



PGIM

GLOBAL ASSET MANAGEMENT

MEGATRENDS

A NEW ERA OF GLOBALIZATION

Shifting Opportunities in a Dual-Track World

SPRING/SUMMER 2025

For professional investors only.
All investments involve risk, including
possible loss of capital.



About PGIM

PGIM is the global asset management business of Prudential Financial, Inc. (PFI). In 41 offices across 19 countries, our more than 1,450+ investment professionals serve both retail and institutional clients around the world.

As a leading global asset manager, with \$1.38 trillion in assets under management, PGIM is built on a foundation of strength, stability, and disciplined risk management.* Our multi-affiliate model allows us to deliver specialized expertise across key asset classes with a focused investment approach. This gives our clients a diversified suite of investment strategies and solutions with global depth and scale across public and private asset classes, including fixed income, equities, real estate, private credit, and other alternatives.

All data is as of December 31, 2024.

* PGIM is the investment management business of Prudential Financial, Inc. (PFI). PFI is the 12th largest investment manager (out of 411 firms surveyed) in terms of worldwide institutional assets under management based on Pensions & Investments' Top Money Managers list published June 2024. This ranking represents institutional client assets under management by PFI as of December 31, 2023. Participation in the P&I ranking is voluntary and open to managers that have any kind of U.S. institutional tax-exempt AUM.

INTRODUCTION

2024 was a year of change, with roughly half of the world's population voting in national elections across more than 60 countries.¹ One theme dominated almost universally: dissatisfaction with a global economy that favors *others over us*.² Nationalist rally slogans like “Les notres avant les autres”, “America First” and “Make in India” resonated strongly with voters. In a wave of populist-fueled discontent, presiding governments had their worst electoral performance in over 100 years.^{3,4} From South Africa, Uruguay and India to France, Japan and the US, incumbents lost electoral support or were thrown out of office altogether.

On the surface, these election results – and the swirling headlines around tariffs, migration crackdowns, beggar-thy-neighbor policy and supply chains aligning along geopolitical fault lines – would suggest the high-speed globalization train barreling down the tracks since the 1990s has been utterly derailed as the world *de*-globalizes.

However, today's reality is far more nuanced. We argue instead that the world has entered a new era where globalization has essentially splintered into two distinct and separate tracks.

The **first** track of globalization, which has sharply decelerated, if not come to a sputtering halt altogether, represents just 25% of global GDP but captures nearly all the media and political focus.* It is currently focused primarily on a narrow set of industries which are deemed to be of vital national security or deep strategic importance, often as a result of pandemic-era epiphanies or rising great power rivalries. Sectors in this so-called “small yard, high fence” approach include artificial intelligence (AI) and high-end semiconductors, 5G telecommunications networks, critical minerals, oil and natural gas, electric vehicles (EVs) and batteries, as well as military technology. It is in *these* areas that deglobalization is occurring – most strikingly between China and the US. Many other countries, including most emerging markets, are still seeking the cheapest, most efficient access to traded goods and services even as the G7 and China erect higher fences and wider moats around select sectors.

The **second** globalization track, rarely mentioned in sensationalist media stories and often ignored in

political discourse, continues to move forward at a high speed and represents roughly 75% of global GDP. On this track, a vast array of goods and services are still traded across borders based on comparative economic advantage – regardless of geopolitical rivalries and growing protectionist instincts. Though periodically challenged by threats of sweeping tariffs, globalization on this track remains at a high-water mark across these sectors – which include textiles and apparel, luxury goods, consumer electronics, travel and tourism, entertainment as well as outsourced professional and IT services.

To understand the investment opportunities and hidden risks from this new bifurcated era of globalization, with its distinct fast and slow tracks across sectors and countries, we have drawn on the insights of over 40 researchers and investment professionals across PGIM's fixed income, equity, real estate, and private alternatives managers – as well as leading academics, industry analysts and investors.

Chapter 1 of this report identifies the three phases of the post-1990s globalization era (including the current “dual track” phase) and describes how their changing nature alters the macroeconomic and investment landscape. In Chapter 2, we then home in on three sectors that are on the stalled globalization track – AI and advanced semiconductors, metals and minerals and electric vehicles – and highlight the resulting implications for investors. Finally, Chapter 3 lays out an action plan for CIOs as they evaluate the significant shifts in the macroeconomic and investment landscape in this new era of globalization.

* See Appendix A for more details around the sectors falling into the first track.

TABLE OF CONTENTS

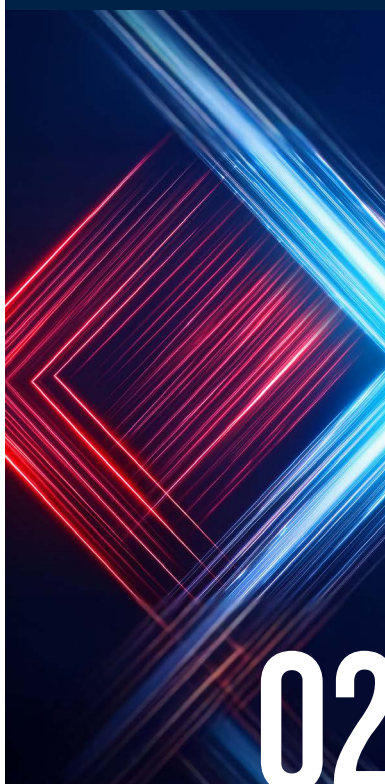
THREE PHASES OF MODERN GLOBALIZATION

Page 3



SECTORS CAUGHT IN THE CROSSHAIRS OF A NEW ERA OF GLOBALIZATION

Page 13



PORTFOLIO IMPLICATIONS

Page 23





CHAPTER 1

THREE PHASES OF MODERN GLOBALIZATION

“

While the tussle between globalization and nationalism has played out over many cycles and centuries, we have entered a new era where globalization has essentially splintered into two distinct and separate tracks.”

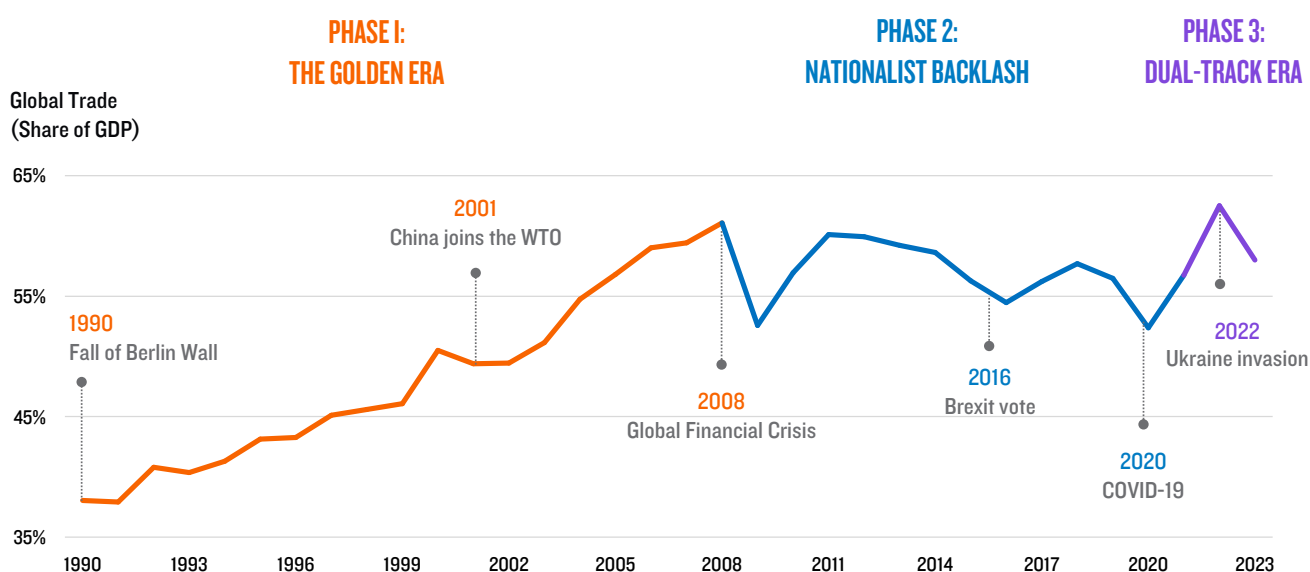
01

CHAPTER 1

THREE PHASES OF MODERN GLOBALIZATION

While the tussle between globalization and nationalism has played out over many cycles and centuries, our focus here is on the last three decades. This modern episode of globalization can be segmented into three phases (Exhibit 1):

Exhibit 1: Three phases of modern globalization



Note: Total trade is the sum of total exports and imports.
Source: PGIM Thematic Research, World Bank.

PHASE 1: THE GOLDEN ERA (1990-2008)	PHASE 2: NATIONALIST BACKLASH (2008-2021)	PHASE 3: DUAL-TRACK ERA (2021 – PRESENT)
<ul style="list-style-type: none">• Berlin Wall falls, China enters the WTO, and the internet goes mainstream• Supply chains are borderless and manufacturing shifts to the lowest-cost producers• Global trade's share of GDP nearly doubles to over 60%	<ul style="list-style-type: none">• The GFC causes the era of unfettered globalization to unravel• Backlash against globalization gains momentum and nationalist movements gather force• Growth in global trade slows significantly	<ul style="list-style-type: none">• Covid-19 pandemic exposes supply chain vulnerabilities• Great power rivalry and national security concerns usher in a new era of industrial policy• Russia's invasion of Ukraine leads to threat of energy crisis in EU

Phase 1: The Golden Era (1990 - 2008)

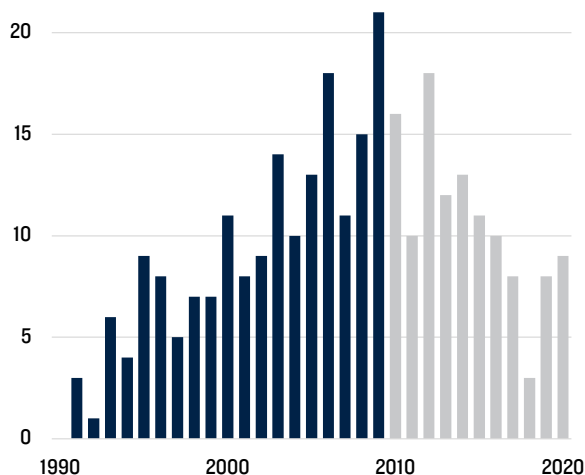
The surge in globalization during this period was propelled by three key drivers. First, neoliberal orthodoxy provided the ideological underpinnings of globalization with broad consensus that the free movement of goods, people and capital based on comparative advantage would bring increased prosperity for all. In this period, regional trade agreements sprouted up around the world (Exhibit 2). And even a *global* trade framework – the World Trade Organization – was created. Furthermore, the integration of China and the Eastern Bloc into the global economy provided a critical element: a supply of labor with wages lower than most developed countries.

Second, innovations in logistics – namely, sharply falling freight and communications costs – reduced the frictions of manufacturing abroad and enabled unbounded supply chains and a seemingly borderless world. Third, widespread adoption of personal computers and the internet launched the digital era and expanded the cross-border possibilities to many professional services, alongside the initial focus on manufacturing.

The relentless pursuit of efficient cross-border resource allocation that prevailed during the Golden Era of

Exhibit 2: New regional trade agreements grew rapidly in the Golden Era

Number of new regional trade agreements



Source: World Trade Organization. As of January 2025.

globalization reshaped the global economy and shifted the macro landscape in several ways:

Concentration of manufacturing in China

China has emerged as the unquestioned leader in manufacturing. Today, China accounts for over 30% of global manufacturing and outproduces the entire G7 (Exhibit 3).

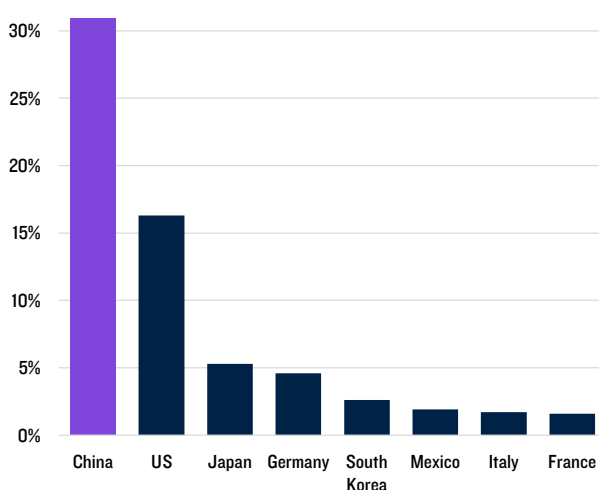
What began decades earlier in low-value sectors like apparel and furniture has matured into specialized technology sectors like cutting-edge pharmaceuticals and electronics. As more production found its way to China, elaborate supplier ecosystems developed there. This led to even greater efficiency and economies of scale that have made production elsewhere uncompetitive despite rising wage levels in China.

Lower cost of goods for consumers, lower interest rates and compressed term premia for investors

Global supply chains not only benefitted workers and firms in new locations of production – who saw their incomes and margins rise – but also global consumers. More-efficient and lower-cost production resulted in a persistent disinflationary pressure on goods that endured for more than two decades (Exhibit 4). This contributed to a low and stable environment for

Exhibit 3: China is the global manufacturing superpower

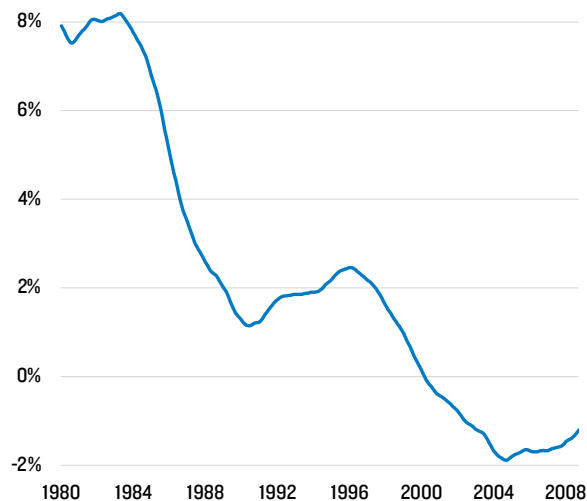
Share of global manufacturing output (2023)



Note: Measured as value add to GDP by economic activity.

Source: United Nations Trade and Development. As of January 2025.

Exhibit 4: Steady and persistent goods disinflation was the norm for almost 30 years
Annual inflation of US durable goods (1980-2008, 5-year moving average)



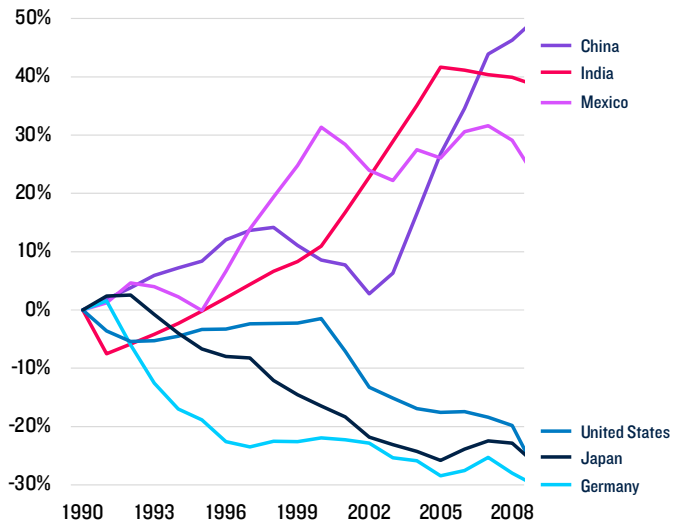
Source: US Bureau of Labor Statistics. As of January 2025.

overall inflation where central banks could maintain accommodative policy rates at ultra-low levels. For investors, this combination of reliably low inflation and policy rates also led to compression of term premia across developed markets.⁵

EM growth at the expense of manufacturing sectors in developed markets

While it created prosperity in many developing economies like Mexico, India and China, globalization also was a factor in the decline of manufacturing and heavy industry in developed countries such as Germany, Japan and the US – contributing to inequality as well as rising political backlash. While many emerging market countries saw the creation of new jobs with foreign investment, manufacturing jobs declined across developed market countries (Exhibit 5). The US and Europe lost a combined eight million manufacturing jobs from 1990 to 2008.⁶ The hollowing out of manufacturing in developed markets – in conjunction with other secular forces like automation – has in part contributed to the strong rise in populist and nationalist movements there.

Exhibit 5: Globalization shifted manufacturing employment
Change in total manufacturing employment in select countries (Indexed to 1990)



Source: United Nations Conference on Trade & Development. As of January 2025.

Phase 2: Nationalist Backlash (2008-2021)

Globalization began to stall after the seismic shock of the GFC. Trade as a share of global GDP plateaued and fluctuated around 55% since 2008 (Exhibit 1).

