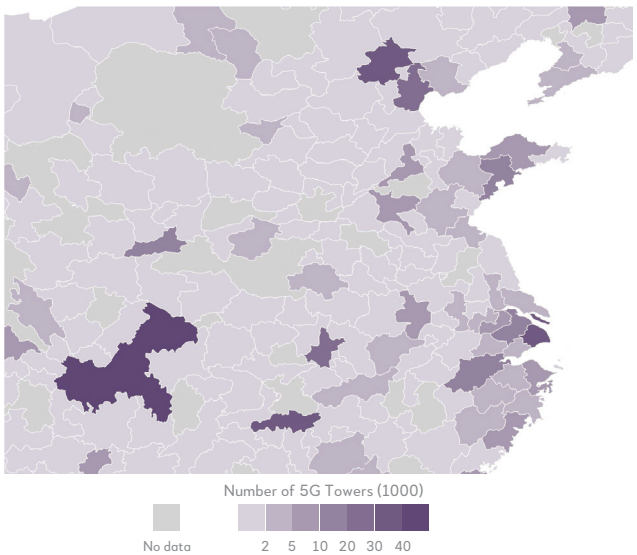
[25] The authors calculated a simple keyword ranking using the textual information drawn from more than 200 reports from prefectures on their 2020 and longer-term plan to build the 5G network. Top words include *chanye* (industry 产业), *zhihui* (smart or intelligent 智慧), *chuangxin* (innovation 创新) and *ronghe* (integration 融合).

infrastructure preparation for industrial digital transformation. Some Chinese manufacturers are already on the path of digitization and upgrading in GVCs, and the development of digital infrastructure such as 5G towers will further promote the upgrading process and provide opportunities for more firms.

Looking into the digital future, connectivity infrastructure will go beyond traditional physical connectivity of transport facilities across countries. The digital future will entail soft, digital connectivity to ensure that digital assets as production factors maximize their values in GVCs powered by new technologies. China's continuous integration and upgrading in GVCs still face challenges:

1. A skilled labor force is essential to developing and adopting digital technologies and equipment. China's human capital index still has some way to go before reaching the OECD average, and more investment in building human capital is needed (Brandt, et al., 2020). Such an investment will rely on higher-quality social infrastructure.
2. Global standards and international cooperation on data and information governance (e.g., data flows and security) are critical in the digital era. Although the recently signed RCEP and the CAI cover some topics on digital trade and digital sectors, many areas in data governance remain to be agreed on between countries.
3. Regional disparity in infrastructure—road density and digital infrastructure distribution—remains in China, although it has improved significantly in the past decades. Further steps are needed to close the gap. While pursuing equity, China should make investment more efficient to reverse the recent slowdown in total-factor productivity growth. Massive infrastructure investment in remote and less densely populated areas contributes little to local total-factor productivity growth (Jia, Ma, Qin, and Wang, 2020).
4. Infrastructure development should help the net zero transition of the whole economy. The fast-growing digital infrastructure can facilitate China's integration into green GVCs by reducing carbon emissions in manufacturing, transport and other fields. Digital technologies can be used to improve energy efficiency and productivity and monitor and trace carbon emissions along GVCs. Power consumption and carbon emissions from the massive use of digital infrastructure, however, are not negligible. More clean energy should be used in China's internet sector.

Figure 35: Number of 5G Towers Deployed by 2020 in Central and Eastern China



AIIB = Asian Infrastructure Investment Bank.

Note: The colors denote the number of 5G stations deployed.

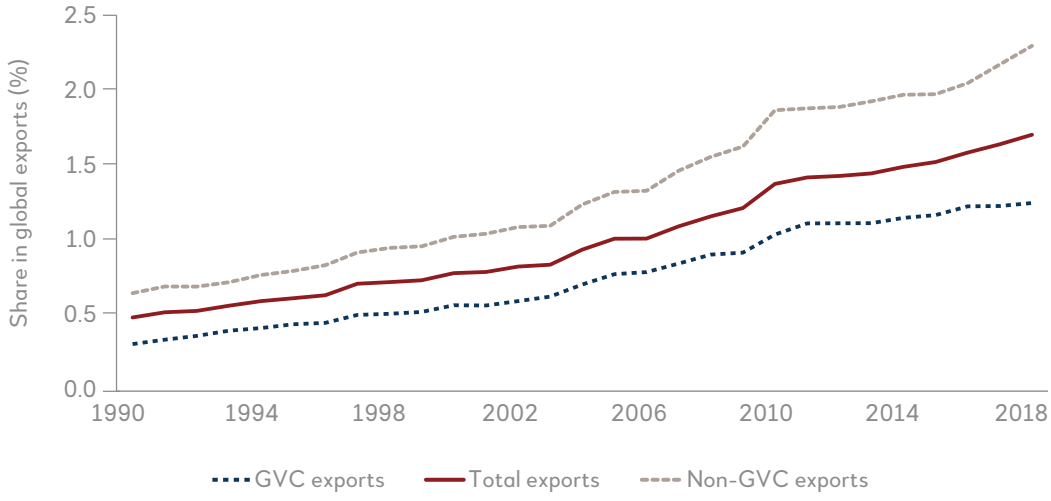
Data source: AIIB staff's manual data collection from prefecture government reports on deploying 5G base stations by 2020. The reports were completed in different months in 2020, so some discrepancies from the latest statistics may exist.

CHAPTER 5

RAISING INDIA'S GLOBAL VALUE CHAIN PARTICIPATION

Together with economic growth, India has steadily expanded its share in global value added, exports and foreign direct investment since 1991 (Gupta and Blum, 2018). Growth has been stable, diversified and largely resilient to domestic and external shocks. Strong growth helped India pull millions out of poverty, with the poverty rate declining from 47.6 percent in the mid-1990s to below 11 percent in 2017 (World Bank, 2020b). While domestic demand remains large, exports have emerged as an important contributor to growth, accounting for nearly a quarter of India's growth from 2000 to 2020. Exports enabled more competition, faster technological progress, spillovers and economies of scale (Agrawal, 2015). India's share in global exports has more than tripled, from 0.5 percent in 1990 to more than 1.7 percent in 2018 (Figure 36).

Figure 36: India's Share in Global Exports



AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Eora database and AIIB staff calculations.

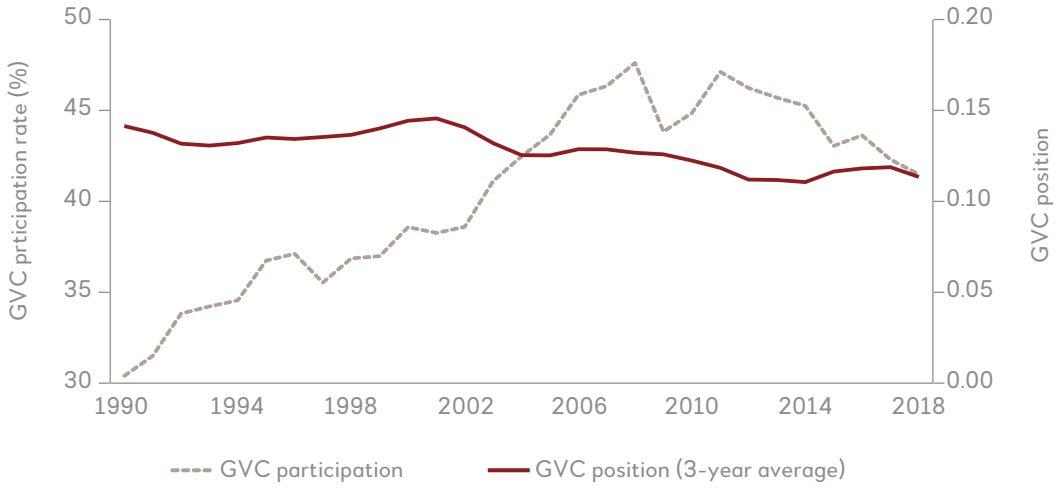
Like most other economies, India saw its global value chain (GVC) participation rise steadily through the 1990s and 2000s, peaking at 47.6 percent before the global financial crisis in 2008, before declining to 41.3 percent in 2018 (Figure 37). India remains a small player, with its quantum of GVC exports trailing not only larger economies such as the United States, China, Japan and Germany, but also several smaller economies such as the Republic of Korea; Russia; Singapore; Hong Kong, China; and Malaysia.

5.1 India's GVC Participation Is Driven by Key Sectors

India's GVC participation is characterized by a higher level of forward linkages (export of raw materials and intermediate inputs) than of backward linkages (exports based on imported inputs). In recent years, India has moved slightly downstream with the increase in GVC participation from 2000 to 2018, primarily driven by the strengthening of backward linkages (Figure 37). India increased the use of imported intermediate inputs for its exports. While the share of foreign value added in total exports increased from 10 percent in 2000 to more than 14 percent in 2018, the share of indirect value added in exports remained stagnant at about 27 percent over the period.

In 2000-2019, the sector composition of India's GVC exports changed markedly. In the 2000s, low- and high-technology manufacturing and business services dominated GVC exports in nearly equal measure. By 2019, high-technology manufacturing accounted for more than half of GVC exports. High-technology exports grew at an average annual rate of 15.2 percent over the period (Figure 38).

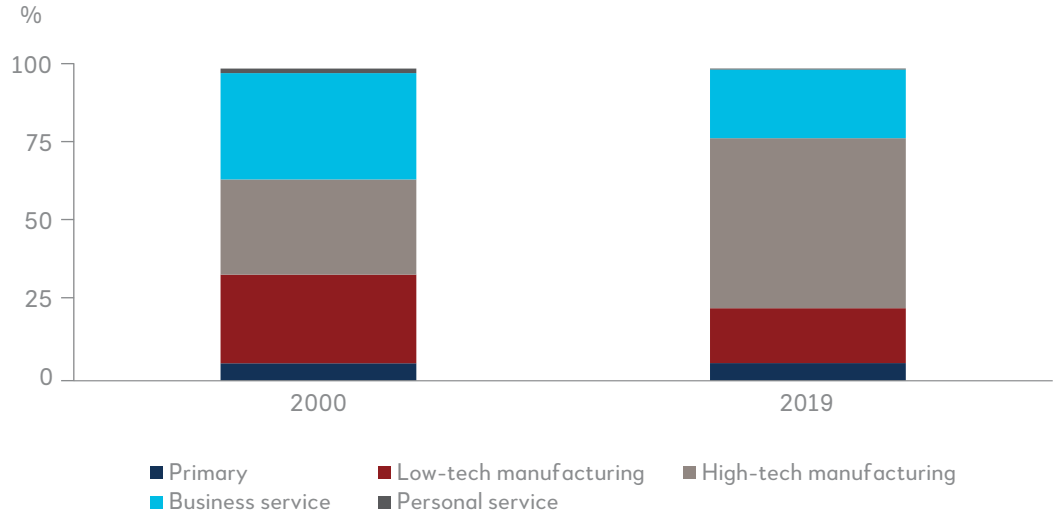
Figure 37: India's Global Value Chain Participation and Position



AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Eora database and AIIB staff calculations.

Figure 38: Sector Decomposition of India's Global Value Chain Exports



AIIB = Asian Infrastructure Investment Bank.

Data source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

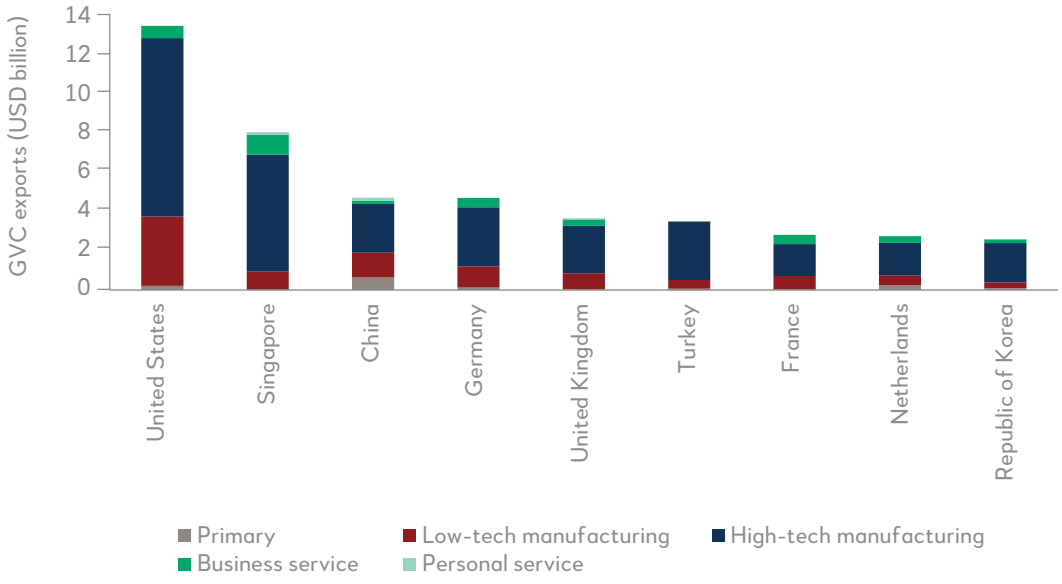
The dominance of high-technology exports is consistent across most major export destinations, accounting for more than two-thirds of India's GVC exports to most economies (Figure 39). Business services are primarily exported to the United States, Singapore and the European economies, while primary products and low-technology manufacturing products form a major part of exports to China.

The simultaneous increase of high-technology exports and the downstream shift in GVC exports are explained by shifts in a few industries such as coke and petroleum and transport equipment, which together account for nearly 28 percent of India's GVC exports (Figure 40). In recent years, refined petroleum products have emerged as India's most important export product, aided by the development of a large number of public and private sector refineries. However, the industry is crucially dependent on imported crude oil, which is processed to produce high-speed diesel, motor spirit, aviation turbine fuel and naphtha, among others, which are exported. Backward linkages are also stronger than forward linkages and foreign intermediate inputs are dominant in automobiles and transport equipment. India's exports in the industry are dominated by cars, motorcycles and other motor vehicles and dependent on sourcing of auto parts and intermediate inputs from different countries (Mazumdar and Khurana, 2019).

Across several sectors, domestic intermediate inputs dominate GVC exports, such as chemicals and electrical and optical equipment. India is one of the largest exporters of generic drugs and a major supplier of pharmaceutical intermediates, which are reexported by the buying country. The chemical industry supplies raw material to various industries such as textiles, paper, paints, detergents and agrochemicals in several countries. In the electrical and optical equipment sector, India has significantly increased its exports of domestic intermediate inputs. They account for most value addition in the textile and apparel industry, driven by the abundance of indigenous raw materials such as cotton yarn and manmade fibers, which are exported to other countries for reexport. The textile industry produces end products such as garments, for which India imports some intermediate inputs.

Finally, India's services GVC exports are led by exports of information technology and information technology–enabled services.[26] The availability of a skilled workforce at competitive cost resulted in a surge in the outsourcing of business and knowledge processes. Value addition was primarily driven by domestic intermediate inputs.

Figure 39: Key Sectors Accounting for India's Global Value Chain Exports to Main Destinations, 2019

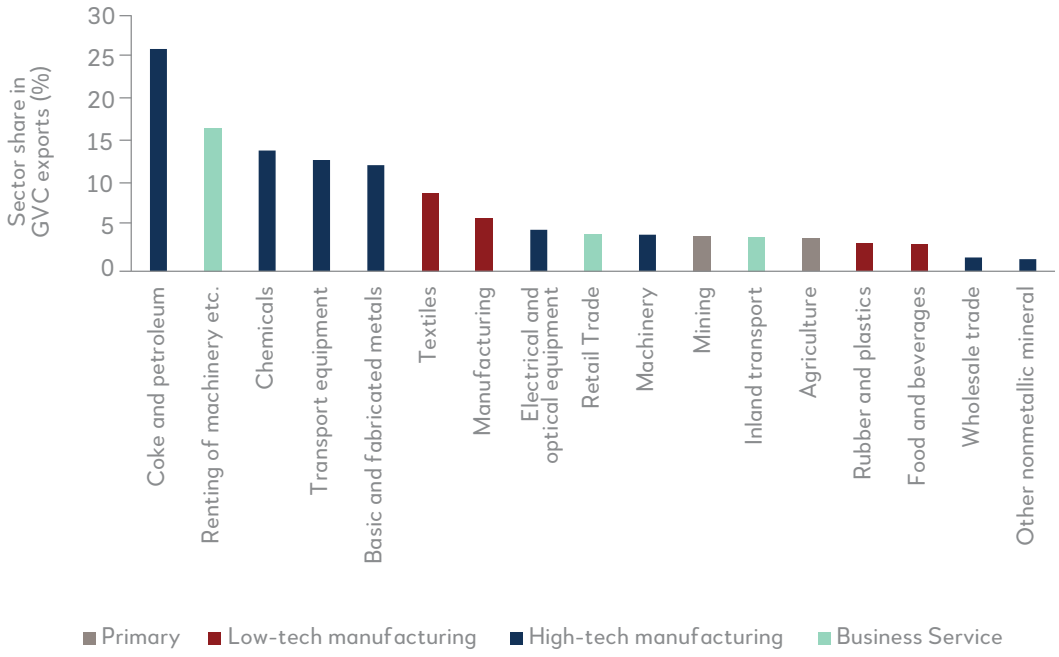


AIIB = Asian Infrastructure Investment Bank, GVC = global value chain, USD = United States dollar.

Data source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

[26] In the Asian Development Bank Multiregion Input-Output database, information technology and information technology–enabled services are included in renting of machinery and equipment and other business activities.

Figure 40: Key Industries Accounting for India's Global Value Chain Exports, 2019



AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

5.2 Closing Regional Infrastructure Gaps Can Boost Global Value Chain Participation and Inclusive Growth

India has the potential to become a bigger player. In 2019, only two out of 35 sectors in India accounted for more than 5.0 percent of worldwide GVC exports: coke and petroleum and renting of machinery and other business activities (Figure 41). Other major economies such as the United States had 23 major sectors, Germany 15, China 14 and the United Kingdom seven.

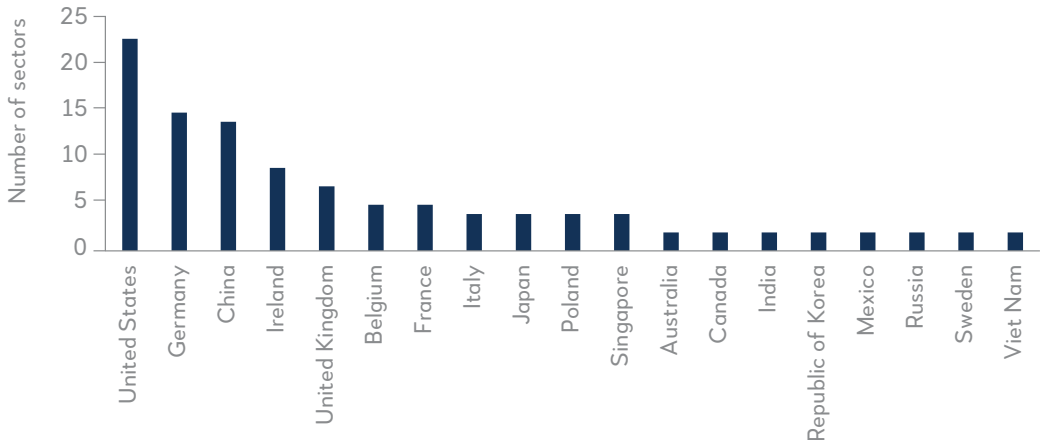
India can capture a bigger slice of the GVC pie as China transitions from labor-intensive manufacturing such as textiles and leather (Chapter 5). Countries such as Viet Nam and Bangladesh benefitted by moving into the space vacated by China, taking advantage of low-cost labor combined with a favorable investment climate and better-quality infrastructure in selected zones (Figure 42).

Since 2011, India has outlined plans to integrate with global markets, although the plans have not always materialized. For example, in 2015, exports were targeted to increase from USD465.9 billion in fiscal year (FY) 2014 to about USD900 billion by FY2020 and to raise India's share in world exports from 2 to 3.5 percent (Government of India, 2015).[27] During FY2020, India's exports stood at USD528.4 billion because of sluggish external demand and rising trade tensions. Exports are estimated to have further declined to about USD493.2 billion during FY2021 because of the pandemic. The government targets increasing India's exports from USD478 billion in FY2018 to USD800 billion in FY2023 (Government of India, 2018a).

Reforms have aimed to smooth trade, as reflected in improvement across various indexes focusing on trade facilitation. India moved up from the 54th position in the World Bank's Logistics Performance Index in 2014 to the 44th in 2018 and improved its position in the Organisation for Economic Co-operation and Development's Trade Facilitation benchmark from 2017 to 2019. India's ranking in Trading Across Borders in the World Bank's Doing Business report significantly improved from 132nd in 2014 to 63rd in 2020.

[27] In India, the fiscal year starts on April 1 and ends on March 31 of the subsequent year. FY2020 refers to the fiscal year beginning on April 1, 2019 and ending on March 31, 2020.

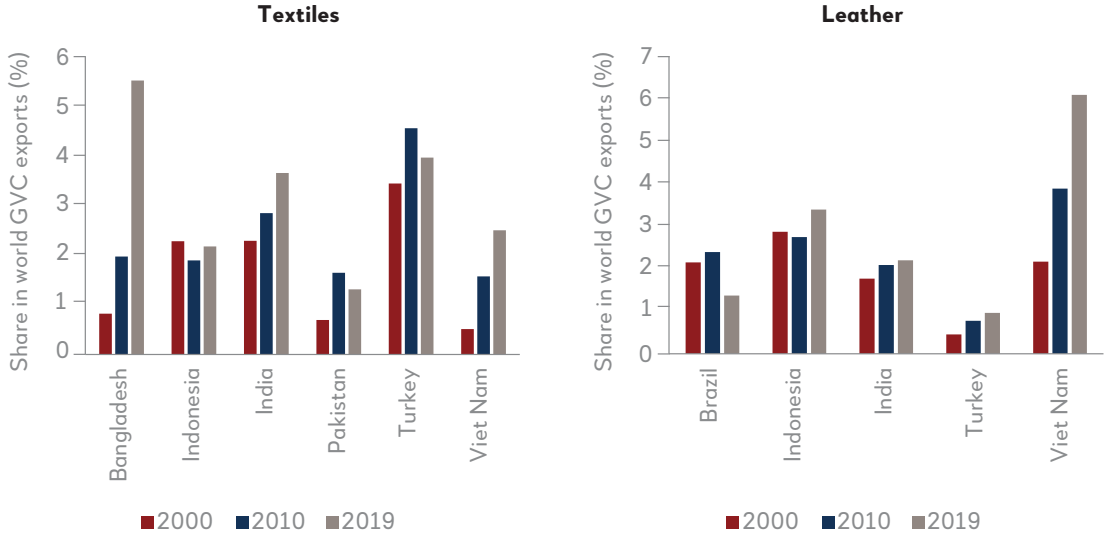
Figure 41: Number of Sectors Accounting for More than Five Percent of Global Exports



AIIB = Asian Infrastructure Investment Bank.

Data source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

Figure 42: Share of Key Emerging Economies in Global Value Chain Exports of Textiles and Leather

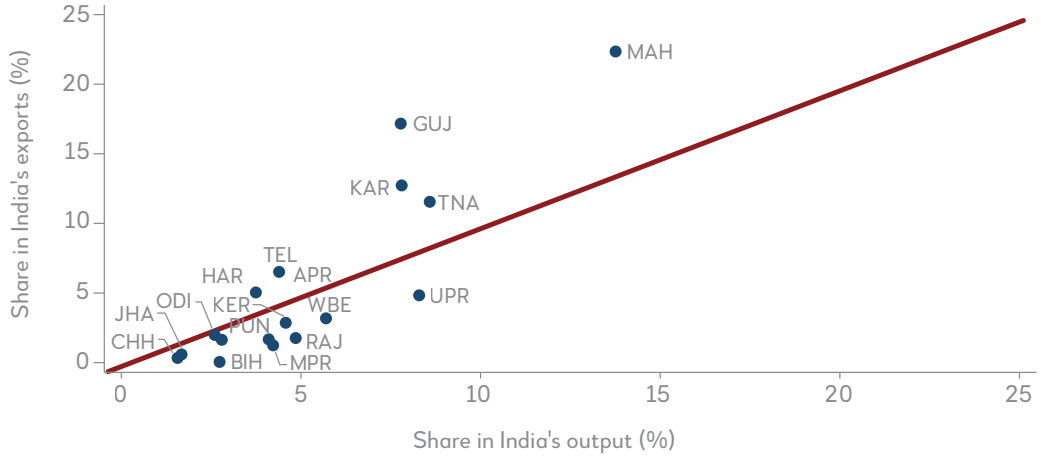


AIIB = Asian Infrastructure Investment Bank, GVC = global value chain.

Data source: Asian Development Bank Multiregional Input-Output database and AIIB staff calculations.

However, these aggregate indexes mask a great deal of subnational heterogeneity at the subnational level. Infrastructure, institutional quality and business climate diverge significantly, as reflected in the disparate export performances. Exports from India tend to be highly concentrated across only a few states. More than 75 percent of exports in FY2018 emanated from Maharashtra, Gujarat, Karnataka, Tamil Nadu, Telangana and Haryana (Government of India, 2018b). Their share in exports is significantly higher than their share in national output, which is about 46.1 percent (Figure 43). The contribution of the next 10 states to overall exports, however, is less than half their share in aggregate output. Clearly, location plays an important role in four of the six states; Maharashtra, Gujarat, Karnataka and Tamil Nadu are coastal states, and the easy access to port facilities is likely to attract firms that intend to export.

Figure 43: Share of Selected States in India's Exports and Gross Domestic Product, Fiscal Year 2018



AIIB = Asian Infrastructure Investment Bank, APR = Andhra Pradesh, BIH = Bihar, CHH = Chhattisgarh, GUJ = Gujarat, HAR = Haryana, JHA = Jharkhand, KAR = Karnataka, KER = Kerala, MPR = Madhya Pradesh, MAH = Maharashtra, ODI = Odisha, PUN = Punjab, RAJ = Rajasthan, TNA = Tamil Nadu, TEL = Telangana, UPR = Uttar Pradesh, WBE = West Bengal.

Data source: Government of India (2018b), Database on the Indian Economy, Reserve Bank of India and AIIB staff calculations.

