



# The Hamilton Index, 2023: China Is Running Away With Strategic Industries

ROBERT D. ATKINSON AND IAN TUFTS | DECEMBER 2023

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China now dominates the strategically important industries in ITIF's Hamilton Index, producing more than any other nation in absolute terms and more than all but a few others in relative terms. Its gains are coming at the expense of the United States and other G7 and OECD economies, and time is running short for policymakers to mount an industrial comeback.

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## KEY TAKEAWAYS

- As of 2020, China was the leading producer in seven of the ten strategically important industries in ITIF's Hamilton Index. Overall, China was producing more than any other nation—and more than all other nations outside of the top 10 *combined*.
- Hamilton Index industries accounted for approximately the same share of the global economy in 2020 (11.8 percent) as in 1995 (11.9 percent), underscoring how the race for global advantage in these industries is a zero-sum competition.
- China's gains have come at the expense of the United States and other G7 and OECD economies. From 1995 to 2020, China also captured more than 80 percent of non-OECD countries' gains.
- China is 70 percent more specialized than America in advanced industries. To match China's specialization, U.S. output would have to expand by \$1.5 trillion (69 percent), which would require doubling output from all Hamilton industries except IT services.
- Time is running short to turn around U.S. advanced industry fortunes. The 2020s are likely to be the decisive decade because once China captures sufficient global market share, U.S. and allied nations' production risks being permanently weakened.
- Congress should make closing this massive advanced-industry output gap its overarching economic policy goal, including through tax, trade, and other elements of a comprehensively focused national industry strategy.

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# INTRODUCTION

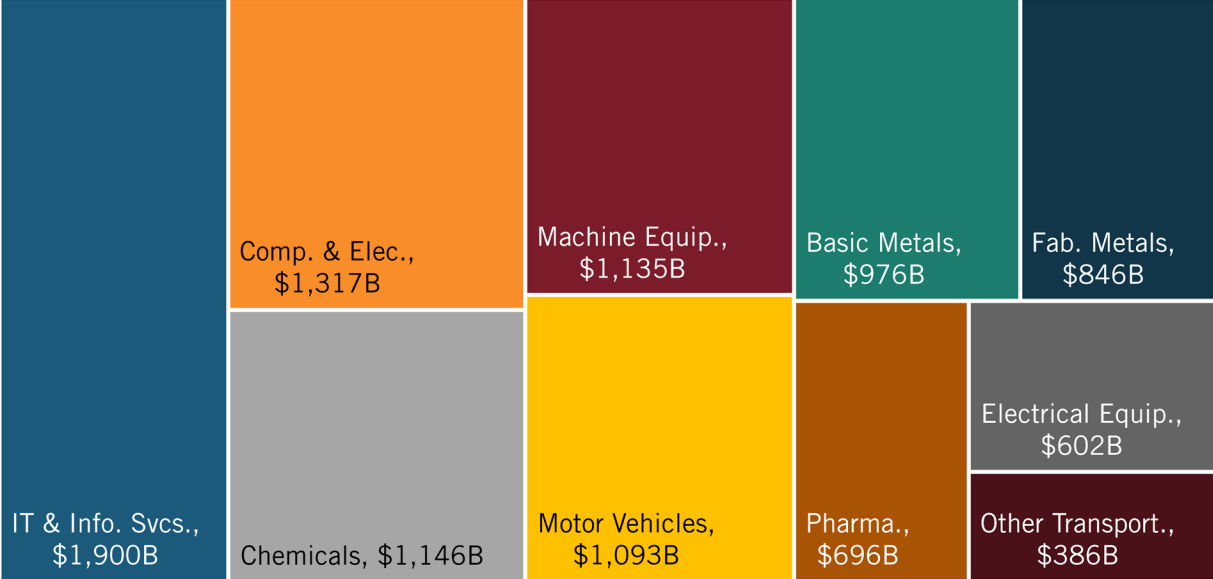
Nations are in a fierce win-lose global competition for market share in advanced, traded-sector technology industries because, for most, winning enables economic and national security. That is especially true for allied nations, as China’s gain usually comes at its loss and vice versa. Winning—not only the competition for innovation leadership but also for production capacity—will boost international competitiveness and economic and national security.

When it comes to U.S. national interest, innovation-based production is key. The United States has a long history of pioneering innovations only to see its production captured by other nations, including China. This reduces growth, weakens the terms of trade (creating a higher trade balance, a weaker dollar, or both), degrades the national security industrial base, and makes America vulnerable to industrial pressure tactics from China.

To assess U.S. and other nations’ performance, the Information Technology and Innovation Foundation (ITIF) has examined changes in global shares of value-added output in 10 advanced industry sectors its Hamilton Center on Industrial Competitiveness has aggregated into the Hamilton Index of Advanced-Technology Performance: pharmaceuticals; electrical equipment; machinery and equipment; motor vehicle equipment; other transport equipment; computer, electronic, and optical products; information technology and information services; chemicals (not including pharmaceuticals); basic metals; and fabricated metals. To conduct this analysis, ITIF uses production data from the Organization for Economic Cooperation and Development’s (OECD’s) dataset on trade in value added, covering the period from 1995 through 2020, and ITIF’s analysis focuses on 40 countries included in that dataset.<sup>1</sup> Because of problems with how Ireland’s output is reported, it is not included in the analysis or in EU-wide aggregate data.<sup>2</sup>

The 10 industries included in the Hamilton Index together accounted for more than \$10 trillion in global production in 2020 (figure 1). The information technology (IT) and information services industry (including software and Internet services) is the largest of the 10, accounting for 18 percent of global advanced industry output.

**Figure 1: Global output from industries included in the Hamilton Index, 2020 (\$10.1 trillion, total)**



The 10 industries' collective production represented 11.8 percent of the global economy in 2020, about the same as 25 years prior, having rebounded from a dip to 10.6 percent following the global financial crisis of 2008 that saw steeper declines in goods output than overall gross domestic product (GDP). (See figure 2.) However, the mix has changed, with the IT and information services share growing 34 percent since 2002. The fact that the overall share of the global economy comprising this advanced industry output has not changed underscores the zero-sum competition between nations. Indeed, there is a noticeable correlation between strength in these industries and nations' balance of trade. (See Appendix B: Advanced Industries' Relationship to National Trade Balances.) Nations are, or at least should be, competing intensively for a greater share of this fixed pie. China certainly is. For the United States, losing this race, either because policymakers are indifferent to the country's industrial structure or because they choose to focus on other economic or societal goals, would be catastrophic, as it would turn the United States into a deindustrialized, United Kingdom-like economy. Time is short. The 2020s are likely to be the decisive decade in which to turn around U.S. advanced industry fortunes, because once China gains sufficient global market share, allied and U.S. production risks being permanently weakened.

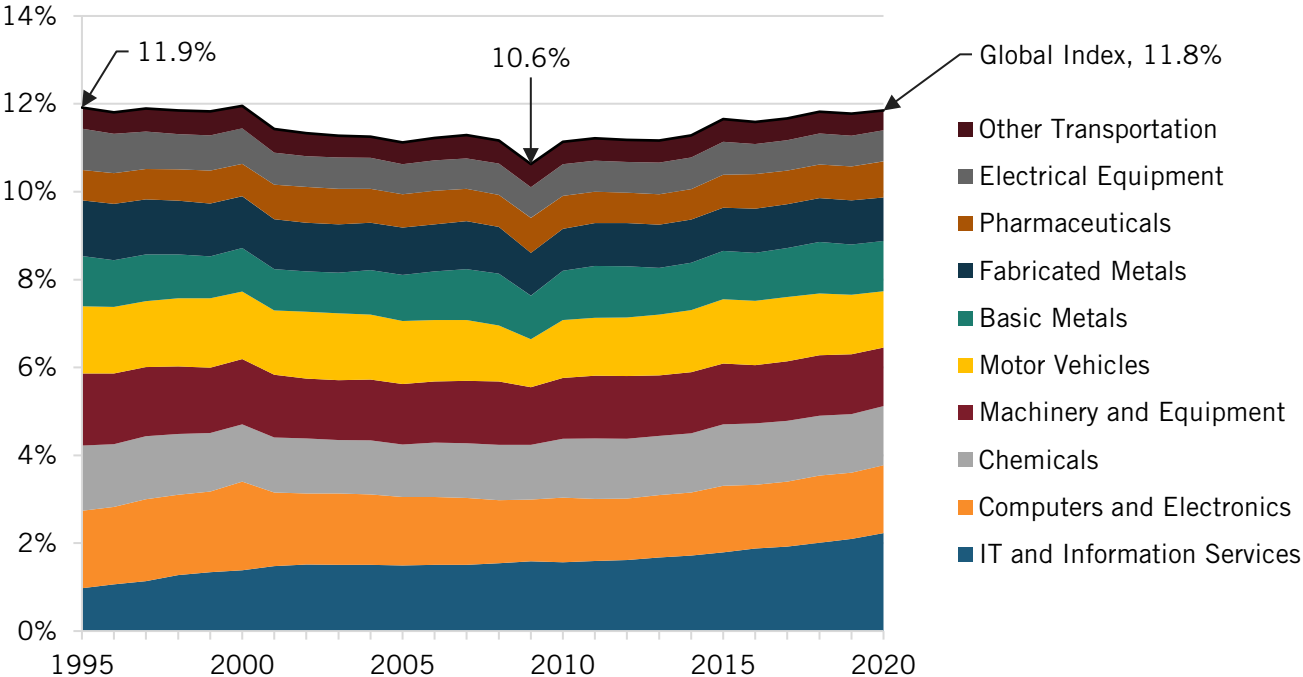
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**The fact that the overall share of the global economy comprising this advanced industry output has not changed underscores the zero-sum competition between nations.**

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In several reports, ITIF has laid out a comprehensive advanced industry strategy.<sup>3</sup> But notwithstanding the passage of the CHIPS Act, the political will in the United States to implement and fully fund such an agenda appears to be relatively low, especially as neither political party wants to address the massive budget deficit to free up needed funding for such a strategy.

**Figure 2: Hamilton industry shares of the global economy**



Of course, global market shares of the advanced industries cannot serve as the only metric of national competitiveness—or even the primary one—because nations have different-sized economies. To assess nations’ relative performance in strategically important industries, ITIF uses an analytical statistic known as a “location quotient” (LQ), which measures any region’s level of industrial specialization relative to a larger geographic unit—in this case, a nation relative to the rest of the world.

The LQ is calculated as an industry’s share of a country’s economy divided by the global industry’s share of the global economy, or as a country’s share of global output in an industry divided by the country’s overall share of the global economy. Either way, an LQ greater than 1 means the country’s share of global output in an industry is greater than the global average; and an LQ less than 1 means a country’s share is less than the global average. For example, the U.S. motor vehicle industry’s output in 2020 was 14.01 percent of global motor vehicle production, while the U.S. economy overall was 24.71 percent of the global economy. Thus, the U.S. LQ in the motor vehicles industry was 14.01 percent divided by 24.71 percent, or 0.57, meaning the United States significantly underperformed in the industry: Its output (and global market share) was just 57 percent of the level we would expect based on the size of the U.S. economy.

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**The 2020s are likely the decisive decade in which to turn around U.S. advanced industry fortunes, for once China gains sufficient global market share, allied and U.S. production risks being permanently weakened.**

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## OVERALL FINDINGS

### Specialization Rankings

Figure 3 ranks 40 countries by their relative performance (LQ) in the composite Hamilton Index based on the most recent data available from the OECD. Fourteen countries have LQs above average for the composite output of the 10 industries, with Taiwan ranking first at 2.1 (with almost all of that driven by its computer and semiconductor output). Three other East Asian nations—Korea, Singapore, China, and Japan ranked second, third, fifth and seventh, respectively. This in large part reflects the focused and dedicated advanced industry policies these nations have had in place for the last several decades. Engineering and chemical industry-intensive nations of Switzerland, Germany, Sweden, and Austria ranked fourth, sixth, ninth, and eleventh, respectively.

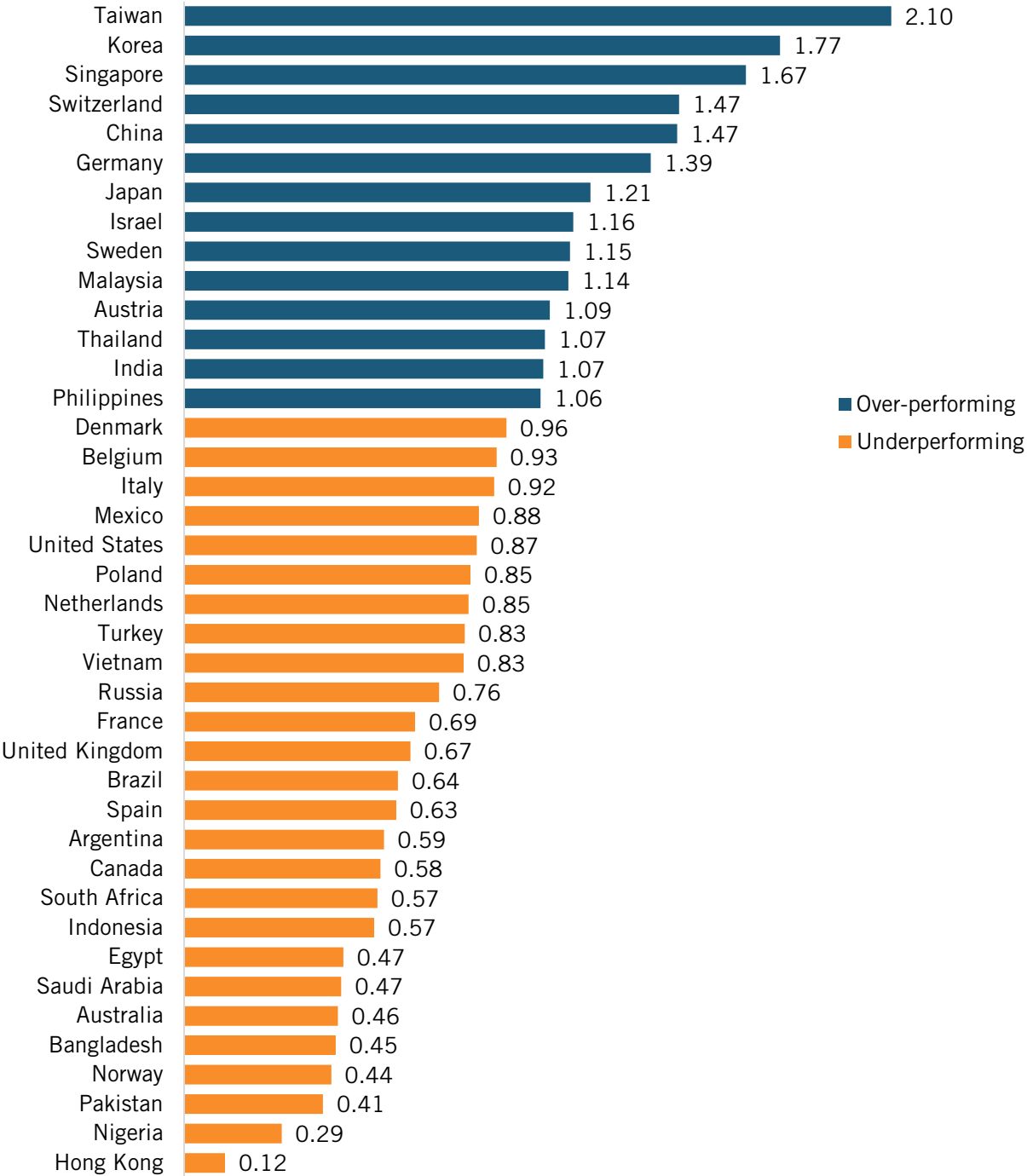
Several developing countries ranked low, with LQs below 0.5, including Egypt, Bangladesh, Pakistan, and Nigeria. In addition, natural resource-intensive nations such as Canada, Saudi Arabia, Australia, and Norway all ranked low.

The United States’ LQ was 0.87, meaning that as a share of U.S. GDP, these industries collectively are smaller than the global average. For the U.S. LQ to be 1.0, advanced industry output would need to expand by \$328 billion, or 15 percent. This would be equivalent to doubling America’s computer, electronics, and optical products industry output.

Some will argue that it’s acceptable or even normal for the U.S. LQ to be this low because it is a large economy and one where the share of GDP that is globally traded is below average. But LQ is not a measure related to trade; it’s a measure related to production. Moreover, there is a small,

positive correlation between national GDP and LQ (0.12), suggesting that the U.S. score should be above average, not below. The reality is America’s low LQ reflects failure, not success; weakness, not strength.