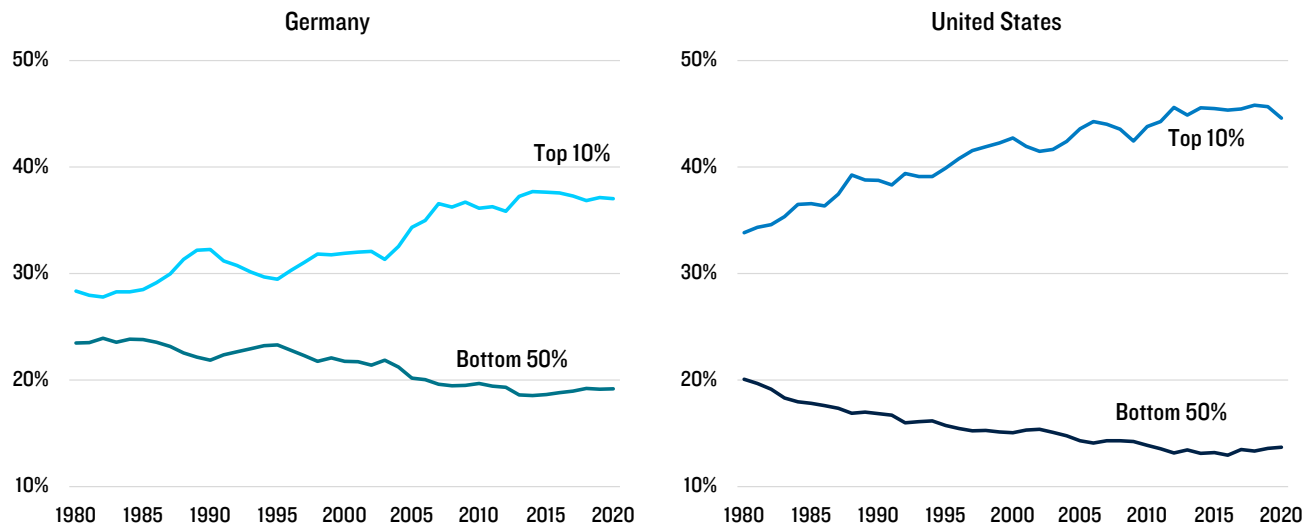
Political backlash and rising inequality shifted economic orthodoxy

Since the GFC, nationalist movements have sprouted up in every region of the world, and globalization has become a target of populist grievances.⁷ The U.K.'s referendum in 2016 about whether to remain in the EU or leave was a powerful example of this. The Brexit vote came after a period of dissatisfaction with liberal trade and immigration policy and is one of the most prominent actions to reclaim sovereignty in a highly globalized world.⁸

Furthermore, a growing income divide – driven by multiple factors, many unrelated to trade and capital movement. This led to a backlash against free trade and immigration as well as declining trust in public institutions and governments (Exhibit 6).⁹

Exhibit 6: Inequality grew in some developed countries during globalization

Share of total national pre-tax income (Top 10% versus Bottom 50% of households)



Source: World Inequality Database. As of January 2025.

Globalization pushes manufacturing into new lower-cost areas

As the wages of Chinese workers rose, manufacturing firms expanded their production into lower-wage markets such as Southeast Asia. It is important to note that in this period, the expansion of manufacturing into new production centers outside of China – like Indonesia, Singapore and Vietnam – was still driven primarily by the desire to find the lowest cost of production (Exhibit 7).

Phase 3: Dual-Track Era (2021 – present)

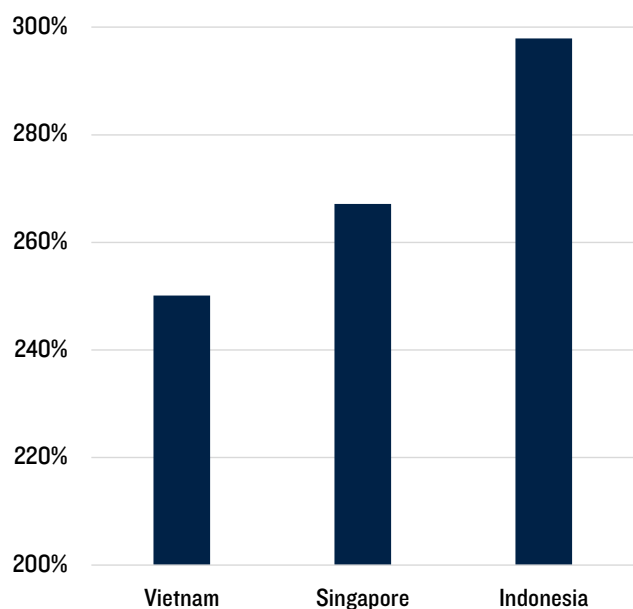
The Covid-19 pandemic exposed the fragilities of highly concentrated supply chains while Russia's invasion of Ukraine underscored the risk of importing vital resources, such as energy and critical grains. A recognition of these vulnerabilities led to the rebirth of industrial policy and accelerated backlash against cross-border trade, especially in sectors considered vital to national security. Increasingly, the import of critical goods – like food, medicine or energy – is viewed as an economic and national security vulnerability.

Indeed, once relegated to the political extremes, tariffs and export restrictions are now a part of “mainstream”

politics and widely deployed. As a result, new trade restrictions have increased significantly. 2023, for example, saw 3,000 new trade restrictions – a nearly fivefold increase from 2015.¹⁰

Exhibit 7: Capital flows into Southeast Asia accelerated post-GFC

Growth of inward FDI between 2008 and 2020



Source: United Nations Conference on Trade & Development. As of January 2025.

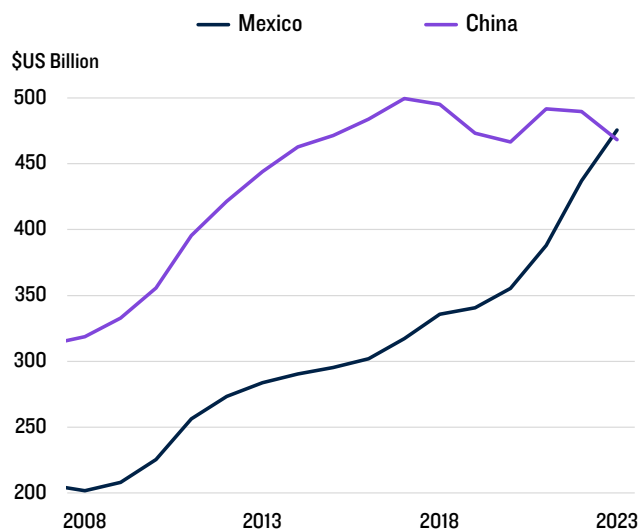
Friend-shoring and near-shoring shift patterns of production and trade

These newfound security concerns have led to significant shifts in the patterns of global trade as well. Relying on geopolitical rivals or uncertain actors is no longer acceptable for supply chains. Instead, nations are opting to partner with countries that are geopolitically aligned and, ideally, geographically closer. Such “friend-shoring” and “near-shoring” is a recognition that imports from nearby and trusted allies can reduce supply chain vulnerabilities.¹¹

Mexico provides a good example of this. Since the North American Free Trade Agreement (NAFTA) was implemented in the mid-1990s, Mexico has evolved into a low-cost production hub for American manufacturers of autos and household appliances. However, the recent surge in near-shoring – spurred by the pandemic and accelerated by great power rivalry – has fueled new growth in US trade with Mexico at the same time as trade with China stagnated. Today, Mexico has replaced China as the largest trading partner of the US (Exhibit 8).

Exhibit 8: Mexico surpasses China as the largest importer to the US

Annual value of US imports (5-year average)



Source: US Census Bureau.

Select industries have derailed off the high-speed globalization track altogether

While the Golden Era of globalization swept across all regions and all industries, the scope for deglobalization in the Dual-Track Era is much narrower. Only a select number of industries – those deemed critical for economic or national security – have derailed from the main globalization track. A handful of prominent sectors – including EVs, oil and gas, AI, semiconductors and critical minerals – are on a different track and are increasingly the focus of trade and industrial policy. The direction of travel along this track is very much towards *de*-globalization.

The two great economic powers of our time – China and the US – have each deemed they need to be more self-reliant in these key industries. Each has enacted a slew of trade restrictions and subsidies to protect and boost domestic production across these sectors. For investors, these dynamics have radically altered the landscape – albeit for a narrow set of industries – and it is critical they understand some of the features of this slower track.

Industrial policy: Great trading partners become great rivals

With the emergence of China as a global power to challenge the US, there is a growing geopolitical rivalry between these trading partners. Over the last decade, enormous, shared interests have become strained and are evolving in increasingly divergent directions. This manifests itself in a fluid and sometimes tense relationship that increasingly includes tariffs and trade restrictions.

Industrial policy has also played a prominent role in driving this great power rivalry. Official Chinese economic policy had identified “strategic emerging industries” as early as 2010.¹² Policy to support these strategic areas expanded in 2015 with the “Made in China 2025” initiative. It was an effort to not only reduce dependence on foreign technology and localize manufacturing, but it also had a more ambitious goal – namely, to make China a global leader in strategically important industries.¹³ Backed by

Risks around today's “small yard” growing larger

In our base case the stalled track for globalization primarily encompasses sectors that are deemed vital for economic and national security. However, the global economic landscape is especially unclear in the first half of 2025. Indeed, some measures of uncertainty around global economic policy are above levels seen during the GFC, the EU Crisis, Brexit or COVID.¹³⁰

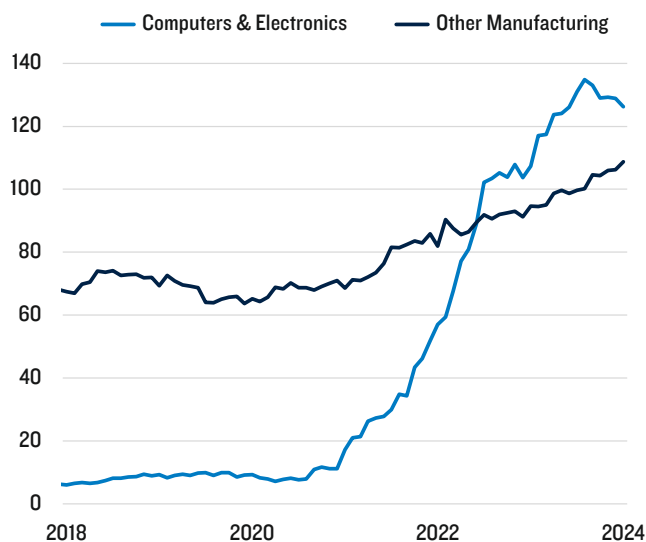
This elevated uncertainty underscores the risk to our base-case thesis – namely, that the scope of trade policy broadens significantly beyond the “small yard”. In this alternate scenario, the nationalist policies of some countries grow stronger and their protectionist impulse spills over into industries and sectors that are far less critical. And we are seeing some evidence of this spillover already with a new populist government in the United States, for example.

For investors it is important to keep two things in mind about this alternate spillover scenario. First, the US accounts for roughly 20% of global trade and even if America's “small yard” of protected industries grows larger, there is a substantial portion of trade that happens beyond US borders and outside sectors deemed critical from a national security lens. In short, the “small yard” may grow larger, but this spillover is not likely to take over global trade.

Second, the economic imperative of producing where it is most efficient remains a compelling and powerful force. Because of this, it is likely to prevail – especially over the long term – across the roughly three-quarters of the global economy that does not easily fit into a national security narrative.

Exhibit 9: US manufacturing investment following the IRA

Private non-residential manufacturing investment
(Annualized, \$US Billion)



Source: US Census Bureau. As of January 2025.

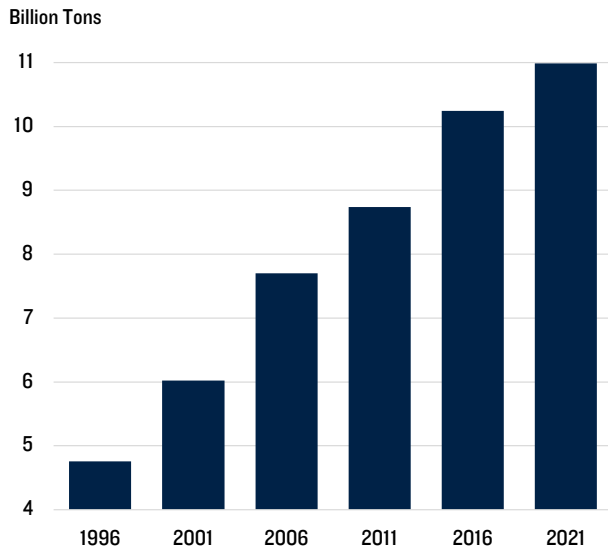
significant resources from the state and state-owned enterprises – including subsidized capital, land and power – China's strategic industrial initiative has been tremendously successful, and they are global leaders in areas like EVs and solar panels.¹⁴

*China's earlier initiatives
have triggered reciprocal
moves by the US.*

However, industrial policy begets more industrial policy.¹⁵ China's earlier initiatives have triggered reciprocal moves by the US – including the Inflation Reduction Act (IRA) as well as the CHIPS and Science Act – which together provide over \$500 billion in manufacturing subsidies, tax breaks and other incentives to industries like renewable energy and semiconductors (Exhibit 9).^{16, 17}

Exhibit 10: Trade has slowed but is still chugging along

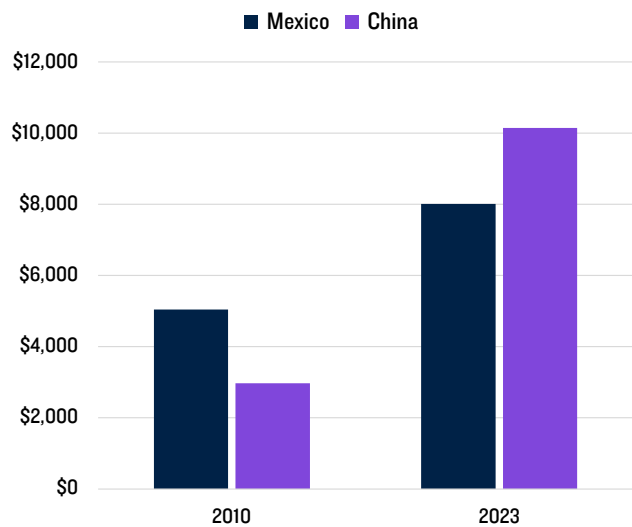
Total sea-born goods loaded



Source: United Nations Trade and Development and World Bank. As of January 2025.

Exhibit 11: China no longer offers the cheapest labor

Annual salary for a manufacturing worker (\$US)



Source: Mexican Ministry of Labor & Social Welfare and China National Bureau of Statistics. As of January 2025.

Pick a side: Trading blocs to limit access to critical resources and technology

Aside from attempts to boost domestic production, great power rivalry has also included attempts to limit resources and technology transfers to rivals. For example, China has increased restrictions on exports of technology to process critical minerals and rare earths such as gallium, antimony, graphite and germanium whose supply the country dominates.^{18, 19}

Increasingly, these limits apply to other countries and force some to choose a side in the rivalry between the US and China – creating “trading blocs” of like-minded allies. For example, the US has been leaning on Japanese and Dutch firms to limit their exports to China of key semiconductor manufacturing parts in an effort to impede China’s progress in chip manufacturing.²⁰ Similar to the Cold War rivalry between the US and the Soviet Union in the 1960s and ’70s, many smaller countries will be forced to choose a side in this current great power rivalry. However, a few countries – India, Brazil, Chile and Indonesia – that provide either a large end-market or are flush with critical resources may be able to remain non-aligned.

Meanwhile, for the rest of the global economy...

There is a second track in this era where the global economy is proceeding along as it has for decades. There is little trade or industrial policy around the bulk of everyday goods that fill our homes, offices and closets. Indeed, these industries and sectors comprising roughly 75% of global GDP remain unaffected in this new Dual-Track globalization era (Exhibit 10).

It is hard to find evidence of deglobalization or reshoring for lower value goods like consumer electronics, furniture or apparel.

Most industries still seek out highest efficiency and lowest cost of production

It is hard to find evidence of deglobalization or reshoring for lower value goods like consumer electronics, furniture or apparel. In fact, some of the reshoring or near-shoring that is taking place today

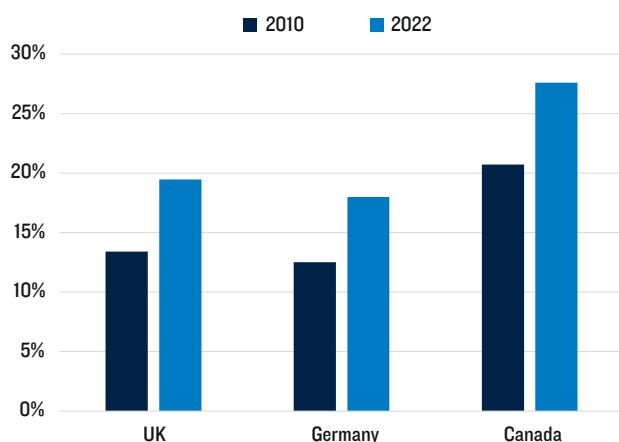
may be more about automated production in Eastern Europe or Mexico being *less* costly than production in China. That is, some near-shoring in lower-value goods may be an extension of globalization's push to find more efficient and lower-cost places for production rather than a repudiation of it (Exhibit 11).

It is worth noting that tariffs may be spreading outside of great power rivalry and critical goods. Nationalist governments in North America and Europe have made self-reliance and limiting imports a key point of their agendas. If this momentum continues and tariffs are more routinely deployed among regional trading partners or if they impact a significantly wider set of goods – including low-value goods with limited economic or national security value – the full-speed track of globalization could diminish.

Despite widespread nativist rhetoric, there has yet to be a major pullback in global migration

While the growth of global trade has stagnated since 2008, the cross-border migration of people has remained far less impacted into the 2020s – especially in countries with aging populations.²¹ New permanent immigrants to developed countries, for example, hit record highs in 2023 with a third of OECD members registering all-time highs, including Australia, France, Japan and Korea.^{22, 23}

Exhibit 12: Migration remains at or near all-time highs
Share of foreign-born workforce



Source: U.K. Office of National Statistics, US Bureau of Labor Statistics, and Germany's Federal Statistical Office. As of January 2025.