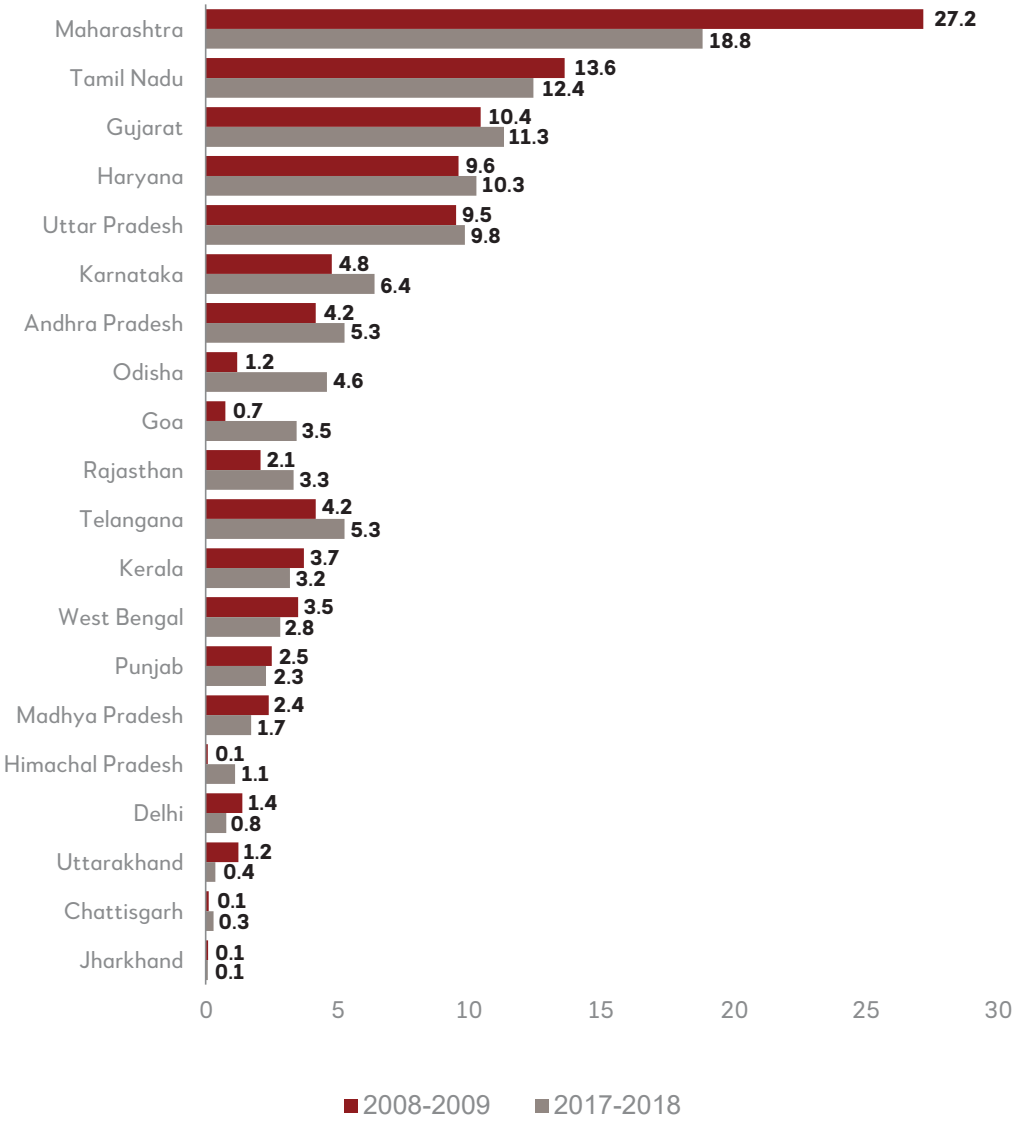
Granular firm-level data from the Annual Survey of Industries corroborates that industrial exports are concentrated in a few states, although less and less so. While the top-10 states accounted for nearly 90 percent of exports in 2008-2009, their share came down marginally to below 86.0 percent in 2017-2018. Maharashtra, which accounted for more than 27 percent of exports in 2007-2008, experienced a significant drop in its share to about 19 percent (Figure 44). Tamil Nadu's share went down slightly from 13.6 percent to 12.4 percent. Karnataka, Gujarat and Haryana have further consolidated their share. Odisha has emerged as an important contributor to overall exports, nearly quadrupling its share from 1.2 percent to 4.6 percent during the period. In recent years, Odisha has significantly ramped up its exports of metallurgical and mineral products such as aluminum and iron ore.

The widely diverging export performance of the various states relative to their economic size translates to a great degree of heterogeneity in export orientation. The ratio of exports to a state's output ranges from more than 30 percent in Gujarat to less than 1.0 percent in Bihar. Higher export orientation is highly correlated with per capita gross state domestic product (Government of India, 2018b).

Exports aid higher growth by (1) improving competitiveness of firms as they engage with competitive world markets, (2) allowing exporters to benefit from economies of scale as they serve a larger global market and (3) fueling domestic competition, thereby encouraging non-exporters to become more competitive. The divergence in export orientation can be related to various factors, including differences in export promotion policies, regulatory frameworks, business environments, infrastructure and access to finance.

Physical infrastructure is important in reducing the marginal cost of production, which will raise productivity and achieve efficient scale of production. Better connectivity infrastructure eases market catchment and access to broader labor markets, improving competitiveness and creating trade opportunities. Power disruptions impose a nontrivial loss on firms by disrupting production and forcing them to rely on costly alternatives. Physical infrastructure is becoming more important in GVCs, which are dependent on timely production of parts and components of international standard at a reasonable cost.

Figure 44: India's Industrial Exports (% of Total Exports), by Geography (Based on State-Level Data)



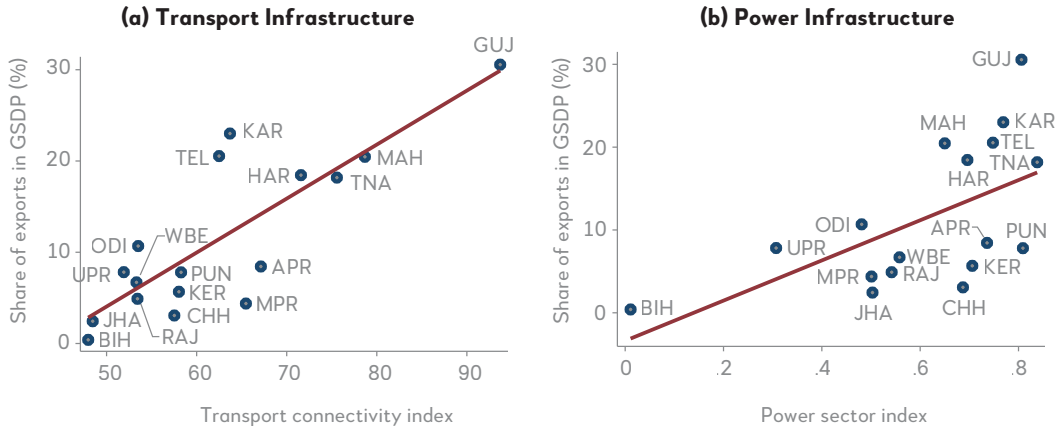
Note: In June 2014, Telangana was carved out of Andhra Pradesh. Thus, separate data for exports from Telangana before 2014 are not available. To ensure consistency, the combined share of Telangana and reorganized Andhra Pradesh is highlighted for the two periods.

Data source: Annual Survey of Industries and Ministry of Statistics and Programme Implementation.

Gujarat, Maharashtra and Tamil Nadu have well-established air cargo facilities, multimodal logistics hubs and inland container depots, which allow the states to reduce the transport cost of goods. The states, along with Karnataka, are major gateway ports, handling nearly 80 percent of total cargo traffic. The top-six states have better road density and higher warehouse and cold-storage capacity (Deloitte, 2019).

Infrastructure development and exports are mutually reinforcing. Most power distribution companies in exporting states have performed better than those in the rest of India and managed to improve cost recovery and reduce transmission and distribution losses. Strong regulatory support, efficient power procurement mechanisms, low loss level and adequate tariff hikes helped Gujarat distribution companies remain profitable and significantly reduce transmission and distribution losses. Better power supply is reflected in the perception of firms across states. While in Gujarat and Maharashtra, less than 5 percent of respondents claimed electricity was the major obstacle, in Odisha and Uttar Pradesh, more than 20 percent of the firms did (World Bank, 2014).

Figure 45: Relationship Between Infrastructure and Export Orientation



APR = Andhra Pradesh, BIH = Bihar, CHH = Chhattisgarh, GSDP = gross state domestic product, GUJ = Gujarat, HAR = Haryana, JHA = Jharkhand, KAR = Karnataka, KER = Kerala, MAH = Maharashtra, MPR = Madhya Pradesh, ODI = Odisha, PUN = Punjab, RAJ = Rajasthan, TEL = Telangana, TNA = Tamil Nadu, UPR = Uttar Pradesh, WBE = West Bengal.

Note: The transport sector index comprises the Logistics Ease Across Different States index, multimodal logistics hubs and areas covered by air cargo facilities and inland container depots, while the power sector index includes rural electrification, transmission and distribution losses and per capita consumption of power.

Data source: Government of India (2018a, 2021a) and Public Affairs Index Database.

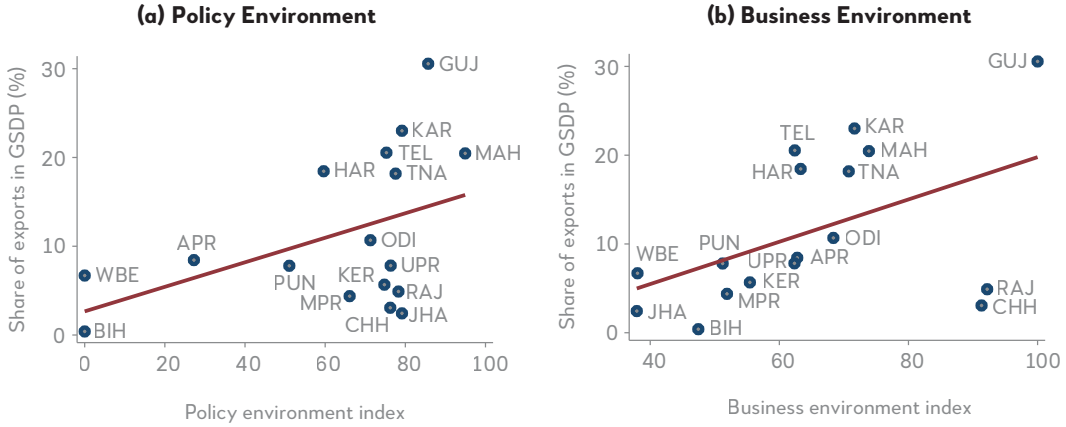
5.3 Reinforcing Infrastructure Benefit through Sector Policies

In addition to infrastructure, an enabling policy environment is likely to have a bearing on the extent of export orientation. A number of states have well-defined sector-specific export policies, including those emphasizing product quality, which are important for gaining confidence of importers. For example, Tamil Nadu aims to bolster exports by identifying sector-specific export plans for key industries such as automobiles, information technology and marine products. The state government provides land and financial aid to exporting companies. In Maharashtra, specific councils focus on key exporting industries such as pharmaceuticals, gems and jewelry and processed food.

Better institutional quality helps promote trade by leveling the playing field and preventing powerful agents from abusing their market power and monopolizing trade (Álvarez, Barbero, Rodríguez-Pose, and Zofío, 2018 and Nunn and Trefler, 2014). Institutional quality is even more important for participating in GVCs given that they involve production in different firms in different jurisdictions. Thus, firms are interdependent and face the risk that other firms in the chain will breach their contracts. Firms are likely to prefer locating in jurisdictions with strong legal institutions, a low level of corruption, strong contract enforcement and quick resolution of insolvency (Shephard, 2016). The finding holds up across states, with export-oriented states scoring higher on institutional framework than others (Government of India, 2021a).

States that exhibit high export orientation have also performed well in developing infrastructure, engendering a conducive policy environment and fostering an enabling business environment (Figure 45 and Figure 46). States are likely to find it challenging to increase export orientation by neglecting any of the pillars. Rajasthan and Chhattisgarh have taken decisive steps to improve the policy and business environment by simplifying filing applications, tracking and monitoring without the need for a physical touchpoint for document submission and by establishing special courts to resolve commercial disputes. Both states rank high on policy and business environment but are yet to emerge as important exporters, likely because of weak transport and power infrastructure. Jharkhand has provided policy support through financial incentives, award systems and allotment of land to improve export performance but has been unable to improve either the business environment or infrastructure, resulting in tepid export performance.

Figure 46: Relationship Between Institutions and Export Orientation



APR = Andhra Pradesh, BIH = Bihar, CHH = Chhattisgarh, GSDP = gross state domestic product, GUJ = Gujarat, HAR = Haryana, JHA = Jharkhand, KAR = Karnataka, KER = Kerala, MAH = Maharashtra, MPR = Madhya Pradesh, ODI = Odisha, PUN = Punjab, RAJ = Rajasthan, TEL = Telangana, TNA = Tamil Nadu, UPR = Uttar Pradesh, WBE = West Bengal.

Note: The policy environment includes export promotion policies and the institutional framework, while the business environment index comprises ease of doing business, innovative capacity, labor reforms, investor summits, power cost and single-window clearance.

Data source: Government of India (2018b, 2021b).

Chapter 4 highlights the role of foreign direct investment (FDI) in upgrading high-technology manufacturing in China. In India, too, firms with some form of foreign ownership have better export orientation. A survey in 2013-2014 found that exports accounted for more than 29 percent of total sales of foreign-owned firms, compared with 17 percent for firms that were not foreign owned (World Bank, 2014). Highly export-oriented states such as Maharashtra, Karnataka, Gujarat and Haryana have received the highest amount of FDI, relative to the size of their economies (Figure 47).

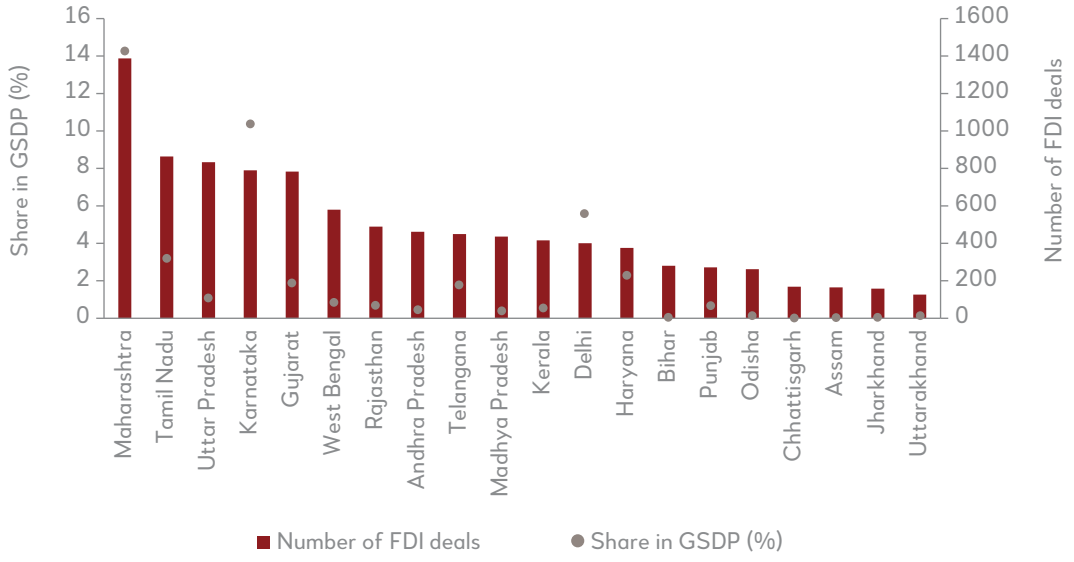
Several countries have successfully utilized special economic zones (SEZs) to increase GVC participation. India's experience with SEZs is more mixed. While exports from SEZs increased 10-fold from 2006 to 2011, they less than doubled over the next decade. The stagnation in SEZ exports in recent years can be attributed to factors that have reduced the incentive to operate within a SEZ. They include withdrawal of fiscal incentives such as winding up the exemption from certain taxes within SEZs and signing of more free trade agreements by India, enabling exporters outside SEZs to import inputs duty free. A 2017 survey found that factors such as policy uncertainty, cumbersome land acquisition processes and regulatory hurdles have resulted in a loss of investor confidence (PHDCCI, 2017). Restrictions on SEZs from securing market access in domestic tariff areas, and the inability of suppliers and ancillary units within SEZs to claim certain tax exemptions have constrained the development of value chains (World Bank, 2020d). SEZs are highly concentrated in six states—Tamil Nadu, Maharashtra, Telangana, Karnataka, Andhra Pradesh and Gujarat—which account for 75 percent of operational SEZs, in line with the states' share of India's exports.

5.4 Port Efficiency and Connectivity to Hinterlands Are Critical

The competitiveness of exports depends on whether cargo can reach its destination on time at a reasonable cost, which is even more important for GVC exports. Improving GVC participation across India will largely rely on a combination of increasing port efficiency, capacity and connectivity with the hinterland. India has the geographic advantage of having two coasts, providing easier access to the hinterland, should connectivity investments be made.

India has more than 300 ports that include seaports, land ports and inland container depots to ease exports and imports. Of these, the top 100 account for nearly 96 percent of trade. While seaports continue to be the dominant conduit for international

Figure 47: Foreign Direct Investment in Indian States Aggregated, 2016-2020



AIIB = Asian Infrastructure Investment Bank, FDI = foreign direct investment, GSDP = gross state domestic product.

Note: The value of foreign direct investment (inward) is aggregated from cross-border merger and acquisition deals (brownfield) and investment projects (greenfield) where the target entity is in India. The information on the state is determined either by the headquarters location of the target company or by the project location. The cross-region or multi-country projects or deals are excluded from the analysis.

Data source: ORBIS Zephyr database and Cross-Border Investment database and AIIB staff calculations.

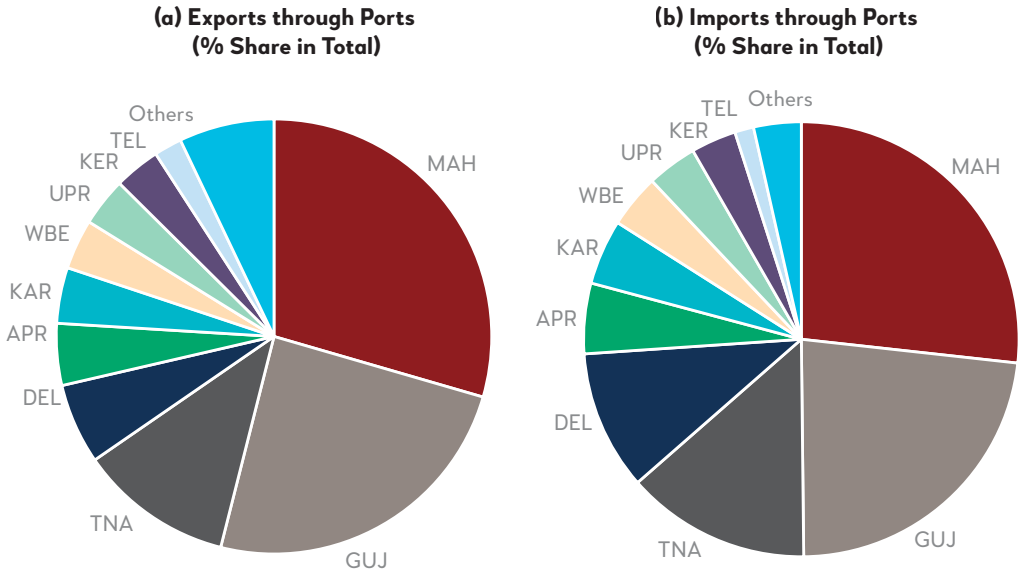
trade, air cargo has emerged as an important channel, especially for high-value goods such as electronics, electrical machinery and equipment, pharmaceuticals and perishables. Transit through ports is highly concentrated in Maharashtra, Gujarat and Tamil Nadu, accounting for nearly two-thirds of exports and imports (Figure 48). Delhi has emerged as an important inland hub for exports and imports, mainly through air freight.

Port efficiency has improved in recent years. Privatization of port operations, upgrade of equipment and better berth planning have helped reduce ship turnaround times from more than 5 days in FY2011 to about 2.6 days in FY2021. India has room for improvement, given that the median turnaround time globally is 0.97 days (Government of India, 2021b).

Less attention has been focused on port-hinterland connections and their impact on exports. More than 85 percent of freight is dependent on roads or railways, and a significant share of cargo experiences idle time during its transit to ports. Container exports take 7-17 days from the hinterland to a vessel in India, compared with six days in China (Government of India, 2016). While the longer time is partly because containers traverse a larger distance in India, the lack of seamless connectivity arising from weak infrastructure and capacity constraints on highways and railway lines that connect ports to production and consumption centers also contributes. International experience and data from Indian ports indicate that better port connectivity is vital to boost exports.

To increase port efficiency and connectivity, the government has embarked on the Sagarmala Program, under which more than 574 projects worth USD82 billion (INR6.0 trillion) have been identified for implementation during 2015-2035. The projects seek to (1) remove bottlenecks and expand capacity of existing ports and develop greenfield ports, (2) strengthen the connectivity of ports to the hinterland, (3) develop port-proximate industrial clusters and coastal economic zones to reduce logistics costs, (4) promote sustainable development of coastal communities and (5) incentivize the movement of cargo through sustainable coastal and inland waterways (Government of India, 2016).

Figure 48: Exports and Imports through Major Sea and Land Ports, 2019



APR = Andhra Pradesh, DEL = Delhi, KAR = Karnataka, KER = Kerala, MAH = Maharashtra, TEL = Telangana, TNA = Tamil Nadu, UPR = Uttar Pradesh, WBE = West Bengal.

Data source: Directorate General of Commercial Intelligence and Statistics (DGCI&S), Ministry of Commerce, Government of India.

Given the myriad benefits of exporting, the government has outlined ambitious plans to significantly increase India's export volume in the medium term (Government of India, 2018a). Realizing the targets will be contingent on increasing India's linkages with GVCs, especially in the high-value segments. Investments in supporting infrastructure and policy reforms will be critical to realizing India's GVC potential (Government of India, 2017).

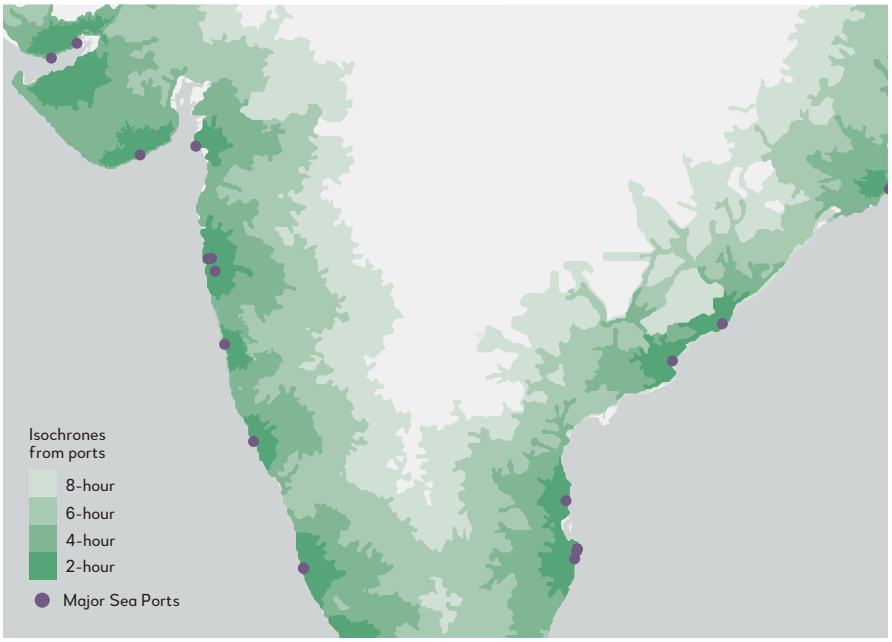
Box C: Why Port Connectivity Matters

by the Economist Intelligence Unit

With maritime trade accounting for the bulk of global merchandise trade, seaports are the gateways of global value chain (GVC) participation for most firms. Exporting and importing firms tend to locate close to a seaport to minimize transport costs and time. But "close" need not refer to physical distance. A firm can enjoy significantly shorter travel time to a port well-connected by a highway network than one that is closer to the port but lacking road connectivity. Building on spatial data, this section illustrates how improving road connectivity to ports can potentially boost participation in GVCs.

Figure C.1 shows two-to-eight-hour isochrones for India's 20 largest ports in 2019 in terms of export value.[a] The better connected a port is in terms of number and quality of road connections, the larger its associated isochrones will be. Mumbai port, for instance, boasts larger isochrones than Visakhapatnam, which is in a more sparsely populated region with fewer roads.

Figure C.1: Isochrones of India's Top 20 Ports by Export Value, 2019



Data sources: HERE and Natural Earth.

As Figure C.2 shows, port-level exports are highly correlated with the number of factories within the two-to-four-hour isochrones, which is intuitive: the more factories located near the port, the more the facility exports.[b] The correlation falls as travel time to the port increases beyond four hours, since factories farther from the port are less likely to be engaging in trade. Four hours is thus used as the benchmark for the remaining analysis.

Isochrones alone, however, are an imperfect measure of road connectivity. If an area is remote and mountainous, there may be no need to construct an extensive road network as there are likely few inhabitants and firms that need connecting.

To construct a better connectivity measure, an "ideal" must first be established for how large an isochrone could be in the absence of any road or traffic restrictions. The ideal must assume that it is possible to drive in a straight line to any destination from the port at high speed (100 kilometers [km] per hour in this case), producing a circle-shaped ideal isochrone with the port as the center.

Next, the factories are incorporated into the connectivity measure by taking the ratio of the number of factories within the actual isochrone to the number of factories within the ideal isochrone. For a four-hour isochrone, the ratio refers to the share of factories within a 400-kilometer radius of the port that can be reached within four hours. The higher the ratio, the better connected the factories are to the port.