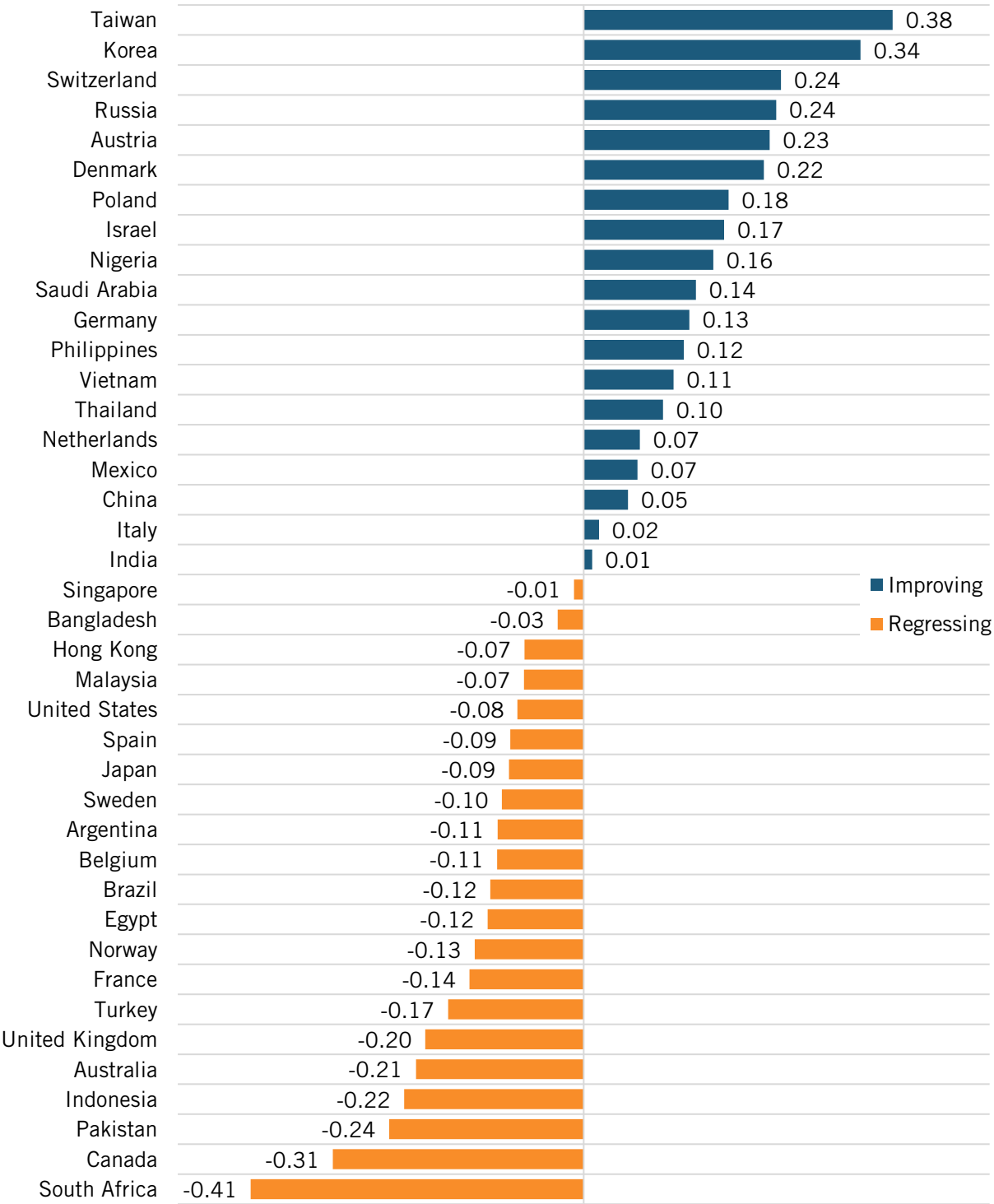
**Figure 3: Relative national performance in the composite Hamilton Index (2020 LQ)**



When it comes to relative change in LQ, the story is somewhat different. From 1995 to 2002, Taiwan and Korea led in LQ growth. (See figure 4.) Several European nations also increased

significantly, including Switzerland, Austria, Denmark, and Germany. Russia increased its score by almost 25 percentage points as it overthrew the straitjacket of Soviet communism and got out from under export controls that the Western Bloc established during the Cold War. The United States' LQ fell slightly by 8 percentage points.

**Figure 4: Change in relative national performance in the composite Hamilton Index (LQ difference, 1995–2020)**





Some industries are more concentrated than others. For example, the country that is most specialized in machinery and equipment production, Germany, had an LQ of 2.02, whereas Taiwan outperformed even more dramatically in computers and electronics with an LQ of 8.79. (See table 1.) Some of this is because leading specialists such as Taiwan, Switzerland, Singapore, Mexico, and Israel are relatively small, making it easier for an industry they specialize in to dominate their economy. But in other cases, it is because industries such as machinery, chemicals, and electrical equipment are much broader and have wider arrays of sub-industries.

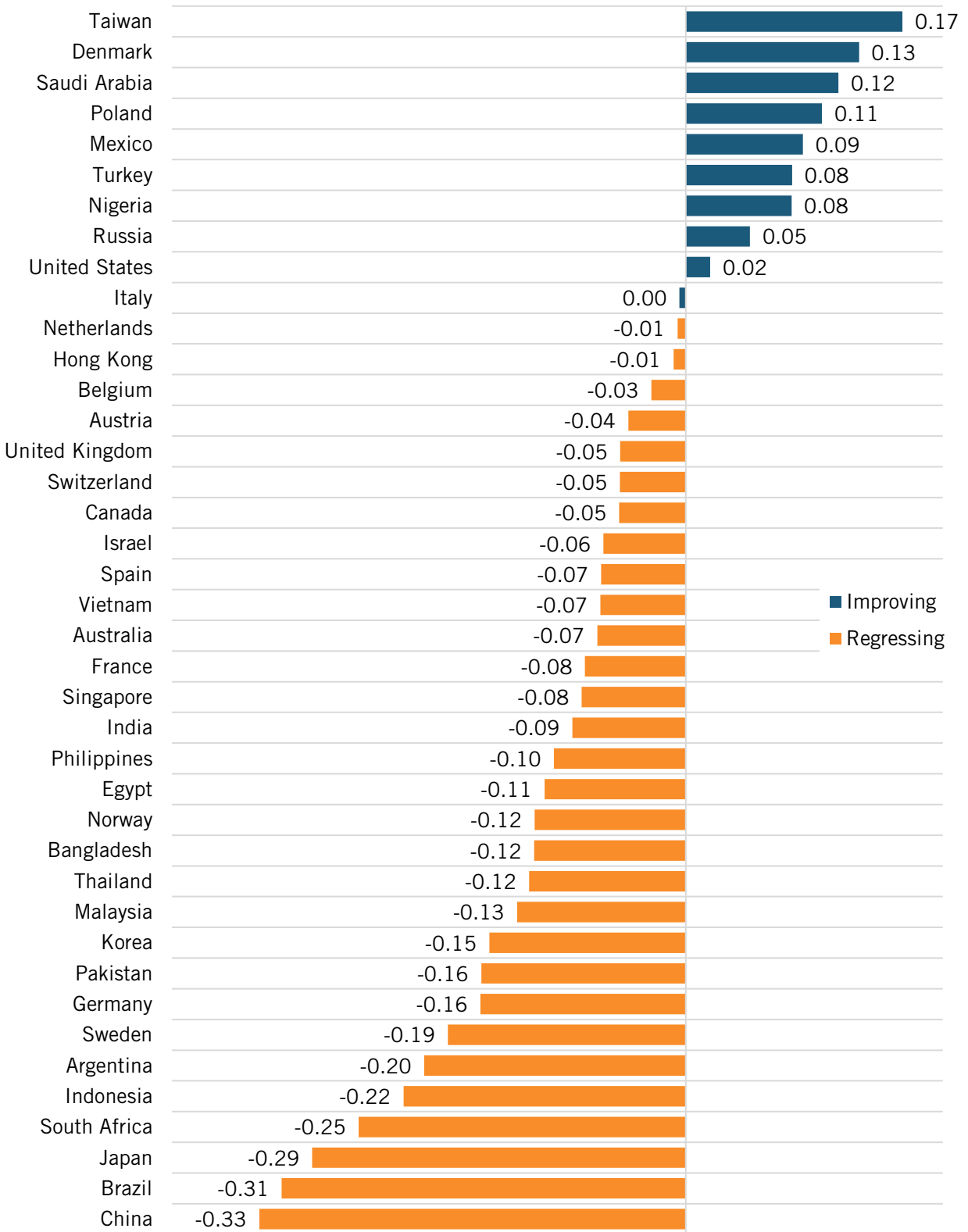
**Table 1: Hamilton Index industry leaders, 2020**

Industry	Global Output (Billions)	Leading Producer	Leader's Share	Relative Leader	Leader's LQ
IT and Information Services	\$1,900	USA	36.4%	Israel	2.89
Computers and Electronics	\$1,317	China	26.8%	Taiwan	8.79
Chemicals	\$1,146	China	29.1%	Saudi Arabia	2.41
Machinery and Equipment	\$1,135	China	32.0%	Germany	2.02
Motor Vehicles	\$1,093	China	24.3%	Mexico	3.14
Basic Metals	\$976	China	45.6%	China	2.64
Fabricated Metals	\$846	China	25.6%	Poland	2.12
Pharmaceuticals	\$696	USA	28.4%	Switzerland	7.26
Electrical Equipment	\$602	China	36.1%	Vietnam	2.36
Other Transportation	\$386	USA	34.5%	Singapore	3.52
<b>Composite Hamilton Index</b>	<b>\$10,097</b>	<b>China</b>	<b>25.3%</b>	<b>Taiwan</b>	<b>2.10</b>

Between 2008 and 2020, more countries have declined in their relative specialization, in part because of faster growth outside the 40 nations covered. Taiwan continued to specialize in advanced industries, almost exclusively because of its growth in computers and semiconductors (figure 5). Mexico grew by 9 percentage points, largely due to expansion of its automobile sector. The United States grew slightly, essentially treading waters since it was struck by the China shock of the 2000s. More importantly, rapid growth in the U.S. IT and information services sector more than offset continued decline in manufacturing. In this sense, strong performance in the IT services sector, including firms such as AWS, Google, and Meta, has masked a continued decline in advanced goods production.

Perhaps most surprising is that China ranked last, with its LQ peaking in 2009 and declining by 33 points by 2020. The reason was not necessarily an ineffectiveness of Chinese advanced industry policy, but rather its enormously fast economic growth, which would lead to lower LQs unless advanced industry grew as fast. In fact, China's advanced industry output grew by 177 percent from 2008 to 2020, more than double the U.S. growth of 78 percent. Only Bangladesh and Vietnam saw greater output growth than did China.

**Figure 5: Change in relative national performance in the composite Hamilton Index (LQ difference, 2008–2020)**



## Relative Momentum

LQs and change in LQs are useful indicators, but they don't consider differences in industry size. If a small industry's high LQ (or strong LQ) growth might be completely offset by a large industry with modest LQ. To account for this, ITIF has developed a momentum index. (See figure 6.) This is the sum of the 10 industries' value-added output divided by their GDP, after first multiplying each industry's 2020 output by its 2020 LQ and the percentage change in its LQ since 2008 (added to 1).

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**The U.S. momentum score since 2008 was slightly below the global average, with 53 percent of its score coming from IT and information services.**

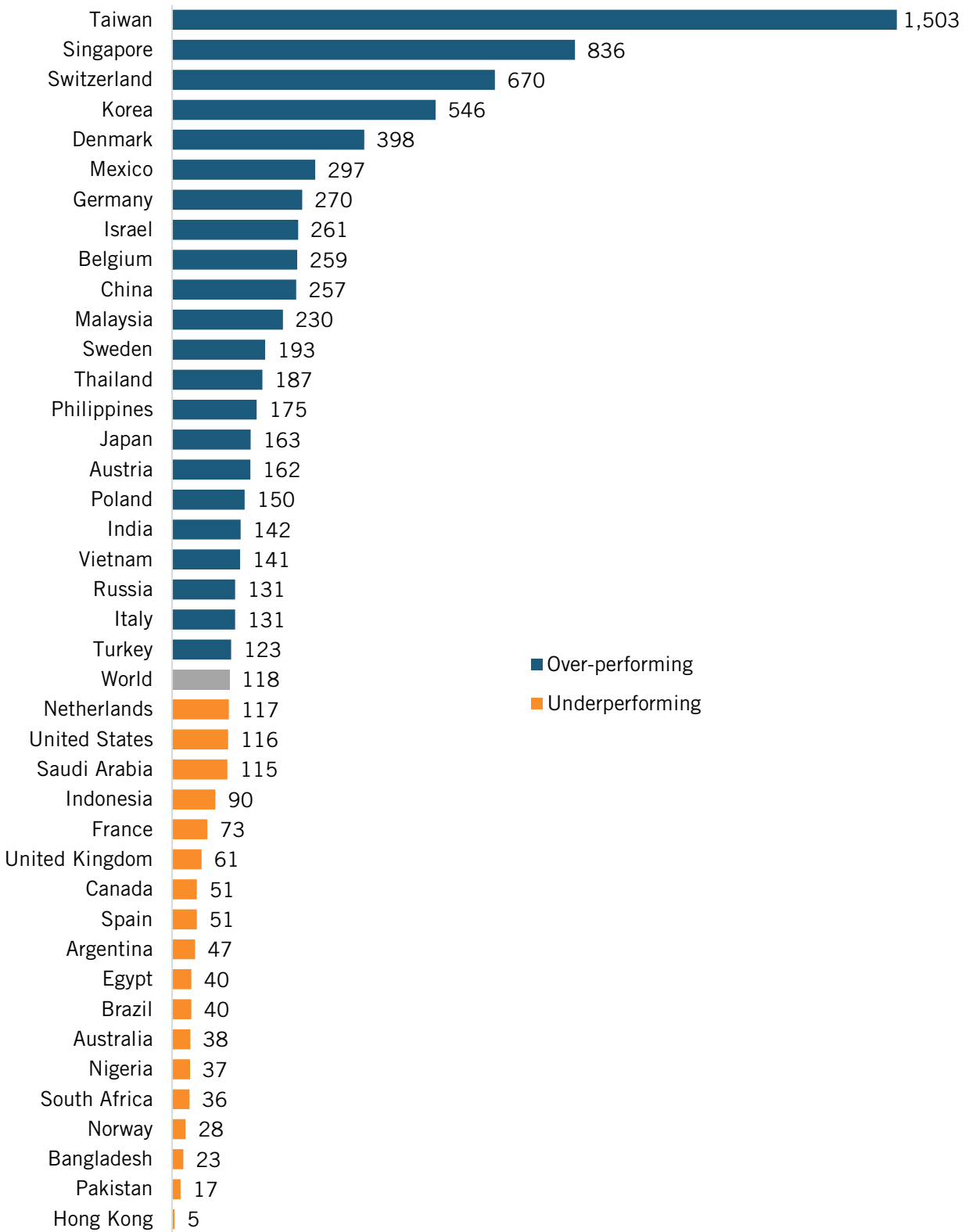
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The results are striking. Taiwan far exceeds any other nation, with an index of momentum of 1,503, almost double Singapore's score of 836 and more than double Korea's, with all three nations' strong scores due principally to computers and semiconductors. Switzerland ranked third, Denmark fifth, and Belgium ninth with over 70 percent of their momentum coming from the pharmaceutical sector. Almost all of Mexico's strong score was due to the motor vehicle sector, while 40 percent of Germany's score also came from this sector. Meanwhile, 75 percent of Israel's momentum came from IT and information services.

The U.S. momentum score from 2008 to 2020 was slightly below the global average, with 53 percent of its score coming from IT and information services. If this sector were the average size and growth, then it would only account for 29 percent of the U.S. momentum score, which would have fallen to just 79.

China's momentum score was more than twice that of the United States and was relatively diversified, with basic metals being its strongest industry, followed by machine equipment then computers and electronics.

**Figure 6: Index of momentum in all Hamilton industries from 2008 to 2020<sup>4</sup>**

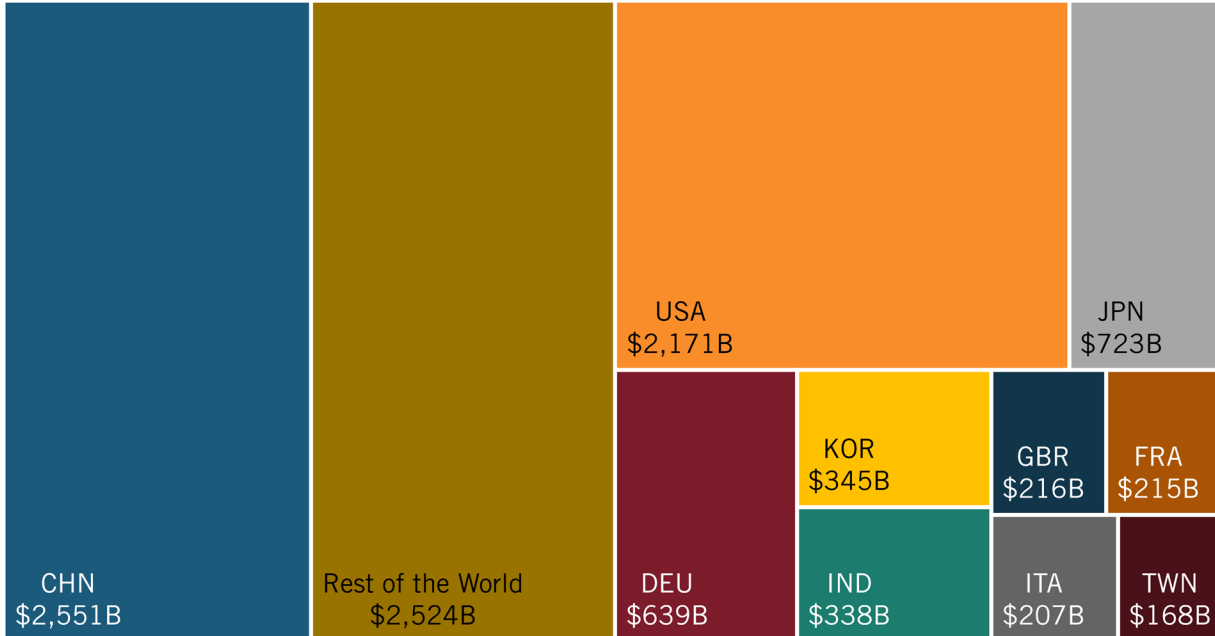


## Top 10 Producers

Hamilton industries together accounted for more than \$10 trillion in global production in 2020, with the top 10 countries accounting for 75 percent of the total. (See figure 7 and figure 8.)

China dominated, with one-quarter of global output. For the first time, its output surpassed that of the rest of the world outside the top 10 producers. The United States was third as of 2020 with 21 percent of output. While India exceeded China's workforce, its advanced industry output was just 13 percent of China's.