While the pandemic lockdowns disrupted the migration of workers for several years, economic growth and productivity in Australia, Canada and the US since then have been driven by ongoing inflows of workers and other migrants.^{24, 25, 26} In fact, despite the anti-immigration slogans, the share of foreign-born workers remains, so far, at or near its peak in several countries (Exhibit 12).²⁷ However, changes in migration policy may be forthcoming with nativist parties gaining political influence in Europe and plans for mass deportations in the United States.^{28, 29}

Cultural globalization remains intact

Entertainment and culture are crossing borders more than ever before. While Hollywood films have been earning a significant share of their box office abroad for years, today prominent singers from all over have global followings. England's Ed Sheeran and Korea's BLACKPINK and BTS earn hundreds of millions outside their home markets.^{30, 31, 32}

Furthermore, digital platforms like Netflix, Tencent, Amazon and Rakuten are the new global players in entertainment and media. And they are increasingly providing global content to their loyal subscribers. Netflix, for example, has been successful in getting its global audiences hooked on Korean thrillers like *Squid Games*.³³ In fact, between 2020 and 2023 global demand for Korean programming overall has nearly doubled.³⁴

And the cross-culture appeal of entertainment is now going from the stage and screen to the sports arena. Broadcasts of the U.K.'s English Premier League matches, for example, attract more viewers in some countries than domestic football leagues.³⁵ Additionally, with live broadcasts to Asia for over a decade – including China, Japan and Korea – America's National Basketball Association is the most popular sports league in China, with a quarter of adults today describing themselves as "avid fans."^{36, 37}

What do these changes mean for investors?

For investors, these changes in trade patterns and supply chains, combined with rising geopolitical tensions, are remaking the global economy. They are likely to lead to a more tumultuous and volatile investment backdrop in three distinct ways (Box 1).

Box 1: The latest phase of globalization alters the macro landscape for investors

1 COMMODITIES TRANSMIT GEOPOLITICAL TENSIONS TO SUPPLY CHAINS AND MARKETS

- Natural resources like fossil fuels, food, as well as critical metals and minerals are prime candidates for geopolitical weaponization by great powers.
- Episodic disruptions of commodity supply chains – whether due to extreme weather, climate events or geopolitical strains – can be transmitted more broadly to the global economy and markets.

2 LESS EFFICIENCY AND PRODUCTIVITY IN SELECT SECTORS

- If globalization optimized for highest productivity and lowest cost, it follows that near-shoring and friend-shoring – which can create redundant sources of supply – may be less efficient.
- In the case of sophisticated, precision manufacturing like advanced semiconductors, much of this new capacity in new locations is not likely to be as efficient or productive as legacy capacity.

3 UPWARD PRESSURES ON INFLATION AND TERM PREMIA

- With economic and national security vulnerability considerations on the rise, efficiency and productivity no longer prevail as sole drivers for supply chains – and this will weigh on economic growth. Furthermore, these new supply chains are often more costly ones.
- This inflationary force can be amplified by key intermediary goods – like energy and semiconductors. That is, they are critical inputs into a wide range of goods and services and can spread the inflationary pressures more broadly.
- The potential for higher and more volatile inflation going forward as well as the increased government spending from industrial policy may lead to less compressed term premia than previously.

The globalization bullet train has lost some speed, and more recently a few railcars have decoupled altogether and are riding on a completely different track. The influx of great power rivalry and the slew of government policies in these industries have altered the investment landscape. Specifically, three industries are the focus of protectionist policies – semiconductors, EVs, and metals and minerals. Chapter 2 examines the emerging dynamics in these sectors and identifies investment risks and opportunities in this emerging era of two-tracked globalization.

CHAPTER 2

SECTORS CAUGHT IN THE CROSSHAIRS OF A NEW ERA OF GLOBALIZATION



Some investors presume the mere presence of tariffs and industrial policy drastically reduces investment opportunities for even dominant firms in those sectors where it is focused. However, that is not always the case.”

02

CHAPTER 2

SECTORS CAUGHT IN THE CROSSHAIRS OF A NEW ERA OF GLOBALIZATION

As we discussed in Chapter 1, deglobalization is indeed happening. But it is playing out more narrowly and more slowly than is commonly thought. In sectors at the heart of great power rivalry and protectionist industrial policy, a new set of investment opportunities *and* risks are emerging. This chapter focuses on three sectors where industrial policy is quite rapidly altering the investment landscape: AI and advanced semiconductors, EVs, and critical metals and minerals.

Some investors presume the mere presence of tariffs and industrial policy drastically reduces investment opportunities for even dominant firms in those sectors where it is focused. However, that is not always the case.

1. AI and Advanced Semiconductors

Semiconductors have always been at the heart of innovation and technology disruption. Compared to the original integrated circuits from the 1960s, today's chips have nearly *two billion* times the computing power of their predecessors.³⁸ This remarkable pace of advancement – and the resulting computing capability – has created and fueled whole industries, from personal computers to smartphones to artificial intelligence.

Cutting-edge chips and GPUs are essential components for AI

For AI to reach its transformative potential, it requires models rapidly processing vast amounts of data – the magnitude of which is only achievable today using chips of 4 nanometers or smaller.* This dependency on massive computing power means access to the most advanced computer chips will be essential for cutting-edge AI models and applications.

AI also requires different microprocessors from the standard central processing unit (CPU) found in most computers. Graphics processing units (GPUs) – initially used in video gaming – are better able to

handle the parallel computation and sophisticated computing demands of AI.³⁹ Nvidia – which gained its first-mover advantage in GPUs with hyper-realistic videogaming – is a dominant global developer of GPUs. Their cutting-edge processors are used for a range of sophisticated computing needs, from autonomous driving to training large language models (LLMs) and developing AI.⁴⁰

Why manufacturing chips is so different from other goods

The dynamics for advanced chipmaking differ significantly from most other manufacturing processes for several reasons.

First, it is all about capital and technology – not labor. Compared to manufacturing other goods, producing computer chips is exceptionally capital intensive, not labor intensive. The complexity of building out fabrication plants and developing the skills of the workforce needed to operate the facility requires lots of time and capital. New fabricating plants routinely cost more than \$20 billion, take years to be operational, and need to be run at maximum capacity 24 hours a day to be profitable.⁴¹

Second, the industry has a “winner-take-all” dynamic with persistent advantages. This is primarily because of the emphasis on leading-edge technology and the short cycles for next-generation chips.

* Chips are broadly categorized by the distance of transistors (expressed in nanometers) on them – with smaller numbers implying greater computing power.

If a company's chip is even slightly better than its competitors, it typically captures the bulk of market share and revenues.⁴² Chipmakers either develop next-generation chips in-house or acquire the underlying building blocks through technology transfer. This winner-take-all dynamic is apparent across the entire value chain – from equipment and material providers to actual chip manufacturers. This industry feature also tends to create a persistent advantage for leaders. Since these leaders are often years ahead in technology development, challengers find it very difficult to catch up quickly.

This winner-take-all dynamic is apparent across the semiconductor value chain – from equipment and material providers to actual chip manufacturers.

A truly global supply chain

In the industry's pursuit of efficiency, what has developed is a truly global supply chain. Different regions specialize in different segments of the value chain: chip design in America; production of chipmaking equipment and gear in Europe, the US and Japan; fabrication facilities where that equipment is used in Taiwan and South Korea; and the packaging of the chips and their assembly into devices in China and Malaysia.⁴³

China has a strong position in manufacturing lower-end computer chips – namely microcontroller units, or MCUs. This typically includes *less* sophisticated chips – 7 nanometers and above – which account for 90% of global chip manufacturing and have been commoditized.⁴⁴ These chips are primarily used for simple electronic applications like televisions and refrigerators. China is simultaneously both a major producer and consumer of this category of computer chips. They have acquired the capabilities to produce these chips through tech transfer and from manufacturing electronic components and goods. Unsurprisingly, this is **not** the segment of the market where great power rivalry plays out.

Industrial policy to build domestic fabrication capabilities for advanced chips

With more countries focused on ensuring a supply of semiconductors that relies less on China and Taiwan, industrial policy has ramped up in the sector. The EU's Chips Act and the CHIPS and Science Act in the US are just two examples of industrial policies that provide tens of billions of dollars to firms like TSMC, Samsung and Intel to build the necessary ecosystems that support local fabrication plants and train workers for the specialized technical skills needed.⁴⁵ Semiconductors are a major thrust of industrial policy in Japan, Korea and India as well.

Export restrictions as rivals look to limit technology transfer

Aside from ramping up its own production of advanced chips, the US also is seeking to limit technology transfer. Increasingly, companies integral in the chip value chain – like Nvidia – are finding themselves entangled in trade restrictions. By slowing the advancement of China's chip design and manufacturing capabilities, the US is trying to limit their progress in artificial intelligence and high-performance computing.⁴⁶ To this end, the US has imposed restrictions on directly shipping Nvidia's leading-edge GPUs to China – as well as other nations who may pass them on to China. The US is pushing its allies in the chip supply chain to limit technology transfer as well.^{47, 48} Increasingly, Dutch and Japanese makers of fabricating equipment are coming under pressure from US authorities to reduce shipments of new equipment and spare parts as well as limit maintenance and repairs of existing machinery in China.⁴⁹

Investment Implications

TSMC provides essential components for AI infrastructure

TSMC is a leading fabricator of semiconductors and may be positioned to adapt to the changing globalization wave in the industry. The company provides important components, especially to companies focused on AI technologies and applications, as it produces infrastructure components

that are essential and are currently difficult to source from alternative providers.

TSMC is the clear global leader in computer chip manufacturing. With more than 60% of global market share, it is the world's largest dedicated semiconductor foundry (Samsung is second with 13%).⁵⁰

Importantly, TSMC dominates manufacturing of leading-edge semiconductors with a more than 90% share of chips 7 nanometers or smaller.⁵¹ It specializes in producing chips based on designs from their customers which include Apple, AMD and Nvidia. It has built up this advantage over decades with a technology platform it shares with suppliers to shorten cycles for enhancements and innovation.⁵²

Furthermore, with great power rivalry rippling across the chip industry, many consumers of less sophisticated chips are seeking to diversify supply chains and looking for producers outside China. As a result of this, TSMC margins are increasing in this portion of the market.

Government support for domestic fabrication facilities provides geographic diversification

Government subsidies to build out manufacturing capacity outside of Taiwan present both positive and negative elements for investors. On the one hand, TSMC is receiving meaningful financial support to expand and diversify its operations outside of Taiwan – something it had decided to do on its own as early as 2020.⁵³

On the other hand, investment in production in new regions is likely to reduce the return on invested capital – at least initially. Some may argue that even with massive subsidies from governments in India, Europe and the US, it will be extremely difficult for operations outside of Taiwan to be as efficient, productive and profitable – especially right away. Replicating the specialized ecosystem of human capital, materials and other inputs is a daunting task that will take years. For investors, today's immense capital spending to build facilities in new places that may lead to quality, diversified production several years down the road only adds to uncertainty.

Even fabricating leaders like TSMC have faced considerable challenges with its plans to build a facility on the outskirts of Phoenix, Arizona.⁵⁴ Initially, it found difficulties sourcing local technicians and labor for its chip fabricating plants, contributing to delays in the plant's opening. Furthermore, difficulties with labor unions around safety and training left TSMC to question how less-efficient production from its overseas plants could compete with production elsewhere.⁵⁵

However, there are some early signs of progress. Almost five years since its 2020 announcement of opening a new facility in the US, TSMC is effectively managing these challenges. The computer chip fabricator achieved early-stage production yields at its Arizona plant for 4-nanometer process technology that are comparable to similar factories in Taiwan.⁵⁶ The success rate or yield of a facility is critical because it determines whether or not companies will be able to recover the enormous costs of putting up a fabrication facility.

TSMC's experience in the US may be difficult for others to replicate, though. Intel, for example, is struggling to get its fabrication plant in Germany on track.⁵⁷ Meanwhile, India's plan for chip manufacturing faces challenges finding suitable partners.⁵⁸

Regional geopolitical tensions and a different trajectory for AI development pose risks for TSMC

Despite being the premier manufacturer of leading-edge chips, TSMC remains outside the scope of tariff and trade restrictions. Great power rivalry has not limited TSMC's business in a significant way. Unlike other prominent players in AI, like Nvidia, it has a more diversified set of customers in multiple segments of the industry. And this diverse set of clients and segments reduces its reliance on AI as the sole engine of its growth.

However, TSMC does face some unique risks in this era of heightened geopolitical tension. Despite its multiple fabrication plants overseas, TSMC still produces up to 90% of its chips in Taiwan.⁵⁹ This heavy dependence on production in Taiwan presents a geopolitical vulnerability for TSMC should tensions in the Taiwan Strait rise. Conflict in that area need

not rise to the level of a full-blown military conflict to upend TSMC’s business in a meaningful way. A naval blockade or limited access to sea-lanes would also be highly disruptive.

Another area that presents risk to TSMC and other players in leading-edge chips is the trajectory of AI development. Currently, development of AI and its inference capabilities is heavily dependent on ramping up computing power. In this mode of development, designers and manufacturers of leading-edge chips have a source of dependable ongoing demand as global AI players like Alphabet, Meta, Apple and Microsoft build up their infrastructure and computing power to advance their LLM models.

However, if the mode of AI development shifts to having models learn and compute more efficiently and to other methods of developing neural networks, the soaring demand seen by leading-edge chip designers and makers could be slowed substantially. DeepSeek represents a new AI model that appears to be comparable in sophistication to the leading AI models but at a fraction of the cost – and, importantly, *without* the benefit of the most advanced chips or computing power.⁶⁰ Should this mode of developing AI that leans more on efficiency and optimized problem-solving become widely adopted, it could be a risk for some designers and makers of advanced chips like TSMC.

2. Electric Vehicles: Manufacturing and Supply Chains Dominated by China*

Industrial policy has reshaped several industries caught in the “small yard, high fence,” but it may have made the greatest impact in the market for EVs. Some estimates suggest the Chinese government has poured over \$230 billion into Chinese EV makers since 2009.⁶¹ And that figure does not include direct investments into the EV and battery sector by Chinese states and municipalities nor the tax rebates and subsidized land and power many offer to manufacturers, which total tens of billions more.

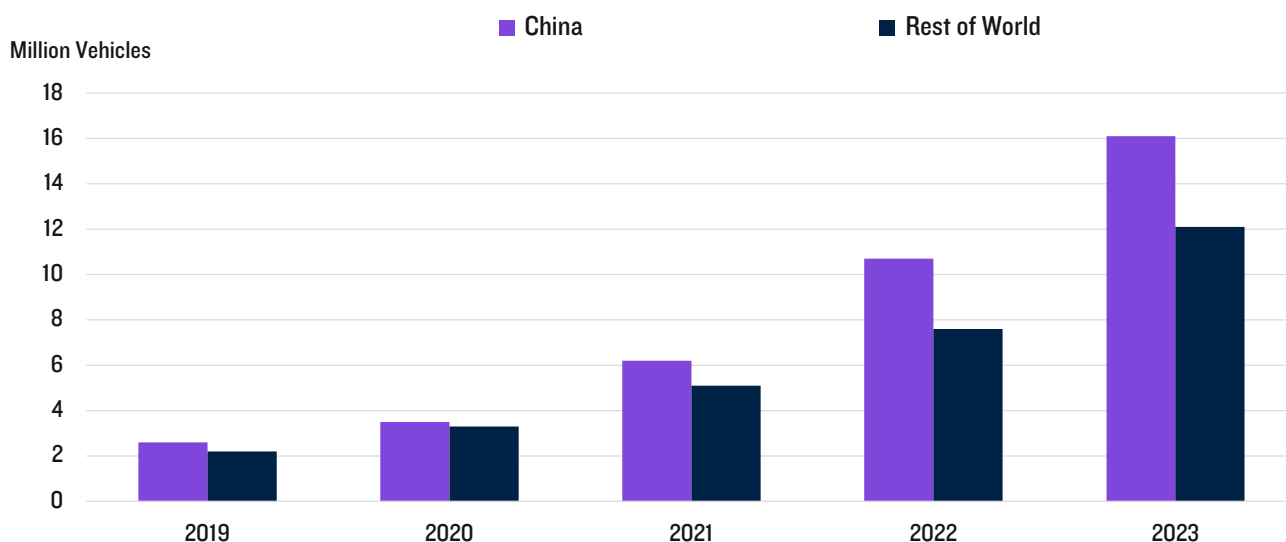
Chinese manufacturers are global tech leaders and shaping market dynamics

The effect of decades of financial and regulatory support for Chinese EV makers has contributed to them being global leaders in battery technology and manufacturing.⁶² Batteries from Chinese companies like CATL are used in vehicles from major automakers including Tesla, Toyota and Ford.

Today, China is both the largest consumer market for EVs as well as the largest producer of them. In 2023, China accounted for nearly 60% of EVs sold globally, and more than half of the EVs in operation around the world are on Chinese roads (Exhibit 13).⁶³

Exhibit 13: China’s EV sales outpace the rest of the world

Annual EV sales



Note: EV refers to both electric vehicle and hybrid models.

Source: International Energy Association. As of January 2025.

* In this paper, the terms “electric vehicles” and “EVs” refer to both battery electric vehicles and plug-in hybrid vehicles.

Additionally, their auto exports surged last year, and China is now the world's top auto exporter – ahead of both Japan and Germany.⁶⁴

If you can't beat 'em...