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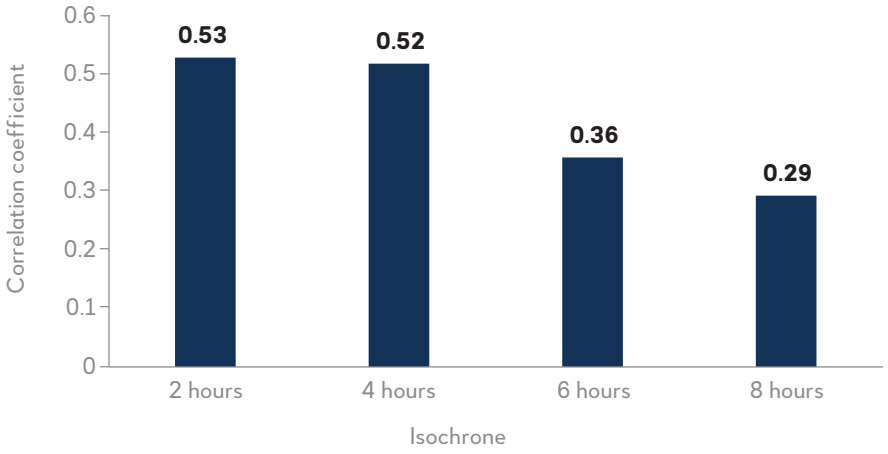
Box C: *continued*

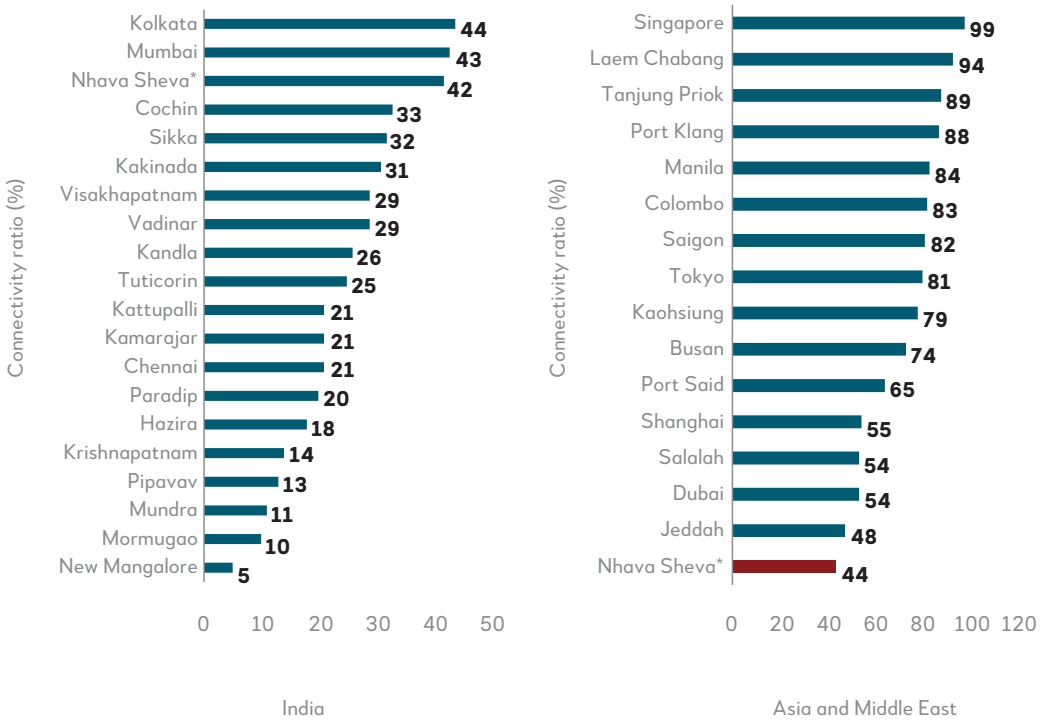
Figure C.2: Correlation of Port Exports in 2019 and Factory Count by Isochrone



Data sources: HERE and Directorate General of Commercial Intelligence and Statistics (DGCI&S), Ministry of Commerce, Government of India.

Figure C.3 shows the road connectivity performance of each of India's top 20 ports based on the measure described above. India's best connected is Kolkata port, with a ratio of 44% (44% of factories within 400-kilometer can be reached in four hours), followed by Mumbai's two ports (Nhava Sheva and Mumbai). A relatively high-quality road network around Mumbai (the city is linked by a highway to Pune nearby), coupled with a clustering of industries near or in India's economic capital, accounts for the high performance. Yet, there is significant room for improvement. Figure C.4 shows the connectivity ratios of Asia's "prime" ports, defined as the busiest in each economy, selected from a list of the world's top 50 ports ranked by container traffic. Nhava Sheva, India's busiest port, significantly lags behind its peers in connectivity.

Figure C.3: Four-Hour Port Connectivity Ratios



Note: Due to the use of a different dataset for industrial complexes, there is a minor difference in the ratio for Nhave Sheva Port between India and Asia scores.

Data sources: HERE and OpenStreetMap.

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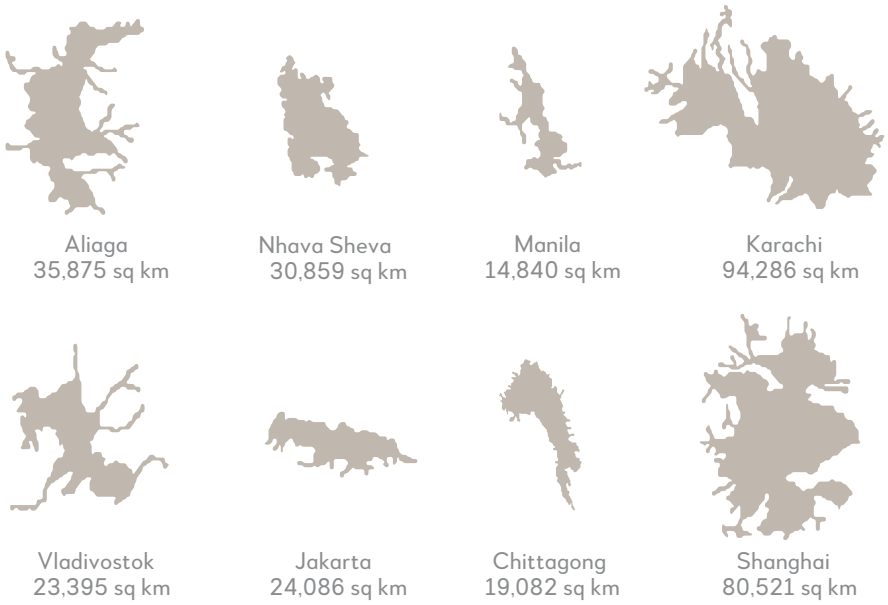
Box C: *continued*

Figure C.4: Four-Hour Isochrones for Selected Ports



sq km = square kilometer.

Data source: HERE.

Not all port isochrones, however, are comparable. In countries less expensive than India, many ports, such as Singapore's or Malaysia's Port Klang, will have isochrones constrained by land area, resulting in factories locating closer to the port and a higher connectivity ratio. More suitable comparisons are the ports of Shanghai or Thailand's Laem Chabang, which do not face such land constraints (Figure C4). The difference among isochrone areas is stark, with Shanghai's more than twice as large as others', illustrating the impact of an extensive highway network. There are 144 km of highway per thousand square kilometers in Shanghai's isochrone, compared with 26 km for Laem Chabang and 8 km for Nhava Sheva.

India's least connected of the top 20 ports, in Mangalore, has a ratio of only 5% (Figure C.5) because the bulk of industry within 400 km of Mangalore is clustered around Bengaluru, which lies beyond the four-hour isochrone (Figure C.5). It takes more than 7 hours to reach Bengaluru from Mangalore by car, covering about 350 km. With a high-speed highway link, it would be possible to nearly halve the drive time. Road trips from Paris to Brussels or from Washington, DC to New York, which span a similar distance, can be done in under four hours.

There may well be deeper reasons why New Mangalore port lacks connectivity to nearby industrial clusters. The port's exports consist largely of commodities such as petroleum products, iron ore, coffee and cashews. Bengaluru's high-technology orientation may be better suited to air shipments. The connectivity measure may not capture all the historical and economic complexities of the region, which should be factored into any conclusions drawn, and merely serves as a starting point for analysis.

How does the road connectivity measure fare in predicting port exports? The correlation between manufacturing exports and the connectivity ratio for the top 20 ports is 0.39 (Figure C.6). A notable outlier is Mundra, India's second largest port by export value, which exports far more than its connectivity score would suggest because it is the export hub for the industrial hinterland in the north, surrounding Delhi. Removing Mundra increases the correlation to 0.5.

Correlation is not causation, however, and the direction of causality can run both ways. Firms may be choosing to locate in better-connected areas, or the government may be prioritizing road improvements in areas with more factories. What is clear is that there is ample room to improve the road network. What is also clear is the mutually reinforcing nature of infrastructure development and exports. Recognizing these facts and creating the right policy environment are critical to India's development.

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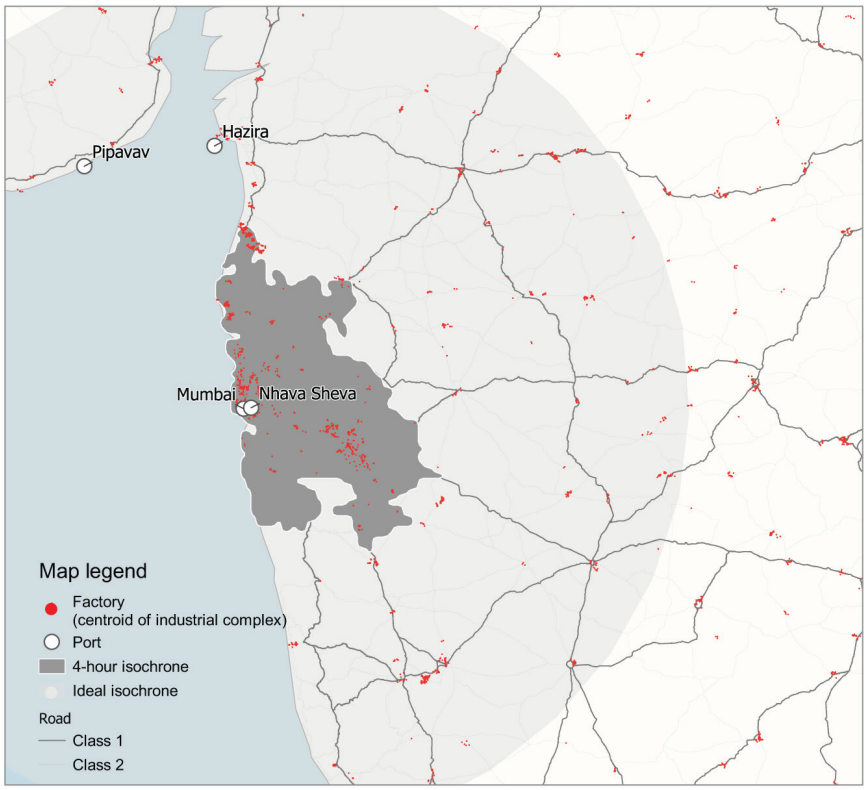
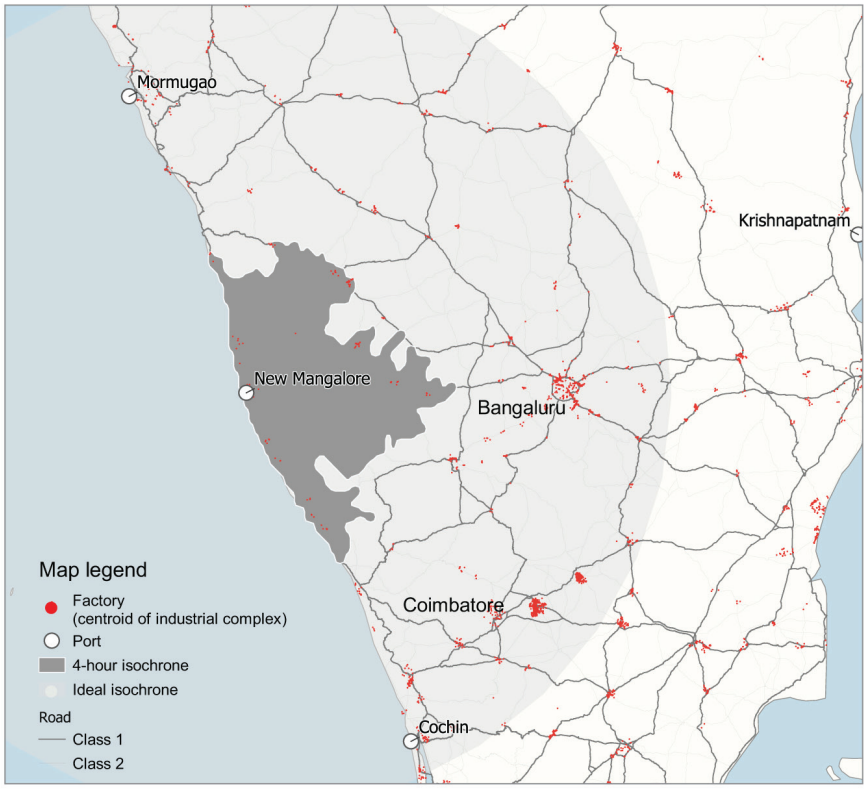
Box C: *continued*

Figure C.5: Industrial Clusters and Port Connectivity in Mumbai and Mangalore



Mumbai Havasheva



New Mangalore

Data source: HERE; Natural Earth.

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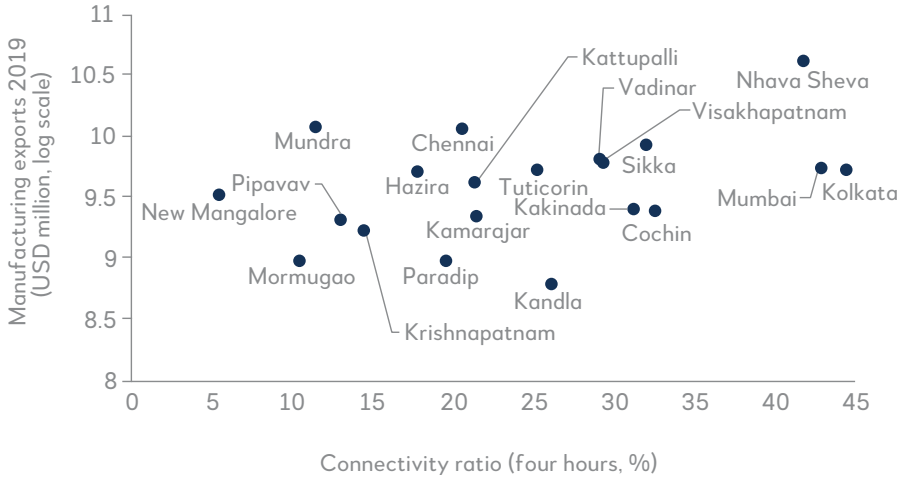
Box C: *continued*

Figure C.6: Manufacturing Exports and Port Connectivity Ratios



Data source: HERE and Directorate General of Commercial Intelligence and Statistics (DGCI&S), Ministry of Commerce, Government of India.

AIIB = Asian Infrastructure Investment Bank.

[a] An isochrone is a geometric shape that maps the boundaries of how far one can travel from a fixed point in a given amount of time. To ensure international comparability, the isochrones are generated under "no traffic" assumptions.

[b] Defined as the number of "industrial complexes."

CHAPTER 6

A POLICY FRAMEWORK FOR INFRASTRUCTURE DEVELOPMENT AND GLOBAL VALUE CHAINS

Infrastructure is the material underpinning of integration into global trade and global value chain (GVC) participation. This chapter reassesses infrastructure investment in an analytical and policy framework that considers the nature and evolution of GVC participation. With proper GVC mapping and well-coordinated GVC-sensitive policy interventions, policy makers can ensure that infrastructure investments support GVC participation, positioning and, ultimately, upgrading.

6.1 The Paradigm for Infrastructure Development and GVC Participation Is Evolving

Infrastructure matters for GVC participation (Chapter 3). Supportive infrastructure endowment—from reliable energy provision and domestic accessibility to international cross-border connectivity—is a necessary, although not sufficient, condition for participation in global trade and investment flows. However, limited fiscal capacity and other institutional constraints make it difficult for policy makers to align quantity and quality of infrastructure provision with the growing (and evolving) needs of domestic and foreign firms and their suppliers. Under these conditions, the scope of infrastructure policy is not limited to prioritizing the right types of infrastructure for the right contexts to maximize returns. On the contrary, policy also involves the coordination of a wider system of targets and policy areas shaping long-term patterns of participation in global flows of goods, capital and knowledge, with long-term implications for innovation, economic growth and development trajectories. When looking at infrastructure investment and policies from a GVC standpoint, a wide set of factors should be considered in systematically.

6.1.1 Task Nature of GVCs

Given that participation in GVCs implies specialization in specific intermediates or a small set of products to support production processes globally, it is the tasks that matter for GVCs. Tasks, or value-added activities within sectors, vary from primary (basic production, assembly) to medium-skilled support and sales (design, commercialization) to high value added (technological development, specialized services) (Taglioni and Winkler, 2016).

All GVCs are different and, where possible, public policy and infrastructure development should mirror the difference. There is merit in developing countries targeting not only the infrastructure development specific to the GVC segment they seek to engage but also the tasks they want their firms and workers to deliver (Bamber, Fernandez-Stark, Gereffi, and Guinn, 2014). The contribution and impact of different types of infrastructure depend on the nature of the tasks that decision makers aim to prioritize and push their economies to accomplish when engaging with GVCs.

For example, a GVC engagement further downstream in production will likely have greater

need for hard infrastructure such as electricity and transport. Hard infrastructure is, therefore, important in attracting manufacturing investment, particularly by lead firms in the downstream segment of the GVC (Crescenzi, Harman, and Arnold, 2018; AMRO, 2021). Conversely, more knowledge-intensive segments of a GVC will likely have greater need for high-speed trains, high-density public transit infrastructure, well-structured urban spaces and public commons infrastructure such as university laboratories to allow workers to easily share ideas with each other. Services-related GVC activities require infrastructure such as well-connected business parks, close to skilled-labor concentrations. Infrastructure policy, therefore, can affect various GVCs in differentiated ways. It should be grounded in a detailed mapping of GVC participation and positioning and anticipate in the best possible manner the dynamic evolution of both parameters, to accompany and support domestic upgrading. Achieving this closely links infrastructure policy with the retention of foreign direct investment (FDI), which plays a central role in shaping GVC participation and positioning (Crescenzi, Harman, and Arnold, 2018) as they have in Asia, including China (AMRO, 2021).

6.1.2 Institutional Support and Soft Infrastructure

Institutional support and soft infrastructure must complement hard infrastructure. Even if a country has the best hard infrastructure, the lack of supportive soft infrastructure can deter investment and upgrading. For example, poorly protected property rights and land titling can result in reduced investment (Besley and Torsten, 2011). Other studies show that national institutional quality is a vital location driver of FDI (Bénassy-Quéré, Coupet, and Mayer, 2007) as are subnational institutional arrangements, particularly for more knowledge-intensive investors. Institutional quality could even be more important than accessibility and agglomeration economies (Crescenzi, Pietrobelli, and Rabellotti, 2013). Besides hard infrastructure, customs efficiency is a major determinant of international connectivity and underpins GVCs. Delays at the border can slow down and increase uncertainty of buying or selling in GVCs (Taglioni and Winkler, 2016).

As a country develops, statistical evidence shows strong complementarity between hard and soft infrastructure (Portugal-Perez and Wilson, 2012). Raising the quality of institutions and directing them to where investment is sought will help engagement with GVCs. General institutional quality will form the basis for GVC engagement (especially through FDI), but specific institutional arrangements are key to the participation of an economy in GVCs and for its potential upgrading trajectories.

6.1.3 Trade Policy and Regional Connectivity

Given the need to reduce trade costs and to smooth production sharing, trade in intermediate goods—a key feature of GVCs—is more regionalized than trade in final goods (Baldwin and Freeman, 2020). As a result, regional trade policy has a large impact on both GVC participation and the political and economic feasibility of the necessary supportive cross-border infrastructure. A regional trade framework, such as the Regional Comprehensive Economic Partnership, that can facilitate regional integration and shape future strategic cross-border infrastructure investment decisions is, therefore, important. This involves promoting quality regional connectivity, such as connected highways, rail and efficient cross-border customs or immigration clearance. While requiring coordination and political effort, a regional approach to developing infrastructure and attracting key industries can bring wider benefits.

6.2 Special Economic Zones Are Place-Based Infrastructure Interventions

Locational or place-based infrastructure policy can help initiate GVC participation. Many developing economies face fiscal or institutional constraints on infrastructure quantity and quality. Targeting and prioritizing selected geographies and sectors and removing the bottlenecks identified through the wider diagnostic approach outlined above might be necessary to kick-start upgrading and development. Special economic zones (SEZs) are examples of such spatially targeted infrastructure interventions. By upgrading infrastructure quality in

a defined location and targeting institutional policy support, developing and emerging economies can jump-start their participation in GVCs. By offering location incentives for selected priority sectors and/or specific categories of foreign investors, SEZs can support the shift to more sophisticated knowledge-intensive tasks. SEZs target specific locations and their influence is limited to well-defined areas. SEZs are set up to attract global investment flows to priority sectors, and activities are usually focused on export markets, influencing GVC participation and positioning.

SEZs are a popular policy instrument increasingly seen as a way to create jobs and promote industrial development; 147 countries have an SEZ policy (UNCTAD, 2019a). Most SEZs are in Asia (about 4,750 of 6,000), half of them in China. Some East Asian economies have enjoyed considerable success using SEZs, although the record is mixed. For example, in India, although 625 SEZs had been formally approved as of 2014, only 152 sites were operational, a common situation in other countries (Khandelwal and Teachout, 2016).

Despite SEZs' mixed record, for countries facing fiscal or institutional constraints on development, SEZs remain an attractive tool. For example, in Bangladesh, SEZs focused on reducing delays to obtain import licenses, clear customs (i.e., improved international connectivity) and reduce the number of power outages (i.e., improved domestic network connectivity). The result of the targeted intervention saw Bangladesh's eight SEZs attract USD2.6 billion of investment, creating more than 350,000 jobs (World Bank, 2016).

Assessments of SEZs' success must weigh investment in hard and soft infrastructure to build and embed GVCs against resources devoted to tax breaks or financial incentives. For example, cross-country evidence from Africa shows that providing financial incentives does not correlate with SEZ outcomes (Farole, 2011). Financial incentives for firms in SEZs are among the least important drivers of investment flows into the SEZ in Kigali, Rwanda (Steenbergen and Javorcik, 2018). In Myanmar's first SEZ, Thilawa, however, the main benefit of FDI was domestic workers acquiring new skills (Khandelwal, Macchiavello, Teachout, Park, and Htet, 2018). The trained, higher-skilled workers then shared their expertise with domestic workers, especially managers, who then spread the benefit to the rest of the economy. Yet, the SEZ faced an infrastructure constraint. One policy proposal to improve the zone was shortening commuting times. Managers were most discouraged by the long commute, with about 65% traveling more than 2 hours per day.

It is difficult to obtain detailed data on SEZs' infrastructure or export performance that allow clear, generalizable findings. However, an analysis of China's manufacturing SEZs, for which more detailed data are available, shows that export performance is positively correlated with population and infrastructure in the vicinity (e.g., road density) and negatively correlated with travel times to transport nodes such as train stations, ports and airports. SEZs—where appropriate national framework conditions are in place—effectively compete for exports and GVC participation by leveraging their infrastructure and connectivity advantages.

6.2.1 Adding the Institutional Component: Investment Promotion and Local Content Units

A key reason for SEZs' mixed record is that policies must be tailored to local capabilities and the needs of specific GVCs. Both hard and soft infrastructure must not only help build connections with GVCs but also enable upgrading within them. Often missing, however, is more direct and targeted engagement with localized markets because of institutional failures and information asymmetries. To deal with them, investment promotion agencies (IPAs) and local content units (LCUs) are key tools, ideally within SEZs or independently.

IPAs aim to attract foreign investment to a country or, in the case of the increasingly popular subnational IPAs, to a region or to a clearly delimited jurisdiction such as an SEZ. The impact of IPAs is maximized where they act as "localized institutional plumbers" that closely cooperate with foreign investors to tailor the local investment ecosystem to their changing needs (Crescenzi, Di Cataldo, and Giua, 2021). IPAs are important in engaging with lead firms that, in different forms, orchestrate GVCs, often via FDI,

particularly in less dynamic regions within countries. The global investment flows that IPAs aim to attract are key to the growth of domestic value added. Such flows represent the initial link that many regions use to hook into GVCs. The flows can drive value added, as in ASEAN+3, where FDI is key to the growth of domestic value-added exports (AMRO, 2021). IPAs can be both inward and outward facing, with different merits. Well-planned IPAs and associated strategies were critical in attracting catalytic GVC investments by multinational enterprises (MNEs) in countries such as Costa Rica, Malaysia and Morocco (World Bank, 2020a).

Developing wider connections between domestic firms and foreign firms that directly engage in GVCs within SEZs can be enabled by dedicated local content units (LCUs), which are usually set up within or alongside IPAs. LCUs enable connections between investors and suppliers, specifically local linkages with small and medium-sized enterprises and MNEs. LCUs provide an opportunity to embed GVCs by working with MNEs to integrate local companies into their supply chains (Sutton, 2016). Embedding activities of foreign affiliates in domestic value chains could drive up domestic activities and value-added exports (AMRO, 2021). While waiting for more systematic evidence on the impact of LCUs, further experimentation is needed to complement attracting key GVC-oriented firms with developing local linkages. Working with LCUs should not come at the expense of efficiency.

IPAs and LCUs highlight the importance of the lead firm in GVCs, with implications for infrastructure policy. Infrastructure provision sets the ground for internationalized firms to choose their location and engage with the local ecosystem. Ultimately, however, the firms' strategies shape GVC engagement and the associated returns for the wider domestic economy. Countries engaging successfully with GVCs are those that leverage the lead firm for the most gain. The lead firm's characteristics and choices should influence key decisions on the type and function of infrastructure investment as part of a wider coordinated strategy, which involves IPAs and LCUs influencing strategic decisions through information and ecosystem development.