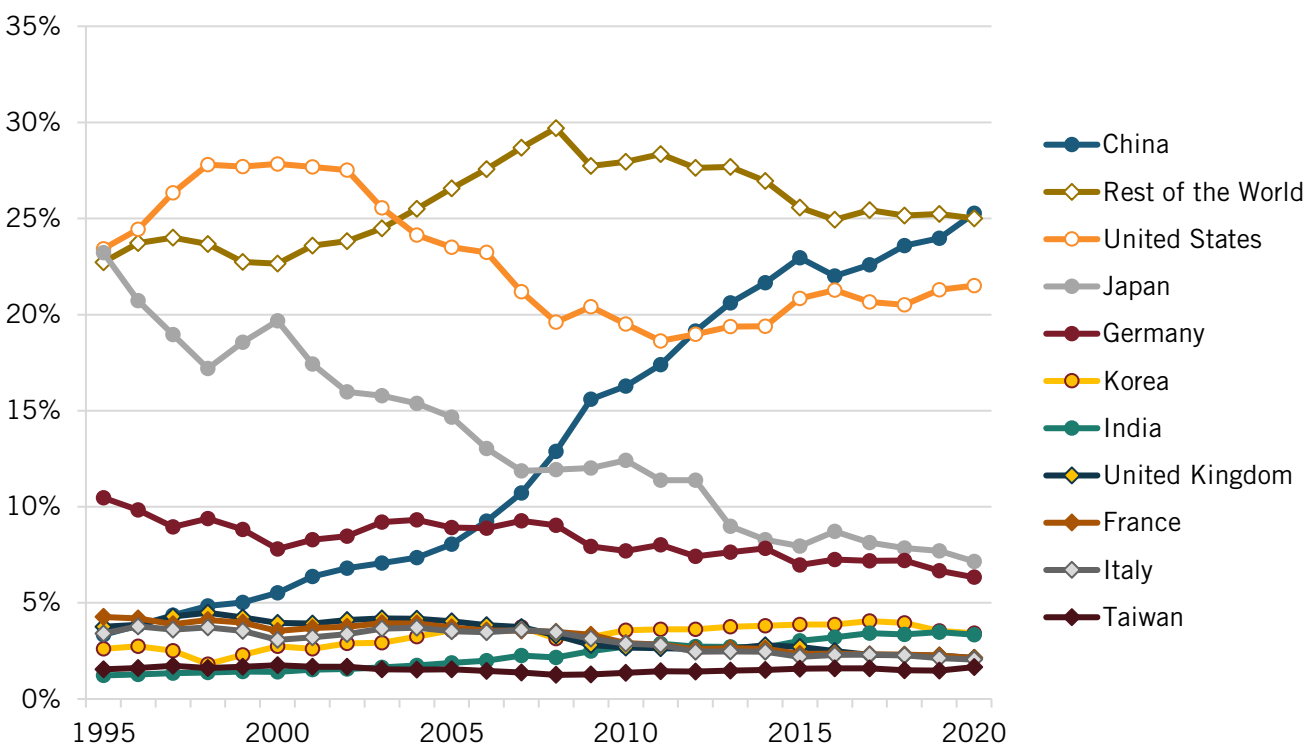
**Figure 7: Global output in Hamilton industries by the top 10 producers in 2020 (\$7.6 trillion out of \$10.1 trillion)**



From the early 2000s to 2019, the rest of the world's combined output comprised the largest global share, overtaking that position from the United States, which ranked first from 1995 to 2003. Then, following China's acceptance into the World Trade Organization (WTO), the U.S. share started to fall significantly until 2010. Since then, it has rebounded, but with the lion's share of that growth coming from the IT and information services industry.

Leaving IT and other information services out of the equation, the U.S. global share of Hamilton industries fell from around 24 percent in the last half of the 1990s to around 15 percent from 2010 to 2020. In contrast, China's growth skyrocketed after its WTO accession, from around 6 percent in 2001 to over 25 percent in 2020. In aggregate, China's growth matched almost all of Japan's decline. Previously, Japan had held about the same global market share as did the United States as of 1995, but its share had dropped to around 7 percent by 2020. Notwithstanding Germany's supposed strong performance (at least until recently), its share fell from around 10 percent in 1995 to just 6 percent in 2020.

**Figure 8: Top 10 producers' historical shares of global output in Hamilton industries**



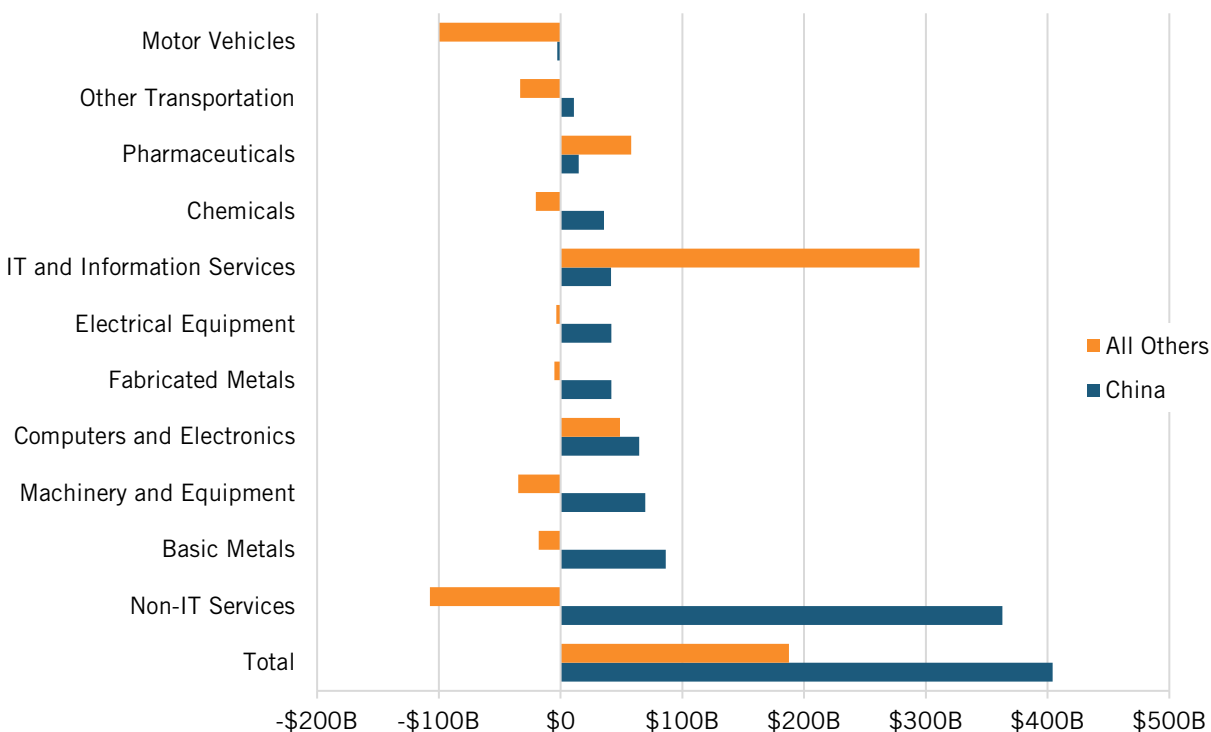
**Leaving out IT and other information services, U.S. global share fell from around 24 percent in the last half of the 1990s to around 15 percent from 2010 to 2020.**

### The China Juggernaut

As discussed, the amount of advanced industry output globally has been fairly stable as a share of GDP throughout the 25-year period covered in this analysis. As such, when some countries gained share, others lost. From 1995 to 2020, China's share of global advanced industry output increased 22 percentage points, from 3 percent to 25 percent. In the same period, OECD nations' share fell 27 percentage points, from 85 percent to 58 percent. In other words, China's growth came at the expense of the OECD.

More recently, from 2017 to 2020, Chinese output increased 17 percent, while the rest of world combined increased just 2 percent. Chinese output in Hamilton Index industries increased by \$404 billion in that period, compared with an increase of \$187 billion in the rest of world. (See figure 9.) However, when IT and other information services are exempted (an industry in which the United States and Europe are strong and China is weak), the picture is even starker. Chinese output grew \$363 billion while output in the rest of the world fell by \$107 billion. This difference was most profound in the machinery and equipment sector, other transportation, chemicals, and basic metals. The rest of world did outperform China in pharmaceuticals and IT and information services. But that might not last, as the Chinese government has targeted biopharmaceuticals and artificial intelligence as key industries for development.

**Figure 9: Nominal change in advanced industry output from 2017 to 2020, China vs. the rest of the world**



**When IT and other information services are exempted (an industry in which the United States and Europe are strong and China is weak), the picture is even starker. Chinese output grew \$363 billion while output in the rest of the world declined by \$107 billion.**

We can see this zero-sum competition play out in individual nations. ITIF identified the industries and countries where there was the most nominal decline in output from 2017 to 2020, not counting motor vehicles, which overall saw declines:

- In Austria and Switzerland, the biggest declines were in electrical equipment (declines of \$1.15 billion and \$115 million, respectively). During this period, China expanded its output by \$42 billion.
- The nations where the largest loss was in machinery and equipment were Germany (\$16.4 billion), Japan (\$14 billion), Italy (\$5.0 billion), Brazil (\$4.1 billion), Argentina (\$1.8 billion), Mexico (\$1.5 billion), and the United Kingdom (\$1.8 billion). China expanded its output by \$69.4 billion.
- In computers and electronics, Denmark's output fell \$80 million, Japan's fell \$6.5 billion, and Korea's fell \$18 billion. China's output increased by \$64.7 billion.
- In chemicals, Brazil's output fell \$8.7 billion, Canada \$900 million, Netherlands \$1.4 billion, Norway \$400 million, Pakistan \$600 million, Singapore \$5 billion, South Korea \$5.6 billion, Germany \$5.4 billion, and France \$3.8 billion. China's output increased \$35.5 billion.

- In basic metals, Japan’s output fell \$17.2 billion and Turkey’s \$5.3 billion, while China’s increased \$86.4 billion.
- In fabricated metals, Germany’s output fell by \$7.1 billion, South Korea’s output fell by \$4 billion, France’s by \$3.4 billion, and Spain and Sweden \$1.2 billion, while China’s increased \$41.8 billion.

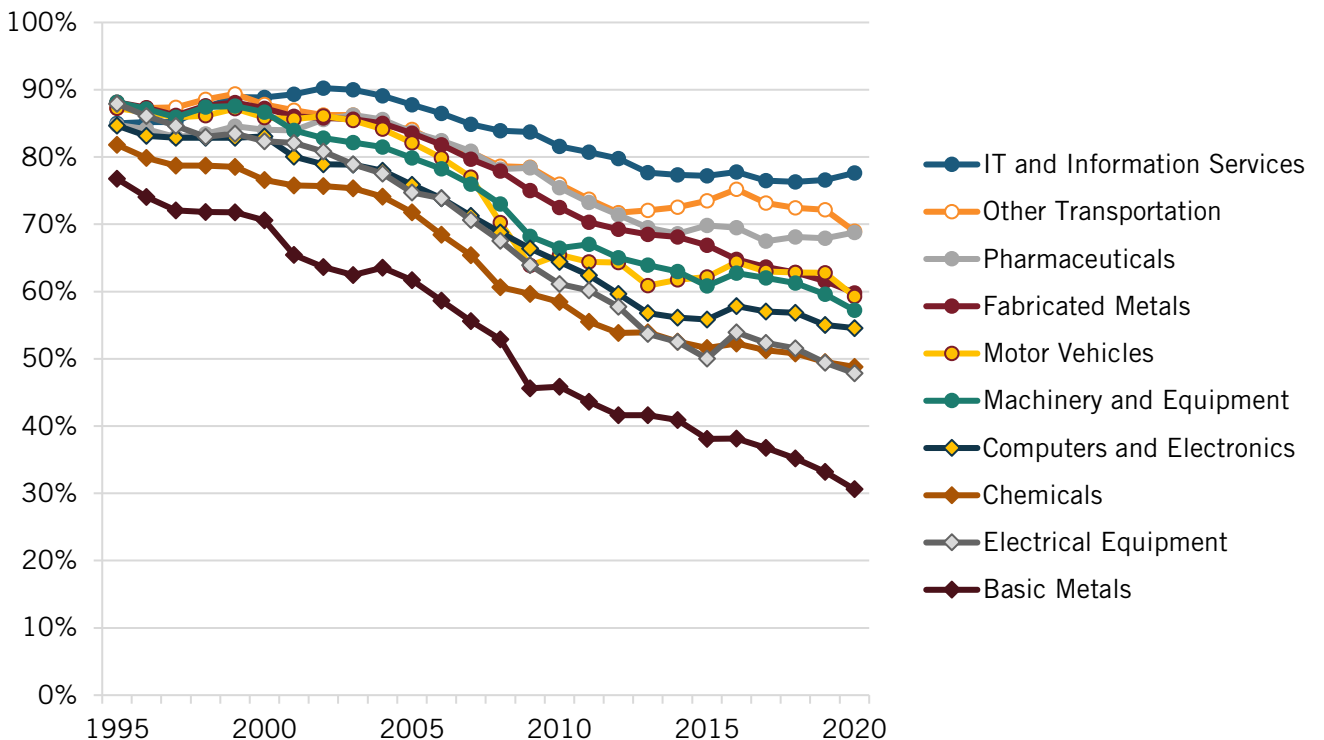
### Global Market Shares: China vs. the OECD and G7

Between 1995 and 2020, OECD nations’ global market share dropped by 26.8 percentage points across all Hamilton Index industries. (See figure 10.) Within the OECD, the slope was even more pronounced for the G7 nations that have led the global economy since World War II—their overall market share in Hamilton industries dropped by 27.9 percentage points. (See figure 11.) By contrast, China’s overall market share increased by 21.9 points. (See figure 12.) During this period, China’s gains were strongly correlated with U.S. losses (an R coefficient of -0.79).

The largest declines for the OECD came in basic metals, where the bloc’s market share dropped by 46.2 percentage points, and electrical equipment, which declined by 40.1 points. It was a similar story for the G7: Its largest declines were in electrical equipment (a decline of 41.5 points), followed by basic metals (a decline of 38.8 points). China was the big beneficiary in both cases: Its biggest increases in market share were in basic metals (a 39.5-point increase) and electrical equipment (32.4 points).

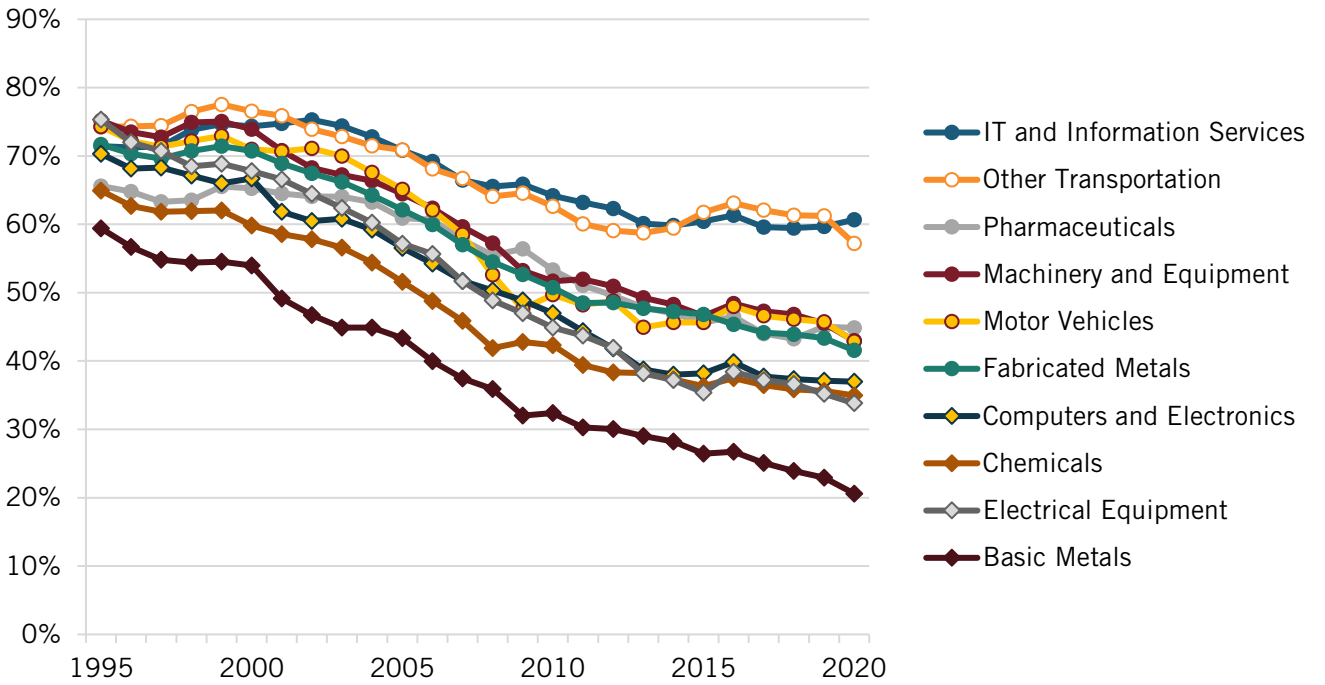
**The total Hamilton Index market share for the OECD declines by 26.8 percentage points. China, by contrast, increased its market share by 21.9 percentage points.**

**Figure 10: OECD global market shares in Hamilton Index industries**



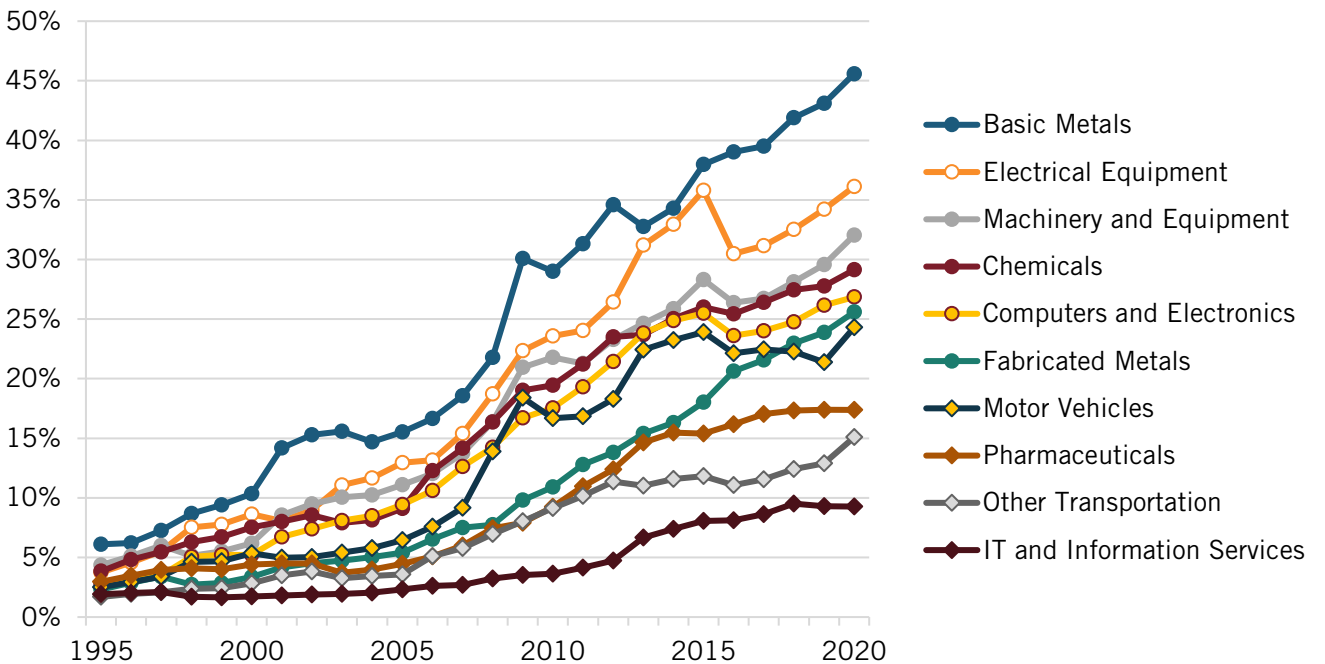


**Figure 11: G7 global market shares in Hamilton Index industries**



To match the advanced-industry share of China’s economy, U.S. output in Hamilton industries would need to expand by nearly \$1.5 trillion (69 percent). That would require doubling U.S. output in pharmaceuticals, electrical equipment, machinery and equipment, motor vehicles, other transportation, computers electrical and optical, chemicals, basic metals, and fabricated metals.