Meanwhile, German manufacturers are losing ground with the shift to EVs in China. After dominating the Chinese market for high-performance, luxury gasoline-fueled cars for years, Porsche, Mercedes and BMW are seeing annual sales decline between 15% and 20%. German automakers still command a 15% share of the Chinese market – though this is down from 25% before the pandemic. However, their share of the rapidly growing EV segment remains under 10%.⁶⁵

Increasingly, European EV manufacturers are forming partnerships with Chinese makers to build EVs and boost their technology. VW has made investments in XPeng to build cars for the Chinese market; Mercedes is partnering with CATL and Tencent for technology transfer; and BMW is partnering with Great Wall Motor to build EVs for its Mini brand.⁶⁶

In anticipation of restrictive trade policies and tariffs, Chinese manufacturers have been moving more production to Europe and North America.

Cat and mouse games: Tariffs and tariff avoidance

Both the European Union and the US have responded to Chinese dominance in EVs by increasing tariffs to protect their domestic industries. Current tariffs on Chinese-made EVs run up to 45% in Europe and as high as 103% in the US.^{67, 68} In anticipation of restrictive trade policies and tariffs, Chinese manufacturers have been moving more production to Europe and North America. By shifting production overseas, Chinese manufacturers can avoid import restrictions and tariffs. While tariffs and policy are a

regular feature of the EV market, investors need to be mindful of how dynamic the situation is. And risks to changes in trade or industrial policy are embedded in the sector as well.

Investment Implications

BYD and Tesla are currently in pole position in the race for the global EV market

Tesla and BYD are the largest EV manufacturers and clear leaders in the global market. They share several characteristics – both are vertically integrated and have global production capabilities, for example. However, they dominate different segments of the EV market and rarely compete directly against each other currently. BYD dominates the low and middle tiers of the market and is the highest-selling EV maker in the world. Tesla is a front-runner in the luxury end of the market, selling half as many cars but with higher margins. Importantly for investors, despite new tariffs and trade restrictions, they are both well positioned to lead their segment of the growing global EV market for years.

New markets and new models provide growth opportunities for BYD and Tesla

While BYD has earned its stripes by producing affordable EVs for the ultra-competitive Chinese domestic market, exports offer an opportunity for them to *increase* their margins. They face considerably less competition abroad and margins on exports are higher than on domestic sales.⁶⁹

Currently exports make up less than 10% of BYD's sales volume. Despite facing rising tariffs and restrictions in the European and US markets, BYD has ample room to grow exports – and margins – in Southeast Asia, Latin America as well as the Middle East.^{70, 71}

Additionally, BYD is increasingly stepping into higher-margin luxury EVs where it is gaining Chinese market share from German competitors.⁷² BYD is gaining a reputation for plush interiors and creature comforts as well as leading-edge technology like floating center-console screens and intelligent driving systems that learn a driver's habits and enhance safety.⁷³

Tesla also has several opportunities for growth. First, while Tesla is a strong player in the US, Europe and China, Latin America presents an opportunity for growing its market geographically.

Second, Tesla has opportunities to expand with new models. Its recently-launched Cybertruck reached positive gross margins after about a year and is among the best-selling EVs in the US.⁷⁴ While the prospect of creating a lower-margin competitor to their upscale models may not be very attractive, Tesla appears to be leaning into making robotaxis. In their vision, these self-driving taxis will be the mass-market cars of the future. Tesla demonstrated a Cybercab in late 2024 and expects to have them operational by 2026.⁷⁵

Mexico is an attractive place for parts making and assembly given its existing auto facilities but unclear trade policy with a new US administration has caused uncertainty.

Trade and industrial policy risk in EVs

Changes to the trade and industrial policy landscape are material risks for both BYD and Tesla. In the case of BYD, Chinese EV manufacturers will remain the focus of tariffs and other restrictive trade policies in major markets like Europe and the US for some time. While nations in Southeast Asia and Latin America are unlikely to take similar approaches in the near term, BYD's export opportunities in these regions certainly hinge on that remaining the case.

Additionally, trade policy with Mexico is especially unclear in 2025 with a new US administration. Rising turbulence around trade policy has already put Tesla's plan for a gigafactory in Mexico on hold as further tariffs and restrictions are under consideration in Washington.⁷⁶ Adverse changes to the terms and costs of trade between the two countries would have a direct impact on Tesla's investment decisions in the region.

Real estate opportunities along the US-Mexico border as production moves there

While there is significant near-term uncertainty, the combination of near-shoring momentum and the United States-Mexico-Canada Agreement's (USMCA) regional content requirements – stipulations that a substantial portion of a car's components be sourced in North America – create a strong long-term tailwind for industrial real estate on *both* sides of the US-Mexico border.⁷⁷ For investors unfamiliar with industrial real estate in Mexico, it is important to note that lease agreements there are denominated in US dollars and are usually with large, multinational manufacturers like Ford, Medtronic, BMW, Honeywell and Nissan.

Manufacturing in Mexico for export to the US and Canada drives opportunities in industrial real estate

Current USMCA regional content requirements stipulate that assembly must be in North America and a specified portion of parts need to be sourced in the region. Mexico is an attractive place for parts making and assembly given its existing auto facilities and the presence of a robust auto supplier ecosystem already. For investors, industrial real estate in Mexico can be attractive given the strong fundamentals of manufacturing to export to the US. This dynamic is enhanced by the geopolitical forces encouraging near-shoring. The country has existing infrastructure in place to support automobile manufacturing – as well as other industries that have been present for decades. The prospect of import restrictions and tariffs on other regions may also provide a tailwind for incremental demand for industrial real estate and rental growth over the medium term. With more Mexican production of goods like autos, EVs and electronics, the need for manufacturing and assembly facilities is clear and compelling.

Mexico has three industrial zones: the Central region around Mexico City, the Bajío region – including the states of Jalisco, Guanajuato and San Luis Potosí – and the Northern section along the border with Texas, Arizona and California.

Of Mexico's three industrial regions, the Bajío has been the preferred location for several global auto

manufacturers and has emerged as the hub of Mexican auto production – both gasoline-powered cars and, increasingly, EVs. In the Northern region, Saltillo City – two hours from the border with Texas – has also emerged as a hub of EV manufacturing serving auto manufacturers in both Mexico and the US.

Re-freighting creates demand for logistics and transport facilities on the US side near major border crossings

While the industrial real estate opportunities in Mexico are well-known, the opportunities created on the US side of the border are often overlooked. Specifically, the need to re-freight cargo from Mexico on US soil provides a steady and often overlooked source of demand for industrial real estate like logistics and transport hubs within a few miles of the US-Mexico border.

Mexican drivers are only permitted to drive in special commercial zones in the US within a few miles of border crossings.⁷⁸ Consequently, the goods hauled by trucks originating in Mexican industrial areas with Mexican drivers need to be discharged at facilities in these border commercial zones and re-freighted for further distribution throughout the US. This need for re-freighting of goods on the US side of the border creates demand for specific logistics facilities to enable this intermediary step. These real estate opportunities in re-freighting are especially prominent in US border cities like El Paso and Laredo in Texas and San Diego in California.

Uncertainty in trade policy creates risks for industrial real estate

US-Mexico trade policies certainly impact demand for industrial real estate along the border. And material changes to trade terms are certainly a risk for real estate investors. For example, tariffs on a significant share of goods imported from Mexico remain a real possibility. If enacted for a longer period of time, this would substantially alter the investment prospects for industrial real estate.

In addition to this near-term uncertainty from a new US administration, the entire USMCA will be

open to renegotiation in 2026. And investors should be mindful of potential changes in tariffs, regional content requirements and other provisions of the agreement.

For owners of industrial real estate along the border, there are some characteristics of the business that may insulate them from abrupt policy changes. First, having multinational firms as tenants and multiyear leases in place provides some protection for rental incomes and cash flows. Another mitigating factor is that currencies can absorb at least some of any new tariff costs. In the past, as the US has placed (or threatened to place) tariffs on goods from Mexico and Canada, the US dollar has strengthened against the peso and the Canadian dollar.⁷⁹ These currency adjustments provide a bit of a safety valve for manufacturers and investors caught up in trade wars.⁸⁰

Copper, nickel and lithium are vital inputs for electrification, batteries and clean energy, while rare earths are essential for making semiconductors.

3. Metals and Minerals: Regional Blocks and Great Power Rivalry

A handful of metals and minerals play an outsized role in the energy transition and new technologies. Copper, nickel and lithium, for example, are vital inputs for electrification, batteries and clean energy, while rare earths are essential for making semiconductors.^{81, 82}

Critical metals and minerals are often geographically dispersed and mined in different countries across multiple regions. Because of this, no country has an absolute advantage across the *mining* of critical metals.

China dominates refining and processing of metals and minerals

However, it is possible for one country to have a comparative advantage across other segments of the value chain which includes processing, refining

and production – and China has done precisely this.⁸³ Today, China is the world’s leading producer and refiner of dozens of different commodities including several critical metals and minerals.⁸⁴ This concentration of refining, processing and production of critical minerals represents a significant supply chain vulnerability for other countries. That is, supply of these vital resources is subject not only to usual market dynamics and logistical risks but also to geopolitical-induced export restrictions.⁸⁵ With China a major player in metals processing and refining, removing them completely from mineral supply chains is simply not feasible.^{86, 87}

China has spent decades securing access to critical minerals

Africa and its mineral resources have become a focus of great power competition. China has made substantial investments in Africa – especially in the last 10 years – to ensure their access to these raw materials. Between 2013 and 2022 Chinese net direct investment into Africa totaled \$35 billion vs. just \$1 billion for the US.⁸⁸ Indeed, major parts of China’s Belt and Road Initiative focus on providing necessary infrastructure to access and export Africa’s mineral resources.⁸⁹

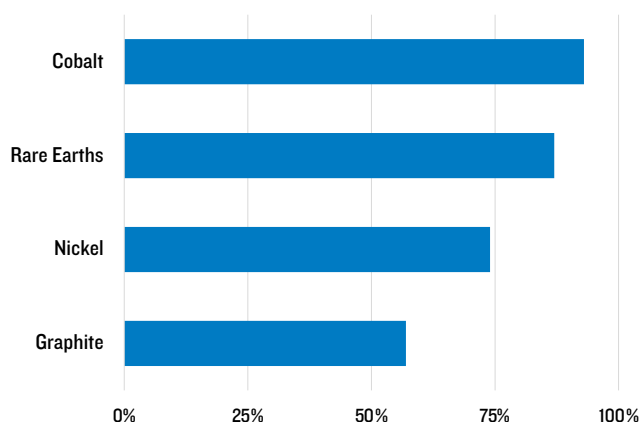
While Chinese firms control only 8% of Africa’s total mining sector, they have an outsized share of some critical metals.⁹⁰ The Democratic Republic of Congo (DRC), for example, is responsible for roughly three-quarters of global cobalt production.^{91, 92} And Chinese miners and producers accounted for more than 70% of cobalt mined in the DRC – or just over half the global supply.⁹³ China has a similarly strong position in Africa’s mining of lithium as well as copper.^{94, 95}

Great power rivalry leads to a less global market and factional sourcing for critical metals

There are mounting examples of China leveraging its dominant role in key metals and minerals for political gain. Between 2009 and 2020, China increased restrictions on its exports of critical minerals nine times – more than any other supplier. Over that time, China has cut off supply of rare earth metals to Japan over political tensions around contested islands and curtailed access to US defense contractors in response to arms sales to Taiwan.^{96, 97} More recently, China has

Exhibit 14: China dominates the processing of some critical metals and minerals

Share of global processing capabilities (2023)



Source: Center for Strategic and International Studies. As of December 2024.

imposed a series of export bans on rare earths – like gallium, graphite and germanium – as well as new restrictions on extraction and separation technologies in an attempt to maintain its strategic advantage.^{98, 99} These metals are used in everything from semi-conductors and satellites to night-vision goggles.

Investment implications

Copper remains outside the realm of great power rivalry

Great power rivalry and export restrictions certainly complicate the investment thesis for many areas of investment in metals and minerals. However, there are several reasons why copper may present an intriguing investment opportunity. First, because of its extraordinary conductivity, resiliency and malleability, copper is essential to major global industries including construction and telecommunications but also key industries like EVs, advanced electronics and semiconductors as well as renewable energy. Because of its range of uses in industry, the global demand for copper is projected to more than quadruple by 2050.¹⁰⁰ And because of its unique properties, copper may be challenging to fully replace in many electric systems. Its centrality to multiple growing industries and its difficulty to be substituted provide strong fundamentals for future demand.

Second, despite the strong and widespread demand for it, production of copper has not been caught up in great power rivalry. While rare earths and cobalt have been the focus of export restrictions, copper has not. Chile and Peru, the two largest producers, continue to supply the world with few constraints. The fact that copper has the demand trajectory it has, and has not been ensnared in great power rivalry, makes for an intriguing proposition for investors in this new era of globalization. Investors need to be aware, however, that should copper be entangled in future great power rivalry, it would alter the investment proposition around it.

Great power rivalry and export restrictions certainly complicate the investment thesis for many areas of investments in metals and minerals.

As for the supply of copper, it is usually found in remote locations, and mining is very capital and time intensive.¹⁰¹ As a result, building new capacity can take years and cost billions. New primary copper mines that started production between 2019 and 2022, for example, had an average lead time of more than 20 years.¹⁰² In fact, with declines of up to 25% in the average quality of copper ore being mined, some

copper producers will have to spend more just to maintain their current levels of production.^{103, 104}

For investors, this could create very attractive long-term supply-demand dynamics.¹⁰⁵ Two pure-play copper miners – Ivanhoe Mines and Ero Copper – may offer potential growth prospects for investors. Not only do they produce copper efficiently now, but they also have capacity to expand production soon to meet rising demand. Additionally, Southern Copper and Freeport-McMoRan are large producers with economies of scale as well as stable cash flows from ongoing business and healthy balance sheets that might support future exploration.

The shifts in globalization certainly impact several important sectors, creating both new investment opportunities and vulnerabilities. We have examined semiconductors, EVs and critical minerals, but the analysis could certainly extend to other industries of national strategic importance like military technology, 5G networks and advanced biotechnologies. So, what are the implications for CIOs taking a cross-portfolio view? Chapter 3 proposes four distinct areas where institutional investors will want to take a broader view of the resulting opportunities and risks.



CHAPTER 3

PORTFOLIO IMPLICATIONS

“

To prepare for the ongoing tussle between globalization and nationalism, CIOs need to consider the various ways these tensions are rippling across their investment portfolios and creating new risks and opportunities.”

03

CHAPTER 3

PORTFOLIO IMPLICATIONS

The International Monetary Fund views geopolitical tensions and financial fragmentation as serious threats to global financial stability.¹⁰⁶ And prominent corporate leaders cite these same trends as creating “the most dangerous time the world has seen in decades.”¹⁰⁷ To prepare for the ongoing tussle between globalization and nationalism, CIOs need to consider the various ways these tensions are rippling across their investment portfolios and creating new risks and opportunities. In this final chapter we lay out four cross-portfolio implications that we believe should be at the top of a CIO’s agenda when considering the impact of the new Dual-Track Era of globalization.

KEY PORTFOLIO-WIDE CONSIDERATIONS FOR CIOs

1. The new era of globalization could create national winners in manufacturing and mining

2. Energy and food present new import vulnerabilities for countries

3. Stress-test portfolios to ensure sufficient diversification and risk management

4. In an era of volatile inflation and markets, investors should consider option-based portfolio strategies

1. The new era of globalization could create national winners across two dimensions

By introducing layers of political risk into the business and investment decisions of firms, trade and industrial policy often cloud the environment for investors. However, the movement towards friend-shoring and near-shoring may also positively impact the prospects of some countries. And investors should consider industrial real estate as well as transport and power infrastructure in these national winners (Exhibit 15). While each national winner brings a unique set of strengths, they also share some common characteristics.

Exhibit 15: Potential national winners in the Dual-Track Era of globalization

	Manufacturing	Minerals & Metals
Asia	India Malaysia Thailand Vietnam	Australia Indonesia
EMEA	Czechia Hungary Morocco Poland	Morocco South Africa Zambia
Americas	Colombia Costa Rica Mexico	Brazil Chile Peru

Source: PGIM Thematic Research analysis..

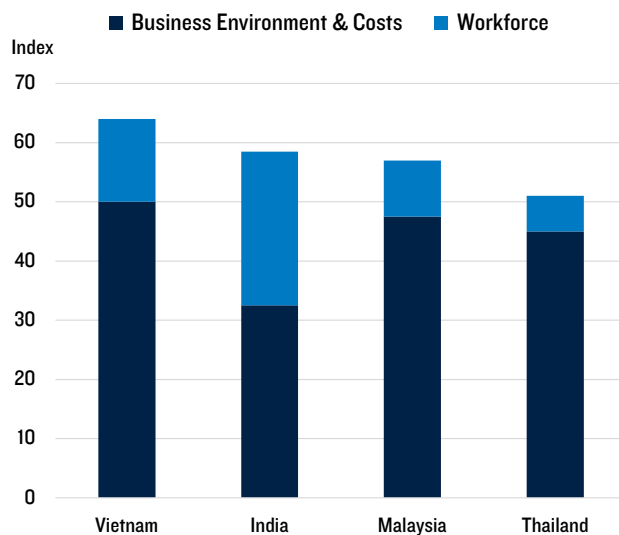
Manufacturing: Near-shoring and friend-shoring candidates

Countries that already have *some* manufacturing capabilities in place today are typically more attractive as friend-shoring or near-shoring candidates. The presence of qualified labor, supply chains and infrastructure for even simple manufacturing can provide a significant advantage in attracting more sophisticated production. Countries like Mexico, Hungary and Poland are examples of strong near-shoring candidates. They already have manufacturing infrastructure and capabilities in place and are also situated within the EU and the USMCA.