6.3 Infrastructure Should Be Connected to Industry Development

As policy makers invest in infrastructure, they must engage in specific industrial verticals: that is, make a deliberate public policy choice to attract and anchor certain industry clusters. Doing so is essential to realize the value of GVC participation. User industries are needed to ensure the economic sustainability of infrastructure investment. Major infrastructure development, without a wider strategy to develop industry verticals, risks creating "white elephants." With GVCs, countries do not need to cover the needs of a whole industry but can target only specific segments or value-added activities that build backward and/or forward linkages and that are aligned with the countries' capabilities.

The success of Asia's garment manufacturers highlights the importance of building industry verticals. The manufacturers were initially integrated into GVCs by North American and European lead firms but are now taking on significant coordination functions alone (Azmeh and Nadvi, 2014). A classic infrastructure development lens would highlight more typical infrastructure needs for garment processing, including transport, energy and water, as priorities. The GVC lens, however, fits infrastructure development and targets to the value chain. The needs for GVC upgrading or GVC integration into services would see future infrastructure planning refocus on information and communication technology (ICT) and logistics. Firms need ICT to share codifiable design knowledge.

Logistics are important so firms can capture value in distribution. Some successful case studies show how some garment manufacturers—such as the Crystal Group based in Hong Kong, China—are starting work on higher-value joint logistics and data platforms with buyers in addition to collaborating on research and design (Azmeh and Nadvi, 2014). Integration into GVCs as "buyers" of foreign value added by developing backward linkages is more significant for countries with low incomes and limited technological capabilities. The formation of forward linkages with high domestic value addition is more typical of countries with higher incomes and more developed capabilities. Countries whose GVC participation is based on leveraging backward linkages (i.e., using foreign inputs) will—at the early

stages of their GVC engagement—give particular importance to air or freight infrastructure and road network development and quality. Conversely, countries leveraging forward linkages—once a minimum level of hard infrastructure is in place—will benefit more from domestic market institutions, driving education, skills and compliance with standards (Engel and Taglioni, 2015). For middle-income countries, if key soft infrastructure is missing, or if key complementary inputs such as specific hard infrastructure or connectivity are lacking, then upgrading will be slower with a high risk of getting stuck in the transition from investment- to innovation-led growth (Paus, 2012). Targeted GVC-sensitive infrastructure investment is, therefore, crucial.

The policy considerations for investing in infrastructure while raising GVC participation are multifaceted and tightly interlinked. They respond dynamically to changes in the marketplace, technological shocks and other disruptions. Policy considerations for informed infrastructure investment choices and impact on GVCs are in Table 2. It shows the different roles and consequences of infrastructure development and GVC engagement. Place-based approaches and tools are designed to target and generate impacts in specific jurisdictions, cities or regions within a country. In contrast, place-neutral policies are not specifically designed to target a specific area but to consider only heterogeneous initial conditions, characteristics and capabilities of the places where they will be implemented or that will be affected or influenced by their implementation. Significant failures have been recorded when infrastructure policy was considered a place-neutral tool. A place-neutral top-down approach to infrastructure policy has often led to overinvestment in poorly targeted infrastructure, resulting in the wrong type of connectivity for some areas and in "white elephants" in others. The first-generation infrastructure policies supported by the European Union Structural Funds in Greece, Spain and Portugal in the 1990s are typical examples of the approach. Understanding infrastructure investment as an addition to public capital in an aspatial production function has led to increasing spatial inequalities, limited economic benefit and lack of resilience to external shocks (Puga, 2002). Only more recently have advancements in economic theory and policy debates supported a shift to infrastructure policies cognizant of locational and spatial impacts (Ottaviano, 2008; Crescenzi et al., 2016).

However, while infrastructure policies are slowly evolving to more place-based approaches, their design is often still GVC neutral. GVC-sensitive or GVC-neutral policy tools look at the result of public policy in GVCs' participation and positioning, particularly issues of building and embedding linkages. Some policies impact and are designed for GVCs, and others, while not explicitly designed for GVCs, will have an impact on them. Some policies are GVC neutral, only indirectly impacting GVCs. Like space-neutral policies, underestimating the GVC sensitivity of key public policies has brought limited benefit to the implementing economies. FDI-led development models and policies in Central and Eastern European countries are a typical example. A significant share of their catching up with euro-area productivity levels has been achieved by leveraging FDI inflows. European Union funds have been used to develop hard and soft infrastructure to attract FDI.

However, impacts across sectors, countries and subnational regions have been highly heterogeneous. Policy makers have paid limited attention to wider ecosystem conditions and to local absorptive capacity (Bijsterbosch and Kolasa, 2009), and failed to promote the development of domestic linkages and upgrading. Countries can utilize GVC- and place-sensitive approaches to ensure that they benefit from participating in GVCs and go beyond simple engagement to capture the gains of GVCs as drivers of development. For example, this is the rationale behind the European Union's Industry 2030 strategy, which revolves around a set of selected strategic value chains and their connection to value creation networks (European Commission, 2019a). The European Commission takes a GVC-sensitive approach (going beyond traditional sector policies), positing that the "policy must be inherently designed for value creation networks rather than for individual sectors, and for companies of all sizes."

Infrastructure investment can be placed in a policy framework that simultaneously adopts a place-based and GVC-sensitive lens to view productivity and growth. Policies targeting general institutional quality or soft infrastructure help create the central preconditions for upgrading but are not designed to target GVC engagement specifically or to connect to a particular GVC segment or industry (GVC neutral). The policies lack spatial targeting and can

be considered space neutral. Newer infrastructure policies are designed to make places more accessible and to induce a reduction in transaction costs that can trigger agglomeration forces in specific locations. However, the policies' impact on GVC participation is only indirect and mediated by the attraction of FDI or lead firms and physical access to suppliers.

By contrast, trade policy and regional connectivity try to actively engage with specific segments of GVCs, but they do not target particular areas and are not tailored to the capabilities and absorptive capacity of specific places. A new approach to public policies for upgrading is to use tools that coordinate place-based and GVC-sensitive approaches, such as SEZs. Where augmented by active investment promotion and local content tools, they can potentially jump-start the infrastructure hardware and institutional software needed for gainful GVC engagement and upgrading.

The policy considerations in making informed infrastructure investment choices by combining spatial and GVC considerations are in Table 2.

Table 2: Public Policy Tools Matrix for Global Value Chain-Sensitive Infrastructure Provision

	GVC-sensitive Impacting and designed for GVC engagement	**GVC-neutral** Not designed to target specifically GVC engagement
Place-based Impacting and designed for a specific area, jurisdiction or geography	Special economic zones; regional (subnational) investment promotion agencies; local content units	Domestic connectivity and accessibility (hard infrastructure)
Place-neutral Not designed to target a specific area	Trade policy and regional connectivity International connectivity (logistics and customs)	Institutional quality, business environment and soft infrastructure

GVC = global value chain.

Source: Asian Infrastructure Investment Bank.

CHAPTER 7

SUSTAINING GLOBAL VALUE CHAINS INTO THE FUTURE

The pandemic and its aftermath have compelled policy makers and investors to ask fundamental questions about GVCs. In the near-medium term, the key challenges are to make supply chains more resilient not only to shocks, including changes in trade policies, but also to extreme weather events and other consequences of climate change. Over the long term, the fundamental challenges are to ensure that GVC trade and related infrastructure are climate and environment friendly and to make GVC trade more inclusive for more countries. These challenges must be met, for they determine the sustainability of future GVCs.

7.1 Ground Infrastructure Must Be Coupled with Robust Digitization

The pandemic has accelerated the growth of e-commerce, a shift that has already led to the sharp increase of "micro-packages" in cross-border trade and last-mile urban or rural connections.[28] The shift has to be complemented by the provision of basic, sustainable infrastructure, including ports and local roads. For example, warehouses and storage, which are dispersed and closer to markets, will be needed, while some traditional retail will be retrenched (DHL, 2020).

In urban areas, infrastructure must cope with high volume and be green and efficient, while minimizing downsides such as congestion and waste. A 2019 report on last-mile delivery found that 97 percent of the companies surveyed did not believe that current last-mile delivery models were sustainable across various shop locations, warehousing and parceling (Capgemini Research Institute, 2019).[29] The finding will have implications for urban planning. For example, to transport goods from a logistics hub to a customer's doorstep, bicycles, motorcycles or even drones may be used more intensively and may require changes in road design to keep bicycle and motorcycle riders safe.

In rural areas, the challenge is the opposite: how to serve thinner and spread-out populations without incurring a high-carbon footprint, and at the same time avoid a situation where the lack of infrastructure (e.g., last-mile roads or digital connectivity) prevents people from enjoying the benefits of e-commerce.[30] Many industry players see digitization as important in itself and a bridge to improved sustainability.

[28] Changes in retail will likely accelerate beyond what was envisaged in earlier research, where retail format was thought to be evolving over a longer period (Hortaçsu and Syverson, 2015).

[29] Last-mile services accounted for more than 41 percent of overall supply chain costs, more than twice the costs incurred for any other spending, including warehousing, sorting and parceling (Capgemini Research Institute, 2019).

[30] Evidence on e-commerce in rural areas is mixed. The latest suggests that rural residents gain from a lower cost of living but less so from an increase in income (Couture, Faber, Gu, and Liu, 2021).

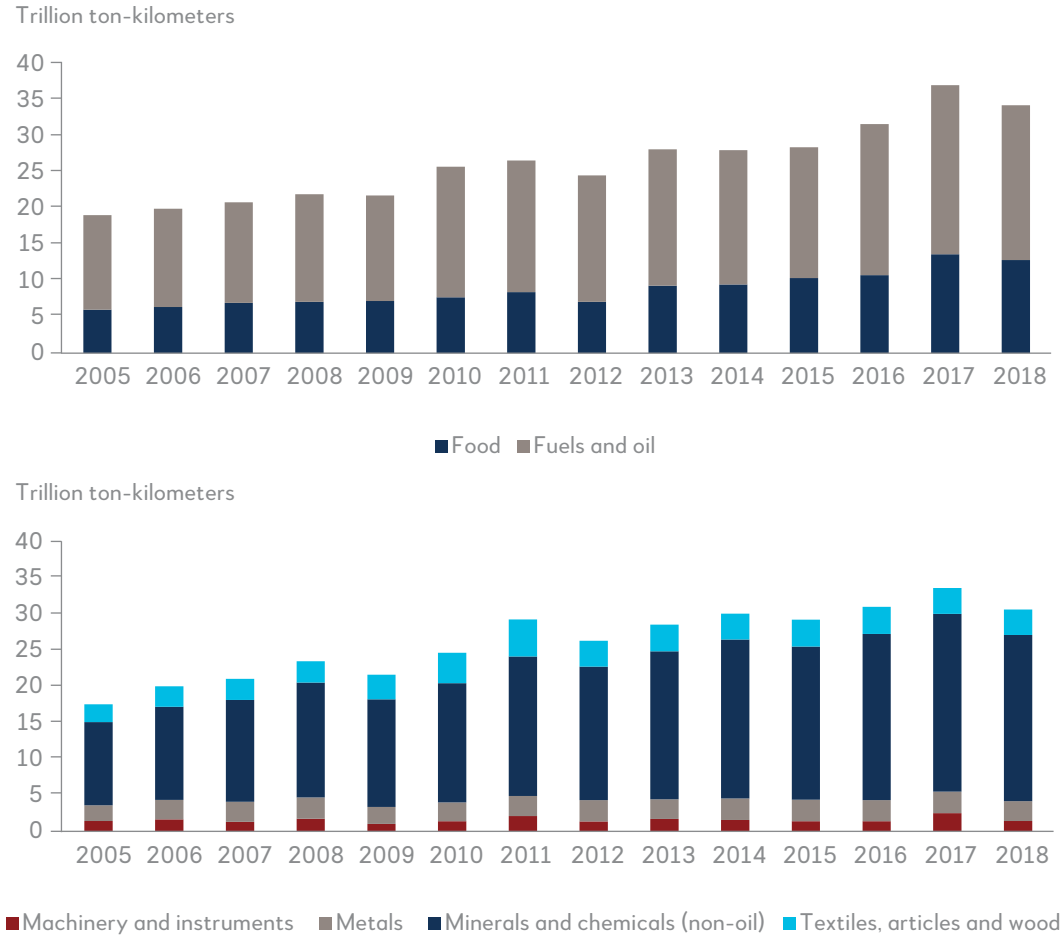
Demand will be greater for logistics infrastructure that is digital and that can improve safety, tracking and transparency while lowering operation and maintenance costs. Thirty percent of shipments are delayed, 25 percent of trucks on the road are empty and 44 percent of executives describe supply chain visibility as a top priority (Deloitte, 2021). Digitization and information technology upgrades are increasingly becoming the norm to improve efficiency and attract customers to ports and logistics facilities around the world.

Digitization can bring about environmental benefits. The most common initiatives to reduce carbon emissions in transport and logistics focus on improving productivity and efficiency, thereby reducing, or eliminating superfluous transport-related emissions ("empty miles"). For example, Alibaba joint venture Cainiao offers a logistics data platform to help network members fill orders more efficiently. Other applications of technologies such as load sensing, warehouse automation, data-driven cargo sorting and delivery-routing optimization all help maximize freight capacity while reducing emissions per kilometer and potentially the number of trips to service client demand.

7.2 We Must Prepare for Higher Trade Costs

International trade incurs a carbon footprint estimated at about 2.1 gigatons per annum. In general, carbon emissions are correlated with weight of goods, distance travelled and mode of transport. For industry-related goods—most closely linked to GVCs—the distance-weight incurred by goods has flatlined in recent years, but the distance-weight of agriculture and oil-related goods continues to rise moderately.

Figure 49: Distance-Weight of Internationally Traded Goods



AIIB = Asian Infrastructure Investment Bank, UN Comtrade = United Nations International Trade Statistics Database.

Data sources: UN Comtrade and AIIB staff calculations.

First, fuel transport has a high-carbon footprint, given the weight and distance travelled. Renewable power generation, to the extent that it reduces fuel imports, further reduces carbon emissions through lower transport needs. Second, trade policies influence carbon emissions. For example, with the rising trade tensions in 2017-2018, distance-weight has seen an uptick as trade in agricultural goods is diverted.

Globally, greenhouse gas emissions, including from land use, stood at about 49.4 gigatons in 2016. Freight emissions (international and domestic) are estimated at about 3.6 gigatons. Using a conservative carbon price of USD40 per ton, this translates roughly to USD144 billion per year.[31] Against the backdrop of a global logistics sector estimated to produce USD12 trillion of services per year, the estimated carbon cost is not overly onerous but certainly nontrivial.

Of concern is that carbon pricing of trade logistics will present a bigger challenge for developing than for developed economies. Shapiro (2016) presented a comprehensive analysis of the impact of carbon pricing on trade costs and showed that higher trade costs could affect developing economies more negatively. Although carbon prices improve global welfare, developing economies bear a larger burden of the costs as they export heavier commodities that require more shipping fuel.

By 2050, demand for freight and nonurban passenger transport is projected to grow 225 percent by 2050, with Asia alone projected to account for 56 percent of the world's surface freight emissions (International Transport Forum, 2019).[32] Greener logistics—defined as the effort to minimize the ecological impact of logistical activities—will, therefore, become a key part of sustainability. Transport infrastructure must reduce its carbon footprint and eventually reach zero emissions. It is critical for sustainable GVC trade.

7.3 Greener and Sustainable GVCs Must Be Secured

GVC trade produces significant levels of carbon emissions, which are then traded across borders. Gross emissions embedded in exports amount to about eight gigatons per year or close to 20 percent of global emissions. Organisation for Economic Co-operation and Development (OECD) countries are largely net importers of carbon emissions, while non-OECD countries are exporters (OECD, 2019).

As countries focus on reducing domestic emissions and meeting their national targets under the Paris Agreement, they will increasingly look at carbon emissions embedded in trade to prevent carbon leakage. Organizations will need to focus more on Scope 3 emissions (Greenhouse Gas Protocol, 2021). Economies and organizations that plug into GVCs via clean energy will enjoy a competitive advantage.

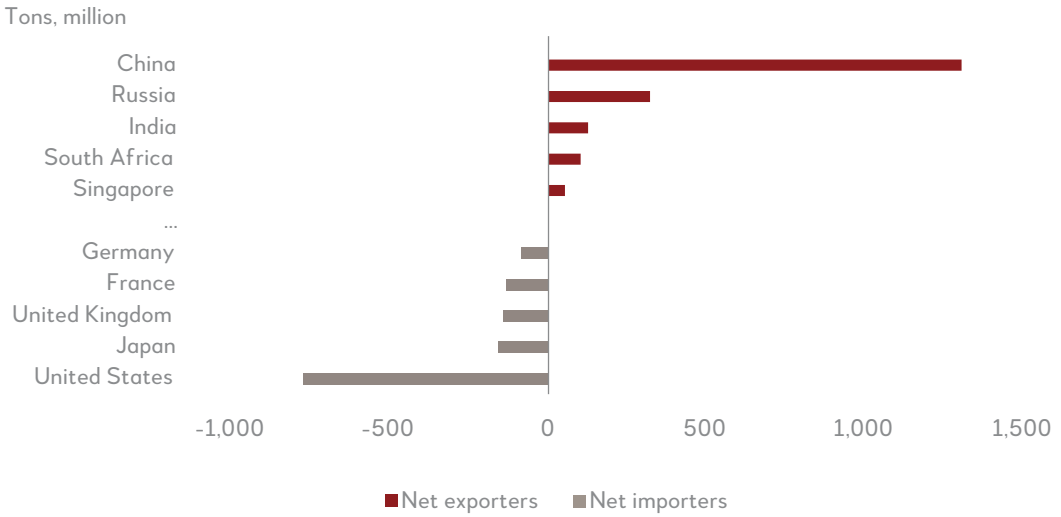
Greening GVCs and achieving commonly high standards are perhaps the most fundamental and difficult of all challenges. They rest on some fundamental pillars:

1. **Continued fast scaling up of renewable energy in each economy.** It underpins the sustainability of all production and consumption, including goods and services produced for trade.
2. **Renewable energy production complemented with renewable energy trade.** The key pathway continues to lead to cross-border transmission lines and greater grid connectivity (Asian Infrastructure Investment Bank, 2019). Trade in biofuels and hydrogen can be expected to become more mainstream for longer-distance energy trade (Ernst and Young, 2021).
3. **Recognition that some manufacturing will shift to renewable energy–abundant locations** and alignment of supporting infrastructure such as transport and logistics. For example, industries such as steel making, which need large amounts of energy, are expected to be located closer to sources of abundant renewable energy (The Economist, 2021).

[31] See Our World in Data (2020). About 16.2 percent of global emissions broadly accrue to transport, 11.9 percent to roads, 1.9 percent to aviation, 1.7 percent to shipping, 0.4 percent to rail and 0.3 percent to pipelines. Emissions from road transport are estimated to be split at about 6:4 between passenger and freight. The split between passenger and freight aviation is estimated at 8:2. Freight transport accounts for some four percent of greenhouse gas emissions and nine percent of carbon dioxide emissions (McKinnon, 2020).

[32] Surface freight refers to goods transported by rail, road and inland waterway.

Figure 50: Largest Carbon Exporters and Importers (Tons, million)

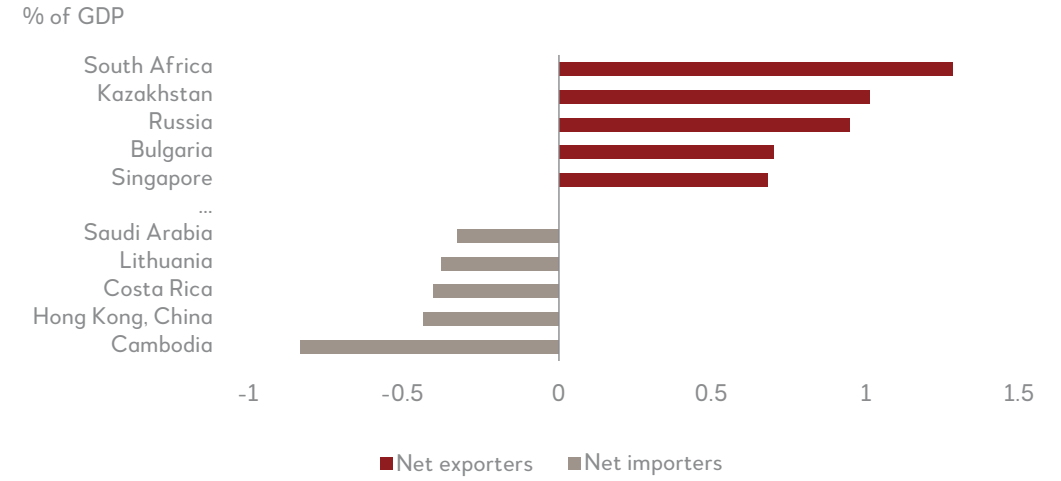


AIIB = Asian Infrastructure Investment Bank, CO_2 = carbon dioxide, OECD = Organisation for Economic Co-operation and Development.

Note: Red bars indicate net carbon emissions embedded in exports; grey bars indicate net carbon emissions embedded in imports.

Data source: OECD CO_2 emissions embodied in international trade database and AIIB staff calculations.

Figure 51: Largest Carbon Exporters and Importers (USD40 per ton and as percentage of GDP)



AIIB = Asian Infrastructure Investment Bank, CO_2 = carbon dioxide, GDP = gross domestic product, OECD = Organisation for Economic Co-operation and Development.

Note: Red bars indicate net carbon emissions embedded in exports; grey bars indicate net carbon emissions embedded in imports.

Data source: OECD CO_2 emissions embodied in international trade database and AIIB staff calculations.

4. **Greening of transport and logistics**
5. **Continued improvement of international governance around carbon emissions and trade and regulations** (including in financial markets), and a greater role played by lead firms to decarbonize production along supply chain and to improve data transparency.

The pillars must be supported by massive investments to remake infrastructure, including energy generation, transmission and transport systems, and require strong international cooperation, including financing, research and technical assistance and regulatory support. The prize will be a greener and sustainable system of trade underpinning global prosperity and development pathways for developing economies.

7.3.1 The Role of GVC Lead Firms

How can the lead firms controlling GVCs and host country governments help achieve these objectives? The GVC angle offers a unique perspective on how to foster the net zero transition. Lead firms are increasingly held accountable for the carbon footprint of the entire value chain. Host governments in the emerging and developing world can attract and retain these companies by offering low-carbon production opportunities. The interaction between firms engaged along the GVCs and governments trying to attract them can help speed up the net zero transition across countries and sectors.

GVC lead firms have increasingly strengthened their control over the standards and procedures used along the value chain, and much of the remarkable efficiency improvements over the last couple of decades come from this capacity to exercise governance across several jurisdictions over wide geographies (Baldwin, 2016). GVC lead firms have used their extensive market power, as large users of intermediates and/or large producers themselves, to pressure suppliers and local policy makers. Implementing the transition to net zero carbon along the value chain would have to happen in much the same way.

Lead firms can "price in" emissions impact of their production and inputs, even in the absence of a global carbon price. In the first instance they would set out to reduce the direct or indirect emissions of their own production (the so-called Scope 1 and 2 emissions). Some large firms, for example, have begun to install their own renewable power or sign Power Purchase Agreements with renewable energy producers. The firms also have the power to affect change along the rest of the GVCs (or Scope 3 emissions). A company's supply chain emissions are estimated to be on average 5.5 times larger than its Scope 1 and 2 emissions. Lead firms, by offering suitable contracts that account for environment impact, can create the necessary financial incentives and encourage local and non-local suppliers to undertake greening initiatives.

Finally, lead firms have a special responsibility for data transparency. Given the fragmented or dispersed nature of GVC production, emissions are often buried deep in the supply chain. Lead firms, given their operations across various jurisdictions and wide scope, can be decisive in bringing about more data transparency, for example, where the parts are sourced, how the goods are produced, among others. Especially when production and emissions are so diffused, data transparency is key to finding collective solutions and actions. Although it would put pressure on greening of activities, including of the lead firms, greater transparency can improve firms' green credentials and offer end consumers (and policy makers) considerable comfort. As awareness grows, data transparency can only become a competitive advantage.

7.3.2 Green Infrastructure as Place-Based Industrial Policy

The pressure on lead firms to reduce the GVC carbon footprint provides an opportunity for policy makers in current and aspiring host countries for activities along the value chain. Lead firms will be heavily dependent on policy makers providing infrastructure that allows for carbon reduction. Offering these opportunities will be part of place-based policies in much the same way as host governments are luring firms with high-quality infrastructure, such as fast and flexible multimodal transport networks and high-speed broadband coverage.

The pillars will have to be supported by massive investments to overhaul existing infrastructure, from energy generation and transmission to transport systems. Close attention must be paid to the supporting policy environment, from macroeconomic and sector policies to place-based ones. With firms and consumers ever more environmentally aware, the race is on to the top, not to the bottom. Economies that invest in greener infrastructure will become more attractive to FDI and companies, and thus reap the benefit of plugging into a future sustainable global production chain.

Europe's pilot CO2TransPorts project is an example of infrastructure supported by governments to offer innovative solutions to reduce carbon emissions. Launched in late 2019, the project aims to capture, transport and store carbon dioxide from the three most important ports in the region—Rotterdam, Antwerp and the North Sea—starting in 2030 (European Commission, 2019c). Supported by their

governments, port authorities and national natural gas infrastructure entities, the ports will cooperate to develop and operate open-access carbon capture and storage (CCS). In phase one, an onshore pipeline will run through the Port of Rotterdam to a compressor station, which will then pump carbon dioxide into depleted P18 gas fields off the coast of Rotterdam for storage. In phase two, a network of cross-border carbon dioxide pipelines will connect Antwerp and the North Sea port with Rotterdam. Phase three will be the project's operationalization. If the project is successful, access to the CCS network may be given to additional members.

7.3.3 The Evolving Policy Context of GVCs

Lead firms are operating within a policy context that is still evolving, but three distinct and potentially complementary approaches are used in the home countries of GVC lead firms:

1. Planning is likely to play an increasingly important role, but countries will differ in their propensity to use this instrument.
2. Carbon pricing of value chain activities will give companies operating across borders the most direct price incentive to internalize their emissions and those of their suppliers.
3. Regulators will exercise financial sector governance by assessing the extent of climate risk in the portfolios of financial institutions and holding them responsible for the climate risk exposure of their borrowers.