**Figure 12: China global market shares in Hamilton Index industries**



It would be one thing if the growth of China’s advanced industries were proportional to the growth of its overall economy. But it hasn’t been. China has made a strategic decision to outperform in these industries, and it has succeeded in relative terms too: It produced 47 percent more than the global average in 2020, while the United States produced 13 percent less than average.

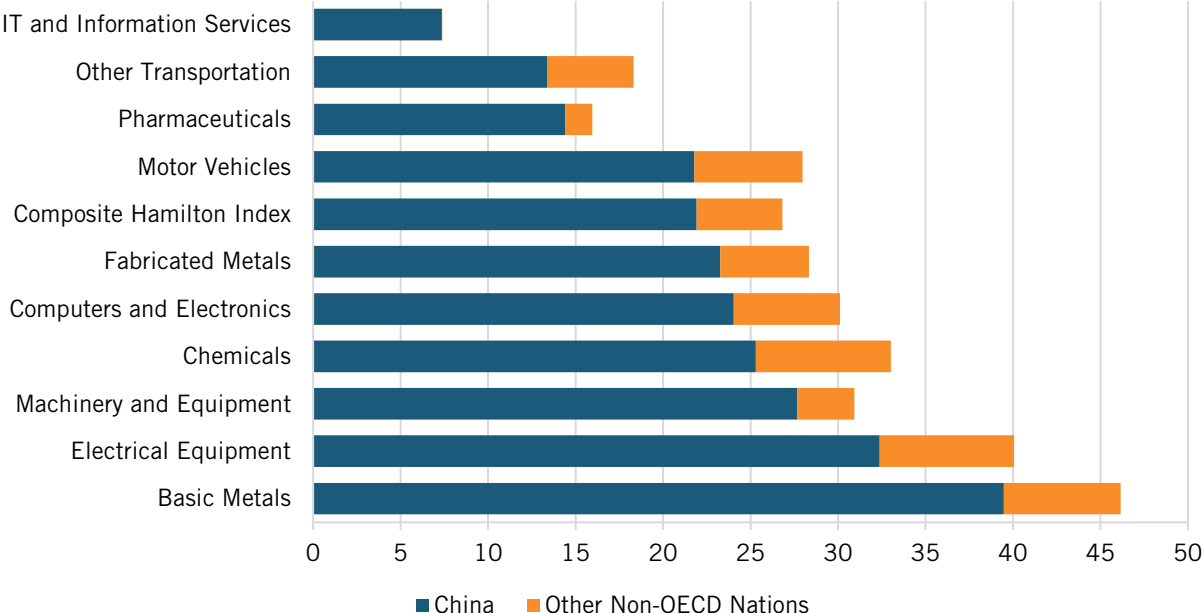
To appreciate the enormity of that gap, consider that to match the advanced-industry share of China’s economy, U.S. output in these industries would need to expand by nearly \$1.5 trillion (69 percent). This would require doubling U.S. output in pharmaceuticals, electrical equipment, machinery and equipment, motor vehicles, other transportation, computers electrical and optical, chemicals, basic metals, and fabricated metals.

**China’s Role in the Growth of Non-OECD Global Market Shares**

Between 1995 and 2020, global production across all Hamilton Index industries shifted to non-OECD nations: Their global market share increased by 26.8 percentage points. But the real story was the extent to which China drove that gain. Industry by industry, it was China’s growth that propelled the lion’s share of the non-OECD bloc’s progress. (See figure 13.)

The largest of those increases occurred in traditional industries such as basic metals (where the block realized a 46.2 percentage point increase in its market share) and chemicals (a 33 percentage-point increase). But thanks to China, the non-OECD bloc also captured substantial increases in market shares in more advanced industries such as computers and electronics (a gain of 30.1 percentage points) and motor vehicles (28 percentage points). But the reality is China’s gain has come at the expense of most of the developing world. Before the Chinese government decided it wanted to dominate manufacturing—especially advanced industries—many developing nations, in part because of favorable labor costs, were growing their manufacturing. Since China’s rise, that growth has slowed and, in some cases, stagnated.

**Figure 13: Non-OECD change in global market shares (percentage point difference, 1995–2020)**



## INDUSTRY PROFILES

### IT and Information Services

The IT and information services sector comprises an array of IT services industries, including software, cloud computing, Internet services (e.g., search, social media), and database services. It is a strategically important sector because much of it is high wage, traded across borders, and a key driver of innovation.

Globally, the sector grew rapidly, 508 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP. Indeed, the industry grew to be the largest advanced-technology industry in the world. Despite the importance of IT services throughout the globe, about 78 percent of the sector's output was concentrated in OECD countries in 2020, although that was down from 85 percent in 1995.

Not surprisingly, given the global leadership position of companies such as AWS, Meta, Google, and Microsoft, the United States led the world in 2020 with 36.4 percent of IT and information services production, up significantly from 26.6 percent in 1995. The next highest-ranking nations were China (9.3 percent, up from 1.9), Japan (6.1 percent, down from 17.2), Germany (6 percent, down from 7.2), and India (4.7 percent, up from 2.8). Notwithstanding the narrative that the EU is lagging far behind in this industry, its global share (not counting Ireland) is a solid 25.3 percent.

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Countries that saw the most growth in their global share of the industry from 1995 to 2020 were the United States (up 9.9 percentage points), China (up 7.4 percentage points), and India (up 2 percentage points). As a group, the EU 10 nations (e.g., Eastern European nations) started from a small share but saw dramatic increase in percentage growth (340 percent), largely because of their relatively highly skilled IT workforces and modest wage levels, making them a source of globally outsourced IT labor. More recently from 2015 to 2020, the United States experienced the most growth in global share (up 2.8 percentage points), with China up 1.2 percentage points.

Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 11.1 percentage points), followed by France (down 5.1 percentage points). From 2015 to 2020, the United Kingdom saw the biggest loss of global market share, down 1.4 percentage points.

## Top 10 Producers

Figure 14: Global output in IT and related services by the top 10 producers in 2020 (\$1.5 out of \$1.9 trillion)

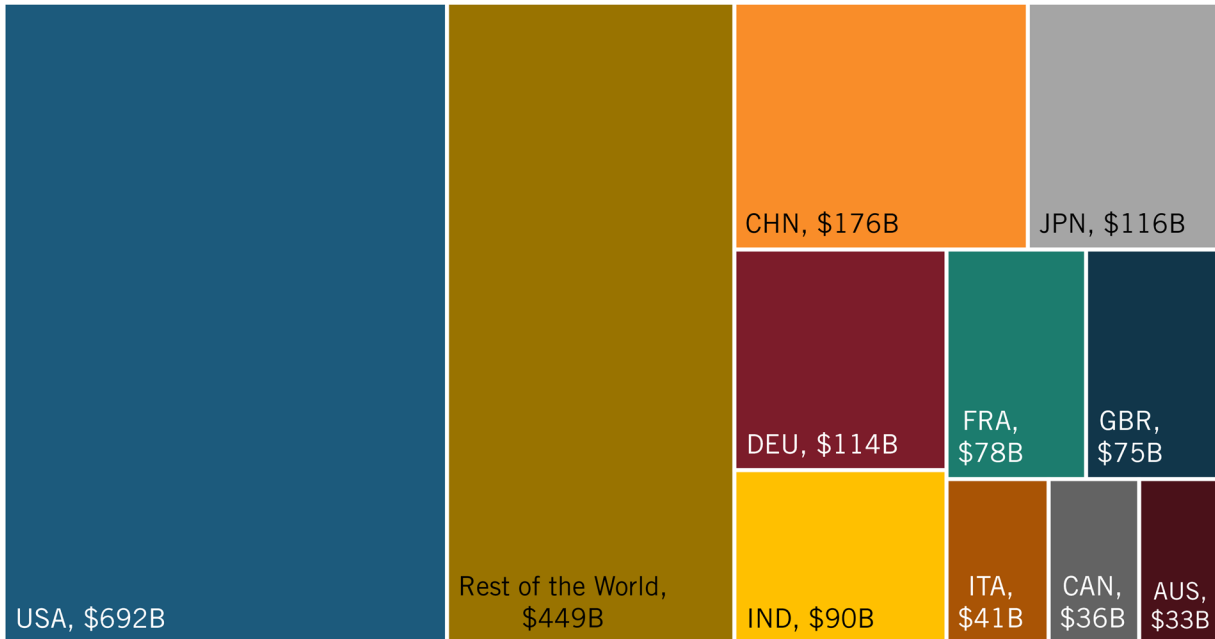
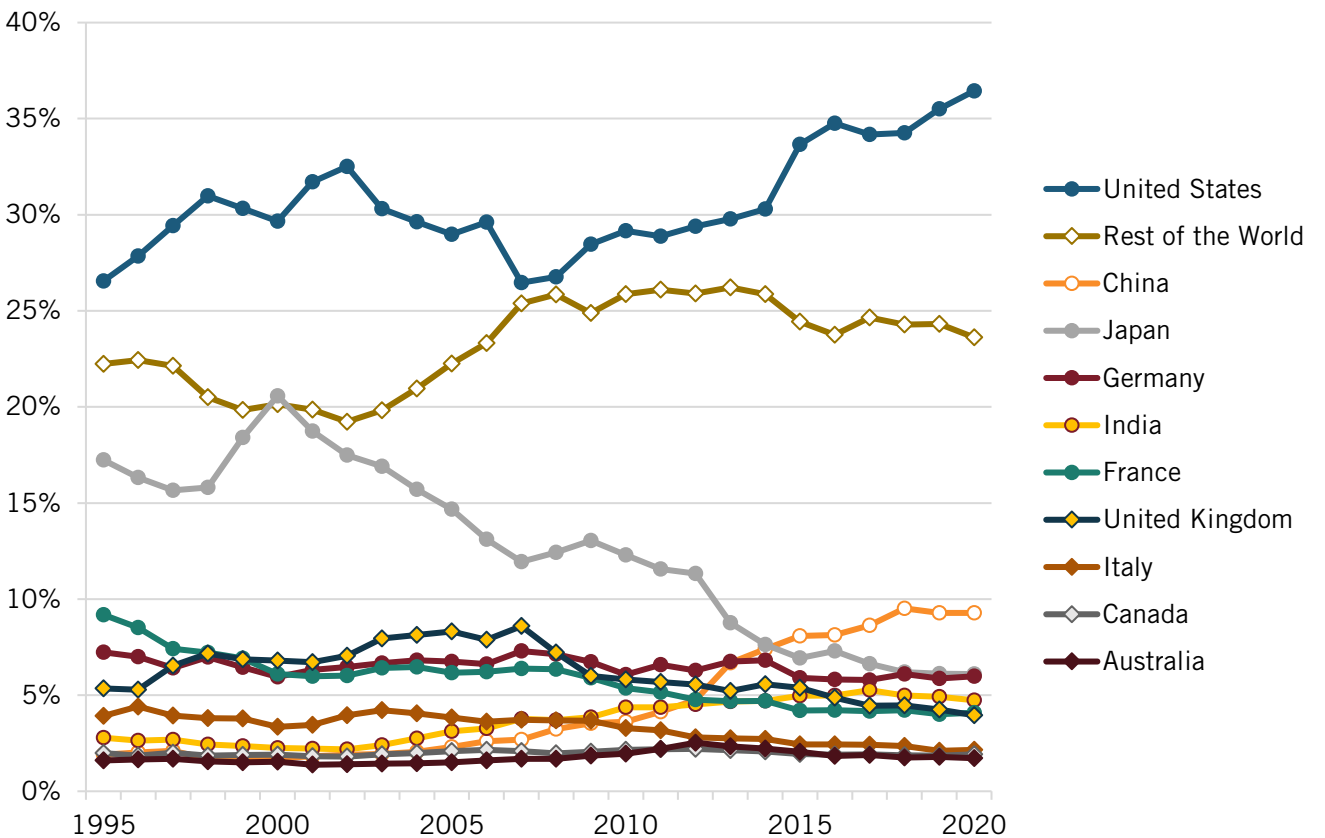


Figure 15: Top 10 producers' historical shares of global output in IT and information services



The picture is similar in some regards when it comes to industrial specialization. The nation with the highest LQ in 2020 was Israel (2.89). Reflecting a top talent pool, plus spinoffs from its defense force, Israel has a significant number of domestic IT services firms. Also among the high-ranking nations were Sweden (LQ of 2.02), India (1.51), the United States (1.47), the Netherlands (1.46), France (1.32), and Germany (1.31). Notwithstanding the EU's complaints about falling behind America in this industry—and its embrace of digital protectionism under the guise of attaining “digital sovereignty”—its LQ of 1.22 is just 0.25 points below the U.S. LQ. Lagging nations were all developing countries. Egypt, Thailand, Indonesia, Vietnam, Saudi Arabia, and Mexico all had LQs under 0.2.

Notwithstanding China's relatively sizeable share of the global market for IT and information services, its LQ was quite low, at 0.54. In fact, of all the industries examined in this report, this is the sector where China is weakest. That is because while China has real strengths in hardware and engineering, it is relatively weak in software, systems integration, and business services. That said, China does have its own national digital champions, such as Baidu and Tencent.

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**Of all the industries ITIF examined, this is the sector where China is weakest.**

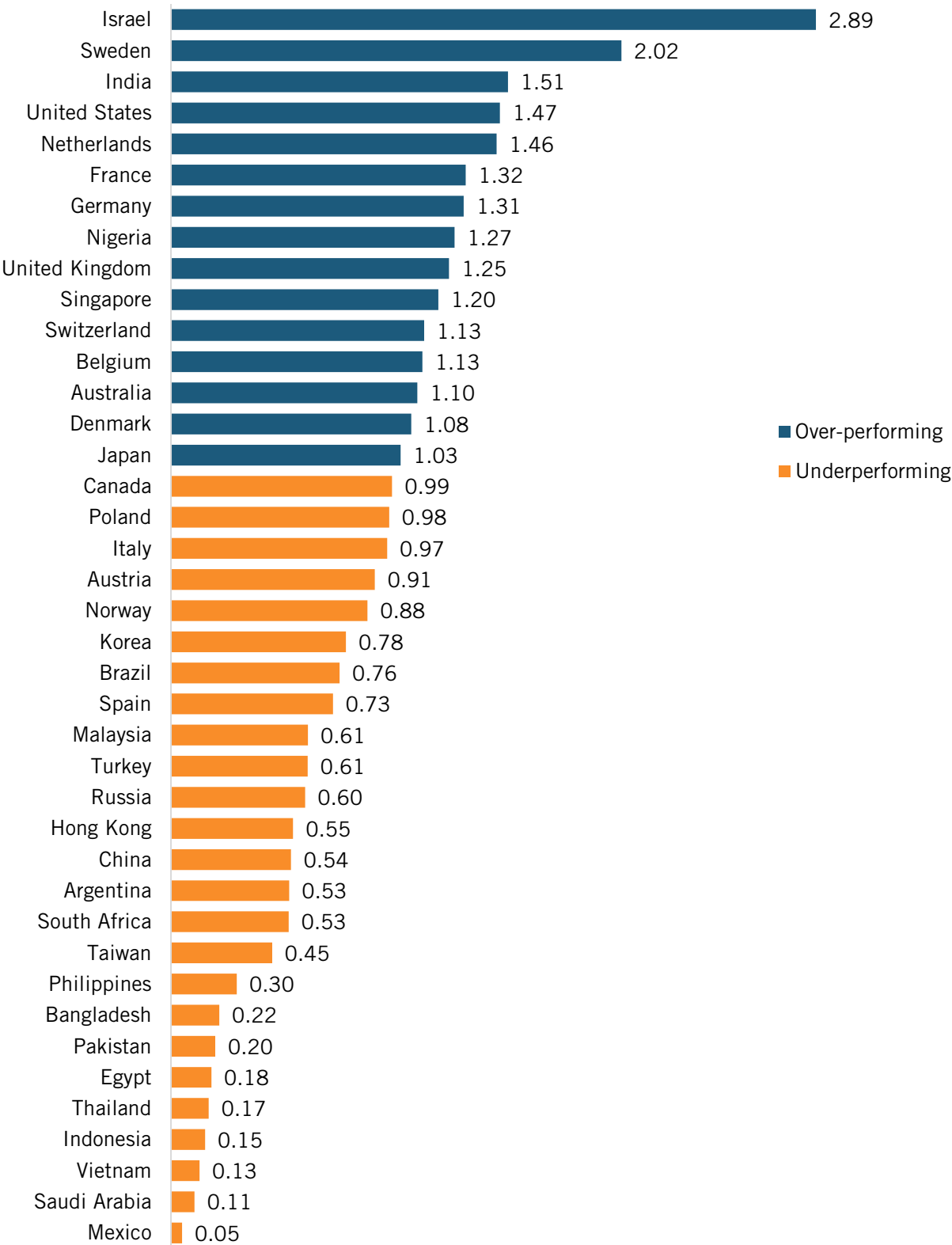
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In the wake of the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Poland (+42 percentage points), the United States (+31), Singapore (+29), Russia (+24), Turkey (+22) and Canada (+18). Overall, OECD nations grew their average LQ by 6 percentage points. Notable among those that lost ground were Japan (-53 percentage points), India (-47), the United Kingdom (-33), and South Africa (-27). One reason for Japan's decline is it was very slow to recognize and respond to the shift to an Internet-driven IT sector. India's decline is surprising given its specialization as a global IT offshoring hub. But while its overall IT services output increased significantly, the country's GDP grew even faster.