In contrast, Thailand, Vietnam, India and Malaysia do not have privileged market access into either Europe or the US. However, they still offer attractive friend-shoring destinations for manufacturers given their positive business environment and relatively low cost of labor (Exhibit 16). India, which is already a producer of electronics and select pharmaceuticals, for example, can be a national winner in more advanced electronics and biologicals.

Exhibit 16: Southeast Asia offers attractive friend-shoring locations

Business and workforce attractiveness index (Max. = 100)



Note: For each of the two categories, countries are compared and measured 0 (low) to 50 (highest).

Source: PGIM Real Estate and Oxford Economics. As of January 2025.

While countries like Vietnam, Mexico and Poland have already seen sizable increases in their manufacturing capacity, smaller countries can be overlooked in this analysis. For example, Costa Rica already has semiconductor and pharma manufacturing facilities; and Morocco and Czechia are active in the auto and pharma supply chains. For sovereign investors evaluating these economies, even a few contracts from multinational companies can have an outsized impact on their economy, fiscal balances and credit ratings.

Natural resource providers who avoid aligning themselves with a great power not only have access to a broader set of markets, but also a broader pool of capital and mining technology.

Minerals

While some key mining countries appear to be clearly aligned with one great power or the other – like Chinese influence over cobalt production in the DRC – there are significant mineral producers who remain “non-aligned.” Natural resource providers who avoid aligning themselves with a great power not only have access to a broader set of markets, but also a broader pool of capital and mining technology to support their production, and make it more efficient.

For broad metals and minerals, Chile, Indonesia, Peru, Australia and South Africa are good examples of non-aligned producers with sizable mining operations in their countries. These nations are likely to remain winners in this new phase of globalization.

While these countries are widely seen as mining leaders today, Brazil has only recently ramped up its mining of critical minerals. In less than two years, it went from zero exports to the world’s fifth-largest exporter of lithium in 2023.¹⁰⁸ Brazil has considerable potential to repeat this kind of production in manganese, rare earths, graphite and nickel. However,

it faces significant challenges in developing its ample critical mineral resources. First, less than a third of the country has been mapped geologically.¹⁰⁹ The lack of data around the extent and location of Brazil's mineral wealth makes it difficult for private or public investment in infrastructure and development. Second, government bureaucracy and regulations can make for extended processes for obtaining all the mining and environmental licenses needed.¹¹⁰

In anticipation of restrictive trade policies and tariffs, Chinese manufacturers have been moving more production to Europe and North America.

Investors face a growing risk: expropriation of metal and mining operations

In what may evolve into a trend, some governments are displacing private investors and nationalizing their natural resources to ensure commodity rights (and profits) remain in their control. For example, Chile's president has mandated that large-scale lithium projects need to be public-private partnerships. Global mining company SQM – producing 20% of the world's lithium – has subsequently entered an agreement to form a joint venture with Chile's state-owned copper producer. This mandated joint venture also diluted a \$4 billion investment in SQM by Chinese lithium producer Tianqi.¹¹¹

Another risk for investors is domestic courts negating agreements around mining operations. Panama's supreme court ruled in 2023, for instance, that a 20-year agreement to operate the Cobre Panama mine was unconstitutional.¹¹² The ruling came following mass protests from citizens based on concerns over environmental degradation and corruption.¹¹³

Other countries are taking action to leverage their natural resource strengths into downstream, higher-value parts of the mineral supply chain and even expand into EV components. Indonesia, for instance,

banned the export of nickel ore and requires processing facilities to be built locally.¹¹⁴

2. Import of energy and food presents risks to economies that are often overlooked

From a risk perspective, a more volatile geopolitical environment means more episodic disruptions to supply chains for vital commodities like food and energy, with some countries facing far greater economic or political disruption than others.¹¹⁵ Current risk methodologies may not fully account for the rising import vulnerabilities around these key commodities. Investors need to ensure their risk framework evaluates a country's vulnerability to price shocks arising from disruptions to commodity supply chains.

A framework for assessing energy import vulnerabilities by country

Even with growing renewable power generation in most regions, many countries remain highly dependent on importing oil, gasoline or natural gas for significant portions of their energy consumption.¹¹⁶ Additionally, some countries may face costly constraints on their domestic capacity to refine these inputs.

Relying on energy imports is a critical dependency because oil price shocks can quickly reverberate across an economy and have a cascading effect on corporate profit margins, consumer spending and inflation. Import-dependent countries are especially vulnerable to disruptions that may arise from geopolitical shocks or extreme weather events. Europe's experience with natural gas in the aftermath of Russia's invasion of Ukraine is a recent example of this economic vulnerability. Even though most countries were able to meet their primary energy needs, the resulting surge in energy prices rippled through portfolios long after.

To assess energy import vulnerability across countries, investors should consider a top-down risk framework with at least two dimensions:

(1) Import dependence – the share of total fossil fuel consumed that is imported, mostly in the form of crude oil, gasoline or natural gas. This provides some measure of exposure to spikes in energy prices.

(2) **Growth of energy demand** – developing economies with rising populations, growing affluence and booming manufacturing face a more rapid pace of growth in energy consumption than advanced economies.

For investors, those countries with strong demand growth *and* high import needs compared to their regional peers are especially vulnerable to energy price shocks (Exhibit 17).

The Americas

Paraguay and the Dominican Republic both face high import dependence and soaring demand for energy.¹¹⁷ While Costa Rica meets roughly two-thirds of its total electricity supply with renewable sources, its hydropower is threatened by climate change and it remains completely dependent on imports for oil and gasoline.¹¹⁸ Meanwhile, Chile is well positioned as a non-aligned provider of commodities. But its ability to capitalize on this opportunity is linked to energy imports, and investors need to monitor the country's strategy to meet its growing industrial energy needs.¹¹⁹

Asia

The list of vulnerable Asian countries includes both developed and developing economies. On the one hand, Taiwan, Singapore and South Korea are highly dependent on energy imports and – as high-end manufacturing hubs – have higher demand growth and energy intensity than most other advanced nations. By contrast, India, with ample supplies of coal and rapidly expanding renewable capabilities, is less dependent on energy imports than the others.¹²⁰ However, India is poised to see one of the highest increases in energy demand over the next decade as its population grows both in number and in affluence.¹²¹

Europe

Despite being leaders in renewable energy, Europe may be the region with the highest dependency on fossil fuel imports. While demand growth in Europe is not as high as in other regions, countries like Turkey, Spain and Ireland have consumption growth that is well above their European peers and leave them more vulnerable. In the case of Ireland, a regional hub for

Exhibit 17: Select countries with elevated energy import vulnerability

REGION	COUNTRY	ENERGY IMPORT VULNERABILITY	
		IMPORT DEPENDANCE	DEMAND GROWTH (2013-22)
The Americas	Paraguay	High	High
	Dominican Republic	High	High
	Costa Rica	High	High
	Chile	High	Medium
Asia	Singapore	High	Medium
	Taiwan	High	Medium
	South Korea	High	Medium
	India	Medium	High
Africa	Kenya	High	High
	Morocco	Medium	Medium
	Zambia	Medium	High
Europe	Belgium	High	Medium
	Spain	High	Medium
	Ireland	High	High
	Turkey	Medium	High

Vulnerability Scale

High

Low

Note: Import dependence is measured as a country's energy consumption of fossil fuel not met by domestic production while demand growth measures growth of total primary energy consumption. Variables are ranked within each region (red to green for highest and lowest quintile, respectively).

Source: International Energy Association, US Energy Information Association and World Bank. As of January 2025.

data centers, the strain on energy supply is likely to increase over coming years.¹²²

Africa

As the continent with the fastest growing population, it is not surprising that many African countries are struggling to meet their energy needs. For Kenya, relying heavily on hydropower amid climate change and its high dependence on energy imports have created challenges. Meanwhile, Morocco and Zambia are moderately reliant on energy imports. But as manufacturing and mining hubs, respectively, their economic output is heavily dependent on energy, so even small disruptions to energy supply can have an outsized economic impact.

Surges in food prices can threaten economic and political stability

Few macro factors impact economies quite like food inflation. At a minimum, it leads to less discretionary spending by households and dampens economic growth. At an extreme, it can trigger food insecurity that results in protests or political unrest. In emerging

and frontier markets, food inflation from supply chain disruptions to critical grains – like rice, wheat, soy and corn – can be a major political destabilizing force.

To assess this ongoing vulnerability, investors should consider a risk framework that evaluates their portfolio countries along two important dimensions:

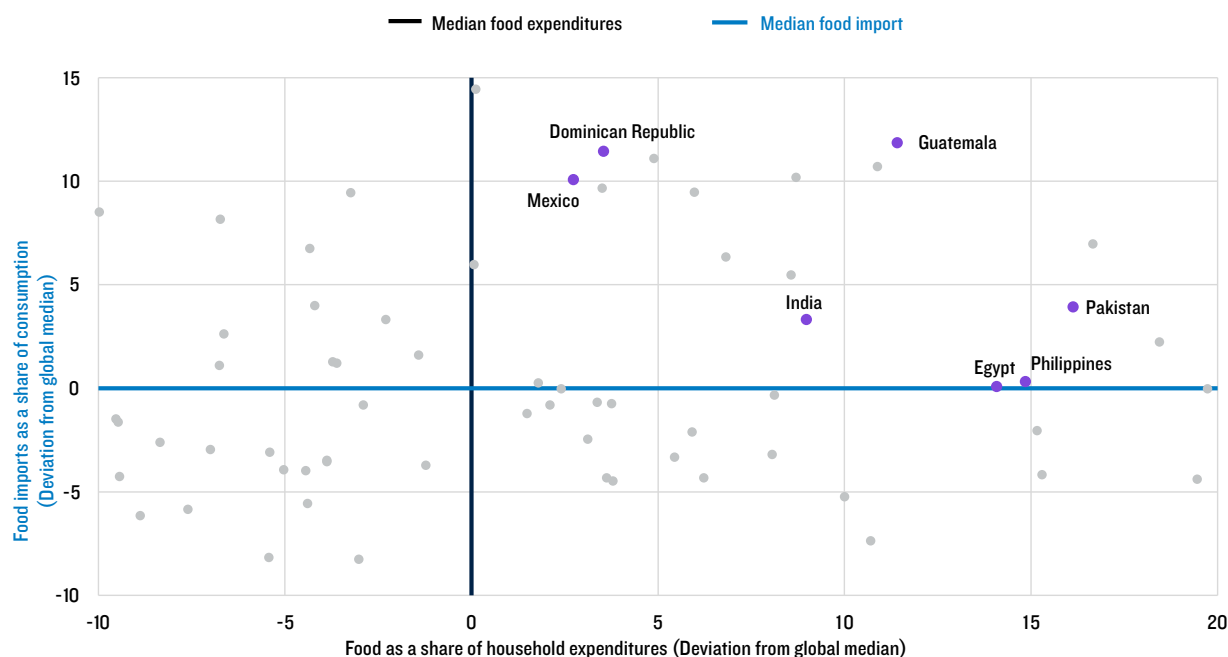
- **Food import dependence** – a country's dependence on food imports and, hence, their exposure to surges in food prices from disruptions in supply chains.
- **Food's share of expenses** – the share of household spending on food and the potential for economic and social disruption caused by a surge in food prices.

For investors, countries that are highly reliant on food imports *and* where food makes up a substantial share of household spending face greater vulnerability to episodes that disrupt critical grain exports or impair global breadbaskets (Exhibit 18).

PGIM's analysis of countries with a significant share of major EM bond indices suggests countries like the Dominican Republic, Philippines, Egypt, Pakistan

Exhibit 18: Prominent EM issuers with elevated vulnerability to food price shocks

Food import dependence and share of consumer expenditures



Note: Our analysis considered the top 30 component countries of either the J.P. Morgan EMB Index or GBIEM Index.
Source: PGIM Thematic Research, World Bank, UN Food and Agriculture Organization and J.P. Morgan. As of January 2025.

and Guatemala face greater vulnerability today than many of their peers to food price shocks.* These are some of the nations that sit above the global median in both dependence on imports and share of household spending, meaning that even minor disruptions to global food markets may lead to outsized economic and social pressures.¹²³

Looking ahead, investors should also monitor Mexico and India closely. As major agricultural producers, they face only moderate import vulnerability today. However, climate change is adversely impacting their domestic production and they are likely to see their food import vulnerability rise over time.

One feature of the new phase of globalization is that its impact is uneven across both sectors and countries. That is, under some trade and geopolitical scenarios, a handful of industries and countries will be harder hit than others.

3. Stress-test portfolios to ensure sufficient diversification and risk management

One feature of the new phase of globalization is that its impact is uneven across both sectors and countries. That is, under some trade and geopolitical scenarios, a handful of industries and countries will be harder hit than others. These divergent impacts challenge existing presumptions of diversification and create new risks to portfolios. Investors should consider conducting stress tests on their portfolios along both industry and country dimensions.

There are three components to this type of stress testing:

- In the case of stress testing by industry, for example, investors should first understand their exposure to sectors that are most subject to trade and industrial policy. That is, how heavily are their equity and credit portfolios tilted to industries at the center of industrial policy, export restrictions and great power rivalry – sectors like semiconductors, military contractors, 5G networks, fossil fuels, EVs and critical minerals. Once investors have a sense of their exposure to these potentially sensitive sectors, they can compare them to broad benchmarks to see whether their portfolios are over- or underweighted to them.
- Second, investors should craft disruptive trade or geopolitical scenarios – like 50% tariffs on all goods from specific countries or an invasion of sovereign territory by a larger neighbor – to stress-test holdings of securities in these sensitive industries and gauge the potential for portfolio loss. Here it is important to also consider second-order effects, such as the interplay of a country's energy intensity and global energy market disruptions.
- Third, once investors know both the size of their exposure to sensitive industries as well as the magnitude of a potential loss during certain scenarios, they can assess whether they are adequately compensated for a downside scenario and act accordingly. Some potential actions could be to adjust their exposure to these sensitive industries or mitigate some of the downside risk with portfolio hedging strategies.

A similar stress-test approach can be utilized for high-import vulnerability countries as well. If, for example, an investor found their portfolios were highly exposed to import-vulnerable countries in a specific region, they may consider adjusting country allocations or hedging strategies to mitigate some of the potential downside risk in their portfolios.

4. In an era of volatile inflation and markets, CIOs should consider option-based portfolio strategies

Most investors rely heavily on portfolio diversification as a strategy for addressing volatility and avoiding large losses to portfolios. However, not all market volatility impacts correlations the same way. Some research suggests that volatility driven by economic policy uncertainty can drive asset correlations higher and can derail portfolio diversification assumptions.^{124, 125, 126}

To counter the risk of rising correlations, CIOs should consider additional approaches to gird their investment portfolios from the idiosyncratic risks around a fragmenting global economy. Specifically, investors may want to revisit several active option-based strategies that can help mitigate risks from volatile markets and correlation breakdowns. These strategies are not alpha-generating but rather hedging strategies. Deploying one or more of them – guided by market conditions and options pricing – can help investors fine-tune their risk exposure.¹²⁷ Though the strategies may not be novel, it is important for investors to recognize that the execution of them is critical. For example, some strategies require long-term options which are often less liquid and have wide bid-ask spreads. Seasoned options managers with strong broker

relationships may actually get favorable pricing and enhance the value of the hedging strategy.

Some strategies for CIOs to consider include:

- **“Defined outcome” strategies** provide exposure to an index combined with a defined period of downside protection (colloquially known as a buffer) with a cap on the upside – also known as a “cap-buffer” structure. The variability of both the cap and the buffer allows investors to fine-tune their risk-return profile in a volatile and unpredictable equity market. Adding “buffered” strategies to multi-asset portfolios may potentially reduce the maximum drawdown and may de-risk the overall portfolio. This strategy can be especially attractive in a rising interest-rate environment when bonds may be more positively correlated to equities like in 2022.¹²⁸
- **Asymmetric convexity strategies** employ options to deliver targeted portfolio outcomes using long-dated call options in a multi-asset portfolio. Such strategies aim to capture a portion of market upside while seeking to limit downside exposure.¹²⁹ It is important for investors to recognize that this is primarily a long-term strategy and the favorable skew of the return profile is primarily a function of the long-dated call option this strategy calls for.

The global trading system has evolved tremendously over the last 30 years and finds itself today in a very different place. Where once efficiency and the lowest cost of production prevailed, now great power rivalry and national security are prominent. For investors, it is important not to get swept up in broad narratives around complete deglobalization and widespread economic fragmentation. Indeed, this new phase of globalization defies simplistic narratives and requires much more nuance.

Though it remains uncertain how the global economy evolves from here, one thing is clear: the Dual-Track Era of globalization is altering the macro and investment landscape. It is up to investors and their asset managers to have the short-term flexibility and long-term vision to capture the emerging new opportunities while also navigating the dynamic risks and vulnerabilities.

INVESTMENT IMPLICATIONS

1. Semiconductors & AI amidst great power rivalry

- Advanced computer chips are critical for cutting edge AI models and applications, but great power rivalry is creating a more fragmented market and increases uncertainty.
- Incumbents, however, will be hard to replace and investors should stick with companies that have a diverse set of customers across multiple segments of technology while also expanding their geographic footprint to address regional fragmentation – such as TSMC.

2. Winning the EV race

- While the world is shifting towards EVs, many automakers have missed the start leaving EV manufacturers such as Tesla and BYD with a big advantage.
- Despite facing steep tariffs in Europe and the US, BYD has growth opportunities in Southeast Asia, Latin America and the Middle East. They are also increasingly stepping into higher-margin luxury EVs.
- Tesla also has export opportunities, especially in Latin America. They are also leaning into self-driving taxis that have the potential of being the mass-market cars of the future.