The Climate Policy Initiative highlighted many such developments in the 2019 Global Landscape of Climate Finance report. Building sustainable capital markets is key to reach the climate finance levels needed to achieve the Paris Agreement objectives. The results are encouraging. According to the latest estimates of the United Nation Conference on Trade and Development (UNCTAD) for 2020, global sustainability-themed investment products are now about USD3.2 trillion, including more than USD1 trillion of green bonds, USD212 billion of social bonds, USD218 billion of mixed-sustainability bonds and more than USD1.7 trillion of sustainability funds (UNCTAD, 2021b).

Governments are attempting to strike a balance between these approaches at different administrative levels and across sectors. The net zero transition will require huge amounts of public investment and significant direct intervention by governments. They must make important decisions about, for example, what investments to make, what technologies to use and what contractual arrangements to rely on in implementation. Countries will differ in their propensity and capacity to intervene, but intervention is likely to be more effective if complemented by informative carbon pricing and effective financial sector governance.

Decarbonization efforts can be catalyzed through financial markets, which require regulatory frameworks. Capital markets have great potential to drive the transition to net zero, including by disclosing assets at risk because of climate change, standardizing green financing standards and reallocating investors' capital to climate-friendly assets. Many central banks are actively trying to expedite the issuance of green financial instruments and increasingly investing in them. The key is increased transparency and harmonization of the many standards (including across borders) to scale up climate finance further, and improvement of tracking and monitoring the use of funds.[33]

7.4 Infrastructure Is Key to the Evolving Development Story

The coronavirus disease pandemic began as a health and socioeconomic crisis and evolved into a political and security one, exposing vulnerabilities and highlighting inequities. The pandemic reminded the world of the importance of global connectivity, for better or worse, highlighted health-care inequities and infrastructure divides, exacerbated underlying trade tensions and underscored broader geopolitical uncertainties. Yet, the pandemic also showed the adaptability of businesses, the resilience of GVCs, the willingness of policy makers to innovate and the value of continued international cooperation to face common challenges.

[33] AIIB partnered with Amundi to develop the Climate Change Investment Framework to provide investors with a benchmark tool for assessing an investment at the issuer level. The approach can be applied across geographies and asset classes in relation to climate change–related financial risks and opportunities. The approach translates the three objectives of the Paris Agreement into fundamental metrics that investors can use to assess an investment's level of progress toward achieving climate change mitigation and adaptation and low-carbon transition.

Transiting to GVCs that have net zero emissions within the next three decades will be a major endeavor, and in it lies no less than the future of global trade. Countries with public policies that support infrastructure investment, industrial development, and net zero transition will have a huge competitive advantage. At the same time, we must ensure that no country and no group within a country is left behind: the transition must be a just one. Infrastructure for tomorrow, invested today, will be key to the evolving development story.

Box D: Making Headway in Sustainable Global Value Chains in Finland

Kesko, a Finnish trading sector corporation, is committed to achieving net zero carbon emission by 2025 across its own operations and transport, and zero carbon emission by 2030. Kesko's Scope 1 and 2 emissions accounts for 89,000 tons of carbon dioxide (CO_2), where upstream and downstream use and end-of-life treatment of products (Scope 3) account for 7.5 million tons of CO_2.

As a global leader in corporate sustainability, Kesko has focused on climate impact on operations and product life cycles for two decades. To green the entire value chain, Kesko must persuade upstream suppliers and downstream consumers to make the entire life cycle of trade fully green and carbon neutral.

Scope 1

Kesko has made important efforts to make operational consumption of energy more efficient (10 percent increase in energy efficiency by 2023) and to shift to renewable electricity and heat instead of using fossils fuels. For example, all Kesko stores in Finland are fully powered with renewable energy, and electricity used by K Charge stations is produced with Finnish wind power.

Scope 2

Kesko aims to reduce its branded products' plastic packaging by 20 percent by 2025 and has designed a holistic approach to manage packaging use and disposal. Kesko ensures that all its packaging is recyclable, compostable, or reusable, and uses targets, indicators, and detailed analyses to track package quantity and type. Kesko directs packaging materials such as plastic, cans or cardboard used in trade to be reused, sometimes in its own brand packaging. Kesko encourages downstream consumer packages to be returned and recycled, to form a circular, green economy within the operation. For instance, Kesko collects plastic packaging in its stores and reuses it for toilet paper packaging. In 2020, Kesko's warehouse operations managed a total of 24,677 tons of waste and achieved 99.98 percent waste recovery in the Finland branch and 92 percent in branches abroad.

Scope 3

Kesko sets sustainable policies for many types of raw materials. For instance, 100 percent of soy used must be sustainably sourced, considering environmental impacts, including biodiversity.

Kesko is committed to getting two-thirds of its suppliers to set emission reduction goals by 2025. It designs ways to induce customers to reduce environmental impacts. It offers a smart distribution network of community convenience stores and products to reduce customer shopping commutes by car, significantly shrinking carbon emissions. The successful and efficient rollout of smart distribution not only relies heavily on advanced machine learning but also depends on sufficient support from policy makers and bank finance to rapidly develop renewable energy transport vehicles.

Data Transparency

Kesko is a member of the Carbon Disclosure Project supply chain program, which aims to evaluate Kesko's suppliers and encourage them to follow suit in Kesko's campaign for a zero-emission value chain. Kesko's K-Ostokset services are equipped with a carbon footprint calculator to aid customers in their choices and raise their awareness of the climate impact of animal-based products. Finally, Kesko's building and technical trade K-Rauta stores offer free support for housing renovation and energy saving.

PART 2: MARKET AND COUNTRY WRITEUPS

INFRASTRUCTURE FINANCE MARKET OVERVIEW

The public sector is the main player in infrastructure investment worldwide. It finances about 92 percent of infrastructure in Asian economies, where the importance of public finance varies. Driven by China, about 90 percent of investment in East Asia is publicly financed, while only 60 percent is in South Asia (Asian Development Bank, 2017). Public sector involvement is greater in certain sectors, such as transport and water (Asian Development Bank, 2017). Overall infrastructure investment can be estimated using several measures, although the emerging consensus is that gross public fixed capital formation, augmented by some private sector investment statistics, provides the best estimate, especially for cross-county comparison (Fay, Lee, Mastruzzi, Han, and Cho, 2019).

The private sector, however, is becoming important. First, market-based financing reflects the extent of private capital mobilization, which is critical to fill Asia's infrastructure gap. Second, many public sector projects increasingly have some private sector participation. Third, private sector transactions deliver a timelier update on market sentiment and development, which provides policy makers with insights. Overall, the private infrastructure market has remained resilient despite the pandemic. Key highlights are the following:

1. Private sector transactions are declining in Asia, but a bright spot is information and communication technology (ICT).
2. Investors continue to shift from loans to bond financing.
3. Brownfield infrastructure foreign direct investment (FDI) into Asia is robust.
4. Bankability could require greater downside protection post pandemic.

Decline in Private Sector Transactions in Asia, but a Bright Spot for Information and Communication Technology

The coronavirus disease (COVID-19) pandemic in early 2020 greatly affected the global economy. Global gross domestic product (GDP) fell by 3.3 percent. The recession would have been much more severe had not it been for a massive, coordinated global policy response. Swift and sizable fiscal and monetary stimulus, particularly in advanced economies, comprising some USD10 trillion in discretionary fiscal measures and more than USD6 trillion in liquidity support, averted worst-case outcomes.

Tentative recovery began in the second half of 2020. Global GDP is expected to expand by six percent in 2021, on average. The recovery has been uneven, with growing divergence between countries in vaccine rollout, policy space available for continued support and the extent of dependence on the most affected sectors (e.g., tourism).

Against this challenging backdrop, the infrastructure market held up well, underpinned by demand and high liquidity. The value of closed private infrastructure transactions in Asia declined moderately to USD163 billion in 2020 from USD184 billion in 2019 (Figure 52).

With the economic crisis, more projects were developed by public entities (e.g., state-owned enterprises or government authorities) but with some elements of private sector financing (such as through loans). Deals with public sector developers and private finance rose from USD49 billion in 2019 to USD65 billion in 2020. While the figure does not include outright fiscal expenditure on infrastructure, it shows that more governments were seeking private financing of projects through public entities. Given fiscal tightness and the need to mobilize private sector finance, the trend might continue for some time.

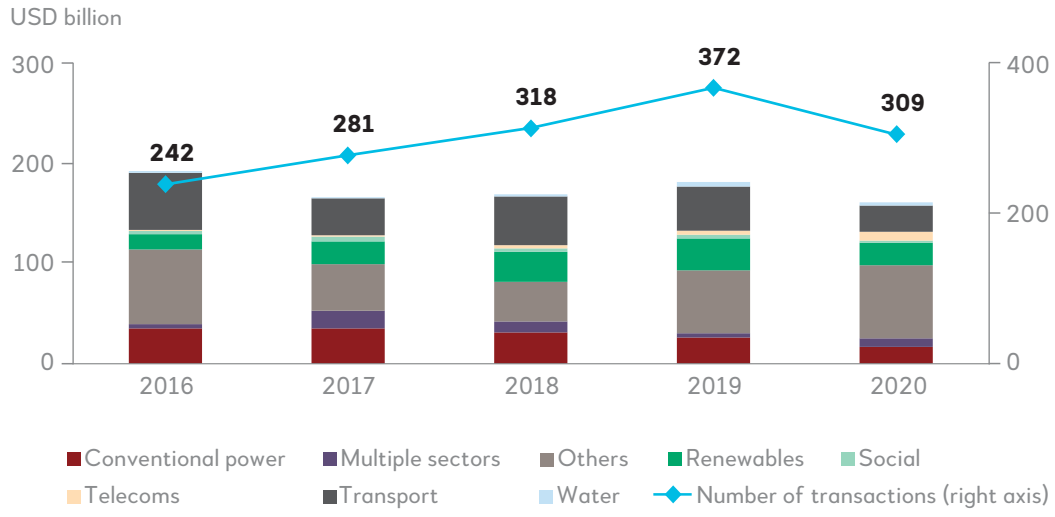
Figure 53 shows the change in sector composition. The pandemic brought about shifts in businesses and lifestyles, with more activities moving online. More activities will continue to be conducted digitally, including commerce, social pursuits, and work from home. Telecommunications infrastructure transactions rose significantly, with USD5 billion worth of deals closed in 2020. The trend is expected to continue into 2021 as part of the global digital transformation accelerated by the pandemic (Lopez, Sen Gupta, and Su, 2020).

Other infrastructure sectors were more negatively affected by the pandemic, such as transport and conventional power, each declining by more than a quarter compared with 2019. The worst impact was observed in transport, with closed transaction value dropping by almost half (USD18 billion). The sharp downturn in economic growth worldwide has temporarily dampened power demand, with the closed value for conventional power and renewables each declining by USD9 billion in 2020.

Figure 54 shows that open and announced projects (not yet reaching financing close) rose to a record high of USD720 billion in 2020, reflecting robust market demand for infrastructure finance and project delays or rollovers caused by the pandemic. Based on pipeline data, the top sector continues to be transport, showing Asian economies' high interest in building connectivity infrastructure such as roads, ports, and highways.

Figure 55 presents the change in open and announced transactions from 2019 to 2020. Like the broader energy sector, renewable energy projects had a disappointing 2020; financing closing declined by USD9 billion (Figure 53), but the number and value of announced projects continue to build up in the pipeline. While the transition from conventional energy to renewables continues apace in Asia, the value of announced conventional power projects remains large.

Figure 52: Value and Number of Closed Private Transactions in Asia

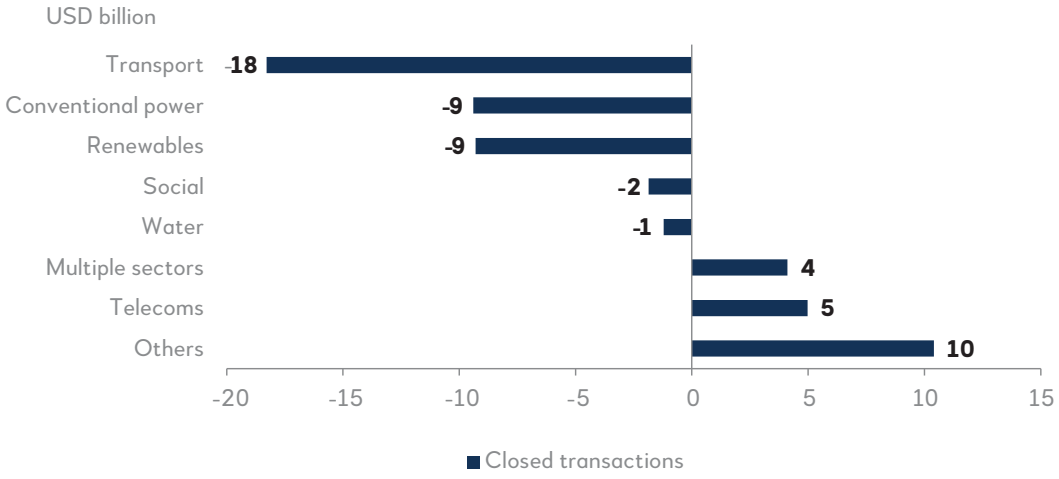


AIIB = Asian Infrastructure Investment Bank.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Figure 53: Change in Value of Closed Private Transactions in Asia, 2019-2020

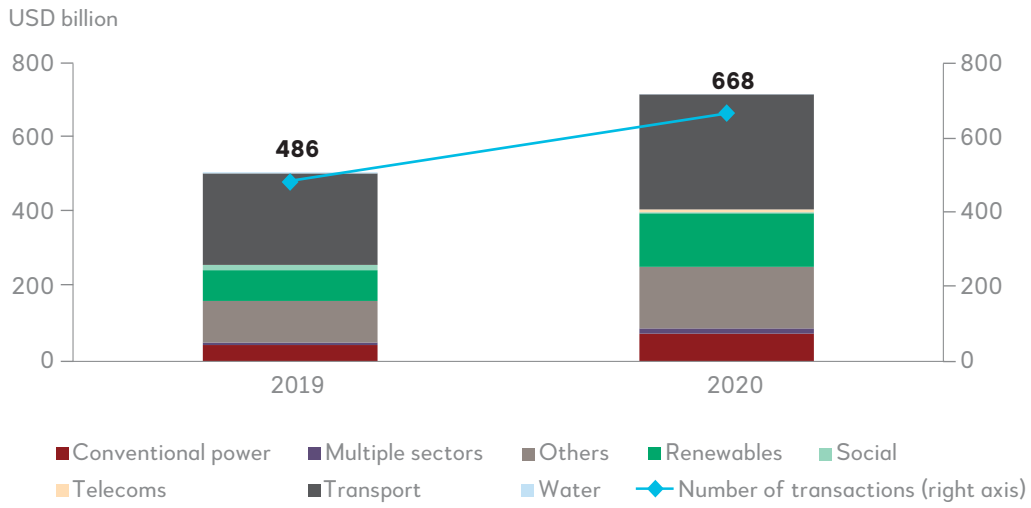


AIIB = Asian Infrastructure Investment Bank.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Figure 54: Value and Number of Open and Announced Private Transactions in Asia



AIIB = Asian Infrastructure Investment Bank.

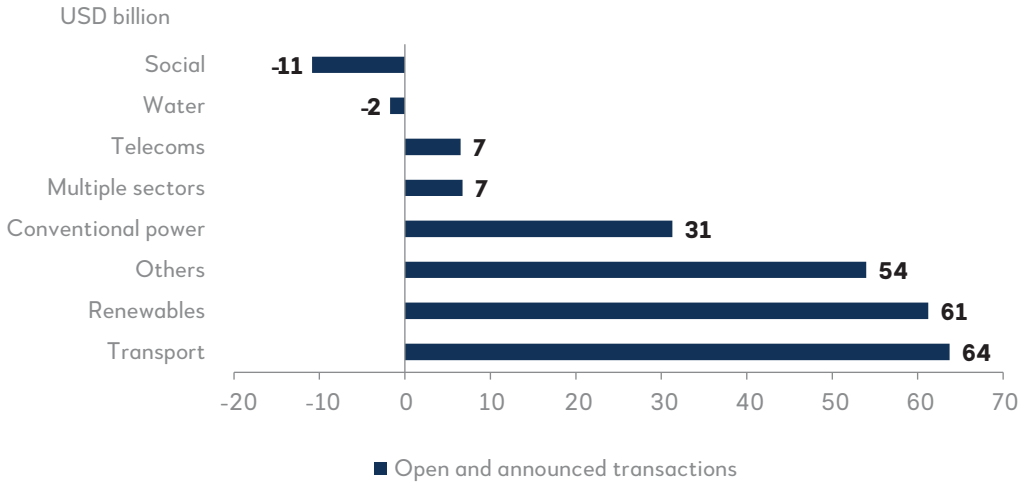
Note: Acquisition deals are excluded from samples. Past years' data on pipeline projects (open and announced projects) are from archived datasets. Checking current data of 2020 against 2019 archived (or vintage) data allows for a more accurate comparison.

Data source: IJGlobal and AIIB staff calculations.

Announced telecommunications projects saw a large increase, from USD480 million in 2019 to USD7 billion in 2020. Social infrastructure saw no growth in either closed or announced projects. While the pandemic has increased the need for social infrastructure such as health care, demand has yet to translate into more private sector projects.[34]

[34] A USD9.8-billion health-care project in Uzbekistan was announced and captured in the 2019 pipeline, which accounted for most of the year-on-year decline.

Figure 55: Change in Value of Open and Announced Projects, 2019-2020



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

While the increase in open and announced projects shows the presence of underlying demand, it does not always translate to more closed transactions. Financing close will depend on many other factors such as macroeconomic and financing conditions and the bankability of projects.

Continued Shift from Loans to Bond Financing

Figure 56 shows syndicated loans to infrastructure sectors in eight markets in Asia: Bangladesh, China, India, Indonesia, Pakistan, Philippines, Russia and Turkey. The value of syndicated loans in 2020 declined to USD71 billion (close to a 30-percent decrease from 2019 and half the value of the high mark seen in 2016). Amid global uncertainties, loan spreads increased in 2020. Average loan spreads for telecommunications rose from 179 basis points (bps) in 2019 to 278 bps in 2020.[35] The higher spreads could reflect high loan demand from the sector.

Loan spreads rise when a lender is more affected by COVID-19. Firms that are more vulnerable to COVID-19 shocks, therefore, now face higher borrowing costs. Loan spreads are about 11 bps higher when a lender's exposure to COVID-19 increases by one standard deviation (Hasan, Politsidis, and Sharma, 2020).

All sectors except for renewables saw a decrease in syndicated loan financing in 2020.[36] The renewable energy sector was less affected by tighter bank lending as lenders moved to increase sustainable assets in their portfolios. Albeit from a small base, total syndicated loan financing for renewables tripled from USD3.8 billion in 2019 to USD13.6 billion in 2020.

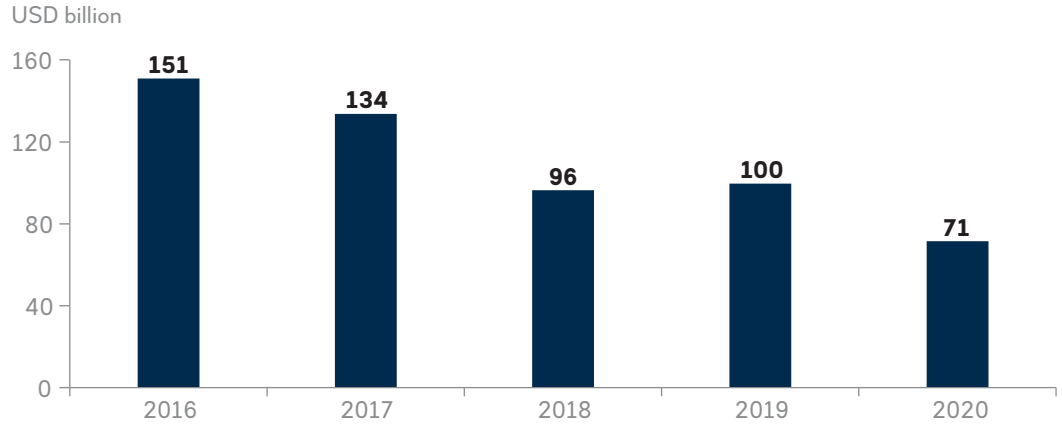
The year saw a continuing shift from loans to bond financing. In contrast to the drop in syndicated loan volume, annual bond issuance reached an all-time high in 2020 (Figure 57). Led by easier access to bond markets, large investment-grade firms significantly increased their capital market borrowings (Goel and Garralda, 2020). Overall, global bond issuance surged by nearly a quarter, with infrastructure sectors participating in the "bond rush."[37] Total infrastructure bond issuance for eight selected economies—Bangladesh, China, India, Indonesia, Pakistan, Philippines, Russia and Turkey—reached USD640 billion, a year-on-year increase of nearly 30 percent.

[35] Loan spreads are cited as margins over referenced hard currencies such as the US dollar, euro or yen.

[36] In the Refinitiv industry classification, renewables are "alternative energy sources," which are a subsector of "energy and power." Alternative energy sources include solar, wind and geothermal, among others.

[37] Corporate debt sales saw a record boom in 2020 (data up to Dec. 22, 2020). See more at Financial Times (2020).

Figure 56: Value of Syndicated Loans to Infrastructure Sectors in Eight Economies

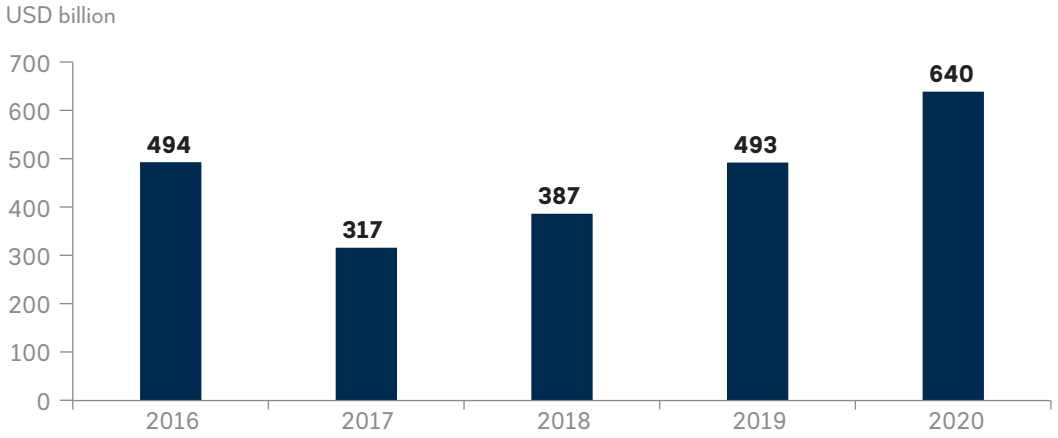


USD = United States dollar.

Note: Transactions cover energy and power (and water and sanitation), telecommunications, transport and construction engineering. Because of data availability, the chart covers only eight developing economies in Asia: Bangladesh, China, India, Indonesia, Pakistan, Philippines, Russia and Turkey.

Data source: Refinitiv.

Figure 57: Value of Bond Issuance by the Infrastructure Sector in Eight Economies



USD = United States dollar.

Note: Transactions cover energy and power (and water and sanitation), telecommunications, transport and construction engineering. Because of data availability, the chart covers only eight developing economies in Asia: Bangladesh, China, India, Indonesia, Pakistan, Philippines, Russia and Turkey.

Data source: Refinitiv.

Although China accounts for about 95 percent of issuance given the size of its economy, bond issuance remains robust for the remaining seven economies. Transport is the highest bond issue, accounting for 33 percent of total issuance, followed by power and building and construction.

The shift from bank lending to bond markets is a result of low interest rates and high liquidity, coupled with rising caution in banking, given the pandemic. In early 2021, there were concerns that global interest rates would start to rise with the recovery of economies and large fiscal stimuli. Higher interest rates are expected to, but do not yet, affect infrastructure financing. Nevertheless, the reversion to higher interest rates may result in less liquidity for bond markets and shift financing back to banking. In the medium term, developing capital markets and infrastructure as an asset class and diversifying financing options for infrastructure investors to ensure sustained sources of financing for projects remain important.

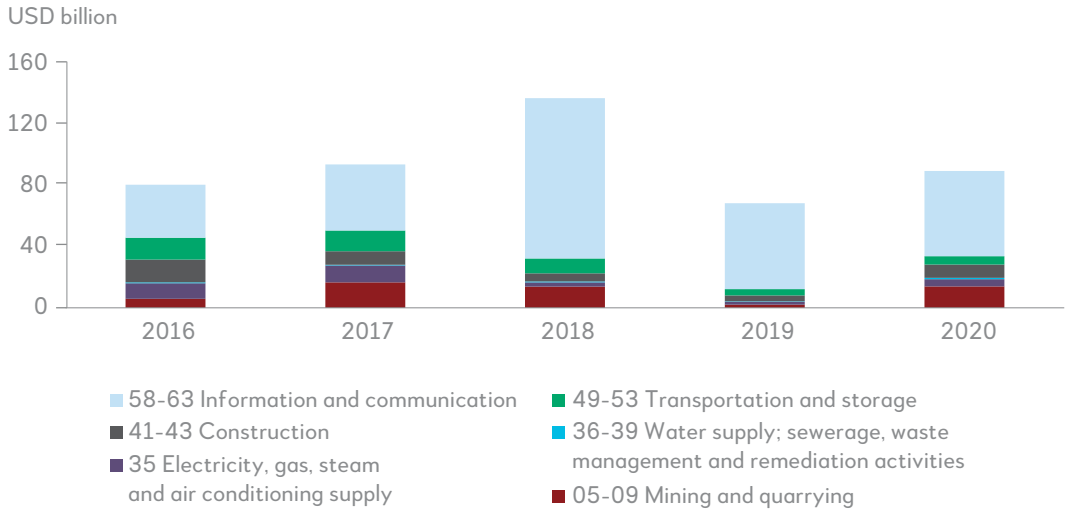
Robust Brownfield Infrastructure Sector Foreign Direct Investment into Asia

Inward FDI in infrastructure in Asia was resilient in 2020. Brownfield FDI saw an uptick of USD21 billion in 2020, and overall investment partially recovered from the sharp decline in 2019 (Figure 58).[38]

ICT has been the top receiving sector of inward infrastructure FDI since 2012.

In contrast to the generally resilient brownfield FDI, greenfield infrastructure FDI saw a 71 percent decline (USD22.3 billion) in 2020 (Figure 59).