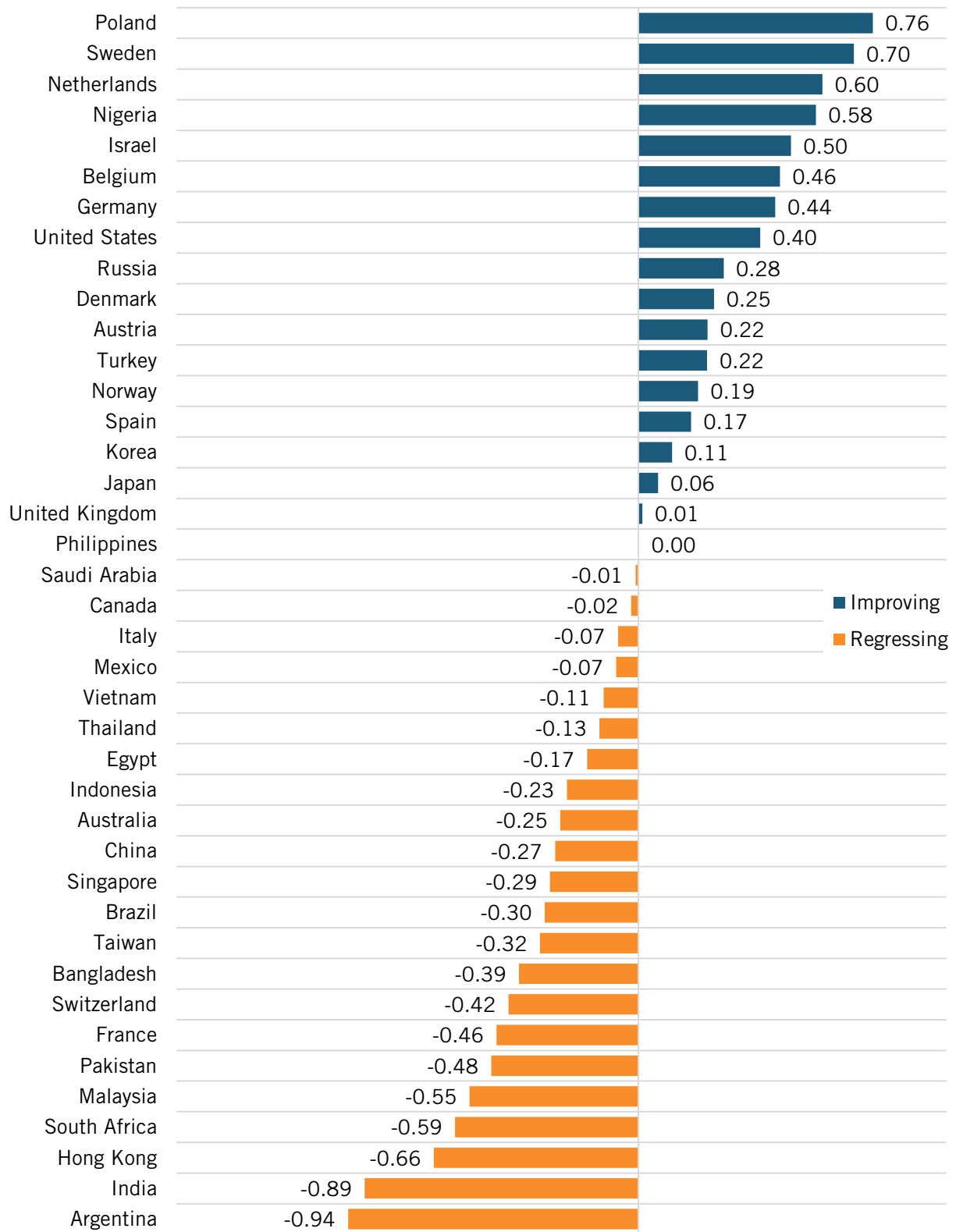
Finally, from a geopolitical perspective, the Quad nations (Australia, India, Japan, and the United States) far surpass China and the Belt & Road nations in their levels of industrial specialization in IT and information services. The former group's LQ averaged 1.39 in 2020, up 10 percentage points from 2008. The latter group's was just 0.61 in 2020, up only 1 percentage point from 2008.

# Specialization Rankings

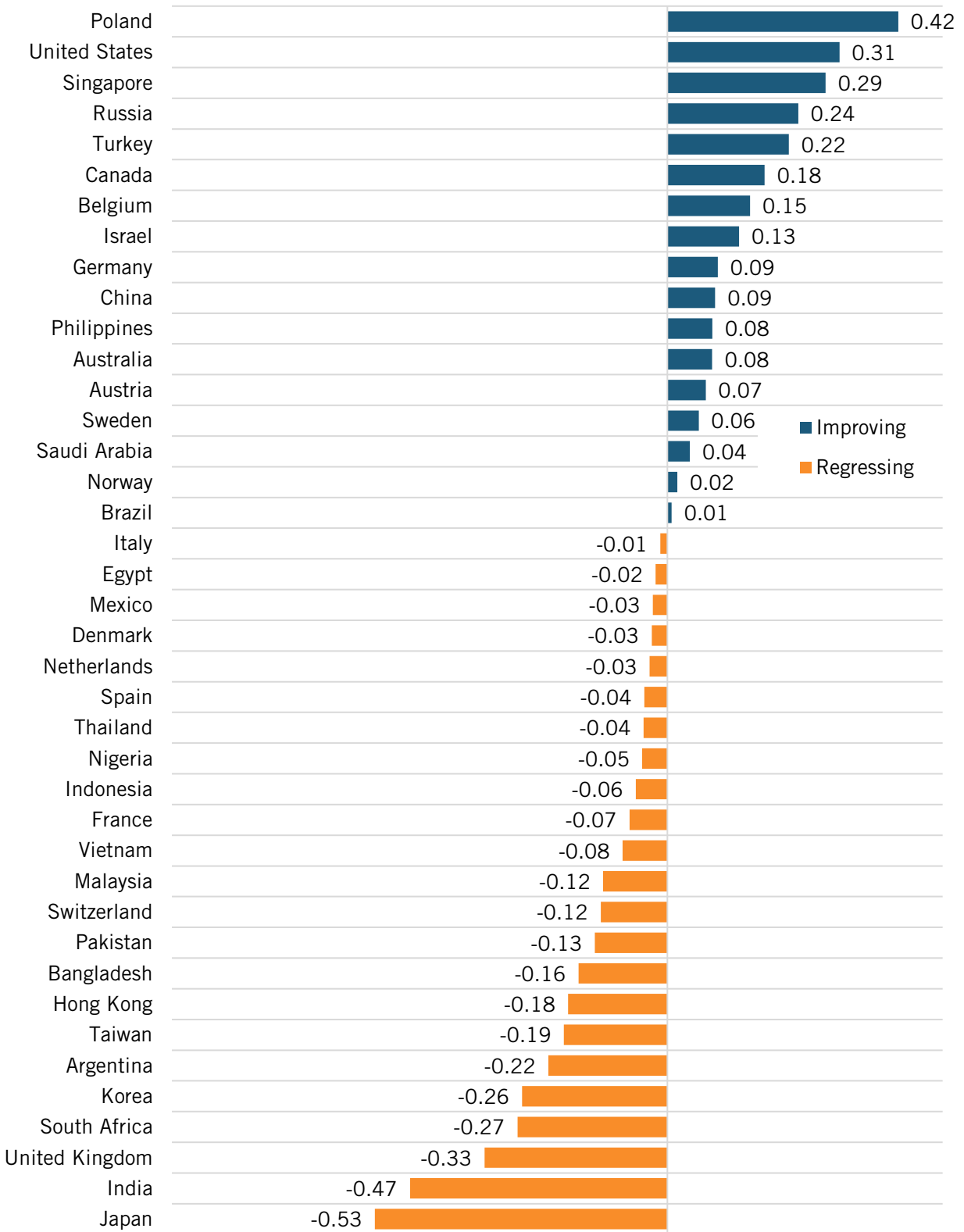
**Figure 16: Relative performance in IT and information services (2020 LQ)**



**Figure 17: Net change in relative performance in IT and related services, 1995–2020 (LQ difference)**



**Figure 18: Net change in relative performance in IT and related services, 2008–2020 (LQ difference)**





### Computers, Electronics and Optical Products

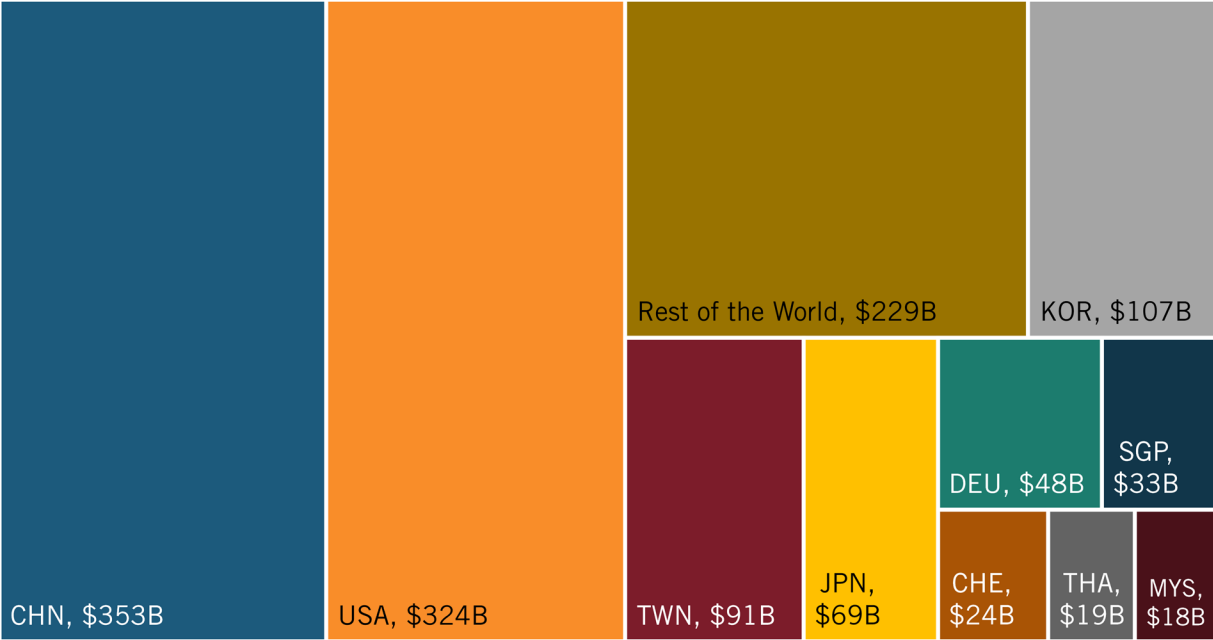
This is the computer hardware industry including semiconductors. As such, it’s an industry now fiercely competed over internationally.

The sector grew 141 percent from 1995 to 2020 in nominal U.S. dollars, but slower than the 174 percent for global GDP. It is a sector that has seen much faster growth in developing nations (especially China), with just 55 percent of the sector’s output in OECD countries in 2020, down from 85 percent in 1995.

China led the world in 2020 with 26.9 percent of production; significantly up from 2.8 percent in 1995. China now surpasses the U.S. share (24.6 percent, down from 29.1). The next highest-ranking nations were South Korea (8.2 percent, up from 4.1), Taiwan (6.9 percent, up from 5.1 percent), and Japan (5.2 percent, down significantly from 26.6 percent). The Quad lost significant market share in this industry, largely driven by the U.S.’s and Japan’s losses. Its global share is 30.9 percent, down from 56.3 percent. The EU has also lost significant market share, concentrated mainly in the EU-17 (excluding the EU-10 that joined in 2004). Its global share is 8.9 percent, down from 18.4 percent.

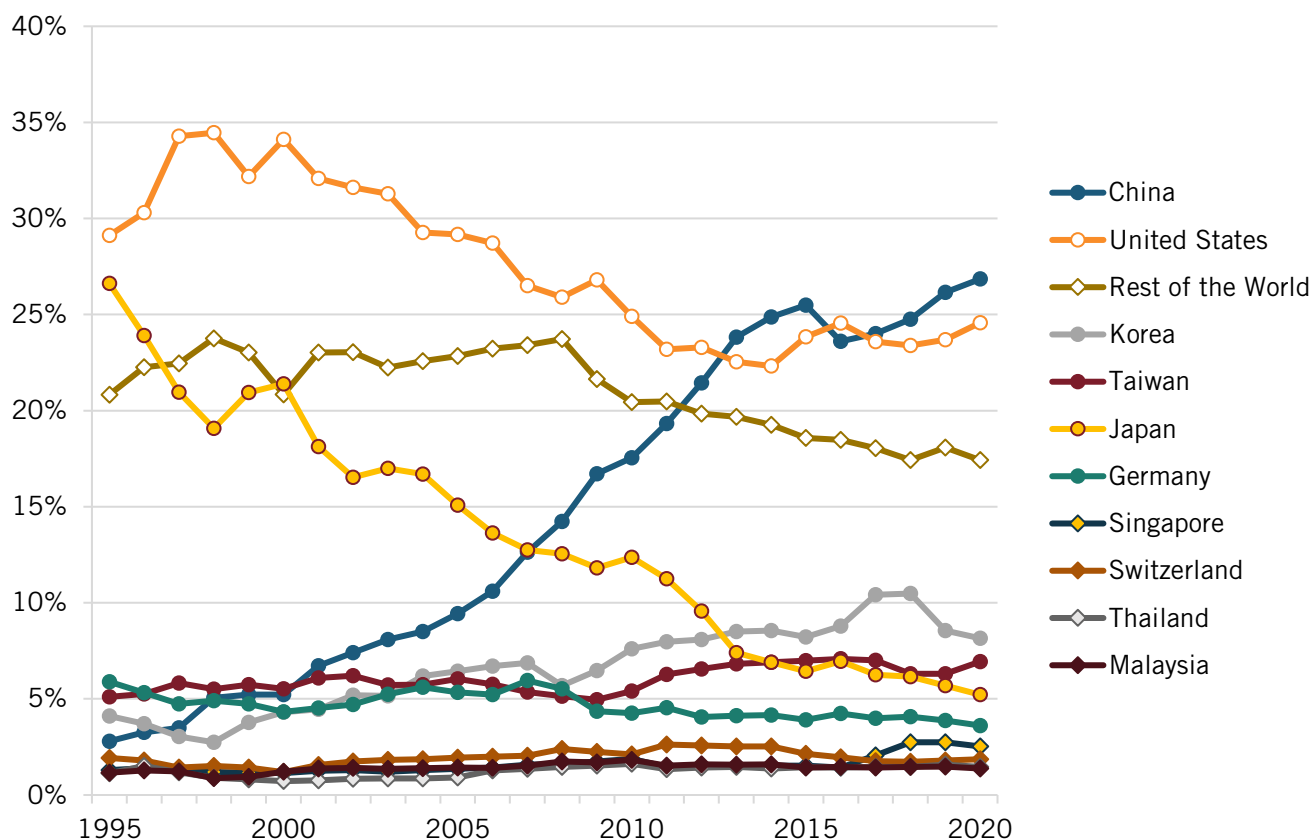
#### Top 10 Producers

**Figure 19: Global output in computers and electronics by the top 10 producers in 2020 (\$1.1 out of \$1.3 trillion)**



**China led the world in 2020 with 26.9 percent of production; up from 2.8 percent in 1995.**

**Figure 20: Top 10 producers' historical shares of global output in computers and electronics**



Countries that saw the most growth in their global share from 1995 to 2020 were China (up 24.1 percentage points), South Korea (up 4.1 percentage points), Taiwan (up 1.8 percentage points), and Singapore (up 1.2 percentage points). As a group, the Belt & Road nations started from a small share but tripled their share (209 percent), largely because of China’s growth. More recently from 2015 to 2020, China experienced the most growth in global share (up 1.4 percentage points), with Singapore up 1 percentage point.

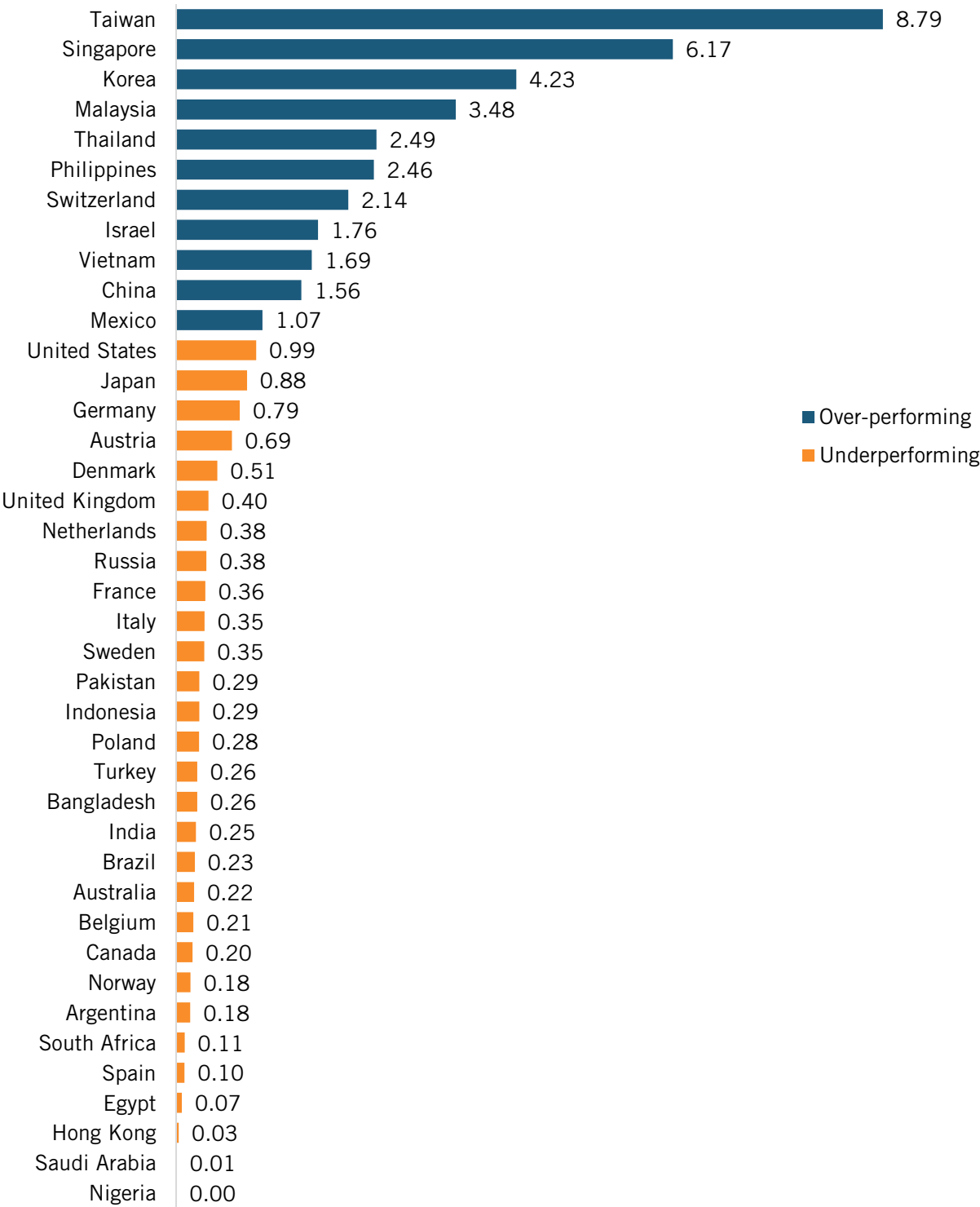
Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 21.4 percentage points). It is easy to remember in the early 1990s when Japan looked to be a powerhouse in computers and electronics. But a slowing economy, coupled with mistakes by leading Japanese firms, led to significant decline.