3. Real estate opportunities on both sides of the US-Mexico border

- Despite temporary roadblocks, the near-shoring momentum creates a strong tailwind for industrial real estate in Mexico. Importantly, leases are denominated in US dollars and tenants are often large multinational manufacturers.
- A steady demand for industrial real estate in the US from near-shoring trends is often overlooked. Specifically, there is a need to re-freight cargo from Mexico once it arrives on US soil.

4. No way around critical minerals & metals

- Copper is critical to several major industries including EVs, semiconductors, renewable energy and construction. While long-term demand is robust, supply is more limited, making the fundamentals intriguing for investors.
- Two pure-play copper miners – Ivanhoe Mines and Ero Copper – may offer solid growth prospects for investors. Additionally, Southern Copper and Freeport-McMoRan are large producers with economies of scale.

PORTFOLIO IMPLICATIONS

1. The new era of globalization is changing national winners

- Countries that already have some manufacturing capabilities in place today are often more attractive as friend- or near-shoring candidates in the future. Investors should consider industrial real estate as well as transport and power providers in these countries.
- Investors should focus on countries with privileged access to free-trade zones such as Poland and Mexico, or countries with comparative advantages in business environment or labor cost like India or Vietnam.

2. Energy and food present hidden import vulnerabilities for some countries

- Investors need to ensure their sovereign risk framework evaluates a country's vulnerability to price shocks arising from disruptions to food or energy supply chains.
- Current risk methodologies may not fully account for rising risks of supply chain disruptions, and investors should consider a framework to identify countries with elevated vulnerabilities to commodity price shocks.

3. Dual-track economy may require supplementing current risk frameworks for portfolios

- Investors should consider conducting geopolitical stress-tests on their portfolios as the new era of globalization will likely lead to divergent outcomes across both sectors and countries.
- A stress-test would enable investors to (i) understand the magnitude and breadth of their exposure to at-risk sectors and countries; (ii) assess whether they are adequately compensated for that exposure and (iii) act accordingly.

4. In an era of volatile inflation and markets, investors should consider option-based portfolio strategies

- To counter rising geopolitical risk and the market volatility it can create, CIOs should consider additional approaches to protect their portfolios from the idiosyncratic risks around a fragmenting global economy.
- While option-based strategies are not alpha-generating, they may offer CIOs an additional way of managing their portfolio risk.

APPENDIX

QUANTIFYING THE DUAL-TRACK ECONOMY

There is considerable uncertainty around how exactly global trade and supply chains will adjust in the dual-track era of globalization. However, we have sufficient reason to draw some lines around what is most likely to be part of the slower, national-security track that will be most affected by new industrial policy and trade restrictions.

In our base-case scenario, seven industries – that collectively represent approximately 25% of GDP – will be at the center of the slower deglobalizing track. Note that industrial policy in these sectors will be particularly acute in countries most closely associated with the great power rivalries and less prominent in “non-aligned” countries that may continue to look for the most efficient import partners.

SECTOR	SHARE OF GLOBAL GDP
Energy Energy security has come to the forefront of national security concerns and is growing in importance in most countries. Support for renewables and increased domestic drilling or refinery capacity are natural responses to this import vulnerability.	13% ¹³¹
Telecommunications 5G networks and other aspects of telecommunications are among the areas where China and the US are competing head-to-head trying to limit dependencies. National security concerns in Europe and the US around Huawei’s network are one example of this.	5% ¹³²
Critical Minerals & Mining Metals and minerals are essential to many high growth industries including EVs, AI, semiconductors and renewable energy – examples include everything from steel and aluminum to lithium, nickel and copper. As geopolitical alliances shift, countries are increasingly concerned not only about the source of these commodities but also potential vulnerabilities from supply chain concentration in refining and processing of these essential minerals.	3% ¹³³
Military Technology There is an increasing acknowledgment across the political spectrum that more needs to be done to secure national borders and to be more self-reliant on defending against potential military conflicts.	2.5% ¹³⁴
AI and Advanced Semiconductors While AI may be the most prominent example, advanced computer chips are critical for energy transition, autonomous driving and other key areas. Both the design and manufacturing of advanced chips have been impacted by industrial policy, and supply chains are increasingly being drawn along geopolitical lines.	2.5% ¹³⁵
Biologicals Pharmaceutical supply chains and concentration of production have been a focal point since the Covid-19 disruptions. However, there is an increasing shift towards securing development and manufacturing of more cutting-edge biologicals within a set of friendly and aligned countries that are less susceptible to geopolitical tensions.	1% ¹³⁶
Critical Grains While grains are a minuscule share of overall trade, the impact of supply chain disruptions can be devastating. Going forward, countries will be much more strategic about their supply chains and the potential for extreme climate or geopolitical-induced disruptions.	< 1% ¹³⁷

ACKNOWLEDGMENTS

PGIM gratefully acknowledges the contributions of the following individuals:

Dr. Robert J. Johnston, Senior Director, Center on Global Energy Policy, Columbia University

Prof. Raghuram Rajan, Katherine Dusak Miller Distinguished Service Professor of Finance, Chicago Booth

Dr. Nathan Sheets, Chief Economist, Citi

Dr. Robin Brooks, Senior Fellow, Global Economy and Development, Brookings

PGIM Contributors

Dr. Marco Aiolfi, PGIM Quantitative Solutions

Zulfi Ali, PGIM Fixed Income

Dr. Gustavo Arteta, PGIM Fixed Income

Jason Boe, PGIM Private Capital

Neil Brown, Jennison Associates

Denis Cole, PGIM Fixed Income

Omari Douglas-Hall, PGIM Fixed Income

Bobby Edemeka, Jennison Associates

Jith Eswarappa, Jennison Associates

Dr. Shikeb Farooqui, PGIM Fixed Income

Dr. Guillermo Felices, PGIM Fixed Income

Devang Gambhirwala, PGIM Quantitative Solutions

Gerardo Guadarrama, PGIM Real Estate

Elizabeth Gunning, PGIM Fixed Income

Margaret Harbaugh, PGIM Real Estate

Dr. Peter Hayes, PGIM Real Estate

Dr. Lorne Johnson, PGIM Quantitative Solutions

Greg Kane, PGIM Real Estate

Albert Kwok, Jennison Associates

Mehill Marku, PGIM Fixed Income

Lee Meniffee, PGIM Real Estate

Sara Moreno, Jennison Associates

Dr. Katharine Neiss, PGIM Fixed Income

Steve Oliveira, PGIM Real Estate

Anuj Parikh, Jennison Associates

George Patterson, PGIM Quantitative Solutions

Giancarlo Perasso, PGIM Fixed Income

Michael Pettit, PGIM Fixed Income

Greg Peters, PGIM Fixed Income

Magdalena Polan, PGIM Fixed Income

Tom Porcelli, PGIM Fixed Income

Steven Postal, Jennison Associates

Nicolas Rubinstein, Jennison Associates

Jay Saunders, Jennison Associates

John Smigelsky, PGIM Fixed Income

James Sonne, PGIM

Aayush Sonthalia, PGIM Fixed Income

Robert Tipp, PGIM Fixed Income

Henri Vuong, PGIM Real Estate

Dr. Noah Weisberger, PGIM IAS

David Winans, PGIM Fixed Income

Principal Authors

Shehriyar Antia, PGIM Thematic Research

Dr. Taimur Hyat, PGIM

Jakob Wilhelmus, PGIM Thematic Research

ENDNOTES

- 1 Ewe, Koh, "The Ultimate Election Year: All the Elections Around the World in 2024," Time, Dec. 28, 2023. <https://time.com/6550920/world-elections-2024/>
- 2 "Global Elections In 2024: What We Learned in a Year of Political Disruption," Pew Research Center, Dec. 11, 2024. <https://www.pewresearch.org/global/2024/12/11/global-elections-in-2024-what-we-learned-in-a-year-of-political-disruption/>
- 3 Burn-Murdoch, John, "Democrats Join 2024's Graveyard of Incumbents," Financial Times, Feb. 4, 2025. <https://www.ft.com/content/e8ac09ea-c300-4249-af7d-109003afb893>
- 4 Rising, David, Lawless, Jill, Riccardi, Nicholas, "Global Elections 2024: Incumbents Defeated," Associated Press, Nov. 17, 2024. <https://apnews.com/article/global-elections-2024-incumbents-defeated-c80fbd4e667de86fe08aac025b333f95>
- 5 Bernanke, Ben, "Why Are Interest Rates So Low, Part 4: Term Premiums," Brookings Institution, April 13, 2015. Accessed Feb. 4, 2025. <https://www.brookings.edu/articles/why-are-interest-rates-so-low-part-4-term-premiums/>
- 6 United Nations Conference on Trade & Development. As of January 2025.
- 7 Frieden, Jeffrey, "The Political Economy of the Globalization Backlash," Harvard University, March 2019. Accessed Feb. 4, 2025. https://scholar.harvard.edu/files/frieden/files/the_political_economy_of_the_globalization_backlash.pdf
- 8 Stojanovic, Alex, "Understanding the Economic Impact of Brexit," Institute for Government, Oct. 17, 2018. <https://www.instituteforgovernment.org.uk/publication/report/understanding-economic-impact-brexit>
- 9 "OECD Survey on Drivers of Trust in Public Institutions: 2024 Results," OECD, July 10, 2024. Accessed Feb. 4, 2025. https://www.oecd.org/en/publications/oecd-survey-on-drivers-of-trust-in-public-institutions-2024-results_9a20554b-en.html
- 10 "Global Trade Has Nearly Flatlined: Is Populism Taking a Toll on Growth?" World Bank, Feb. 22, 2024. Accessed Feb. 4, 2025. <https://blogs.worldbank.org/en/voices/global-trade-has-nearly-flatlined-populism-taking-toll-growth>
- 11 Kessler, Sarah, "What Is Friendshoring?" New York Times, Nov. 18, 2022. <https://www.nytimes.com/2022/11/18/business/friendshoring-jargon-business.html>
- 12 Kennedy, Scott, "Made in China 2025," Center for Strategic and International Studies, Feb. 4, 2025. <https://www.csis.org/analysis/made-china-2025>
- 13 McBride, James, "Is 'Made in China 2025' a Threat to Global Trade?" Council on Foreign Relations, May 13, 2019. <https://www.cfr.org/backgroundunder/made-china-2025-threat-global-trade>
- 14 Weisenthal, Joe, Alloway, Tracy, "Almost 10 Years Later, China's 'Made in 2025' Has Succeeded," Bloomberg, Oct. 31, 2024. <https://www.bloomberg.com/news/articles/2024-10-31/almost-10-years-later-china-s-made-in-2025-has-succeeded>
- 15 Rajan, Raghuram G., "The Costs of Industrial Policy," Project Syndicate, Sept. 9, 2024. <https://www.project-syndicate.org/commentary/industrial-policy-subsidies-tariffs-regulations-will-add-costs-harm-innovation-by-raghuram-g-rajan-2024-09>
- 16 "The Inflation Reduction Act: Here's What's in It," McKinsey & Company, Aug. 16, 2022. <https://www.mckinsey.com/industries/public-sector/our-insights/the-inflation-reduction-act-heres-whats-in-it>
- 17 Kurilla, Michelle, "What Is the CHIPS Act?" Council on Foreign Relations, April 29, 2024. <https://www.cfr.org/in-brief/what-chips-act>
- 18 "China's Curbs on Exports of Strategic Minerals," Reuters, Aug. 15, 2024. <https://www.reuters.com/markets/commodities/chinas-curbs-exports-strategic-minerals-2024-08-15>
- 19 Baskaran, Gracelin, "What China's Ban on Rare Earths Processing Technology Exports Means," Center for Strategic and International Studies, Jan. 8, 2024. <https://www.csis.org/analysis/what-chinas-ban-rare-earths-processing-technology-exports-means>
- 20 Wu, Debby, Elstrom, Peter, "Export Controls Will Impede China's Chip Progress, US Commerce Official Says," Bloomberg, Oct. 21, 2023. <https://www.bloomberg.com/news/articles/2023-10-21/export-controls-will-impede-china-s-chip-progress-us-commerce-official-says>
- 21 "The Transformation of Labor Markets," PGIM, November 2023.
- 22 "International Migration Outlook 2024," Organization for Economic Co-operation and Development, Nov. 14, 2024. https://www.oecd.org/en/publications/international-migration-outlook-2024_50b0353e-en.html
- 23 "International Migration Flows," Migration Data Portal, Nov. 20, 2024. Accessed January 2025. <https://www.migrationdataportal.org/themes/international-migration-flows>
- 24 Heydari, Anis, "Economic Impact of Immigration Cuts," CBC News, Oct. 25, 2024. <https://www.cbc.ca/news/business/economic-impact-immigration-cuts-1.7362448>
- 25 Saraiva, Augusta, Curran, Enda, "Immigration Is Fueling US Economic Growth While Politicians Rage," Bloomberg, March 22, 2024. <https://www.bloomberg.com/news/articles/2024-03-22/immigration-is-fueling-us-economic-growth-while-politicians-rage>
- 26 OECD, "The Impact of Migration on Regional Labour Markets in Australia," OECD Publications, Dec. 13, 2023. https://www.oecd.org/en/publications/the-impact-of-migration-on-regional-labour-markets-in-australia_d72110b5-en.html
- 27 Tipp, Robert, "Low Ranger, High Plains Drifter," PGIM Fixed Income, Aug. 22, 2023. Accessed Feb. 3, 2025.
- 28 "Why Immigration Is Back on the European Union Agenda," The Guardian, Oct. 17, 2024. <https://www.theguardian.com/world/2024/oct/17/why-immigration-back-european-union-agenda-far-right>
- 29 Hesson, Ted, Ulmer, Alexandra, "Trump to Declare National Emergency at the Border, Trump Official Says," Reuters, Jan. 21, 2025. <https://www.reuters.com/world/us/trump-declare-national-emergency-border-trump-official-says-2025-01-20/>
- 30 Rascoe, Ayesha, "What the Pull of the Foreign Box Office Means for Hollywood," NPR, Jan. 8, 2023. <https://www.npr.org/2023/01/08/1147737254/what-the-pull-of-the-foreign-box-office-means-for-hollywood>
- 31 Nelson, Eshe, "The Taylor Swift Economy Has Landed in Europe," New York Times, June 21, 2024. <https://www.nytimes.com/2024/06/21/business/taylor-swift-eras-tour-inflation-europe.html>
- 32 Kim, Kevin, "Music Without Borders: Global Impact of K-Pop Tours," Korea Times, June 10, 2024. https://www.koreatimes.co.kr/www/opinion/2024/11/638_376026.html
- 33 Hailu, Selome, "'Squid Game' Season 2 Ratings: How Netflix's Hit Show Performed in Views," Variety, Dec. 31, 2024. <https://variety.com/2024/tv/news/squid-game-season-2-ratings-views-netflix-1236262980/>