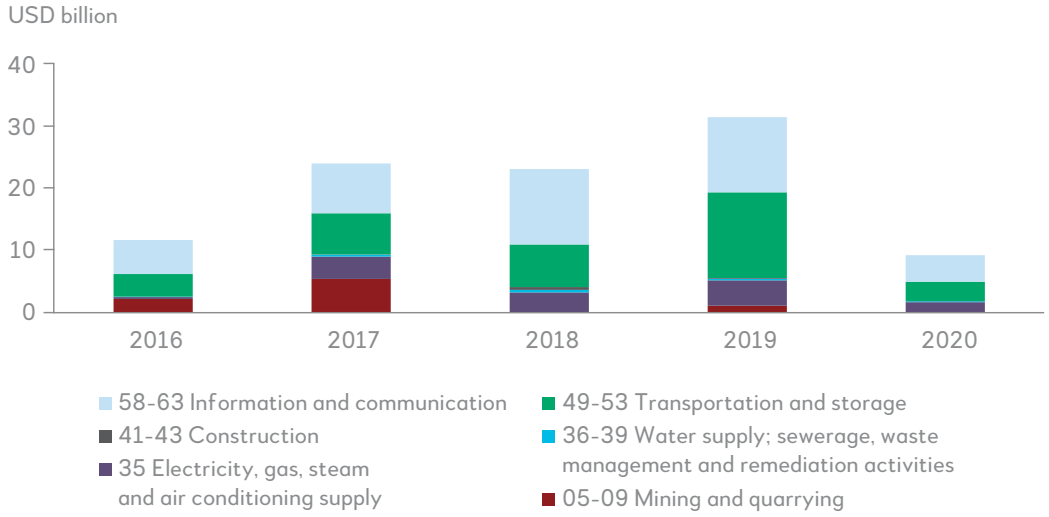
Figure 58: Brownfield Foreign Direct Investment Flow for Infrastructure Sectors in Asia



Note: Inward infrastructure foreign direct investment is defined by the industry of the target company in a cross-border transaction, either for merger and acquisition deals or for greenfield projects. The numbers in the legend are from ISIC Industry Code Revision 4.

Data Source: ORBIS Zephyr.

Figure 59: Greenfield Foreign Direct Investment Flow for Infrastructure in Asia



Note: Inward infrastructure foreign direct investment is defined by the industry of the target company in a cross-border transaction, either for merger and acquisition deals or for greenfield projects. The numbers in the legend are from ISIC Industry Code Revision 4.

Data source: ORBIS Cross-Border Investment.

[38] Brownfield FDI is measured by cross-border merger and acquisition deals and greenfield FDI by closed cross-border investment projects.

The pandemic has resulted in increased caution or general operational difficulties in kick-starting greenfield projects, while acquisition of brownfield or operational assets remains buoyed by global liquidity conditions and the lower risk profile of such assets.

Project Bankability Could Require Greater Downside Protection Post Pandemic

Unlike a typical recession or even the global financial crisis of 2008, the pandemic was not generalized across the business cycle downturn but has had highly diverse impacts on different infrastructure sectors. Transport has been impacted negatively, with the shifts in business models and consumer lifestyles potentially affecting the fundamental viability of some infrastructure projects. The pandemic has boosted ICT, however, judging from the value of projects reaching financing close and from FDI trends.

The pandemic has brought about shifts in risks or risk perceptions, which will impact the bankability of projects. Private sector investors and financers will require greater downside revenue protection for projects, especially for shocks that are beyond their control (as experienced in this pandemic). For example, who should bear the revenue losses arising from lockdowns or other stoppages will need to be spelled out more clearly in contracts. Force majeure clauses in infrastructure contracts—actively discussed in the infrastructure financing community throughout the pandemic—should undergo greater scrutiny.

Policy makers may need to adjust to changes in risk concerns to maintain the bankability of projects in the pipeline to attract private capital. The private sector has more opportunities to innovate to mitigate the risks.

COUNTRY WRITE-UPS

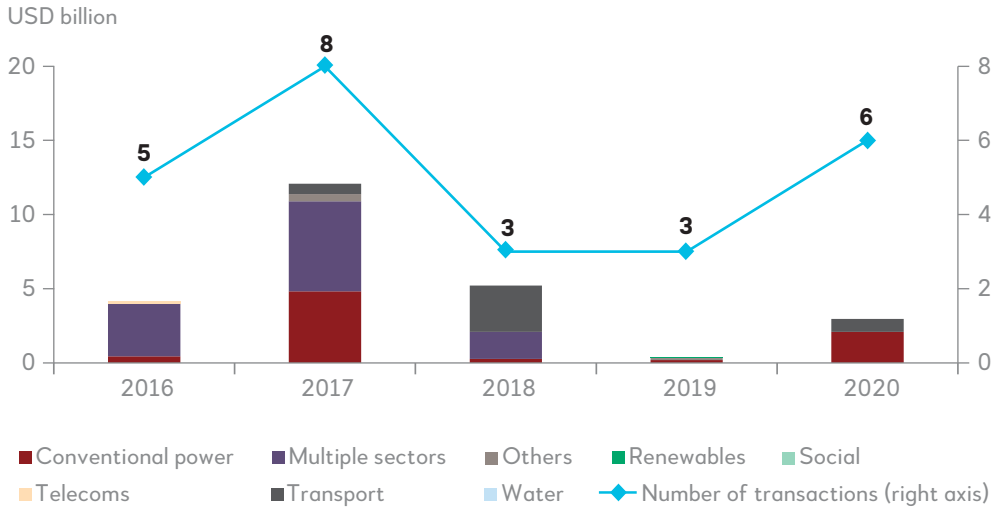
BANGLADESH

Before the coronavirus disease (COVID-19) pandemic, Bangladesh grew at an annual rate of 7.4 percent in fiscal year (FY) 2015-FY2019.[39] However, economic activity was significantly dented in the second half of FY2020 (January-June 2020) because of the pandemic and associated lockdown measures. Consequently, growth declined to 3.5 percent in FY2020. The garment industry, which had been the economy's mainstay, was significantly impacted, with orders cancelled in March-June 2020. Initial estimates indicate that growth inched up to 4.6 percent in FY2021 as economic activity picked up with the relaxation of containment measures. The surge in the pandemic and the resulting lockdown measures are estimated to have trimmed growth in the last quarter of FY2021.

Despite the challenges, the government mostly stuck to its expenditure plan via higher domestic and foreign borrowing. The government continued to prioritize infrastructure investment to speed up implementation and prevent cost escalation associated with time overruns. Despite financing challenges in FY2021, the Annual Development Program (ADP), which accounts for the bulk of infrastructure spending, grew by an impressive 27.1 percent. For FY2022, the government has increased the allocation to ADP by 14 percent (9.8 percent of gross domestic product [GDP]). Transport and communication, power and fuel, housing and community facilities, health and education will remain the key focus areas, with 76.3 percent of ADP budgetary allocation. Major projects include the Rooppur Nuclear Power Plant, Padma Bridge Rail Link, Dhaka Mass Rapid Transit Development and Dhaka-Ashulia Elevated Expressway.

Despite a challenging year, closed private transaction activity picked up in 2020. Total deal value reached USD2.95 billion. The largest deal was the Meghnaghat Gas-Fired Power Plant, which involves the construction of a 745-megawatt natural gas combined-cycle power project, with power sold under a 22-year power purchase agreement with the Bangladesh Power Development Board. Another major project that closed financially is the Dhaka Elevated Expressway, which will construct 46.73 kilometers (km) of elevated road to ease congestion in the capital city.

Figure 60: Value and Number of Closed Transactions by Sector, Bangladesh



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

[39] In Bangladesh, the fiscal year starts on July 1 and ends on June 30 of the subsequent year. FY2020 refers to the fiscal year starting on July 1, 2019 and ending on June 30, 2020.

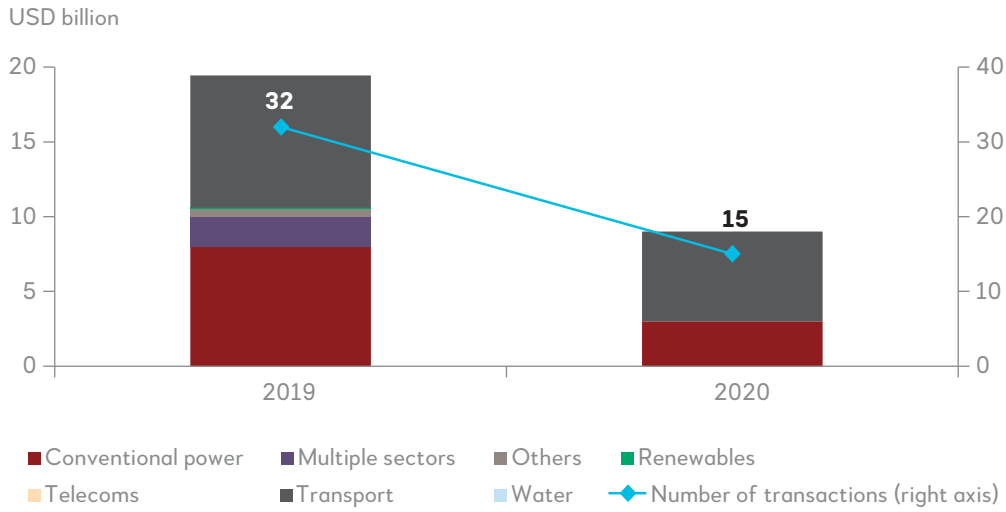
But the project pipeline declined. The value and number of open and announced private projects, however, declined. The decline was broad-based, with transport, conventional power and multiple sectors witnessing a dip in activity. In 2020, transport and conventional power dominated open and announced transactions along with two health transactions. Most of the interviewed market participants did not expect the sharp decline in 2020 to continue and anticipated a reversal in 2021 aided by government stimulus measures, low borrowing cost and rising demand for various infrastructure services. However, new projects could be sluggish, especially in power and energy, because of high installed capacity.

Easing infrastructure constraints is an important pillar of the development strategy (Government of Bangladesh, 2020). In energy, the government intends to triple generation capacity, reduce transmission and distribution losses, diversify fuel use to balance low-cost fuel with low-carbon fuel mix, increase private sector investment, encourage energy trade, and ensure universal access to electricity by 2041. In transport, the government has ambitious plans to increase passenger traffic by nearly 30 times and freight traffic by nearly 10, develop urban mass transit in all major cities and improve transport infrastructure. The government intends to provide quality water supply, sanitation and solid waste management infrastructure to all urban residents. The setting up and running of 100 economic zones across the country will depend on whether they have adequate infrastructure.

Achieving these ambitious targets will depend on whether finance for projects and capacity to implement them are adequate. The implementation rate of infrastructure projects, measured as the ratio between actual and budgeted expenditure, ranged from 74 to 84 percent in FY2015-FY2019 and likely dropped to about 60 percent in FY2020 because of disruptions caused by the pandemic. The implementation rate remained sluggish in the first seven months of FY2021, with only 28.45 percent of allocated funds spent—the lowest since 2016 (Government of Bangladesh, 2021)—because of weak project design, lengthy internal business processes, lack of institutional capacity and bureaucratic complexities, among others (The Daily Star, 2021).

External funding remains important for infrastructure projects, with more than 40 percent of the ADP in FY2021 financed by foreign funds. Multilateral development banks will continue to play a vital role in developing infrastructure. The World Bank committed to lend USD2.5 billion in 2020 for education, transport, health, urban infrastructure and economic recovery. Indicative resources of the Asian Development Bank (ADB) available for commitment during 2021-2023 for sovereign operations total USD5.9 billion, with transport, education, finance and public sector management, urban infrastructure and energy accounting for most of the projects.

Figure 61: Value and Number of Open and Announced Transactions by Sector, Bangladesh



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

The Asian Infrastructure Investment Bank (AIIB) approved six loans worth USD1.3 billion in 2020, with another three projects worth more than USD1.1 billion scheduled to be approved in 2021 for roads, highways, power and urban infrastructure.

Private sector financing of infrastructure is still in a nascent stage and mostly through public-private partnerships (PPPs). The government has mainstreamed PPPs in economic planning by promulgating a PPP law, viability gap fund guidelines and procurement guidelines. The government has established a separate budget for PPP financing, which rapidly increased from USD300 million in FY2018 to USD4.3 billion in FY2021. Despite the progress made, PPPs are yet to achieve their full potential, especially in transport.

In early 2021, market participants said they expected domestic and foreign borrowing cost to soften over the next 12 months. The government's borrowing cost is expected to decline significantly as evidenced by a sharp drop in government bond yield since mid-2020, driven by excess liquidity caused by stimulus measures and the lack of other investment opportunities. A ceiling on the lending rate at 9.0 percent was imposed for all sectors, barring credit cards. This reduced the borrowing cost for some bigger firms. However, the ceiling may price out some small and medium-sized enterprises as banks may find it imprudent to lend at this rate, given the high supervision cost and weak bad loan recovery framework. The interest rate cap may accentuate the accumulation of bad loans. Market participants expected foreign currency borrowing cost to trend downward because of the decline in global interest rates in 2020 and the improvement in macroeconomic fundamentals.

Government Bond Returns and Syndicated Loan Spreads, Bangladesh	
10-year government LCY bond returns (monthly average)	8.66% (2020) 8.43% (2019)
20-year government LCY bond returns (monthly average)	8.94% (2020) 9.04% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	*Energy and power: London interbank offered rate + 300 basis points*

LCY = local currency, US = United States.

Note: Figures in italics indicate fewer than five transactions in 2020.

Data source: Refinitiv.

Key Project Highlights, Bangladesh

- **Padma Bridge Rail Link Project.** A 225-kilometer railway line connecting two sides of the Padma River, the project will link Dhaka to Jashore. The project is being implemented by Bangladesh Railway and is expected to be completed in June 2024. Exim Bank of China will fund 85 percent of the contract agreement, which is expected to be about USD4.5 billion, and the Bangladesh government the remaining 15 percent. The bridge is expected to shorten domestic travel times and significantly improve domestic connectivity.
- **Dhaka Ashulia Expressway Project.** The elevated expressway will connect the Dhaka economic processing zone and Hazrat Shahjalal International Airport and significantly reduce travel time by bypassing overcrowded roads in the capital city and its suburbs. The expressway will link with Dhaka Elevated Expressway and thereby improve connectivity. The total project cost is estimated at USD2 billion and expected to be completed by mid-2022.
- **Meghnaghat-2 Power Plant.** The 583-megawatt combined cycle gas turbine project is being developed by a joint venture between Summit Corporation and GE Capital US Holdings. International Finance Corporation, Swiss Export Risk Insurance and Standard Chartered Bank are the main project lenders, providing about 60 percent of the total project cost (USD600 million). Financial close was achieved in December 2020. The project is expected to commence operation in 2022 and, when commissioned, become the largest combined cycle gas power plant in Bangladesh.

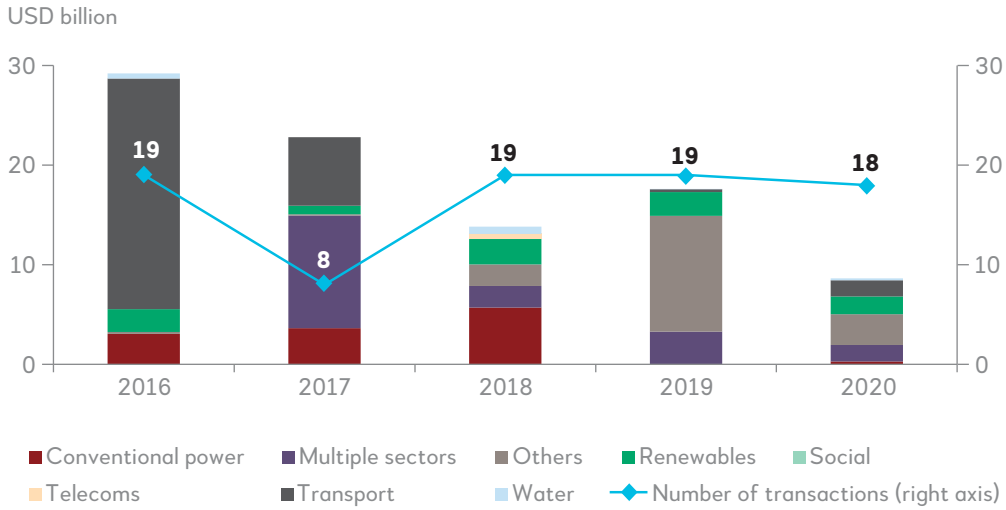
CHINA

In 2020, the economy expanded by 2.3 percent as the country contained the COVID-19 outbreak, implemented effective stimulus packages, restarted the economy ahead of others and benefitted from a boom in export demand. Rate cuts and targeted credit line expansion have supported the recovery of small and medium-sized enterprises, which were affected most by the pandemic and are increasingly essential to the economy.[40] Infrastructure investment increased, but its share of GDP remained more stable (15-18 percent) in 2020 than in 2019.[41] Projects delayed or suspended since the COVID-19 outbreak resumed quickly from late February and early March 2020. Public investment remains the main source of infrastructure financing, including special-purpose bonds issued by local governments.

Closed private sector transactions dropped by 51 percent (by USD9 billion) in 2020 compared with 2019. The decrease was largely attributed to the decline in oil and mining projects (by USD8.5 billion) arising from the combined impact of poorer economic conditions and reduced market appetite for less-green sectors.[42] Private transactions in transport increased to USD1.64 billion, 447 percent more than in 2019, although they are still much smaller than public investment.

The private sector project pipeline dropped by 48 percent to USD20 billion. The decline largely came from transport (by USD9.6 billion) compared with 2019. Few private projects were in the pipeline for conventional power, social sectors, telecommunications and water in 2020, probably because infrastructure in these sectors relies heavily on public investment.

Figure 62: Value and Number of Closed Transactions by Sector, China



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

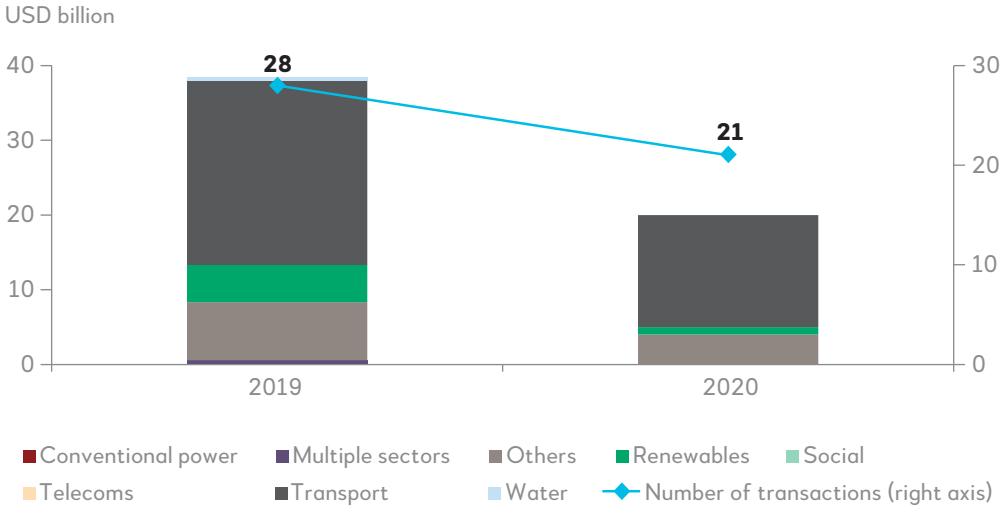
Data source: IJGlobal and AIIB staff calculations.

[40] Data from the People's Bank of China using the year-end aggregate financing to the real economy (stock) divided by nominal gross domestic product in 2020.

[41] National Bureau of Statistics (NBS) fixed-asset investment in infrastructure. Data for 2018-2020 are calculated based on the annual fixed-asset investment growth rates using 2017 data as the base, because NBS has released growth rates only since 2017. See NBS (2018, 2019, 2020 and 2021).

[42] Included in the "others" category.

Figure 63: Value and Number of Open and Announced Transactions by Sector, China



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations

Government Bond Returns and Syndicated Loan Spreads, China	
10-year government LCY bond returns (monthly average)	2.97% (2020) 3.20% (2019)
20-year government LCY bond returns (monthly average)	3.54% (2020) 3.56% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	*Energy and power: London interbank offered rate + 231 basis points*

LCY = local currency, US = United States.

Note: Figures in italics indicate fewer than five transactions in 2020.

Data source: Refinitiv.

Overall borrowing costs declined in 2020. The 10-year government bond yield (monthly average) was 23 basis points (bps) lower than in 2019. It declined sharply to 2.51 percent in April 2020 because of a policy rate cut and, as the economy recovered, gradually increased to the pre-pandemic level by the end of 2020.

China will prioritize "new infrastructure" development. Rising new infrastructure, which includes mainly data-related infrastructure, gained much attention in 2020, but investment in it appears to be smaller than in traditional infrastructure such as transport. Market estimates suggest total investment in new infrastructure in 2020 was about CNY1.2 trillion (about USD184 billion),[43] less than 10 percent of total infrastructure investment (Bank of China, 2020).

During 2021-2025, annual average investment in new infrastructure is projected at about CNY2.1 trillion (USD323 billion) (Xinhua, 2020c). As technology-driven sectors will rely heavily on innovation, the government encourages private sector investment to finance new infrastructure (Government of China, 2020). In April 2020, China introduced real estate investment trusts to finance infrastructure and mobilize more private participation in many areas such as technology-driven infrastructure projects (China Securities Regulatory Commission, 2020).

[43] Exchange rate as of March 23, 2021.

Besides new infrastructure, transport continues to be a main investment sector (CNY3.4 trillion, USD522 billion) with annual growth of 6.6 percent. Road and waterway investment increased by 9.6 percent, while railway investment declined by 2.8 percent.[44] Growth of investment in water, environmental protection and urban facilities slowed to 0.2 percent in 2020, compared with 2.9 percent in 2019.[45]

China accelerated investment in renewable energy infrastructure by further shifting electricity power supply from thermal to clean energy. In 2020, total investment in electricity generation infrastructure was CNY524 billion (USD80 billion) (an increase of 67 percent year-on-year). More than 40 percent was in wind electricity generation (more than CNY215 billion, about USD33 billion), which may have increased by about 140 percent.[46] Investment in electricity infrastructure generated by solar, geothermal and bio-electricity sources likely increased by more than 130 percent (CNY46.8 billion, USD7.2 billion). Hydropower generation has seen an increase of about 19 percent (CNY107.7 billion, about USD16.5 billion), while thermal power investment plummeted by 27 percent, continuing its downward trend (by CNY55.3 billion, about USD8.4 billion), which had started in recent years (National Energy Administration, 2021).

Key Project Highlights, China

- The **Luxi–Qiubei–Guangnan–Funing Highway Project**, led by the provincial government-led road project approved by Yunnan's Development and Reform Commission in 2020. The cost of the 268-kilometer road is estimated at about CNY49 billion. It is designed to improve interconnectivity within Yunnan province, linking urban and rural areas. The funding source is split between local governments (20 percent) and bank loans (20 percent) (Yunnan Development and Reform Commission, 2020).
- The **National Ultra-High-Voltage Grid Project** connects 24 provinces by a new electricity grid network with higher transmission efficiency. Total investment in 2020 was about CNY181.1 billion (about USD12.4 billion) (CCTV, 2020) and 23 new lines were reviewed or planned in 2020 (State Grid, 2020).
- **Tianjin LNG Terminal and Pipeline Portfolio Phase I** includes a portfolio of construction projects, including natural gas receivers, ports, storage and pipelines. The project is estimated to cost CNY21.1 billion (about USD3.2 billion) and expected to be completed in 2022. The pipeline will connect to Beijing to secure natural gas supply to the capital (Tianjin Economic and Technology Development Area, 2020).

[44] Infrastructure investment has been biggest in water, urban facilities (e.g., rebuilding of old residential areas) and environmental projects, followed by transport. Transport investment data are from annual reports or press conferences hosted by the Ministry of Transport, and include only railways, roads, waterways and aviation (Ministry of Transport, 2019 and 2020).

[45] See National Bureau of Statistics (2018, 2019, 2020 and 2021).

[46] AIIB estimate based on National Energy Administration 2020 data and China Electricity Council January-November data on investment in electricity generation. In January-November 2020, investment in wind electricity generation was CNY215 billion. There are no data for this indicator in December, so January-November total data are used as a proxy for annual data. See China Electricity Council (2020a,b) and National Energy Administration (2021).

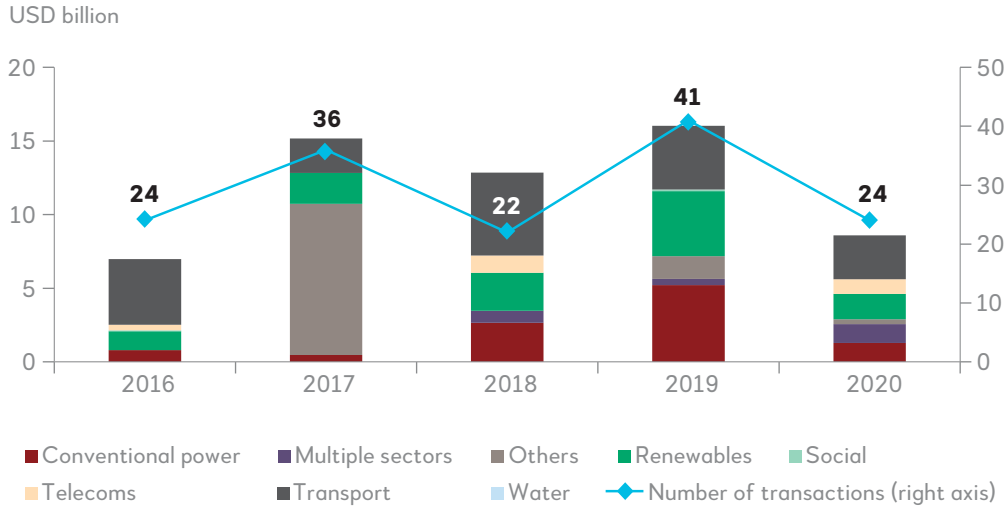
INDIA

India's economy had already been slowing down before the COVID-19 pandemic, which, coupled with associated social distancing measures introduced since March 2020, had a significant impact on the economy in FY2020 (fiscal year ending March 2021). Economic activity contracted by 7.3 percent during FY2020, with much of the contraction taking place during April-September 2020. Contact-intensive sectors such as construction, trade, hotels, transport and communication and manufacturing were most impacted. With the easing of lockdown measures since June 2020, economic activity picked up sharply, resulting in a smaller contraction for FY2020 than anticipated.[47] The economy is expected to experience close to double-digit growth in FY2021, although the surge in COVID-19 cases in April and May 2021 may have diminished growth prospects a bit.