As a group, the OECD (down 30.1 percentage points) and the Quad (down 25.4 percentage points) lost significant shares. By contrast, the Belt & Road countries gained a significant share (up 31.4 percentage points).

The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was Taiwan, with an LQ of 8.79. Other high-ranking countries were Singapore (6.17), South Korea (4.23), and Malaysia (3.48). By contrast, the United States had an LQ of 0.99 in 2020, down from 1.18 in 1995. By contrast, China had an LQ of 1.56 in 2020, up from 1.18 in 1995. Other nations with a relatively high LQ include Thailand (2.49), the Philippines (2.46), Switzerland (2.14), and Israel (1.76).

## Specialization Rankings

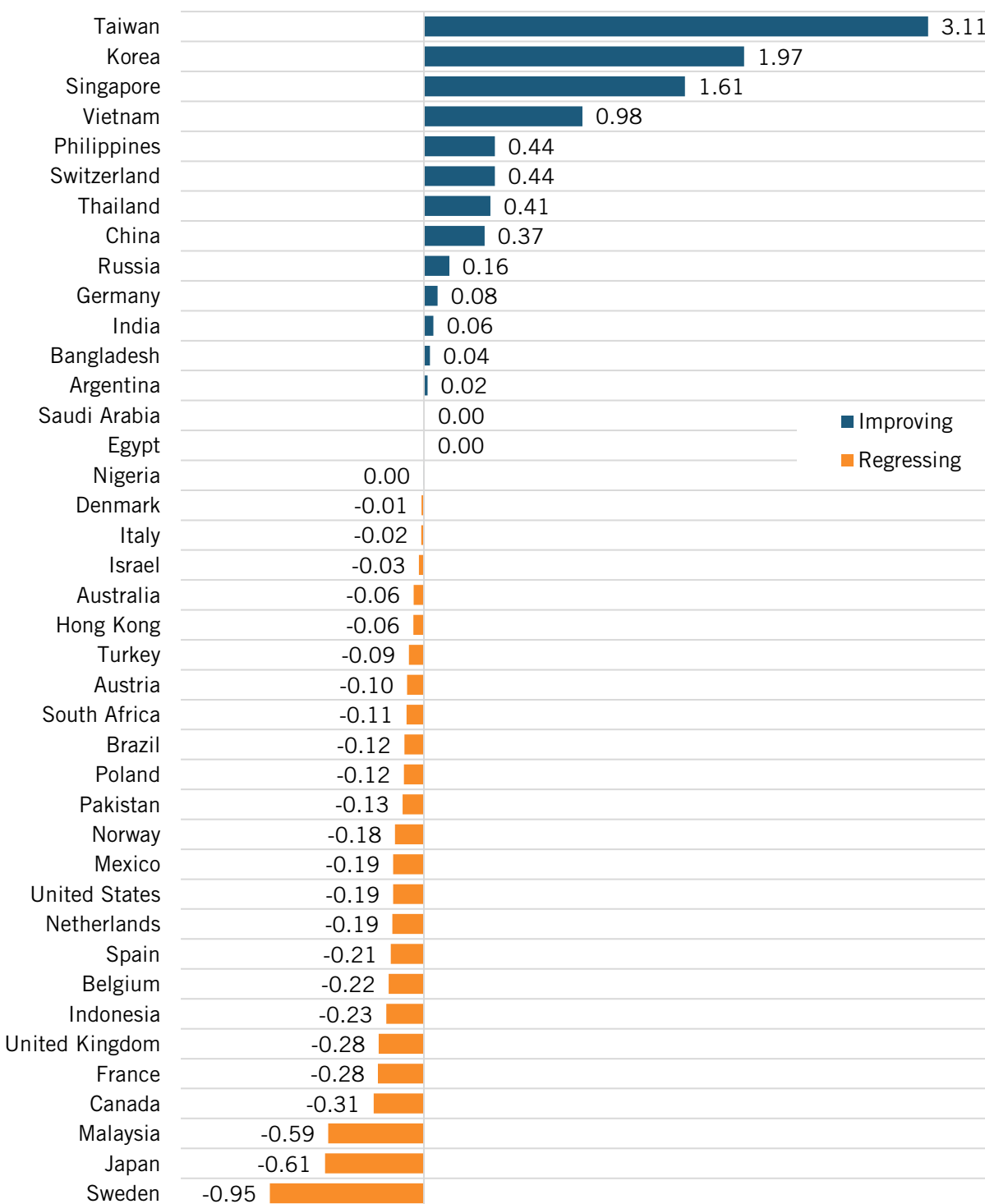
**Figure 21: Relative performance in computers and electronics (2020 LQ)**



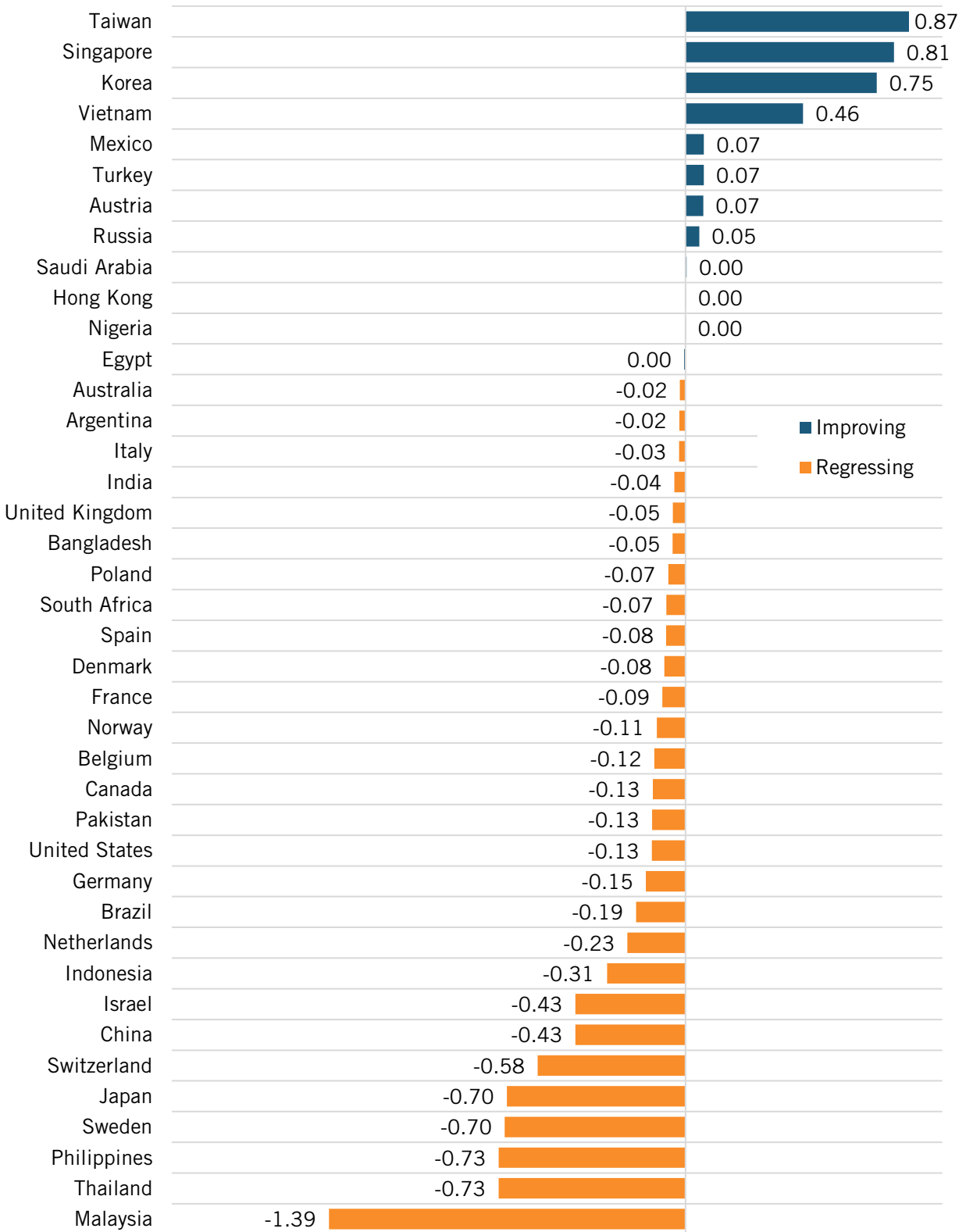
Since the global financial crisis, the nations with the fastest percentage point growth were Taiwan (+87 percentage points), Singapore (+81 percentage points), South Korea (+75

percentage points), and Vietnam (+46 percentage points). Overall, OECD nations saw a decline in their average LQ by 7 percentage points. Notable among those that lost ground were Malaysia (-139 percentage points), Thailand (-73 percentage points), the Philippines (-73 percentage points), Sweden (-70 percentage points), and Japan (-70 percentage points).

**Figure 22: Net change in relative performance in computers and electronics, 1995–2020 (LQ difference)**



**Figure 23: Net change in relative performance in computers and electronics, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the China and the Belt & Road nations surpassed the Quad and the EU in their levels of industrial specialization in computers and electronics. The former group’s LQ averaged 1.31 in 2020, up 15 percentage points since 2008. However, the latter groups’ LQs had declined to 0.87 and 0.47, respectively.

**Chemicals**

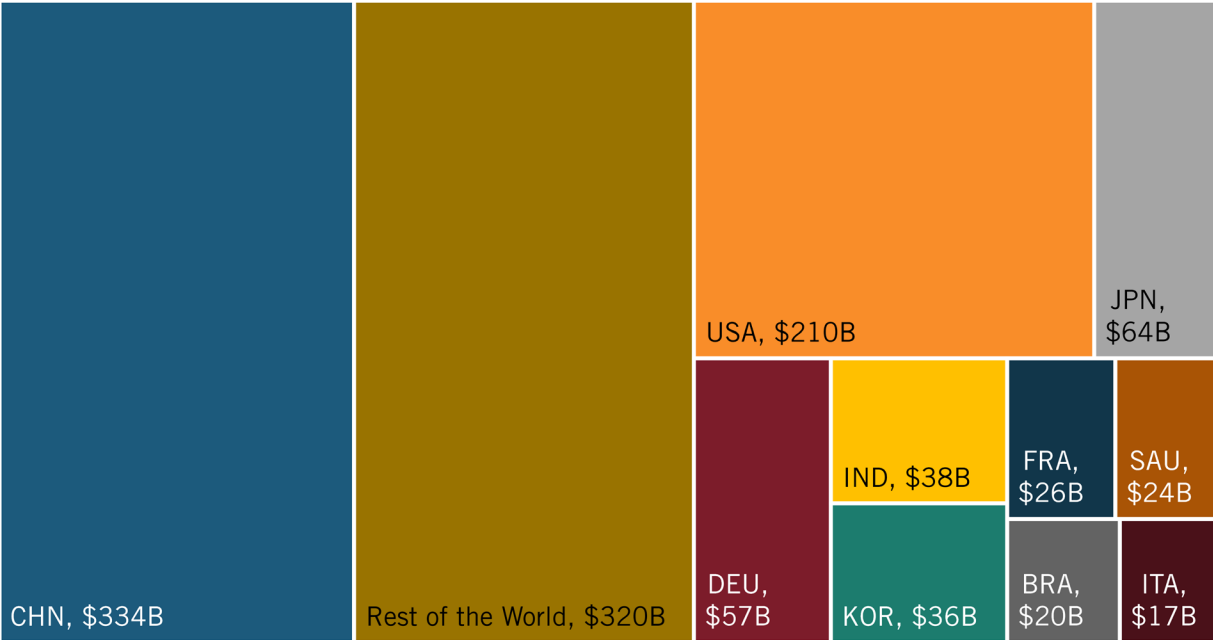
The chemicals sector comprises both specialty chemicals and commodity chemicals. Globally, the sector grew slower than world GDP: 149 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP.

About 49 percent of the sector’s output was concentrated in OECD countries in 2020, although that was down dramatically from about 82 percent in 1995.

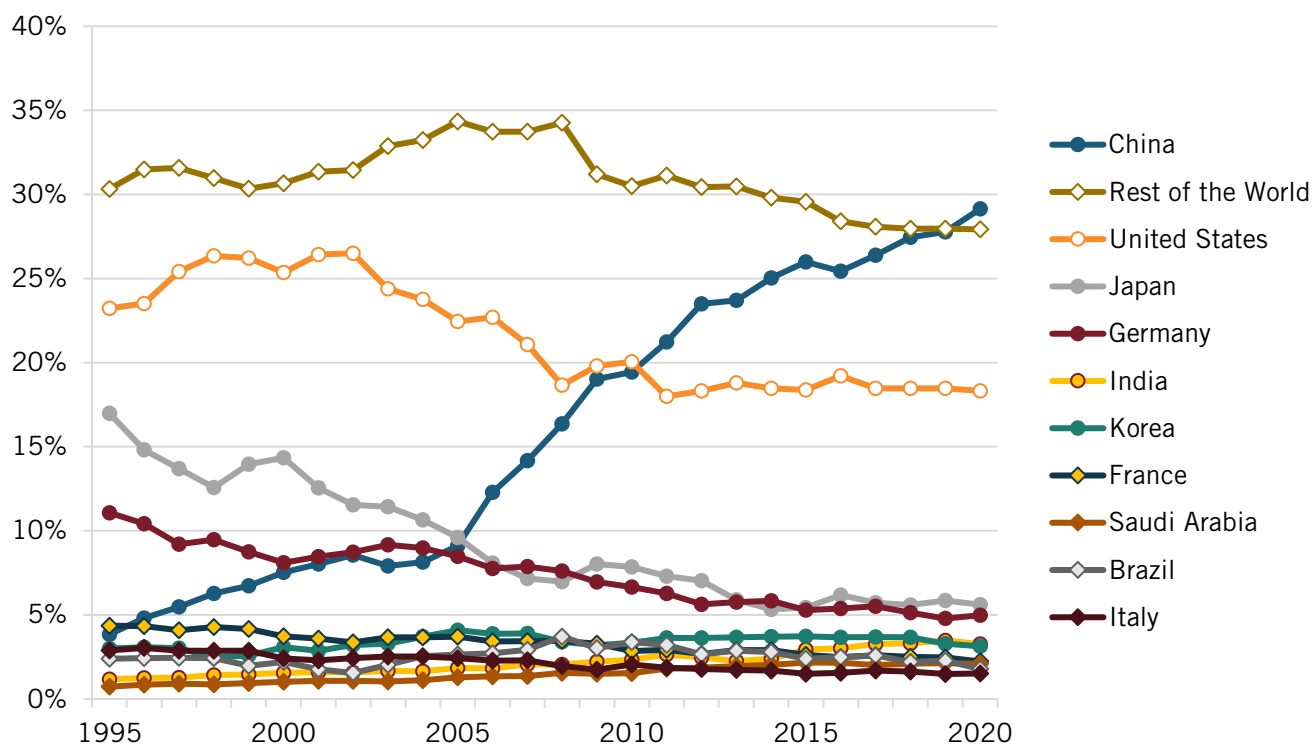
China led the world in 2020 with 29.1 percent of chemicals production—significantly up from 3.8 percent in 1995. The next highest-ranking nations were the United States (18.3 percent, down from 23.2 percent), Japan (5.6 percent, down significantly from 17 percent), and Germany (5 percent, down from 11.1 percent). The Quad (Australia, Japan, India, United States) lost significant market share in this industry, largely driven by the United States’ and Japan’s losses. Its global share was 27.6 percent, down from 41.8 percent. The EU also lost significant market share, concentrated mainly in the EU-17 (excluding EU-10 that joined in 2004). Its global share was 14.9 percent, down from 31 percent.

**Top 10 Producers**

**Figure 24: Global output in chemicals by the top 10 producers in 2020 (\$826 billion out of \$1.1 trillion)**



**Figure 25: Top 10 producers' historical shares of global output in chemicals**



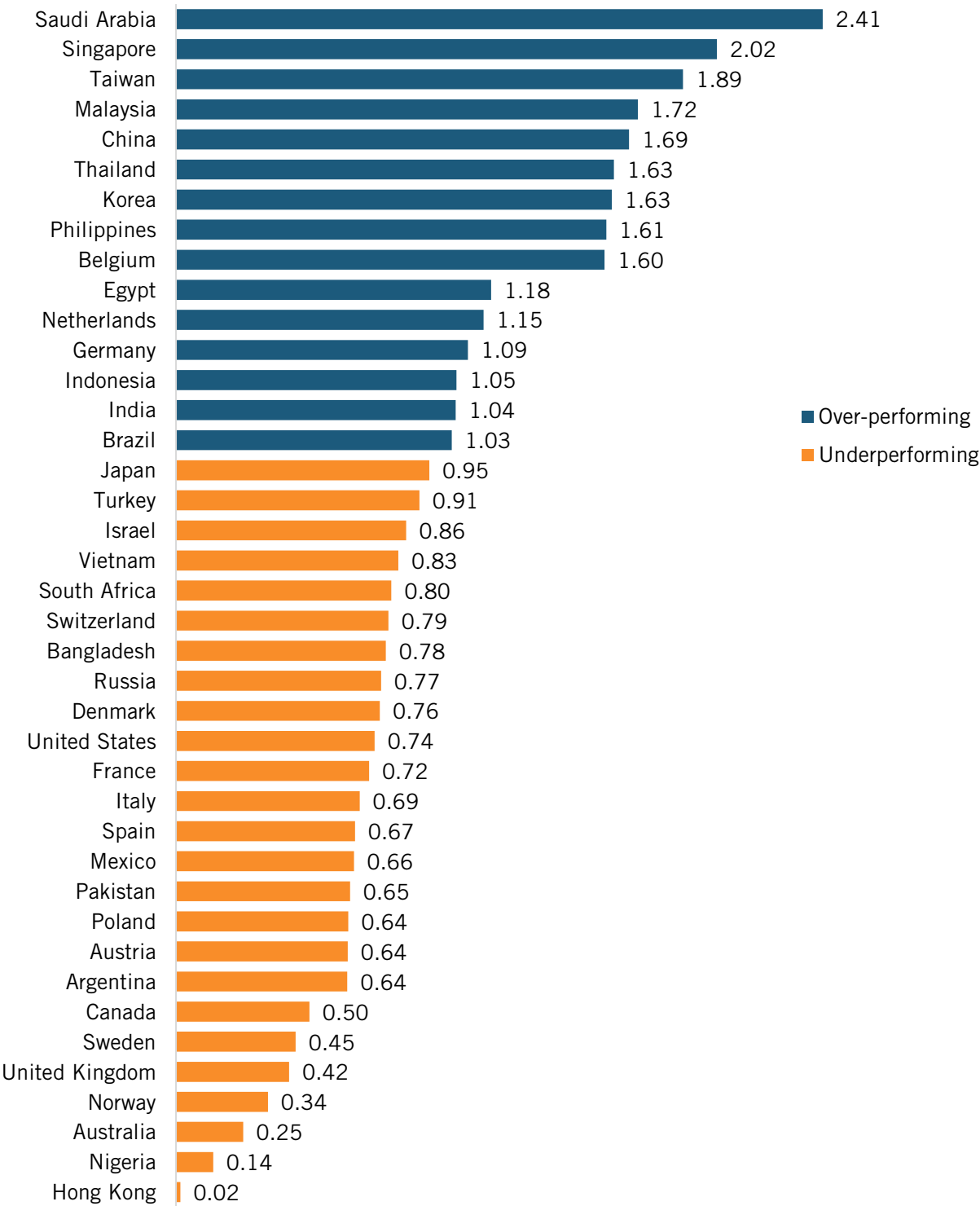
Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 25.3 percentage points), India (up 2.1 percentage points), and Saudi Arabia (up 1.4 percentage points). As a group, the Belt & Road nations together started from a share of about 19.6 percent but more than doubled their share (141 percent), largely because of China’s growth in chemicals. More recently from 2015 to 2020, China experienced the most growth in global share (up 3.2 percentage points), with India up about 0.3 percentage points.

Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 11.4 percentage points). As a group, the OECD (down 33 percentage points), the EU (down 16.1 percentage points), and the Quad (down 25.4 percentage points) lost significant shares. By contrast, the Belt & Road countries gained a significant share (up 27.6 percentage points).

The picture is quite different when it comes to specialization. The nation with the highest LQ in 2020 was Saudi Arabia, with an LQ of 2.41. Other high-ranking countries were Singapore (2.02), Taiwan (1.89), Malaysia (1.72), China (1.69), Thailand (1.63), South Korea (1.63), the Philippines (1.61), and Belgium (1.60). The United States underperformed, with an LQ of 0.74. Hong Kong and Nigeria were the lowest-ranked nations in this industry, each with an LQ under 0.20.

# Specialization Rankings

**Figure 26: Relative performance in chemicals (2020 LQ)**

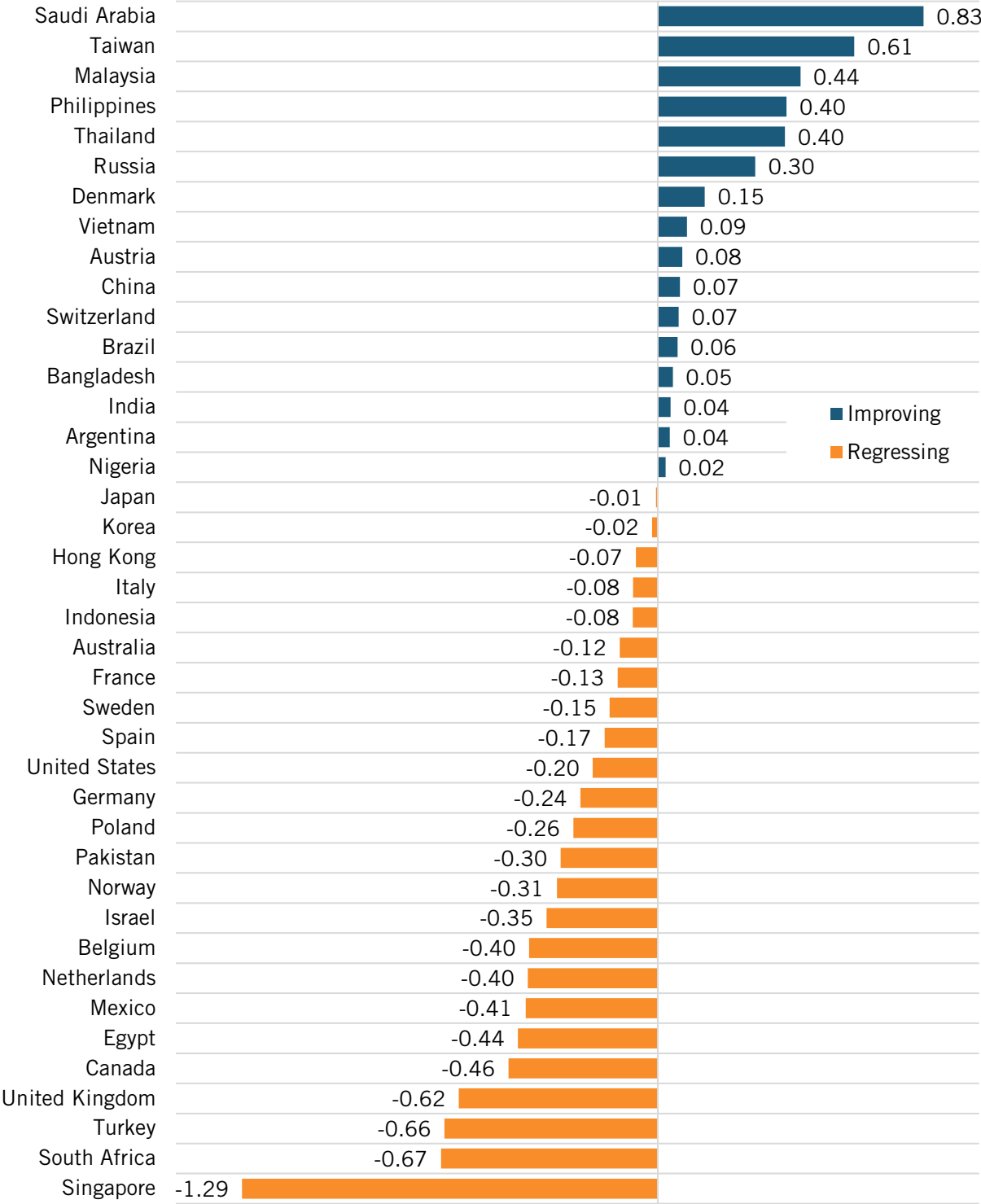


Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Saudi Arabia (+49 percentage points) and Taiwan (+35 percentage

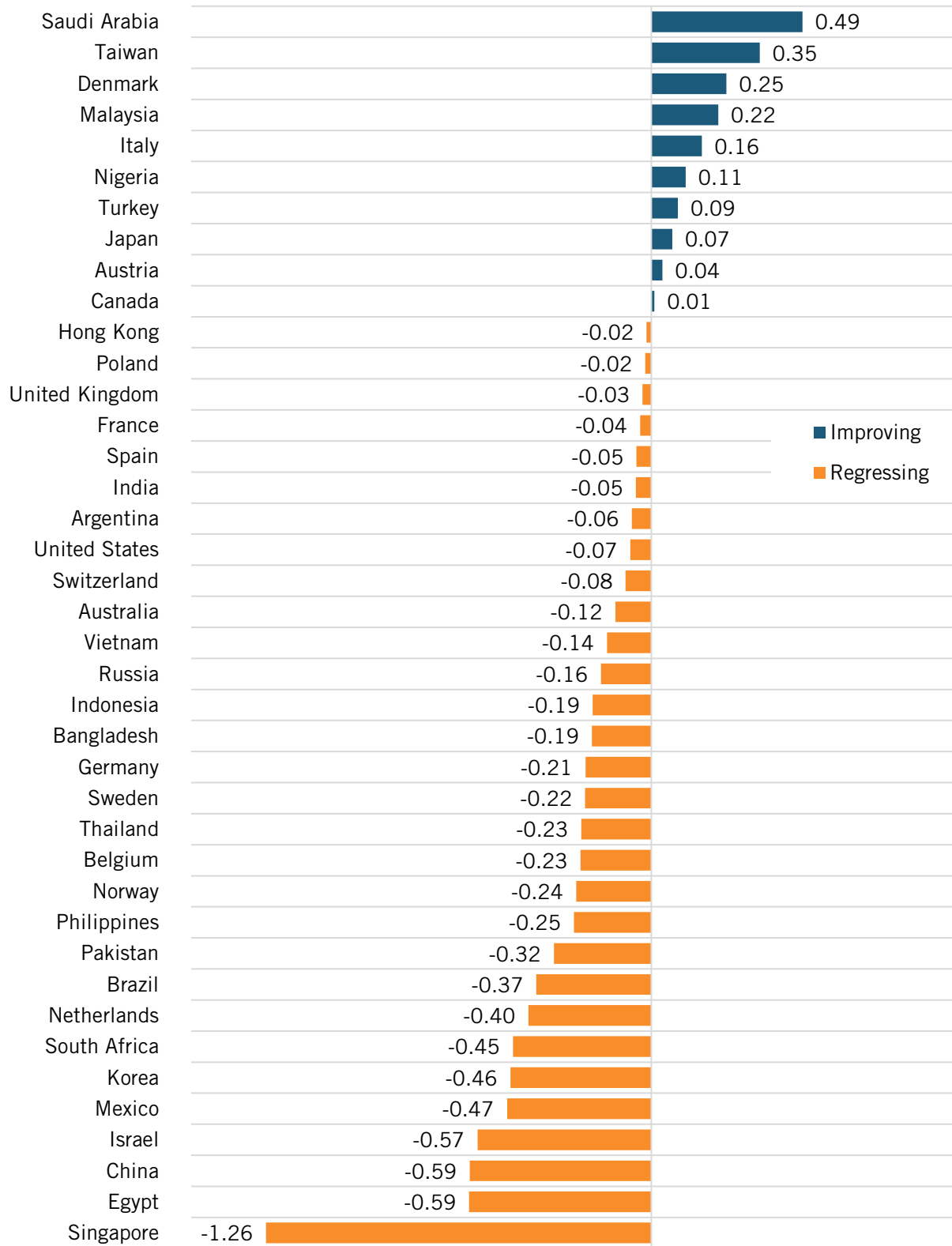


points). Overall, OECD nations saw a decline in their average LQ by 5 percentage points. Notable among those that lost ground were Singapore (-126 percentage points), Egypt (-59 percentage points), China (-59 percentage points), and Israel (-57 percentage points).

**Figure 27: Net change in relative performance in chemicals, 1995–2020 (LQ difference)**



**Figure 28: Net change in relative performance in chemicals, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the China and the Belt & Road nations surpassed the Quad, the EU, and NAFTA (the North American Free Trade Agreement bloc) in their levels of industrial specialization in chemicals. China and the Belt & Road nations' LQ averaged 1.33 in 2020, which is unchanged since 2008. However, the Quad's, the EU's, and NAFTA's LQs had declined to 0.78, 0.77, and 0.72, respectively.

**Pharmaceuticals and Biotechnology**

The pharmaceutical sector comprises medicinal chemicals and botanical products. It is a strategically important sector because much of it is high wage, traded across borders, and a key driver of innovation.

Globally, the sector grew rapidly—223 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP. The OECD nations have lost market share, from 85 percent in 1995 to 78 percent in 2020.

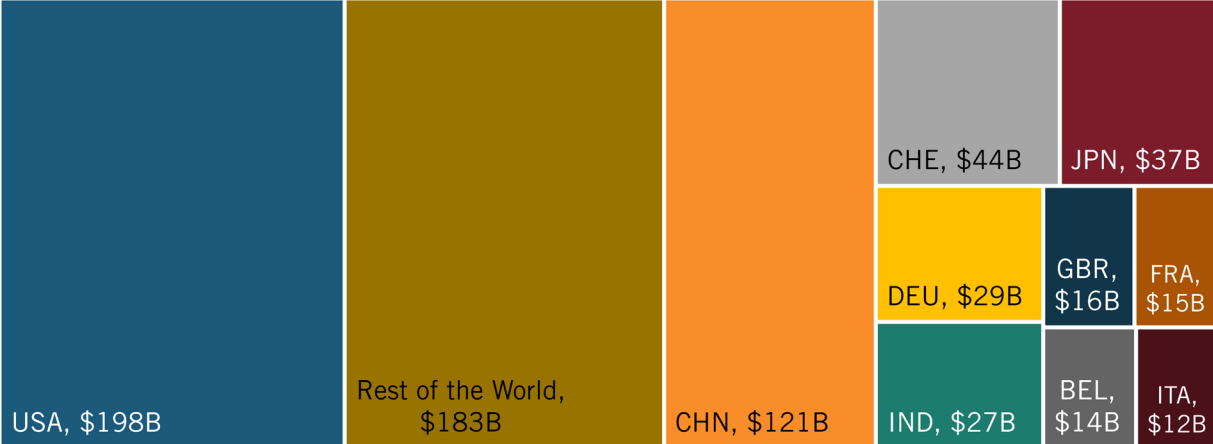
Given the global leadership position of companies such as Amgen, Lilly, J&J, Merck, and Pfizer, the United States led the world in 2020 with 28.4 percent of pharmaceutical production, up slightly from 26.2 percent in 1995. The next highest-ranking nations were China (17.4 percent, up significantly from 3.0), Switzerland (6.3 percent, up from 3.6), and Japan (5.4 percent, down significantly from 18.4). In part because of policy mistakes, the EU lost significant market share in this industry, its global share (not counting Ireland) was 19 percent, down from 35.6 percent.

Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 14.4 percentage points), Switzerland (up 2.7 percentage points), and India (up 2.6 percentage points). As a group, the Belt & Road nations together started from a small share but saw dramatic growth in percentage growth (102 percent), largely because of China's growth in pharmaceuticals. More recently from 2015 to 2020, the United States experienced the most growth in global share (up 2.2 percentage points), with China up 2.0 percentage points.

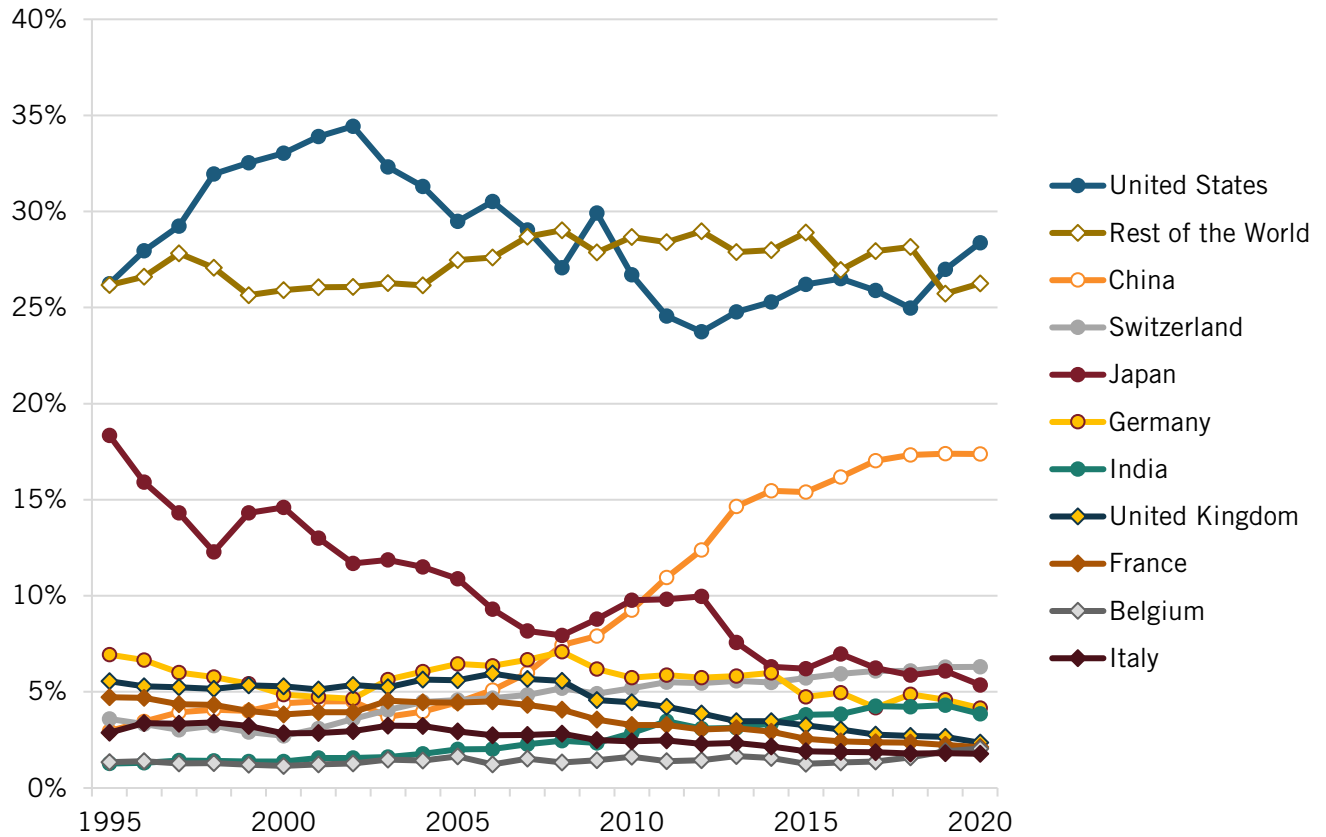
Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 13 percentage points). As a group, the OECD (down 15.9 percentage points) and EU (down 10.5 percentage points) lost significant shares. The EU's loss was concentrated in the EU-17 nations.