- 34 "The Third-Largest Exporter of Television Is Not Who You Might Expect," *The Economist*, Feb. 15, 2024. <https://www.economist.com/culture/2024/02/15/the-third-largest-exporter-of-television-is-not-who-you-might-expect>
- 35 Sheldon, Dan, "How the Premier League Grew into the Biggest Soccer League in the United States," *New York Times*, Jan. 23, 2024. <https://www.nytimes.com/athletic/5218686/2024/01/23/premier-league-united-states/>
- 36 Saiidi, Uptin, "The NBA Is China's Most Popular Sports League. Here's How It Happened," *CNBC*, Nov. 20, 2018. <https://www.cnbc.com/2018/11/20/the-nba-is-chinas-most-popular-sports-league-heres-how-it-happened.html>
- 37 Burns, Mark J., "US Sports Fandoms in China: Why the NBA Leads the Pack," *Morning Consult Pro*, Aug. 1, 2023. <https://pro.morningconsult.com/analysis/us-sports-fandoms-china-nba>
- 38 Arcuri, Gregory, Shivakumar, Sujai. "Moore's Law and Its Practical Implications," Center for Strategic & International Studies, Oct. 18, 2022. <https://www.csis.org/analysis/moores-law-and-its-practical-implications>
- 39 "CPU vs. GPU: Understanding the Difference," Intel, 2024. <https://www.intel.com/content/www/us/en/products/docs/processors/cpu-vs-gpu.html>
- 40 Wile, Rob, "What Is Nvidia? What Do They Make?" *NBC News*, Feb. 24, 2024. <https://www.nbcnews.com/business/business-news/what-is-nvidia-what-do-they-make-ai-artificial-intelligence-rcna140171>
- 41 King, Ian, Wu, Debby, "Nvidia, TSMC, Samsung, and Intel: How the Chip War Puts Nations in a Tech Arms Race," *Bloomberg*, Jan 9, 2025. <https://www.bloomberg.com/news/articles/2024-05-15/nvidia-tsmc-samsung-and-intel-how-chip-war-puts-nations-in-tech-arms-race>
- 42 Bauer, Harold, et al., "Semiconductor Design and Manufacturing: Achieving Leading-Edge Capabilities." McKinsey & Company, Aug. 20, 2020. <https://www.mckinsey.com/industries/industrials-and-electronics/our-insights/semiconductor-design-and-manufacturing-achieving-leading-edge-capabilities>
- 43 "Strengthening the Global Semiconductor Supply Chain in an Uncertain Era," Semiconductor Industry Association, April 2021. <https://www.semiconductors.org/strengthening-the-global-semiconductor-supply-chain-in-an-uncertain-era/>
- 44 "AI Has Returned Chipmaking to the Heart of Computer Technology," *The Economist*, Sept. 16, 2024. <https://www.economist.com/technology-quarterly/2024/09/16/ai-has-returned-chipmaking-to-the-heart-of-computer-technology>
- 45 Shih, Willy C., "The New Era of Industrial Policy Is Here," *Harvard Business Review*, September 2023. <https://hbr.org/2023/09/the-new-era-of-industrial-policy-is-here>
- 46 Wang, Che-Jen, "4 Ways China Gets Around US AI Chip Restrictions," *Security Info Watch*, July 1, 2024. <https://www.securityinfowatch.com/security-executives/news/55092389/4-ways-china-gets-around-us-ai-chip-restrictions>
- 47 Hawkins, Mackenzie, "US Weighs Capping Exports of AI Chips from Nvidia and AMD to Some Countries," *Bloomberg*, Oct. 14, 2024. <https://www.bloomberg.com/news/articles/2024-10-15/us-weighs-capping-exports-of-ai-chips-from-nvidia-and-amd-to-some-countries>
- 48 Koc, Cagan, Deutsch, Jillian, Nardelli, Alberto, "ASML Faces Tighter Restrictions on Servicing Chip Gear in China," *Bloomberg*, July 14, 2023. <https://www.bloomberg.com/news/articles/2023-07-14/asml-faces-tighter-restrictions-on-servicing-chip-gear-in-china>
- 49 Ibid.
- 50 Bowman, Jeremy, "This 1 Number May Ensure TSMC's Market Dominance," *Nasdaq*, Aug. 17, 2024. <https://www.nasdaq.com/articles/1-number-may-ensure-tsmcs-market-dominance>
- 51 "Estimates Based on Node Breakdown of TSMC, UMC, and GFS Excluding Samsung, Vanguard, and SMIC," *Arete Research*, 2023.
- 52 Chen, M., Shen, S., "The Making of TSMC and Its Ecosystem," *DIGITIMES Asia*, Sept. 19, 2022. <https://www.digitimes.com/news/a20220907PD207/foundry-intel-samsung-tsmc.html>
- 53 Park, Hanah, "TSMC Arizona Yields Highlight Advancements in US Manufacturing," *Asia Matters for America*, Oct. 29, 2024. <https://asiamattersforamerica.org/articles/tsmc-arizona-yields-highlight-advancements-in-us-manufacturing>
- 54 Liu, John, "What Works in Taiwan Doesn't Always in Arizona, a Chipmaking Giant Learns" *New York Times*, Aug. 8, 2024. <https://www.nytimes.com/2024/08/08/business/tsmc-phoenix-arizona-semiconductor.html>
- 55 Hawkins, Mackenzie, "Biden's Economic Dilemma Reaches Arizona: TSMC Chip Plant in Union Fight," *Bloomberg*, Sept. 29, 2023. <https://www.bloomberg.com/news/articles/2023-09-29/biden-economic-dilemma-reaches-arizona-tsmc-chip-plant-in-union-fight>
- 56 Ibid.
- 57 Rauwald, C., Kowalcze, Kamil, "Germany Faces Fresh Setback as Intel Halts Planned Chip Factory," *Bloomberg*, Sept. 17, 2024. <https://www.bloomberg.com/news/articles/2024-09-17/germany-faces-fresh-setback-as-intel-halts-planned-chip-factory>
- 58 Vengattil, Munsif, Kalra, Aditya, Lee, Jane, "India Chip Plan Stalls After Tower-Intel Deal Setback: Modi," *Reuters*, June 1, 2023. <https://www.reuters.com/world/india/india-chip-plan-stalls-after-tower-intel-deal-setback-modi-2023-05-31/>
- 59 Hilton, Isabel, "Taiwan Makes the Majority of the World's Computer Chips. Now It's Running Out of Electricity," *Wired*, Oct. 5, 2024. <https://www.wired.com/story/taiwan-makes-the-majority-of-the-worlds-computer-chips-now-its-running-out-of-electricity/>
- 60 Schechner, Sam, Woo, Stu, "DeepSeek AI: China Tech Stocks Explained," *Wall Street Journal*, Jan. 28, 2025. <https://www.wsj.com/tech/ai/deepseek-ai-china-tech-stocks-explained-ee6cc80e>
- 61 Kennedy, Scott, "The Chinese EV Dilemma: Subsidized Yet Striking," Center for Strategic and International Studies, June 28, 2024. Accessed Feb. 4, 2025. from <https://www.csis.org/blogs/trustee-china-hand/chinese-ev-dilemma-subsidized-yet-striking>
- 62 L, Jennifer, "EV Wars and Breakthroughs: BYD to Overtake Tesla, CATL's New Battery with 1.5M KM Range," *Carbon Credits*, July 24, 2024. <https://carboncredits.com/battery-wars-byd-to-beat-tesla-in-2024-ev-sales-catl-new-lithium-battery/>
- 63 "Global EV Outlook 2023: Executive Summary," International Energy Agency. Accessed Feb. 4, 2025. <https://www.iea.org/reports/global-ev-outlook-2023/executive-summary>
- 64 Hancock, Tom, "US-Europe Gripes on China Overcapacity Aren't All Backed by Data," *Bloomberg*, April 2, 2024. <https://www.bloomberg.com/news/articles/2024-04-02/us-europe-gripes-on-china-overcapacity-aren-t-all-backed-by-data>
- 65 Zhang, Chunying, Wilkes, William, "BMW, Mercedes, and Volkswagen: EVs Struggle to Compete in China," *Bloomberg*, Oct. 14, 2024. <https://www.bloomberg.com/news/features/2024-10-14/bmw-mercedes-and-volkswagen-bmw-mbg-vow-evs-struggle-to-compete-in-china>
- 66 Ibid.
- 67 Reuters, "EU Slaps Tariffs on Chinese EVs, Risking Beijing Payback," Oct. 29, 2024. <https://www.reuters.com/business/autos-transportation/eu-slaps-tariffs-chinese-evs-risking-beijing-payback-2024-10-29/>
- 68 "Fact Sheet: President Biden Takes Action to Protect American Workers and Businesses from China's Unfair Trade Practices," *The White House*, May 14, 2024. <https://www.commerce.gov/news/fact-sheets/2024/05/fact-sheet-president-biden-takes-action-protect-american-workers-and>

- 69 Carey, Nick, Klayman, Ben, "Why BYD's EV Exports Sell at Twice China Price," Reuters, April 26, 2024. <https://www.reuters.com/business/autos-transportation/why-byds-ev-exports-sell-twice-china-price-2024-04-26/>
- 70 Saxena, Vishakha, "BYD Sales Boom in Southeast Asia While Tesla Growth Slows," Asia Financial, July 24, 2024. <https://www.asiafinancial.com/byd-sales-boom-in-southeast-asia-while-tesla-growth-slows>
- 71 Pearson, Samantha, "China's EV Makers Set Sights on Latin America in Global Expansion," Wall Street Journal, Nov. 2, 2024. <https://www.wsj.com/business/autos/chinas-ev-makers-set-sights-on-latin-america-in-global-expansion-8297bc78>
- 72 Zhang, Chunying, Wilkes, William, "BMW, Mercedes, and Volkswagen: EVs Struggle to Compete in China," Bloomberg, Oct. 14, 2024. <https://www.bloomberg.com/news/features/2024-10-14/bmw-mercedes-and-volkswagen-bmw-mbg-vow-evs-struggle-to-compete-in-china>
- 73 Joane, "BYD Unveils Hiace 07 EV with Luxurious Interior and God's Eye at Beijing Auto Show," Gizmochina, April 22, 2024. <https://www.gizmochina.com/2024/04/22/byd-unveils-hiace-07-ev-with-luxurious-interior-and-gods-eye-at-beijing-auto-show/>
- 74 Klender, Joey, "Tesla Cybertruck Achieves Positive Gross Margin for the First Time," Teslarati, Oct. 23, 2024. Accessed Feb. 4, 2025. <https://www.teslarati.com/tesla-cybertruck-achieves-positive-gross-margin-for-first-time/>
- 75 Roy, Abhirup, Sriram, Akash, "Tesla CEO Elon Musk Unveils 'Cybercab' Robotaxi," Reuters, Oct. 11, 2024. <https://www.reuters.com/technology/teslas-musk-unveil-robotaxis-amid-fanfare-skepticism-2024-10-10/>
- 76 "Will Elon Musk Scrap His Plan to Invest in a Gigafactory in Mexico?" The Economist, Jan. 16, 2025. <https://www.economist.com/business/2025/01/16/will-elon-musk-scrap-his-plan-to-invest-in-a-gigafactory-in-mexico>
- 77 "Cross-Border Operating Requirements for Mexico-Domiciled Motor Carriers," US Department of Transportation. Accessed Feb. 4, 2025. <https://www.fmcsa.dot.gov/international-programs/cross-border-operating-requirements-mexico-domiciled-motor-carriers>
- 78 Ibid.
- 79 Vizcaino, Elena, Johnson, Carter, "Canada's Dollar, Mexican Peso Rebound as Tariffs Delayed," Bloomberg, Feb. 2, 2025. <https://www.bloomberg.com/news/articles/2025-02-03/mexican-peso-rand-lead-em-currency-selloff-on-trump-tariffs>
- 80 Lang, Hannah, "Dollar Lower After US Tariffs on Mexico Paused for a Month," Reuters, Feb. 3, 2025. <https://www.reuters.com/markets/currencies/yuan-hits-record-low-mexican-peso-canadian-dollar-tumble-trump-tariffs-2025-02-02/>
- 81 "Semiconductor Materials," IEEE Industry Relations. Accessed Feb. 4, 2025. <https://irds.ieee.org/topics/semiconductor-materials>
- 82 "The Role of Critical Minerals in Clean Energy Transitions: Mineral Requirements for Clean Energy Transitions," International Energy Agency, January 2025. <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/mineral-requirements-for-clean-energy-transitions>
- 83 "Securing Clean Energy Technology Supply Chains," International Energy Agency, 2023. Accessed Feb. 4, 2025. <https://iea.blob.core.windows.net/assets/0fe16228-521a-43d9-8da6-bbf08cc9f2b4/SecuringCleanEnergyTechnologySupplyChains.pdf>
- 84 "World Mining Data 2023," World Mining Data. Accessed Feb. 4, 2025. <https://www.world-mining-data.info/wmd/downloads/PDF/WMD2023%20Backbone.pdf>
- 85 Leruth, Luc, et al., "The Impact of Trade Agreements on Economic Growth," Peterson Institute for International Economics, August 2022. <https://www.piie.com/sites/default/files/documents/wp22-12.pdf>
- 86 Coyne, John, Campbell, Henry, "The Road to Critical Mineral Security Leads Through Australia," Australian Strategic Policy Institute, Sept. 22, 2023. Accessed Feb. 3, 2025. <https://www.aspi.org.au/opinion/road-critical-mineral-security-leads-through-australia>
- 87 "China's Grip on Rare Earths Undercuts Projects from US to Japan," Bloomberg News, Sept. 16, 2024. Accessed Feb. 3, 2025. <https://www.bloomberg.com/news/articles/2024-09-16/china-s-grip-on-rare-earths-undercuts-projects-from-us-to-japan>
- 88 "Chinese FDI in Africa Data Overview," China Africa Research Initiative. <https://www.sais-cari.org/chinese-investment-in-africa>
- 89 "National Plan for Mineral Resources 2016-2020," International Energy Agency, Oct. 30, 2022. Accessed Feb. 4, 2025. <https://www.iea.org/policies/15519-national-plan-for-mineral-resources-2016-2020>
- 90 Egvyn, Desmond, "Addressing China's Monopoly over Africa's Renewable Energy Minerals," Wilson Center, May 2, 2024. <https://www.wilsoncenter.org/blog-post/addressing-chinas-monopoly-over-africas-renewable-energy-minerals>
- 91 Williams, Georgia, "Where Is Cobalt Mined?" Investing News, Nov. 7, 2024. Accessed Feb. 4, 2025. <https://investingnews.com/where-is-cobalt-mined/>
- 92 "Largest Cobalt Reserves by Country," NS Energy, June 7, 2021. <https://www.nsenergybusiness.com/analysis/largest-cobalt-reserves-country/>
- 93 "Cobalt Production Map," China Global South. Accessed Feb. 4, 2025. <https://chinaglobalsouth.com/cobaltmap/en/production.html>
- 94 Hill, Matthew, "China's Grip on Africa's Minerals Sparks a US Response," Bloomberg, Nov. 2, 2023. <https://www.bloomberg.com/news/articles/2023-11-02/china-s-grip-on-africa-s-minerals-sparks-a-us-response>
- 95 Mutsaka, Farai, "China's Control over Lithium Processing Plant Raises Global Concerns," AP News, July 5, 2023. <https://apnews.com/article/lithium-processing-plant-chinese-92ccd10bd4ba028bc38fdadedffc06da>
- 96 Jha, Saurav, "Did China Overplay Its Rare Earth Hand?" The Diplomat, Nov. 17, 2010. <https://thediplomat.com/2010/11/did-china-overplay-rare-earth-hand/>
- 97 Pao, Jeff, "China Takes Rare Earth Aim at Raytheon and Lockheed," Asia Times, Feb. 22, 2022. Accessed Feb. 3, 2025. <https://asiatimes.com/2022/02/china-takes-rare-earth-aim-at-raytheon-and-lockheed/>
- 98 White, Edward, "China Bans Export of Rare Earth Processing Technologies," Financial Times, Dec. 21, 2023. <https://www.ft.com/content/5b031db7-23dd-43d3-afe1-cef14817296f>
- 99 "Tiny But Vital Metal Markets Rush to Adjust to Chinese Clampdown," Bloomberg, Dec. 21, 2024. <https://www.bloomberg.com/news/articles/2024-12-21/tiny-but-vital-metal-markets-rush-to-adjust-to-chinese-clampdown>
- 100 Elshkaki, Ayman, et al., "Copper Demand, Supply, and Associated Energy Use to 2050," Global Environmental Change-Human and Policy Dimensions, 39, 305-315, Yale School of the Environment. <https://environment.yale.edu/bibcite/reference/3240>
- 101 "Rio Tinto Digs Deep as \$7 Billion Copper Mine Finally Delivers," Bloomberg, March 13, 2023. <https://www.bloomberg.com/news/articles/2023-03-13/rio-tinto-digs-deep-as-7-billion-copper-mine-finally-delivers>
- 102 Li, Ying, "Copper Miners Enjoy High Profits, But Development Capital Expenditure Lags," S&P Global Market Intelligence, April 26, 2023. <https://www.spglobal.com/marketintelligence/en/news-insights/research/copper-miners-enjoy-high-profits-but-development-capital-expenditure-lag>
- 103 Fernyhough, James, "Copper Faces Troubled Future as Renewable Energy Causes Demand to Surge," Bloomberg, May 2, 2023. <https://www.bloomberg.com/news/features/2023-05-02/copper-faces-troubled-future-as-renewable-energy-causes-demand-to-surge>
- 104 Skidmore, Zachary, "Copper Supply Chain Fragmentation," Mining Technology, May 30, 2022. Accessed Feb. 4, 2025.