The nationwide lockdown in the first half of 2020 dented the revenue of toll operators, power distribution companies and other utilities and severely impacted aviation and hospitality. Several infrastructure projects were shelved or dropped. Of the 1,695 large infrastructure projects, i.e., those worth INR1.5 billion (USD20 million) and above, more than 25 percent reported cost overruns while nearly 34 percent reported time overruns in December 2020 (Government of India, 2020b). Availability of infrastructure finance remained an important constraint, with banking credit to infrastructure contracting by 0.5 percent in FY2020 compared with 0.5 percent growth in FY2019. Banking credit to telecommunications and power contracted while credit to the road sector increased by a modest 0.7 percent.

The varied challenges impacted infrastructure activity, reflected in a slowdown in closed projects. The value of transactions that achieved financial closure nearly halved, from USD16 billion in 2019 to USD8.6 billion in 2020, matched by a drop in the number of transactions from 41 to 24. The decline was broad based, with key sectors such as conventional power, renewables and transport seeing transactions drop. The Mumbai Trans Harbour Link connecting Mumbai and the satellite town of Navi Mumbai via a 21.8-kilometer bridge received an additional financing facility of USD570 million in 2020. The overall project is estimated to cost about USD2 billion. Sterlite Power secured funds worth USD270 million for the Lakadia Vadodara Transmission line, which connects the wind energy zones of Bhuj in Gujarat to the load centers in Gujarat and Maharashtra.

Figure 64: Value and Number of Closed Transactions by Sector, India



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

[47] In India, the fiscal year starts on April 1 and ends on March 31 of the subsequent year. FY2020 refers to fiscal year starting on April1, 2020 and ending on March 31, 2021.

Transport saw an uptick in infrastructure activity, although other sectors experienced a significant drop. The number of open and announced transactions inched up from 39 in 2019 to 52 in 2020, while the value of these transactions moderated from USD34.7 billion to USD25 billion. Transport continued to attract the most interest, while renewables saw a drop in interest. Major transactions include financing for the 1,275-kilometer Delhi-Mumbai Expressway and the development of the Noida International Airport in Uttar Pradesh using the PPP mode. Market participants pointed out that private concessionaires and bankers lost confidence in key sectors such as roads and airports because of delays associated with regulatory clearances and land acquisition. The government is focusing on the engineering, processing and construction mode to reduce the development risk and incentivize private sector participation.

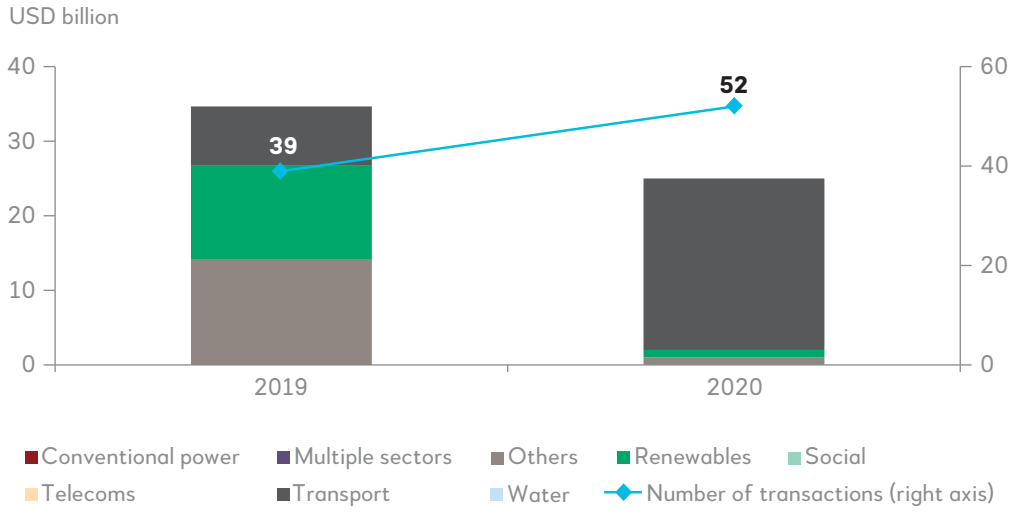
Encouragingly, the central government has continued to provide an impetus to infrastructure spending despite the revenue squeeze. The key policy view remains that public investment will help crowd in private investment, boost consumption and form the foundation for more sustainable growth. Capital expenditure by the central government in FY2020 was 3.1 percent higher than the originally targeted amount and 26.5 percent higher than in the previous year. The government plans to establish a Development Financial Institution to provide and catalyze financing for infrastructure and to have a lending portfolio of USD70 billion until 2024. The impetus to infrastructure spending is expected to continue in FY2021, with 30.5 percent higher capital expenditure.

The National Infrastructure Pipeline, introduced in 2020 to prioritize infrastructure investment, has been expanded to cover 7,400 projects. Adequate finance for these projects will be arranged by (a) creating an institutional structure, including a development financial institution, (b) monetizing existing brownfield assets and (c) increasing the shares of central and state government capital expenditures on infrastructure.

The strong surge in the central government's capital expenditure will help offset the expected decline in states' capital expenditure. Capital expenditure in 12 major states is expected to contract by 10-40 percent in FY2020 because of pandemic-induced strain on revenue and additional expenditure toward health care and public welfare (ICRA, 2020). Private sector investment, which had been tepid in recent years because of myriad challenges such as availability of finance and balancing of risks and regulatory bottlenecks, remains weak, except in sectors such as renewables.

Most multilateral development banks scaled up their operations in 2020. In response to the pandemic, most multilateral development

Figure 65: Value and Number of Open and Announced Transactions by Sector, India



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

banks expanded their operations in India to help develop infrastructure and strengthen economic recovery. The World Bank committed to lend USD5.6 billion, significantly higher than in previous years. ADB expanded its operations to USD4.5 billion in 2020 while indicating a resource envelope of USD12.9 billion during 2021-2023. AIIB approved five loans worth USD2 billion in 2020, with another 21 projects worth more than USD5.8 billion scheduled to be approved in 2021, spanning roads, highways, power, urban and social infrastructure.

Market participants thought that the borrowing cost for infrastructure projects could soften slightly compared with last year. The government has been able to raise funding for infrastructure at more competitive rates, with 10-year bond yields declining through most of 2020. There was a modest uptick in the first quarter of 2021, although rates are still below early 2020 levels. The reduction in key policy rates by over 100 bps in 2020 and various liquidity injection measures have eased the borrowing cost from the banking system. The cost of borrowing in foreign currency may vary across sectors given that the pandemic has impacted them differently.

Government Bond Returns and Syndicated Loan Spreads, India	
10-year government LCY bond returns (monthly average)	6.08% (2020) 7.00% (2019)
19-year government LCY bond returns (monthly average)	6.63% (2020) 7.30% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	*Energy: London interbank offered rate + 193.62 basis points*

LCY = local currency, US = United States.

Note: Figures in italics indicate fewer than five transactions in 2020.

Data source: Refinitiv.

Key Project Highlights, India

- **National Industrial Corridor Development Program.** The government aims to develop 11 industrial corridors across the country. The program envisages 32 infrastructure projects in four phases, multimodal connectivity with complete "plug and play" infrastructure up to the plot level and resilient and sustainable future-ready cities. The program is estimated to cost USD100 billion.
- **Mumbai–Ahmedabad High-Speed Rail Corridor.** The first high-speed rail corridor in India is 508.17 kilometers and is being developed with technical and financial assistance from the Government of Japan. Travel time is expected to be about two hours for limited-stop service and three hours for all-stop service. The project is estimated to cost about USD15 billion.
- **Bhogapuram International Airport.** The greenfield airport, in Bhogapuram, Vizianagarm, Andhra Pradesh, will be developed through a public-private partnership with GMR Visakhapatnam International Airport Limited, a subsidiary of GMR Airports Limited. The airport will be developed in stages and initially service 6 million passengers per annum.

INDONESIA

The economy contracted by 2.1 percent in 2020 because of the pandemic. That year, the government enacted countercyclical measures, resulting in a fiscal deficit that is significantly higher at 5.9 percent of GDP. Nevertheless, the government's past prudence and low public debt meant that borrowing costs have remained low. During the pandemic, Indonesia was able to issue a 50-year bond (its first and the longest-dated in Asia) at relatively competitive yields, signaling investor confidence. Good market liquidity continues as does support for well-structured infrastructure projects.

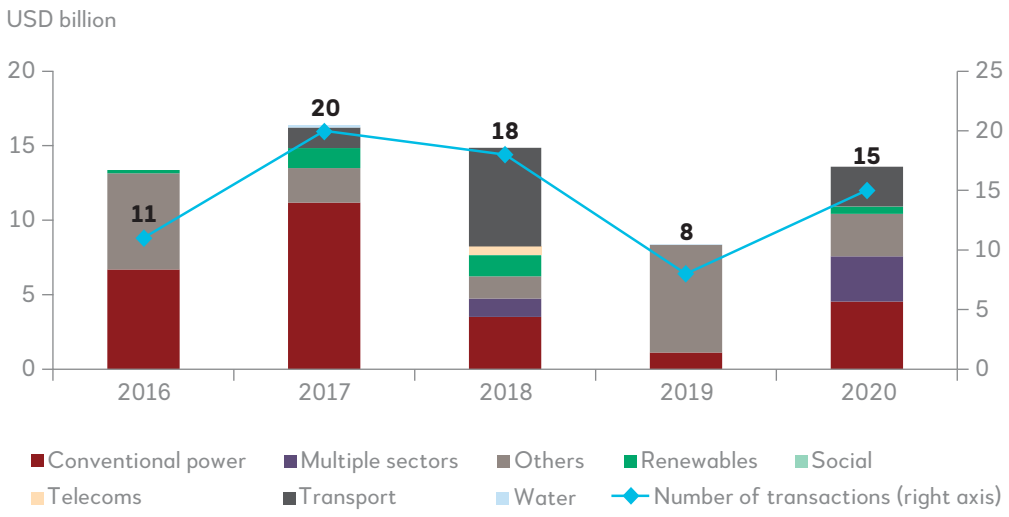
Closed private sector transactions remained resilient. Despite a difficult 2020, the value of closed private sector transactions rose in 2020 compared with 2019 (although still lower than in 2018). The increase was driven by a rebound in conventional power transactions, including coal-based power generation. Private sector and PPP transport projects, including toll roads and ports, also rebounded. A key downside is that private sector renewable energy projects remained muted in 2020, with the project mix shifting from conventional to renewables only slowly, partly because renewable energy projects tend to be much smaller than conventional power projects.

The project pipeline was resilient. The total value of the project pipeline did not change significantly in 2020. The number of projects in the pipeline doubled compared with 2019, partly because projects were delayed (but not canceled) because of operational difficulties during the pandemic. There are encouraging signs that private sector appetite for infrastructure remained resilient in 2020 and will stay healthy in the longer term. Private sector renewable energy projects are still sizable in the announced project pipeline, which includes, notably, waste-to-energy projects. Securing financing for these projects would support energy transition.

Transport projects form a large part of pipeline projects. As in the past few years, infrastructure priorities will remain focused on key transport projects, such as the Trans-Sumatra highway, the Jakarta–Bandung high-speed rail and possible extension and the expansion of Jakarta's mass rapid transit.

Investor confidence in infrastructure development remains resilient and financing conditions remain supportive. Despite the macroeconomic challenges posed by the pandemic, financing conditions have remained benign.

Figure 66: Value and Number of Closed Transactions by Sector, Indonesia

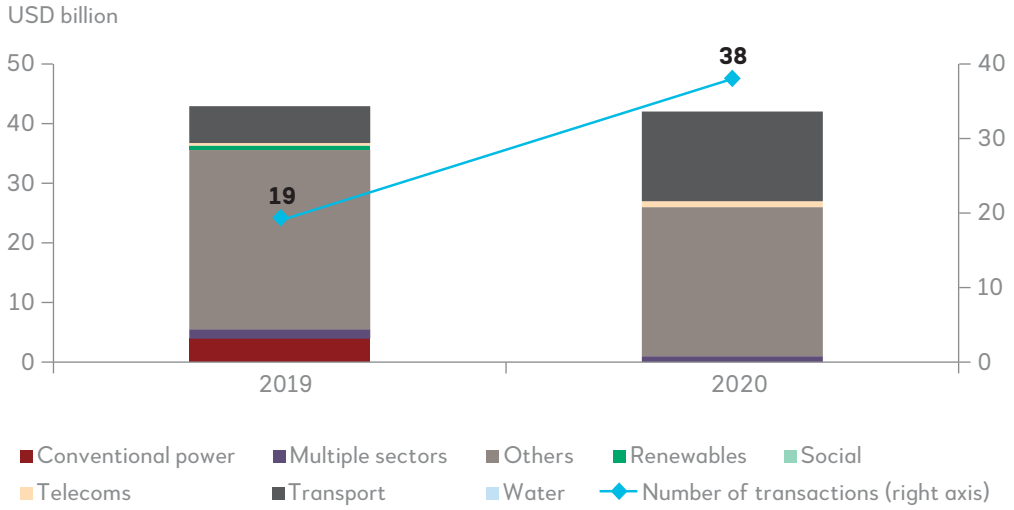


AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Figure 67: Value and Number of Open and Announced Transactions by Sector, Indonesia



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

The government continued to be able to raise financing at competitive rates, with 10- and 20-year bond yields lower than in 2019. For the private sector, loan volumes contracted significantly in 2020 compared with 2019. Based on limited data, there is an uptick in risk premium. Because the pandemic has different impacts on various sectors, borrowing costs will diverge from sector to sector.

Indonesia continued its policy push for infrastructure development. The government has taken proactive steps, first to strengthen macroeconomic stability and then to invest for the future. While infrastructure stimulus was not prominent in the earlier economic recovery stimulus in 2020, there are clear signs that infrastructure development will return as a focus of policy. Government budget outlay to infrastructure declined significantly in 2020 but is expected to rebound sharply based on the 2021 budget (about five percent higher than 2019). The government set up the Indonesia Investment Authority as the sovereign wealth fund to co-invest and catalyze private sector investors. PT Indonesia Infrastructure Finance issued BBB notes at attractive rates to further finance its investments. Indonesia introduced the Omnibus Law (together with implementing regulations) largely to liberalize investment conditions. While it is too early to assess the overall impact of the policy reform, it is expected to encourage more private sector investments over the medium term.

Government Bond Returns and Syndicated Loan Spreads, Indonesia	
10-year government LCY bond returns (monthly average)	6.99% (2020) 7.51% (2019)
20-year government LCY bond returns (monthly average)	7.52% (2020) 8.05% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	*Energy and power: London interbank offered rate + 400 basis points*

LCY = local currency, US = United States.

Note: Figures in italics indicate fewer than five transactions in 2020.

Data source: Refinitiv.

Key Project Highlights, Indonesia

- **Kalibaru Port.** An extension of the busiest port, Tanjung Priok, Kalibaru is a large public project and one of the many port developments to serve Java. The increased capacity is expected to significantly strengthen the logistics chain and improve the environment for trade and other businesses. Construction is expected to begin in 2021.
- **Jatibarang Waste-to-Energy Plant.** The project marks another key step in Indonesia's waste-to-energy journey. The project is in Semarang city and expected to process 1,000 tons per day and reduce waste volume by 80 percent while generating power. The plant is designed as a public-private partnership project to attract private sector investments.

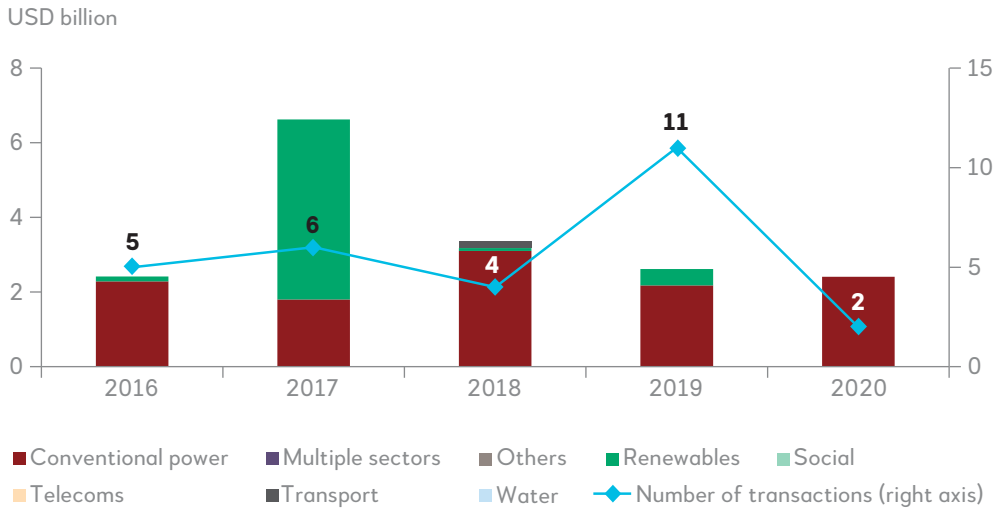
PAKISTAN

Supported by the International Monetary Fund Extended Fund Facility, the pre-pandemic economy was showing signs of macroeconomic stability and 2.4 percent growth was expected in FY2020.[48] The containment measures and the health calamity caused by the pandemic took a toll on the economy. Economic activity dropped in the last quarter of FY2020, resulting in a small economic contraction for the fiscal year. However, economic activity is estimated to have rebounded strongly in FY2021, growing by 3.9 percent. Manufacturing and service sectors led the rebound as relaxation of containment measures bolstered economic activity. Growth is expected to inch up to 4.0 percent in FY2022.

Private sector projects are dominated by conventional power. The impact of COVID-19 was apparent in the number of transactions, which fell from 11 in 2019 to two in 2020. However, the average ticket size of the 2020 transactions was significantly higher compared to 2019. As in previous years, private sector transactions are concentrated in the conventional power sector. Two large coal-fired power plants (combined capacity 1.65 gigawatts [GW]) in Thar were able to secure financial close in 2020, one before the pandemic and one after, which suggests that the market still has appetite for investment in conventional power. Private sector transactions in other sectors have been weak throughout the year.

Compared with preceding years, the average ticket size of infrastructure projects has increased. Although the number of open transactions has been sharply reduced from 40 to 24, overall transaction value saw a slight decrease of 17 percent in 2020. In the hydropower sector, Kohala Hydropower Project (1.1GW) is the biggest private sector deal on the list of open transactions for 2020 and make up about 20 percent of open transactions in terms of deal size. The project is expected to be supported through a project finance modality. In the non-energy space, the M-6 Hyderabad–Sukkur motorway, currently in the pre-tendering phase, is the highest-value project, with an estimated cost of USD980 million.

Figure 68: Value and Number of Closed Transactions by Sector, Pakistan



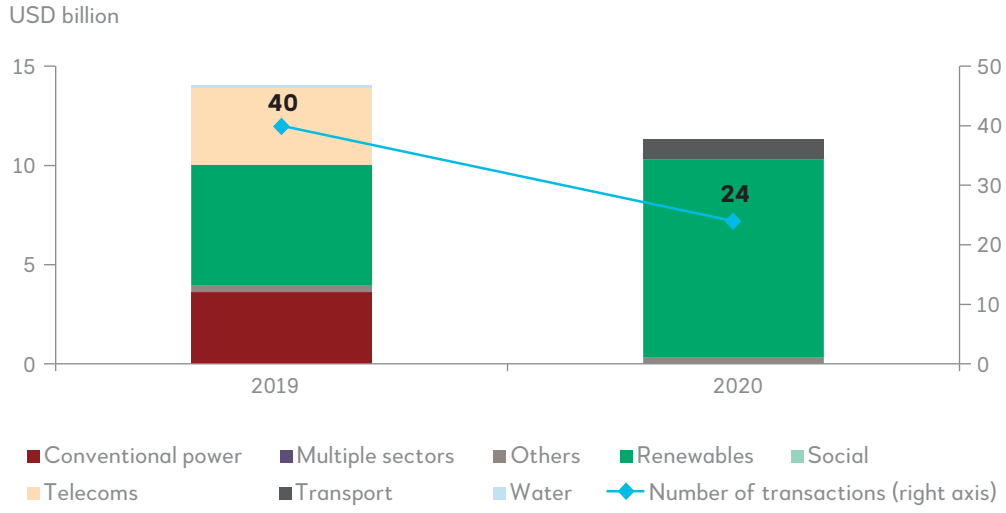
AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

[48] In Pakistan, the fiscal year starts on July 1 and ends on June 30 of the subsequent year. FY2020 refers to fiscal year starting on July 1, 2019 and ending on June 30, 2020.

Figure 69: Value and Number of Open and Announced Transactions by Sector, Pakistan



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Infrastructure financing is typically conducted by the public sector, under a centralized process. The Planning Commission plays a critical role in approving feasibility studies and controlling the Public Sector Development Program. Projects under the program are mostly federally funded. In FY2021, PKR39.6 billion (USD236 million) was disbursed to expand power supply and improve the transmission sector and PKR81.3 billion (USD483 million) to support the water resources division. PKR118.7 billion (USD706 million) was allocated to the National Highways Authority and PKR24 billion (USD143 million) to Pakistan Railways to develop infrastructure. Allocation for the program grew by almost 50 percent to PKR900 billion (USD5.4 billion) for FY2022 compared with disbursement of PKR630 billion (USD3.8 billion) in FY2021. While the allocation for national highways has declined compared with last year, significantly higher funds have been allocated for power transmission, water resources, health and education in FY2022.

Support from development partners remains an important source of funding for infrastructure. Bilateral and multilateral partners will continue to play an important role in developing infrastructure. The World Bank committed to lend USD3.9 billion in 2020 in COVID-19 recovery, food security, education and infrastructure. ADB committed to lend USD2.6 billion to the sectors in 2020. As per its country operations business plan for 2021-2023, ADB is expected to invest USD6.3 billion in infrastructure in Pakistan in 2021-2023. AIIB committed to invest USD750 million in Pakistan's economic resilience in 2020 and is expected to invest USD900 million in 2021 in urban, energy and water projects. The World Bank is expected to focus on renewable energy, water and agriculture productivity and pollution and solid waste in its next partnership cycle. KfW and CDC, UK's development finance institution, have been active in the renewable energy space.

The private sector is active mostly in the energy space. The private sector is more involved in conventional power but is increasingly interested in renewable energy. Since the government invited the private sector to invest in renewables in 2011-2012, there has been limited public investment in renewable energy. The government has changed its regime from cost-plus to feed-in-tariff to attract more private investment to the sector.

The pandemic has affected infrastructure projects, particularly in public finance. The Public Sector Development Program, the government's flagship program for infrastructure delivery, saw its budget cut from PKR650 billion in FY2020 to PKR630 billion as resources were diverted to social protection. Despite the pandemic, however, infrastructure projects in energy and transport have experienced little hindrance. Similarly, private sector projects, mostly concentrated in renewables, have not had many hiccups.

Despite the negative effects of COVID-19, infrastructure has gained traction. The cost of financing is expected to decline in the near term, at least in renewable energy. Market participants posited that the agreement between independent power producers and the government to reduce the cost to end consumer, and efforts of multilaterals to improve cost of financing and sector reforms should help drive costs down. Development finance institutions handle most project financing and domestic banks support balance-sheet financing.

The syndicated loan market is relatively underdeveloped. From 2016 to 2019, the country had 15 syndicated loan transactions, while 2020 saw no syndicated loan transactions in infrastructure, down from three in the preceding year.

The private and public sectors are expected to play sizable roles in infrastructure development. Market participants are hopeful that the number of transactions will pick up, particularly in energy. They believe that support from multilateral and bilateral players will be critical to keep borrowing costs low while unlocking more private capital. Infrastructure is expected to remain a critical component of short- and medium-term development aspirations as the government focuses on getting Pakistan to upper-middle-income country status and, ultimately, among the top-10 economies by 2047. The 12th five-year plan, which is under discussion, is expected to focus on export-led growth, energy and water security, local, regional and global connectivity and a green economy, among others. Infrastructure investments will be critical to achieve these goals. Energy is particularly affected by inefficiencies, system losses and circular debt. Reform and investments are critical to sustain the sector. The government also intends to promote information technology service output and exports, and set up the special technology zone authority in December 2020 to remove the regulatory hurdles and facilitate infrastructure investment for investors in technology zones.

Government Bond Returns and Syndicated Loan Spreads, Pakistan	
10-year government LCY bond returns (monthly average)	9.62% (2020) 12.91% (2019)
20-year government LCY bond returns (monthly average)	10.57% (2020) 13.52% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	No data

LCY = local currency, US = United States.