- <https://www.mining-technology.com/features/copper-supply-chain-fragmentation/?cf-view>
- 105 Woods, Bob, "Copper Is Critical to Climate. The World Is Way Behind on Production," CNBC, Sept. 27, 2023. <https://www.cnbc.com/2023/09/27/copper-is-critical-to-climate-the-world-is-way-behind-on-production.html>
 - 106 Catalan, Mario, et al, "Geopolitics and Fragmentation Emerge as Serious Financial Stability Threats," International Monetary Fund, April 3, 2023. <https://www.imf.org/en/Blogs/Articles/2023/04/05/geopolitics-and-fragmentation-emerge-as-serious-financial-stability-threats>
 - 107 O'Donnell, Katy, "JPMorgan's Dimon: 'The most dangerous time the world has seen in decades'," Politico, October 13, 2023. HYPERLINK "<https://www.politico.com/news/2023/10/13/jpmorgans-dimon-wars-impacts-00121422>" Dimon: 'Most dangerous time the world has seen in decades' - POLITICO
 - 108 Vasquez, Patricia I., "Brazil's Critical Minerals and the Global Clean Energy Revolution," Wilson Center, Oct. 2, 2024. <https://www.wilsoncenter.org/article/brazils-critical-minerals-and-global-clean-energy-revolution>
 - 109 "Fundamentos para Políticas Públicas em Minerais Críticos e Estratégicos," Brazilian Mining Institute, IBRAM, July 2024. https://ibram.org.br/wp-content/uploads/2024/07/Fundamentos_para_politicas_publicas_em_minerais_criticos_e_estrategicos.pdf
 - 110 Vasquez, Patricia I., "Brazil's Critical Minerals and the Global Clean Energy Revolution," Wilson Center, Oct. 2, 2024. <https://www.wilsoncenter.org/article/brazils-critical-minerals-and-global-clean-energy-revolution>
 - 111 Dempsey, Harry, "China's Tianqi Lithium's \$4bn Bet on Chile at Risk of Backfiring," Financial Times, April 9, 2024. <https://www.ft.com/content/cbb6b412-b9aa-480d-bf89-c72bd38c4563>
 - 112 <https://apnews.com/article/panama-mining-canada-first-quantum-mineral-arbitration-6530dceccfb60fb9a06bc3136c04d2cc>
 - 113 <https://www.theguardian.com/world/2023/nov/28/panama-supreme-court-canadian-copper-mine-unconstitutional>
 - 114 Bacchus, James, "Natural Resource Export Bans Are Becoming a Dangerous Global Trend," The Hill, Dec. 22, 2023. <https://thehill.com/opinion/finance/4369714-natural-resource-export-bans-are-becoming-a-dangerous-global-trend/>
 - 115 Perasso, Giancarlo, "The EM Winners and Losers of Soaring Oil and Food Prices," PGIM Fixed Income, Sept. 16, 2021.
 - 116 "Fueling the Future," PGIM, 2024.
 - 117 "World Bank to Boost Efficient Electricity Distribution in the Dominican Republic," World Bank, Dec. 13, 2023. <https://www.worldbank.org/en/news/press-release/2023/12/13/banco-mundial-impulsara-distribucion-eficiente-de-electricidad-republica-dominicana>
 - 118 Murillo, Alvaro, "Suffering Worst Drought in Decades, Costa Rica Orders Electricity Rationing," Reuters, May 9, 2024. <https://www.reuters.com/world/americas/suffering-worst-drought-decades-costa-rica-orders-electricity-rationing-2024-05-09/>
 - 119 Toro Ortiz, Carlos, Muñoz Zurita, Belén, "Chile's Action Plan for Power Sector Decarbonization," Ministry of Energy Chile, July 2023. <https://www.nrel.gov/docs/fy23osti/86636.pdf>
 - 120 N R, Sethruman, "India to Add Record Renewables This Year as Green Push Gains Momentum," Reuters, Sept. 16, 2024. <https://www.reuters.com/business/energy/india-gets-386-bln-financial-commitment-expand-renewable-capacity-2024-09-16/>
 - 121 Nandi, Jayashree, "India Faces Higher Increases in Energy Demand over Next Decade: IEA," Hindustan Times, Oct. 16, 2024. <https://www.hindustantimes.com/india-news/india-faces-higher-increase-in-energy-demand-over-next-decade-ia-101729074049017.html>
 - 122 O'Brien, Matt, "Ireland Embraced Data Centers that the AI Boom Needs: Now They're Consuming Too Much of Its Energy," Associated Press, Dec. 19, 2024. Ireland embraced data centers that the AI boom needs. Now they're consuming too much of its energy | AP News
 - 123 Wise, Timothy A., "Swimming Against the Tide: Mexico's Quest for Food Sovereignty in the Face of US Agricultural Dumping," Institute for Agriculture Trade Policy, May 2023. <https://www.iatp.org/sites/default/files/2023-05/swimming-against-tide.2.pdf>
 - 124 Chiang, Thomas C., "Risk and Policy Uncertainty on Stock-Bond Return Correlations: Evidence from the US Markets," MDPI, June 1, 2020. <https://www.mdpi.com/2227-9091/8/2/58#>
 - 125 Wang, Xiong, et al., "Economic Policy Uncertainty and Dynamic Correlations in Energy Markets: Assessment and Solutions," ScienceDirect, January 2023. <https://www.sciencedirect.com/science/article/abs/pii/S0140988322006041>
 - 126 Weisberger, Noah, Xu, Xiang, "Global Nature of Stock-Bond Correlation and Its Implications for Portfolio Risk," PGIM, 2022.
 - 127 Hall, John, Johnson, Lorne, McClure, John, "Using Options Strategies to Help Achieve More Targeted Portfolio Outcomes," PGIM Quantitative Solutions, Sept. 10, 2024.
 - 128 Hall, John, Johnson, Lorne, McClure, John, "Using Options Strategies to Help Achieve More Targeted Portfolio Outcomes," PGIM Quantitative Solutions, Sept. 10, 2024.
 - 129 Ibid.
 - 130 Global Economic Policy Uncertainty Index. Accessed February 2025. https://www.policyuncertainty.com/global_monthly.html
 - 131 Gillespie, Todd, "Energy Costs Set to Reach Record 13% of Global GDP This Year," Bloomberg, March 16, 2022. <https://www.bloomberg.com/news/articles/2022-03-16/energy-costs-set-to-reach-record-13-of-global-gdp-this-year>
 - 132 "The Mobile Economy 2023," GSMA, March 2023. <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-economy/wp-content/uploads/2023/03/270223-The-Mobile-Economy-2023.pdf>
 - 133 "Global Materials Perspective 2024," McKinsey & Company, Sept. 17, 2024. <https://www.mckinsey.com/industries/energy-and-materials/our-insights/global-materials-perspective>
 - 134 Tian, Nan, et al., "Trends in World Military Expenditure 2023," Stockholm International Peace Research Institute, April 2024. http://www.sipri.org/sites/default/files/2024-04/2404_fs_milex_2023.pdf
 - 135 "Analysis for CHIPS Act and BIA Briefing," US Department of Commerce, April 6, 2022. <https://www.commerce.gov/news/press-releases/2022/04/analysis-chips-act-and-bia-briefing>
 - 136 "The Economic Impact of the Global Pharmaceutical Industry," WifOR Institute, Nov. 20, 2024. <https://www.ifpma.org/publications/the-economic-impact-of-the-global-pharmaceutical-industry/>
 - 137 FAOStat, Food and Agricultural Organization of the United States. Accessed January 2025.

IMPORTANT INFORMATION

Professional Investor Use Only. All investments involve risks, including possible loss of principal. Past performance is not indicative of future results.

The information contained herein is provided by PGIM, Inc., the principal asset management business of Prudential Financial, Inc. (PFI), and a trading name of PGIM, Inc. and its global subsidiaries. PGIM, Inc. is an investment adviser registered with the U.S. Securities and Exchange Commission (SEC). Registration with the SEC does not imply a certain level of skill or training.

In the United Kingdom, information is issued by PGIM Limited with registered office: Grand Buildings, 1-3 Strand, Trafalgar Square, London, WC2N 5HR. PGIM Limited is authorised and regulated by the Financial Conduct Authority (“FCA”) of the United Kingdom (Firm Reference Number 193418). In the European Economic Area (“EEA”), information is issued by PGIM Netherlands B.V. with registered office: Gustav Mahlerlaan 1212, 1081 LA Amsterdam, The Netherlands. PGIM Netherlands B.V. is, authorised by the Autoriteit Financiële Markten (“AFM”) in the Netherlands (Registration number 15003620) and operating on the basis of a European passport. In certain EEA countries, information is, where permitted, presented by PGIM Limited in reliance of provisions, exemptions or licenses available to PGIM Limited under temporary permission arrangements following the exit of the United Kingdom from the European Union. These materials are issued by PGIM Limited and/or PGIM Netherlands B.V. to persons who are professional clients as defined under the rules of the FCA and/or to persons who are professional clients as defined in the relevant local implementation of Directive 2014/65/EU (MiFID II). In Italy, information is provided by PGIM Limited authorized to operate in Italy by Commissione Nazionale per le Società e la Borsa (CONSOB). In Japan, information is provided by PGIM Japan Co., Ltd. (“PGIM Japan”) and/or PGIM Real Estate (Japan) Ltd. (“PGIMREJ”). PGIM Japan, a registered Financial Instruments Business Operator with the Financial Services Agency of Japan offers various investment management services in Japan. PGIMREJ is a Japanese real estate asset manager that is registered with the Kanto Local Finance Bureau of Japan. In Hong Kong, information is provided by PGIM (Hong Kong) Limited, a regulated entity with the Securities & Futures Commission in Hong Kong to professional investors as defined in Section 1 of Part 1 of Schedule 1 of the Securities and Futures Ordinance (Cap. 571). In Singapore, information is issued by PGIM (Singapore) Pte. Ltd. (“PGIM Singapore”), a regulated entity with the Monetary Authority of Singapore under a Capital Markets Services License to conduct fund management and an exempt financial adviser. This material is issued by PGIM Singapore for the general information of “institutional investors” pursuant to Section 304 of the Securities and Futures Act 2001 of Singapore (the “SFA”) and “accredited investors” and other relevant persons in accordance with the conditions specified in Section 305 of the SFA. In South Korea, information is issued by PGIM, Inc., which is licensed to provide discretionary investment management services directly to South Korean qualified institutional investors on a cross-border basis.

These materials are for informational or educational purposes only. The information is not intended as investment advice and is not a recommendation about managing or investing assets or an offer or solicitation in respect of any products or services to any persons who are prohibited from receiving such information under the laws applicable to their place of citizenship, domicile or residence. In providing these materials, PGIM is not acting as your fiduciary. These materials represent the views, opinions and recommendations of the author(s) regarding the economic conditions, asset classes, securities, issuers or financial instruments referenced herein. Distribution of this information to any person other than the person to whom it was originally delivered and to such person's advisers is unauthorized, and any reproduction of these materials, in whole or in part, or the divulgence of any of the contents hereof, without prior consent of PGIM is prohibited. Certain information contained herein has been obtained from sources that PGIM believes to be reliable as of the date presented; however, PGIM cannot guarantee the accuracy of such information, assure its completeness, or warrant such information will not be changed. The information contained herein is current as of the date of issuance (or such earlier date as referenced herein) and is subject to change without notice. PGIM has no obligation to update any or all of such information; nor do we make any express or implied warranties or representations as to the completeness or accuracy or accept responsibility for errors. These materials are not intended as an offer or solicitation with respect to the purchase or sale of any security or other financial instrument or any investment management services and should not be used as the basis for any investment decision. No risk management technique can guarantee the mitigation or elimination of risk in any market environment. Past performance is not a guarantee or a reliable indicator of future results and an investment could lose value. No liability whatsoever is accepted for any loss (whether direct, indirect, or consequential) that may arise from any use of the information contained in or derived from this report. PGIM and its affiliates may make investment decisions that are inconsistent with the recommendations or views expressed herein, including for proprietary accounts of PGIM or its affiliates. Any projections or forecasts presented herein are as of the date of this presentation and are subject to change without notice. Actual data will vary and may not be reflected here. Projections and forecasts are subject to high levels of uncertainty. Accordingly, any projections or forecasts should be viewed as merely representative of a broad range of possible outcomes. Projections or forecasts are estimated, based on assumptions, and are subject to significant revision and may change materially as economic and market conditions change. PGIM has no obligation to provide updates or changes to any projections or forecasts.

PGIM and its affiliates may develop and publish research that is independent of, and different than, the recommendations contained herein. PGIM's personnel other than the author(s), such as sales, marketing and trading personnel, may provide oral or written market commentary or ideas to PGIM's clients or prospects or proprietary investment ideas that differ from the views expressed herein.

Prudential Financial, Inc. of the United States is not affiliated in any manner with Prudential plc, incorporated in the United Kingdom or with Prudential Assurance Company, a subsidiary of M&G plc, incorporated in the United Kingdom.

© 2025 PFI and its related entities, registered in many jurisdictions worldwide.

PGIM'S MEGATREND SERIES

How today's shifting global landscape will affect the investments of tomorrow



Fueling The Future

The energy transition – the shift towards electrification and a low-carbon energy mix – is at a critical inflection point. For investors this not only creates an array of new investment opportunities but also leads to obsolescence risk in waning energy sectors, while simultaneously requiring vigilance against overhyped innovations that are too distant, uneconomic or politically unfeasible.

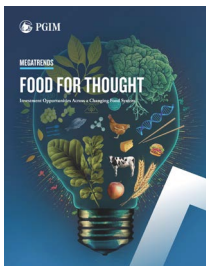
[Learn more at pgim.com/energy](https://pgim.com/energy)



The Transformation of Labor Markets

Among its many tragic human and economic consequences, the COVID-19 pandemic left labor markets in turmoil. While these issues get much media attention – and some may prove to have an enduring impact – they often obscure the profound structural changes to labor markets that were already underway prior to COVID and that will ultimately have a much greater impact on reshaping the global workforce.

[Learn more at pgim.com/labor](https://pgim.com/labor)



Food For Thought

Whether seeking opportunities or mitigating hidden risks, understanding the rapidly transforming food system is crucial for institutional investors.

[Learn more at pgim.com/food](https://pgim.com/food)



The New Dynamics of Private Markets

Private markets have provided entrepreneurs, corporate tycoons and property developers with access to capital for centuries. But the current scale, growth and complexity of private capital is truly unprecedented – and is radically altering the investment opportunities and challenges facing institutional investors.

[Learn more at pgim.com/private-markets](https://pgim.com/private-markets)



Cryptocurrency Investing

Exploring why direct investments in bitcoin and its peers are currently unattractive for an institutional portfolio – underscored by recent gyrations in the crypto market. Still, the technologies that cryptocurrencies helped spawn present new opportunities for savvy long-term investors.

[Learn more at pgim.com/crypto](https://pgim.com/crypto)



Reshaping Services

Technological disruption has finally reached the shores of the service economy. It's a development that will represent a major shift for investors and the global economy as services represent more than two-thirds of global GDP, three-quarters of the workforce in developed markets, and nearly half of the workforce in advanced emerging markets.

[Learn more at **pgim.com/reshaping**](https://pgim.com/reshaping)



Weathering Climate Change

Climate change is no longer a hypothetical risk. It is already transforming the global economy, reshaping markets and altering the investment landscape. In this paper, we propose an actionable climate change agenda that addresses both hidden portfolio vulnerabilities and potential opportunities in the transition to a lower-carbon world.

[Learn more at **pgim.com/climate**](https://pgim.com/climate)



After the Great Lockdown

The pandemic has forced businesses to adapt in ways that will lead to lasting changes in consumer behavior and corporate business models. Now is the time to focus on the massive disruption that lies ahead so we're best positioned for when the Great Lockdown has passed.

[Learn more at **pgim.com/lockdown**](https://pgim.com/lockdown)



The Future Means Business

Disruptive forces have led to the emergence of three new business models that are radically changing the investment calculus for institutional investors. Here we explore the investment implications of these transformative new corporate models.

[Learn more at **pgim.com/futurefirm**](https://pgim.com/futurefirm)



The Technology Frontier

We are living in an era of unprecedented technological change. At PGIM, we believe the implications for investors will be profound, radically transforming investment opportunities across asset classes and geographies.

[Learn more at **pgim.com/tech**](https://pgim.com/tech)



The End of Sovereignty?

Never before in history have people, information and capital moved across borders at the speed, frequency and volume we see today. In this white paper, we take a closer look at the escalating tussle between globalization and nationalism, the implications this could have for global financial markets, and how long-term investors may best position themselves to navigate these uncertain times.



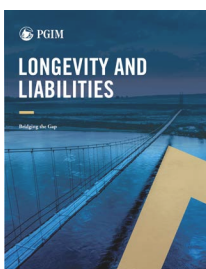
Emerging Markets at the Crossroads

A radical shift in the forces shaping emerging market growth will require investors to take a different investment approach from what may have worked in the past. Increasingly, discovering investment opportunities will be rooted in the ability to capture alpha from the new growth drivers, rather than in chasing the beta of the broad universe.



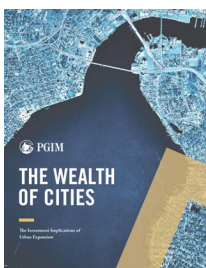
A Silver Lining

The unprecedented aging of the global population creates increased opportunities in senior housing, multifamily condos, biotech, and the emerging silverttech industry. Institutional investors should consider how this megatrend could affect their portfolios, given the trend's evolving impact on consumer spending and far-reaching effects on emerging nations, home to two-thirds of the world's elderly.



Longevity and Liabilities

The rise in global life expectancy has implications for pension plan liabilities that are not fully appreciated. As new mortality tables demonstrate, longevity risk to pension liabilities could increase dramatically over the next two to three decades. This report examines the challenge and the available risk mitigation strategies.



The Wealth of Cities

Never in history has the pace of urbanization been so rapid: 60 to 70 million people moving to cities every year for the next few decades. To help institutional investors benefit from this “prime time” of urbanization, we identified a range of specific investment ideas across the major investable themes of this opportune megatrend.



THE PURSUIT OF OUTPERFORMANCE™

留意事項

※本資料は米国SECの登録投資顧問会社であるPGIMインクが作成したものです。

※本資料は情報提供を目的としたものであり、特定の金融商品の勧誘又は販売を目的としたものではありません。また、本資料に記載された内容等については今後変更されることもあります。

※記載されている市場動向等は現時点での見解であり、これらは今後変更することもあります。また、その結果の確実性を表明するものではなく、将来の市場環境の変動等を保証するものでもありません。

※本資料で取り上げられた資産クラス、個別セクター等はあくまで例示を目的としたものであり、推奨ならびにこれらに係る将来性を明示・暗示的に示唆するものではありません。

※本資料で言及されている個別銘柄は例示のみを目的とするものであり、特定の個別銘柄への投資を推奨するものではありません。

※本資料に記載されている市場関連データ及び情報等は信頼できると判断した各種情報源から入手したものです。その情報の正確性、確実性について当社が保証するものではありません。

※本資料に掲載された各インデックスに関する知的財産権及びその他の一切の権利は、各インデックスの開発、算出、公表を行う各社に帰属します。

※過去の運用実績は必ずしも将来の運用成果等を保証するものではありません。

※本資料は法務、会計、税務上のアドバイスあるいは投資推奨等を行うために作成されたものではありません。

※PGIMジャパン株式会社による事前承諾なしに、本資料の一部または全部を複製することは堅くお断り致します。

※“Prudential”、“PGIM ”、それぞれのロゴおよびロック・シンボルは、ブルデンシャル・ファイナンシャル・インクおよびその関連会社のサービスマークであり、多数の国・地域で登録されています。

※PGIMジャパン株式会社は、世界最大級の金融サービス機関ブルデンシャル・ファイナンシャルの一員であり、英国ブルーデンシャル社とはなんら関係がありません。

PGIMジャパン株式会社

金融商品取引業者 関東財務局長（金商）第392号

加入協会：一般社団法人日本投資顧問業協会、一般社団法人投資信託協会、一般社団法人第二種金融商品取引業協会

PGIMJ117181

4343905_20250325