Data source: Refinitiv

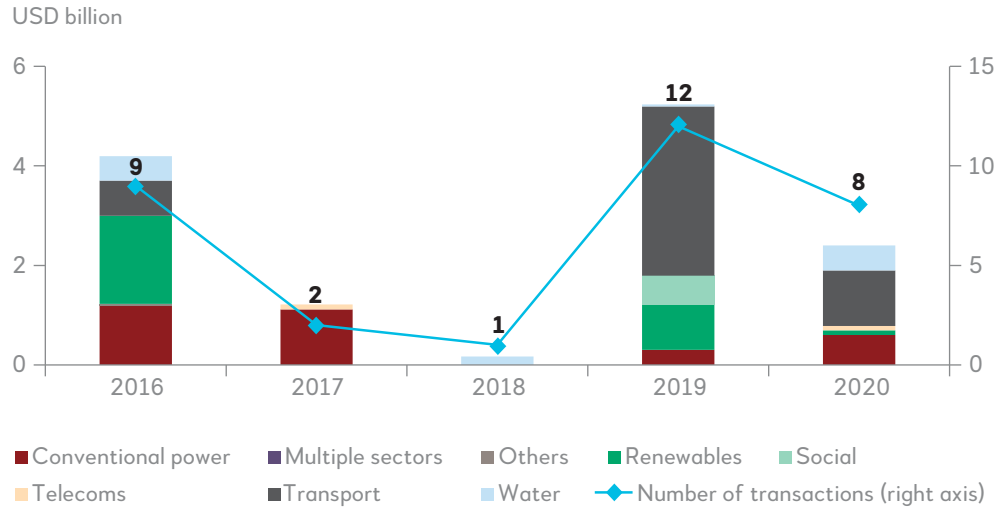
Key Project Highlights, Pakistan

- **Karot Hydropower Station** is a 720-megawatt hydropower project in the Jhelum River, expected to produce 3,206 gigawatt hours of energy annually. The project is expected to be financed under an 80:20 debt-to-equity regime. Equity holders in the project include China Three Gorges South Asia Investment Limited and Silk Road Venture Investment Company. The debt provider consortium is composed of China Exim Bank, China Development Bank, Silk Road Fund and the International Finance Corporation.
- **Rehabilitation and Upgradation of Karachi–Lahore Peshawar (ML-1) Railway Track** project includes doubling the entire 1,872-kilometer (km) track from Karachi to Peshawar. The project is expected to raise the speed of passenger trains from 110 km/hour to 160 km/hour and freight trains to 120 km/hour. The estimated project cost is USD6.8 billion (Dawn, 2021). The project was approved by the Executive Committee of the National Economic Council in August 2020.
- **Sukkur Solar Power Project** is an upcoming 105-megawatt solar project in Sindh province. The project, sponsored by a joint venture of Scatec and Nizam Energy, is expected to cost USD90.91 million. Financial close was achieved in February 2021 as the project sponsors were able to gather debt commitments from Dutch development bank FMO, Bank of Punjab, Faysal Bank and PAK Kuwait Investment. The project was awarded a cost-plus tariff by the regulator.

PHILIPPINES

Because of the ongoing pandemic, the Philippines' real GDP contracted by 9.6 percent in 2020. Key policy responses by the government (totaling more than three percent of GDP) resulted in a fiscal deficit of 5.7 percent of GDP in 2020. The Bangko Sentral ng Pilipinas further cut the policy rate five times by a cumulative 200 bps as a monetary policy response to the pandemic. Regarding repayment capacity, public debt climbed to 51.7 percent of GDP in 2020 and is expected to peak at 59.1 percent in 2021. While remaining manageable, this high public debt level reverses the pre-pandemic low of 37 percent in 2019.

Figure 70: Value and Number of Closed Transactions by Sector, Philippines

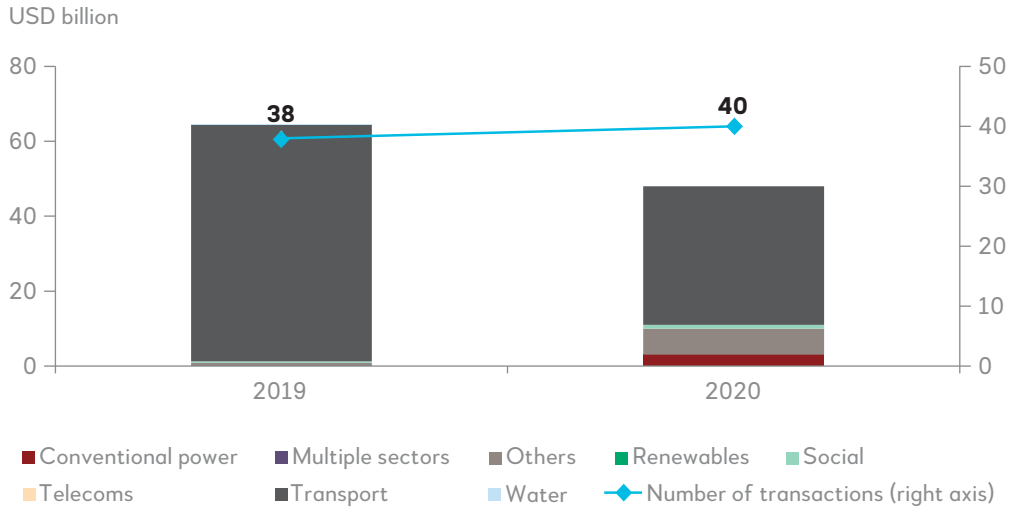


AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Figure 71: Value and Number of Open and Announced Transactions by Sector, Philippines



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Closed private sector transactions declined by 33 percent to USD2.4 billion in 2020. The lower transaction value in 2020 was driven by subdued investments in transport in 2020, at USD1.1 billion (compared with USD3.4 billion in 2019), indicating that the stringent lockdown, one of the longest in Asia, has significantly affected the sector. Despite rising demand, social infrastructure saw no closed deals in 2020 (compared with USD580 million in 2019), which reflects the level of difficulty to finance for the sector. In contrast to transport and the social sector, water, telecommunications and conventional power received more additional facilities in 2020 than in 2019.

The bulk of the project pipeline has been in transport in the past two years. Open and announced transport projects totaled USD48 billion in 2020, corresponding to 77 percent of the total pipeline. The higher number of announced projects, however, signals that private sector appetite for transport remains resilient in the longer term. Transport infrastructure priorities include the Metro Manila Subway Project Phase 1, North–South Commuter Railway System and the Cebu Bus Rapid Transit, among others. Another key upside is that the appetite for the social sector increased in 2020, from USD420 million to USD1 billion, including demand for more healthcare and waste-processing facilities.

Financing conditions in the syndicated loan market remained benign. For the private sector, syndicated loan transactions were similar in 2016-2020 (except for 2018), indicating that appetite for infrastructure remained resilient and that financing remains competitive despite macroeconomic challenges.

Infrastructure development remains the government's key priority. To stimulate an economic rebound from the adverse effects of the pandemic and to tackle natural disasters (e.g., Typhoon Vamco [Ulysses] in November 2020), fiscal spending targets infrastructure investments, such as transport (roads, bridges, rail) and water (flood management). The 2021 national budget allocated about PHP696 billion to the Department of Public Works and Highways, corresponding to more than 15 percent of the aggregate budget. The Department of Transportation received an allocation of about PHP88 billion, about two percent of the budget. These allocations provide continuity to the President's Build, Build, Build flagship projects for 2021.

Government Bond Returns and Syndicated Loan Spreads, Philippines	
10-year government LCY bond returns (monthly average)	3.50% (2020) 5.33% (2019)
20-year government LCY bond returns (monthly average)	4.17% (2020) 5.64% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	*Energy and power: London interbank offered rate + 162 basis points*

LCY = local currency, US = United States.

Note: Figures in italics indicate fewer than five transactions in 2020.

Data source: Refinitiv

Key Project Highlights, Philippines

- **Metro Manila Subway Project Phase 1.** The Department of Transportation project is the country's first subway project and will connect North Caloocan or Meycauayan in Bulacan province and Dasmariñas in Cavite province through the National Capital Region (NCR). Phase 1 will involve a double-tube single-track line of 28.3 km, 13 underground stations covering six cities in NCR and about 28.8 hectares aboveground. The project is under construction and is estimated to start operating in 2025.
- **Mindanao Railway Project Phase 1.** The first phase of the project is a 102-kilometer, single track, non-electrified railway comprising the Tagum City (Davao del Norte), Davao City and Digos City (Davao del Sur) segments. The railway is expected to reduce travel time from 3.5 hours to 1.3 hours. Construction is starting in Q2 2021, and the railway is projected to be operational by Q2 2022.
- **Pasig–Marikina River Basin Flood Management Project.** To be implemented by the Department of Public Works and Highways, the project seeks to improve flood management in the Pasig–Marikina River Basin and comprises the construction of the Marikina Dam and a retention basin between the Montalban and San Mateo bridges.

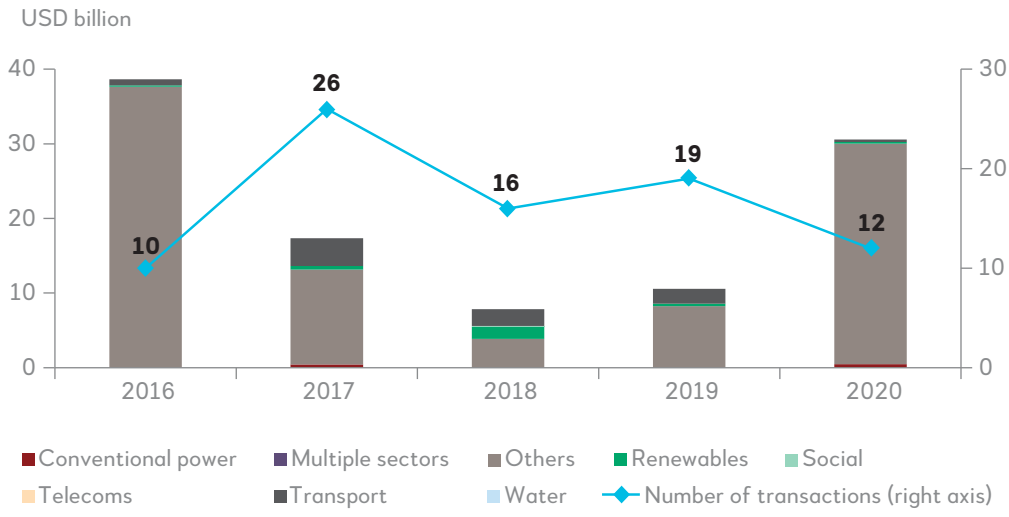
RUSSIA

The economy has been relatively resilient through the pandemic. The main factors of impact were a health crisis, lockdowns and the collapse in the price of oil, the main export commodity and a critical revenue item. However, Russia entered the crisis with a robust macroeconomic position, including large fiscal buffers, a prudent fiscal rule, a stable banking system and an improved monetary framework, with the exchange rate acting as a shock absorber. For these reasons, the authorities were able to implement a sizable policy response, equivalent to about five percent of GDP so far, to support livelihoods. The economic contraction in 2020 was limited to three percent, better than in most G20 countries. Other factors behind this relative resilience include the small service sector, the limited role played by small and medium-sized enterprises, the large state footprint in the economy and strong employment protection. In the third quarter, the economy had returned to growth. The current account has remained in surplus. The International Monetary Fund expects a 4.7 percent recovery in 2021. A strong rebound in oil prices since November 2020 is promising an upside.

Closed transactions increased in 2020, despite the crisis. Some 12 transactions worth USD30.6 billion were closed in 2020, up from USD10.6 billion in 2019. The Amur Gas processing plant project, valued at USD21.4 billion, accounted for two-thirds of the volume; without the project, the total value closed would be 13 percent lower than in 2019. Among private finance deals monitored, transport projects declined by USD1.7 billion and renewables by USD127 million, while telecommunications saw few closed private deals. In conventional power, the USD456-million expansion project of the Zainskaya gas-fired power plant accounts for most of value closed.

The value of open and announced transactions (the pipeline) was broadly stable in 2020. The pipeline registered a slight decline from USD47 billion in 2019 to USD43.6 billion in 2020. The deal count dropped from 11 in 2019 to five in 2020, with open deals becoming even more concentrated in oil and gas. The Arctic LNG II project alone, valued at USD21.3 billion, accounted for half of pipeline deals in 2020. The transport pipeline declined by USD14.8 billion, from USD25.1 billion 2019 to USD10.3 billion. The largest new deal proposed was the M12 Moscow–Kazan Highway, valued at USD8.6 billion, of which the government is the sole sponsor. No major new private finance deal has been announced in renewables, which were still looking for funding in 2020. Non-hydro renewables are yet to take off.

Figure 72: Value and Number of Closed Transactions by Sector, Russia

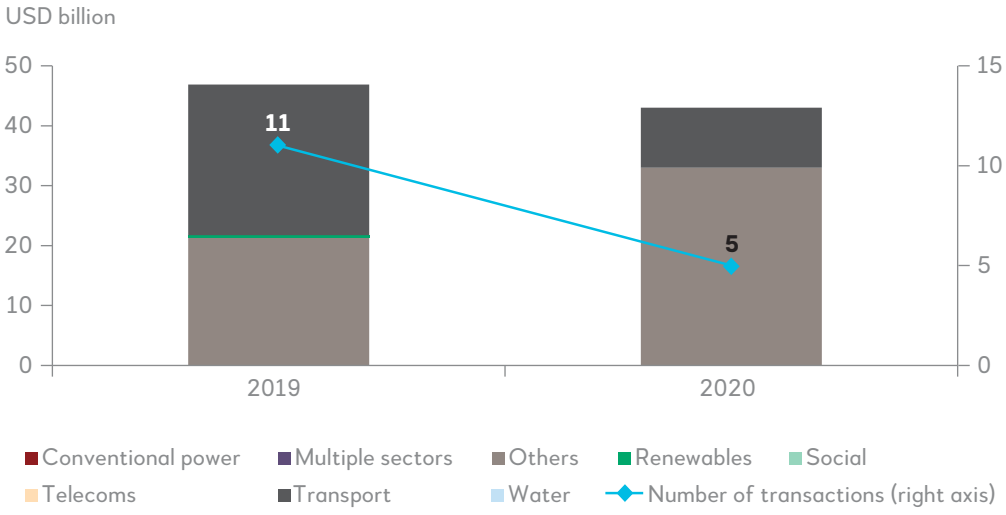


AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Excluding acquisitions.

Data source: IJGlobal and AIIB staff calculations.

Figure 73: Value and Number of Open and Announced Transactions by Sector, Russia



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Excluding acquisition.

Data source: IJGlobal and AIIB staff calculations.

Investor's confidence in infrastructure development remains resilient, while borrowing costs have come down. Despite the pandemic, the government had no problems tapping the international market for funds in 2020.[49] Barring a temporary spike during the market panic in March 2020, yields on sovereign debt continued to decline and fell below two percent as of the end of 2020. Local currency rates declined as the central bank responded to the crisis by cutting the policy rate by 200 bps to a record low of 4.25 percent and providing liquidity to banks. On the corporate side, the trend in borrowing costs was a superposition of two opposing factors: a declining base (policy rate) and increasing risk premia because of higher uncertainty.

As a result, the range of yields on corporate infrastructure bonds has widened to 4.25-8.5 percent. For project finance, the pricing depends on risk-sharing arrangements. For purely private ventures, at the end of 2020, costs were 9-10.4 percent, while for "concessions" (projects supported by the state) were 4-10 percent. A new development was the issuance of the first infrastructure perpetual bonds (by Russian Railways).[50] Market sentiment remains relatively positive. Demand for infrastructure is high and liquidity is generally available, so the focus should be on bankability.

Sovereign Bond Yields and Interest Rates in the Russian Federation	
10-year government LCY bond yields	6.12% (2020) 7.49% (2019)
20-year government LCY bond yields	6.53% (2020) 7.85% (2019)
Central bank policy rate	5.05% (2020) 7.33% (2019)
Sovereign Eurobond yields	2.33% (2020) 3.77% (2019)

LCY = local currency, US = United States.

Note: Year averages. Eurobond yields quoted are for the 2026 maturity, US dollar denominated.

Data source: Refinitiv, Russian central bank.

[49] The 2020 issuances seem to have been related more to a desire to remind investors of Russia's presence in the market than a need for liquidity.

[50] OneInfra Research. (2021). *Quarterly #4 2020:* Инвестиции в инфраструктуру: сколько стоили деньги для отрасли в конце 2020-го?

The government's development and infrastructure priorities are laid out in the program of 13 national projects. Originally proposed in 2019, the USD400 billion package aims to reinvigorate medium-term potential growth by tackling the backlog of underinvestment in infrastructure, health, education, demographics and digitization, among others. About half or more of the investment is slated for hard infrastructure, including roads, railways and power.

Project implementation, however, has so far been lagging. With the pandemic, the deadline for implementation was pushed back from 2024 to 2030. Challenges to more public-driven infrastructure investment include the post-pandemic need to reallocate spending toward social sectors, the government's preference for maintaining large fiscal reserves and general absorption capacity constraints. In the medium term, the national projects allow increased private sector participation in financing infrastructure, given Russia's generally positive experience with PPPs.

Key Project Highlights, Russia

- **Amur gas-processing plant.** The EUR19.1 billion proceeds will be used by the state-owned energy group Gazprom to finance a gas-processing plant, which is being built near Svobodny, Amur Region. The plant is one of the largest infrastructure projects in Russia's far east and will be one of the largest gas-processing facilities in the world. The plant will process natural gas received via the Power of Siberia gas pipeline from the Yakutia and Irkutsk gas production centers. The facility has a design processing capacity of 42 billion cubic meters per year, comprising six production lines to be commissioned during 2021–2025. Debt-to-equity ratio is 60:40. Financing is provided by more than 20 banks in Europe, Asia and Russia. The transaction's financing close was in March 2020.
- **M12 Moscow–Kazan Highway.** The USD8.6 billion proceeds will be used to construct a 794-kilometer highway connecting Moscow and Kazan. About 70 percent of the project cost will come from the government and the Russian Direct Investment Fund, with the remainder from loans and private investors. The project faced several delays before being awarded in January 2020. The route will be a toll road and part of the Europe–Western China international transport corridor.

TURKEY

Turkey is among the few countries that posted overall growth in 2020. Rapid monetary and credit expansion, including sharp policy rate cuts, boosted credit growth, and led to economic growth. The combined measures helped economic activity rebound strongly, but growth exacerbated existing vulnerabilities. Gross reserves reached their lowest level in September 2020 since July 2009, external financing challenges persisted and dollarization increased significantly. The early stimulus relied on rapid credit expansion and monetary growth, state-owned banks provided cheap and fast borrowing and regulatory measures were designed to boost credit expansion. Government countercyclical measures resulted in a decrease in fiscal deficit in 2020.

Infrastructure investment is a government key priority although structural challenges remain. Construction companies have track records in major infrastructure projects, such as highways, railways and airports. The government pushed for a PPP model and offered credit enhancement instruments, which significantly reduced investment risks and facilitated the financing of PPP projects. Infrastructure will remain a key tool of the current government to support economic growth, although investors will have to continue to balance risks and returns.

Borrowing costs are expected to remain unchanged in 2021. A look at the 12-month (Q4 2019 to Q4 2020) infrastructure financing cost indicates a decline in 10- and 20-year government zero-coupon bond yields compared with the average of the previous 12 months. The 10-year bond yield declined from 15.24 percent in 2019 to 12.43 percent in 2020. Most interviewed market participants expect transaction levels to pick up in 2022 onward.

The value of closed private sector transactions declined significantly. The value of closed private sector transactions significantly dropped in 2020 and hit its lowest since 2016. COVID-19 accelerated structural shifts in infrastructure investments. The government has made big strides toward investing in its position as a regional energy hub and has continued investing in gas storage and liquefied natural gas. Conventional power (power generated from natural gas, oil, and coal) was the only infrastructure sector that registered positive growth in 2020 (from USD306 million to USD1.87 billion).

Transport projects constituted most of the pipeline. The overall open and announced transaction pipeline recovered in 2020. However, the project pipeline has taken a hard hit on the back of four consecutive sovereign credit rating downgrades since 2017 and influenced investment sentiment: the total value of open transactions in 2020 was USD17 billion, from USD2.6 billion in 2019. Five new transport projects have been announced, and the Canal Istanbul project has mainly driven recovery.

The USD16 billion value of the Canal Istanbul (45 km) project, expected to be completed by 2023 and at the pre-financing stage since 2016, represented the bulk of the project pipeline's overall value in 2020. An assessment of the project, including the master plan and the financial assessment are still in progress. Aydin–Denizli Motorway (163 km), a PPP, is a major transport project, valued at USD1.5 billion (around EUR1.1 billion). The share of power in the pipeline has significantly decreased since 2018. Power's low performance can be attributed to power companies facing multiple issues such as the floating exchange rate, rising energy costs and the need to restructure debts.

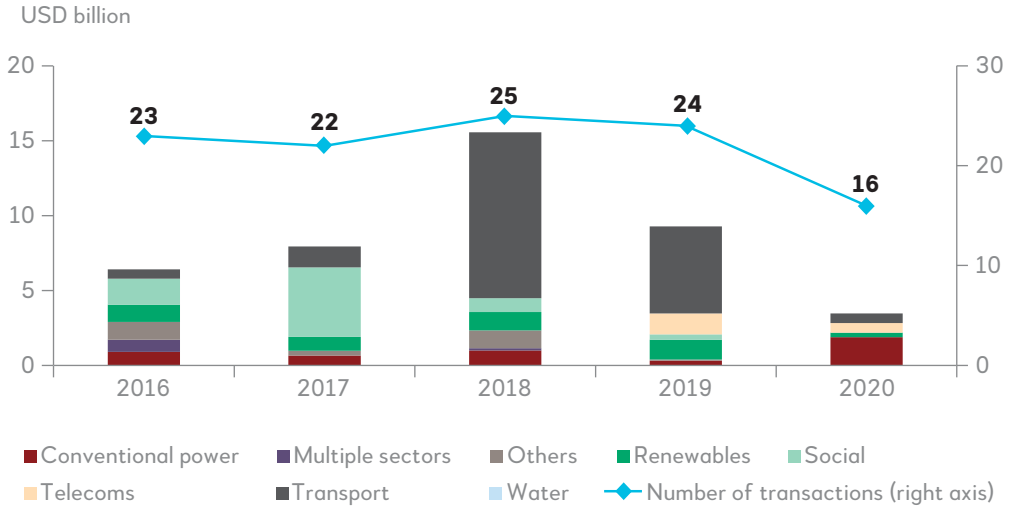
Government Bond Returns and Syndicated Loan Spreads, Turkey	
10-year government LCY bond returns (monthly average)	12.43% (2020) 15.24% (2019)
Syndicated loan spreads, 2020 (over hard currencies: US dollar, euro, pound sterling, yen)	*Telecommunications: London interbank offered rate + 195 basis points (bps)* *Euro interbank offered rate + 299 bps*

LCY = local currency, US = United States.

Note: Figures in italics indicate fewer than five transactions in 2020.

Data source: Refinitiv.

Figure 74: Value and Number of Closed Transactions by Sector, Turkey

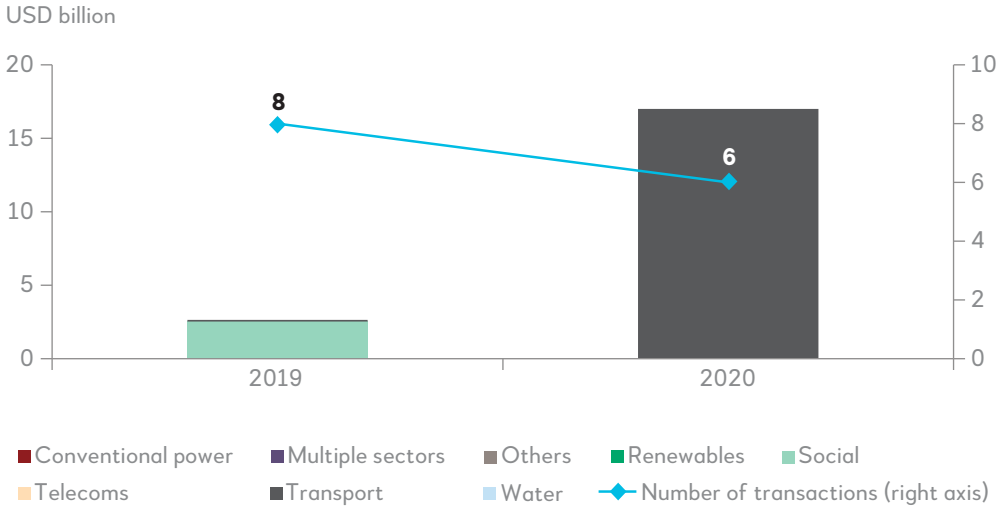


AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Figure 75: Value and Number of Open and Announced Transactions by Sector, Turkey



AIIB = Asian Infrastructure Investment Bank, USD = United States dollar.

Note: Acquisition deals are excluded from samples.

Data source: IJGlobal and AIIB staff calculations.

Investor confidence in infrastructure is still fragile but development remains resilient. Despite the pandemic's macroeconomic challenges, financing conditions have remained benign. The government continued to raise financing at competitive rates in 2020, with 10-year bond yields lower than in 2019. For the private sector, loan volumes contracted significantly in 2020 compared with 2019. Risk premium saw an uptick. Since the pandemic has different impacts on various sectors, borrowing costs will diverge from sector to sector.

The government has taken proactive steps to strengthen macroeconomic stability and invest in the future. While infrastructure stimulus was not prominent in economic recovery stimulus in 2020, the signs are clear that infrastructure development will return as a focus of policy. Long-term prospects for infrastructure remain positive given continuous interest from major investors. The government emphasized a strong commitment to continue addressing infrastructure needs calculated to reach approximately USD823 billion by 2040.

Key Project Highlights, Turkey

- **Canal Istanbul (45 km) Public-Private Partnership.** The USD16-billion proceeds will be used to construct the project. It will link the Black Sea and the Sea of Marmara, which passes through the Kucukcekmece, Sazlidere and Durusu districts in Istanbul. As a result of the technical studies of the project announced in 2011, the route was officially announced on January 15, 2018.
- **Aydin–Denizli Motorway (163 km) Public-Private Partnership.** The USD1.5-billion (around EUR1.1 billion) proceeds will be used to construct the highway in western Turkey. The awarding authority—the Ministry of Transportation and Infrastructure—will be using a build-operate-transfer model to deliver the project. The road section will be 163 km and is the second phase of the 440-kilometer Izmir–Antalya highway project. The first phase, comprising the 115-kilometer Izmir–Aydin section, is operational. Tender for the Aydın–Denizli motorway was held on 3 July 2020.

APPENDIX: RESOURCE PERSONS

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ASIAN INFRASTRUCTURE FINANCE 2021

SUSTAINING GLOBAL VALUE CHAINS

The Asian Infrastructure Finance 2021 report examines how Asian economies, to different extents and in different ways, have integrated global value chains (GVCs) into their growth models. It emphasizes how critical infrastructure quality and capacity are to the agility and resilience of GVCs, as examined against the backdrop of the COVID-19 pandemic, increased trade tensions, rapid technological development, environmental pressures and other factors. Using case studies and research, the AIF 2021 report illustrates how GVCs have provided opportunities for countries and companies to become internationally competitive, in part through technological advancements and efficiency improvements. It also examines how GVC engagement could reinforce existing inequalities and explores possible paths for a just and inclusive transition, recognizing countries' different starting points and capacities. The report highlights how green infrastructure, consistent with net zero transition, will become a source of competitive advantage and the key to sustaining future GVCs.

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