**Top 10 Producers**

**Figure 29: Global output in pharmaceuticals by the top 10 producers in 2020 (\$514 billion out of \$696 billion)**



**Figure 30: Top 10 producers' historical shares of global output in pharmaceuticals**

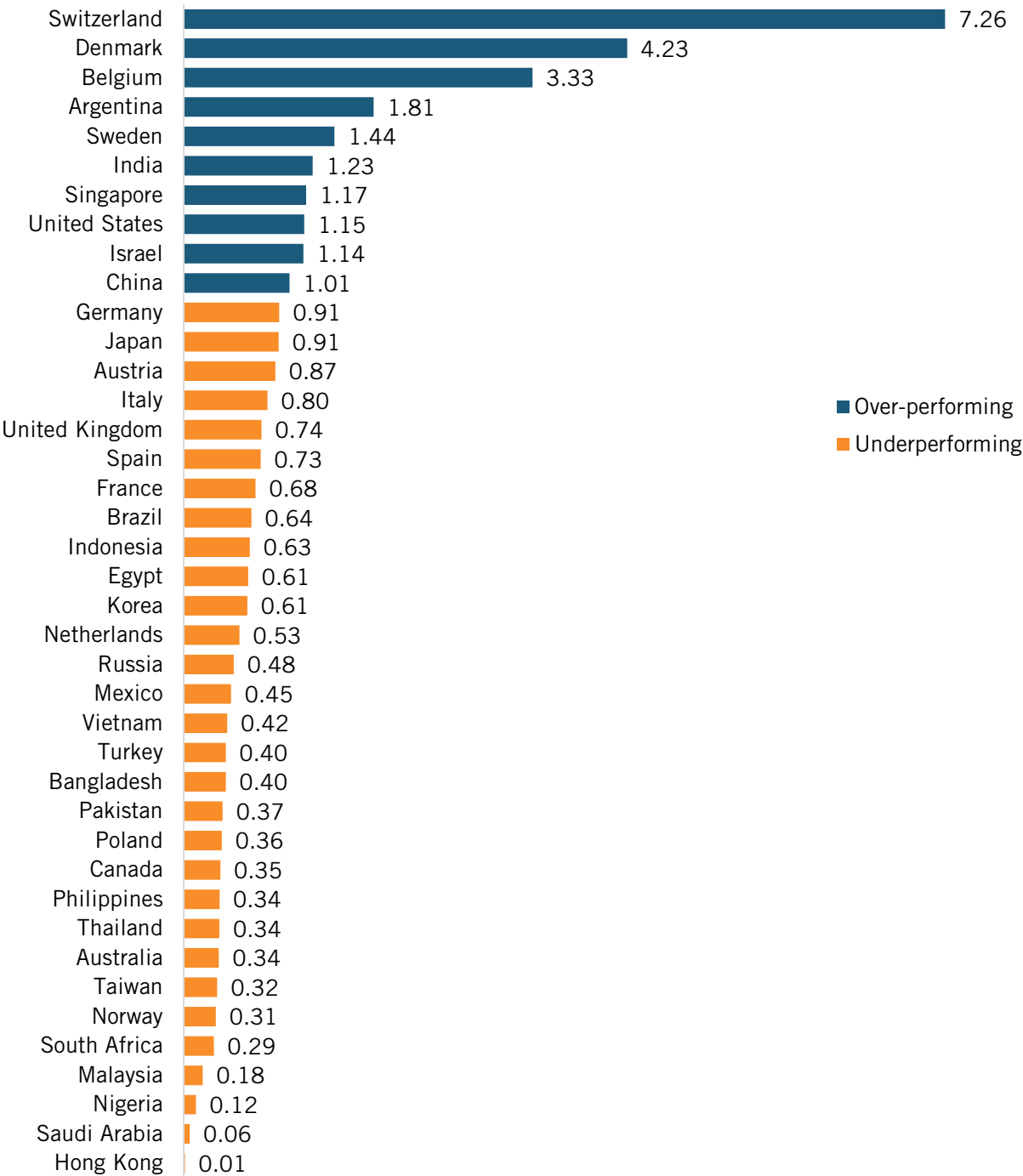


**Given the global leadership position of companies such as Amgen, Lilly, J&J, Merck, and Pfizer, the United States led the world in 2020 with 28.4 percent of pharmaceutical production, up slightly from 26.2 percent in 1995.**

The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was Switzerland, with an LQ of 7.26, in large part because of companies such as Novartis and Roche. The nation with the second highest LQ was Denmark (4.23), due to the growth of Novo Nordisk. The United States (LQ of 1.15) was behind other high-ranking nations such as Belgium (3.33), Argentina (1.81), Sweden (1.44), India (1.23), and Singapore (1.17). Most of the lagging nations were developing countries. Hong Kong, Saudi Arabia, Nigeria, and Malaysia all had LQs under 0.2.

# Specialization Rankings

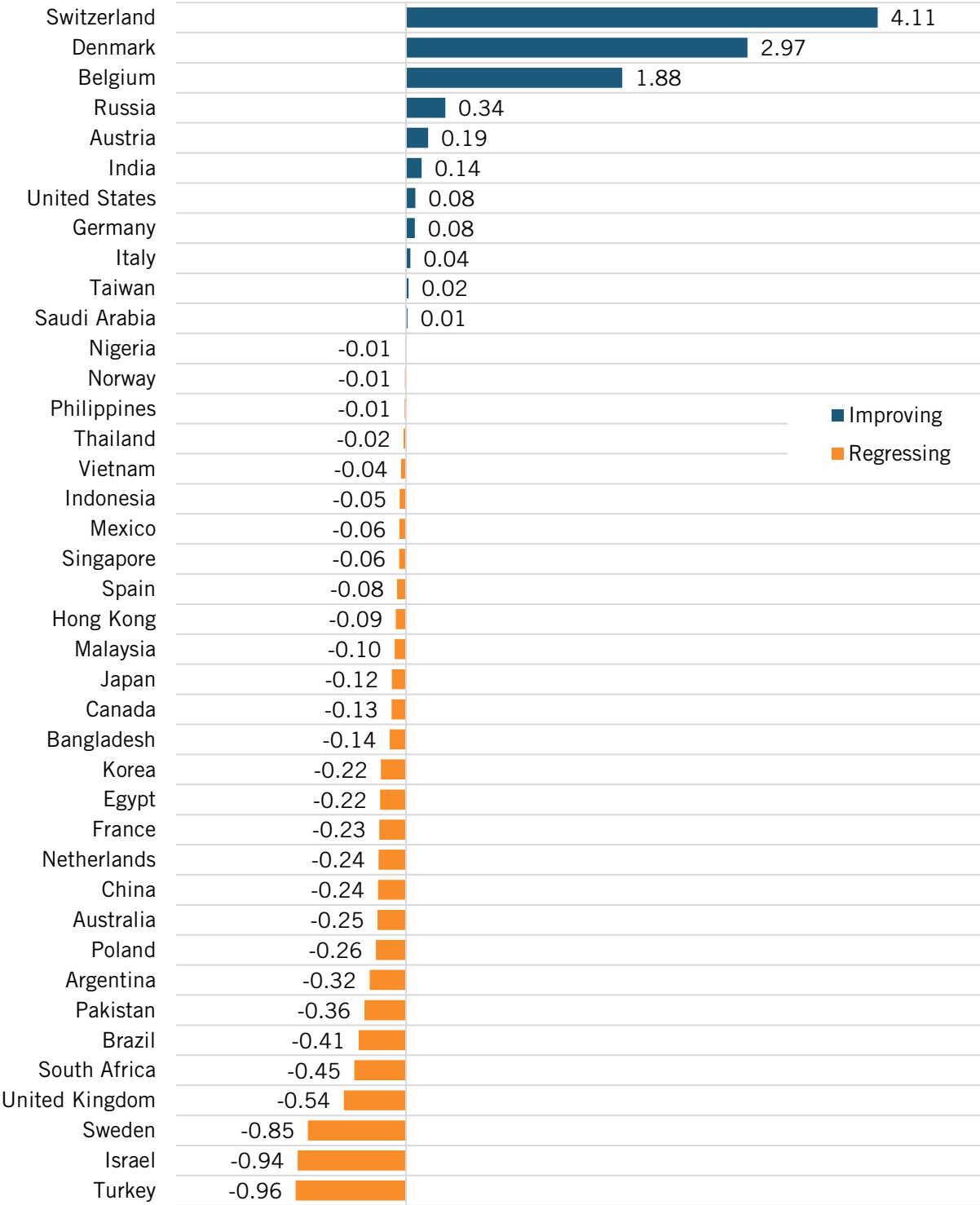
**Figure 31: Relative performance in pharmaceuticals (2020 LQ)**



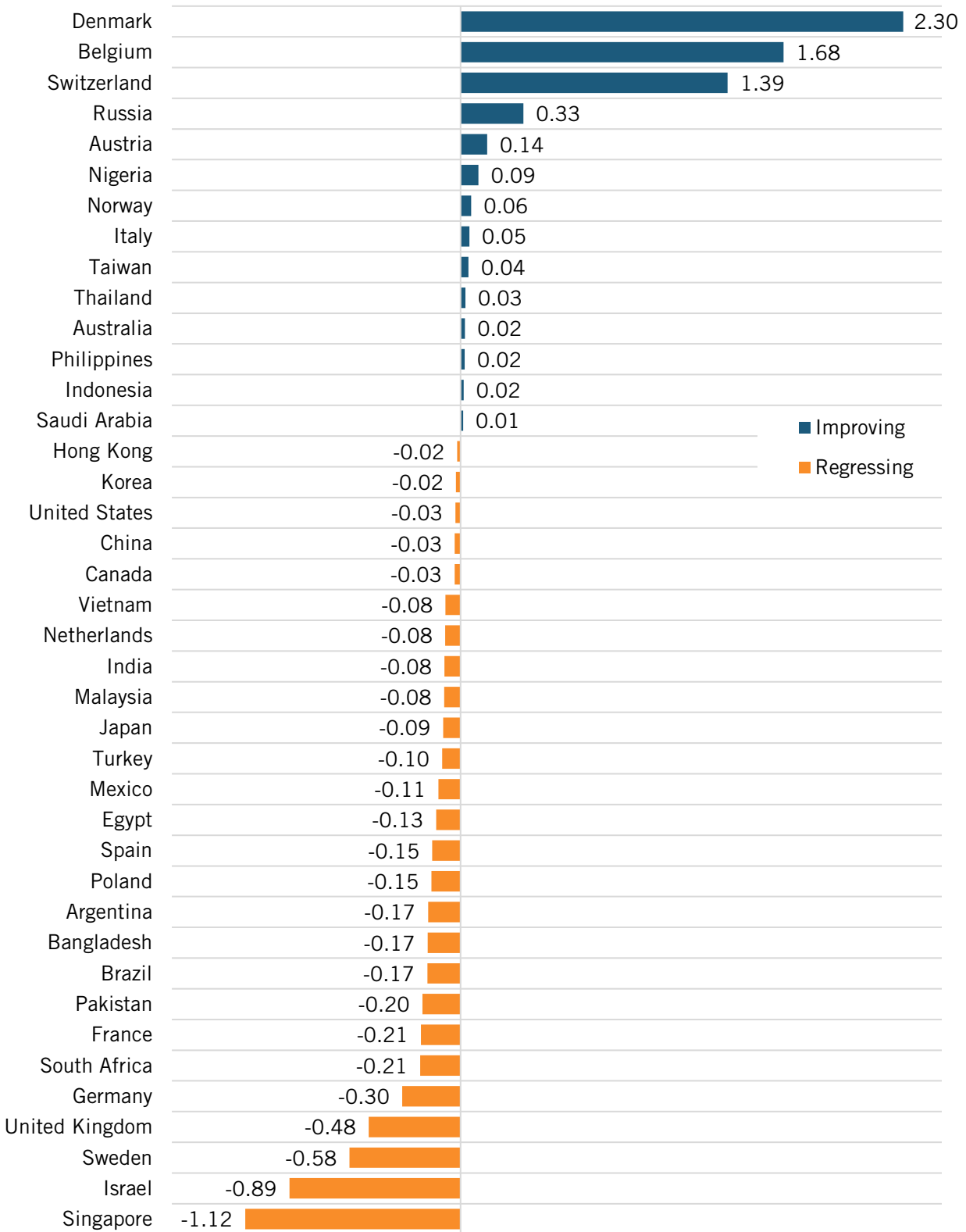
Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Denmark (+230 percentage points), Belgium (+168 percentage points), and Switzerland (+139 percentage points). Overall, OECD nations saw only modest growth in their average LQ by 3 percentage points. Notable among those that lost ground were

Singapore (-112 percentage points), Israel (-89 percentage points), Sweden (-58 percentage points), and the United Kingdom (-48 percentage points).

**Figure 32: Net change in relative performance in pharmaceuticals, 1995–2020 (LQ difference)**



**Figure 33: Net change in relative performance in pharmaceuticals, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the Quad and NAFTA far surpassed China and the Belt & Road nations in their levels of industrial specialization in pharmaceuticals. This was primarily due to the United States being part of the former two groups. The LQ in 2020 averaged 1.06 for NAFTA and 1.08 for the Quad. However, the LQ for the Quad was down 2 percentage points from 2008. The latter group's was just 0.76 in 2020, up 10 percentage points from 2008.

## **Machinery and Equipment**

The machinery and equipment sector comprises machine tools and mechanical systems including agricultural machines, engines, turbines, and industrial machines.

Globally, the sector grew more slowly than global GDP: 123 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP.

About 57 percent of the sector's output was concentrated in OECD countries in 2020, down significantly from 88 percent in 1995.

China led the world in 2020 with 32 percent of machinery and equipment production, up significantly from just 4.4 percent in 1995. The next-highest-ranking nations were the United States (14.6 percent, down from 19.7), Japan (11.6 percent, down significantly from 28.8), and Germany (9.2 percent, down from 14.6). The Quad lost significant market share in this industry: 29.3 percent, down from 49.7 percent.

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**China led the world in 2020 with 32 percent of machinery and equipment production, up significantly from just 4.4 percent in 1995.**

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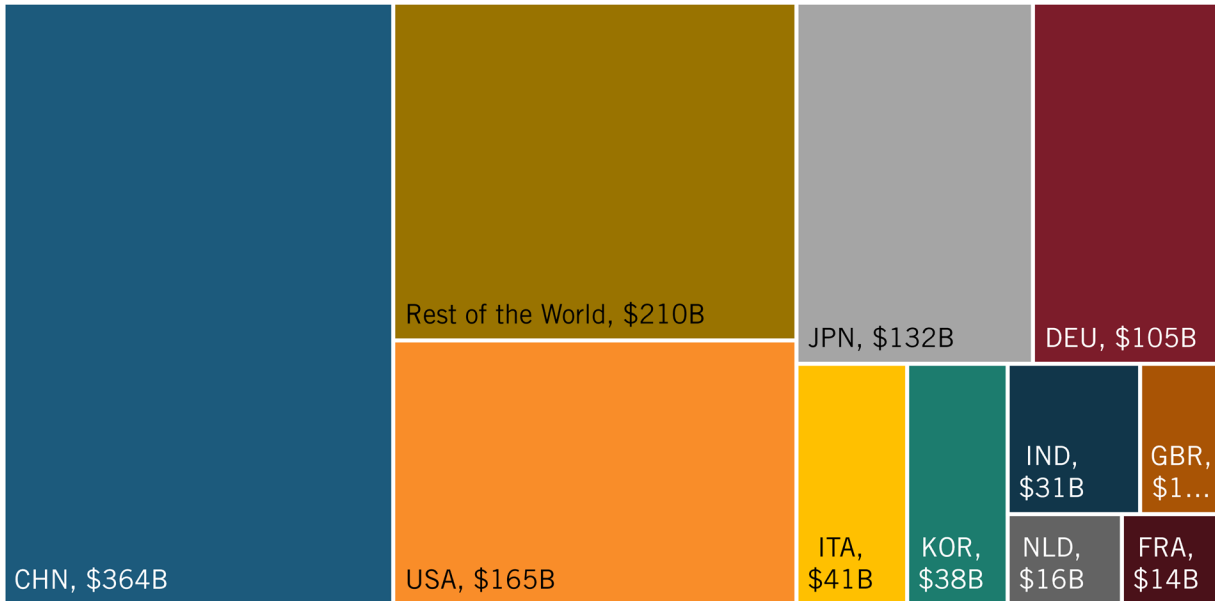
China saw by far the most growth in its global share of the industry from 1995 to 2020, up 27.7 percentage points, with India (up 1.9 percentage points) being a distant second. As a group, the Belt & Road nations together started from a small share but saw dramatic growth in percentage growth (182 percent), largely because of China's growth in machinery and equipment.

Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 17.2 percentage points). As a group, the OECD (down 30.9 percentage points), the Quad (down 20.4 percentage points), and the EU (down 9.6 percentage points) lost significant shares. The EU's loss was concentrated in the EU-17 (down 10.2 percentage points).

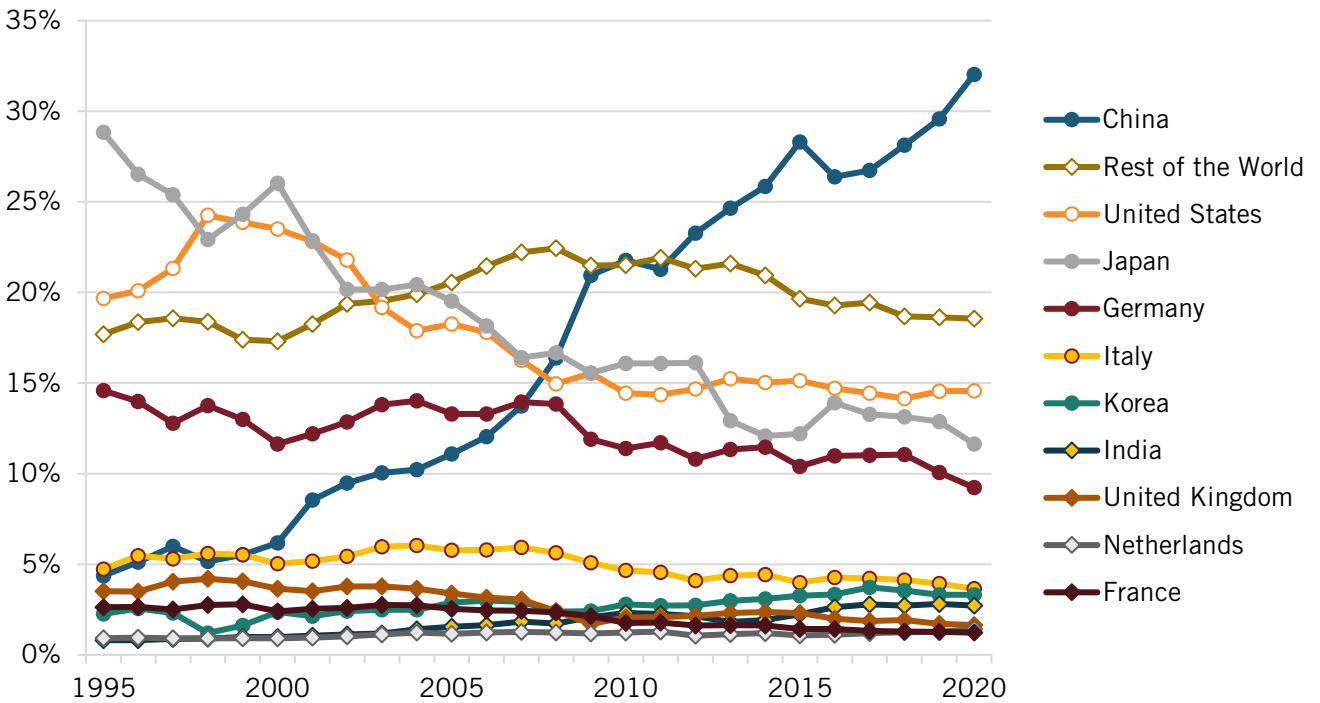


## Top 10 Producers

**Figure 34: Global output in machine equipment by the top 10 producers in 2020 (\$923 billion of \$1.1 trillion)**



**Figure 35: Top 10 producers' historical shares of global output in machinery and equipment**



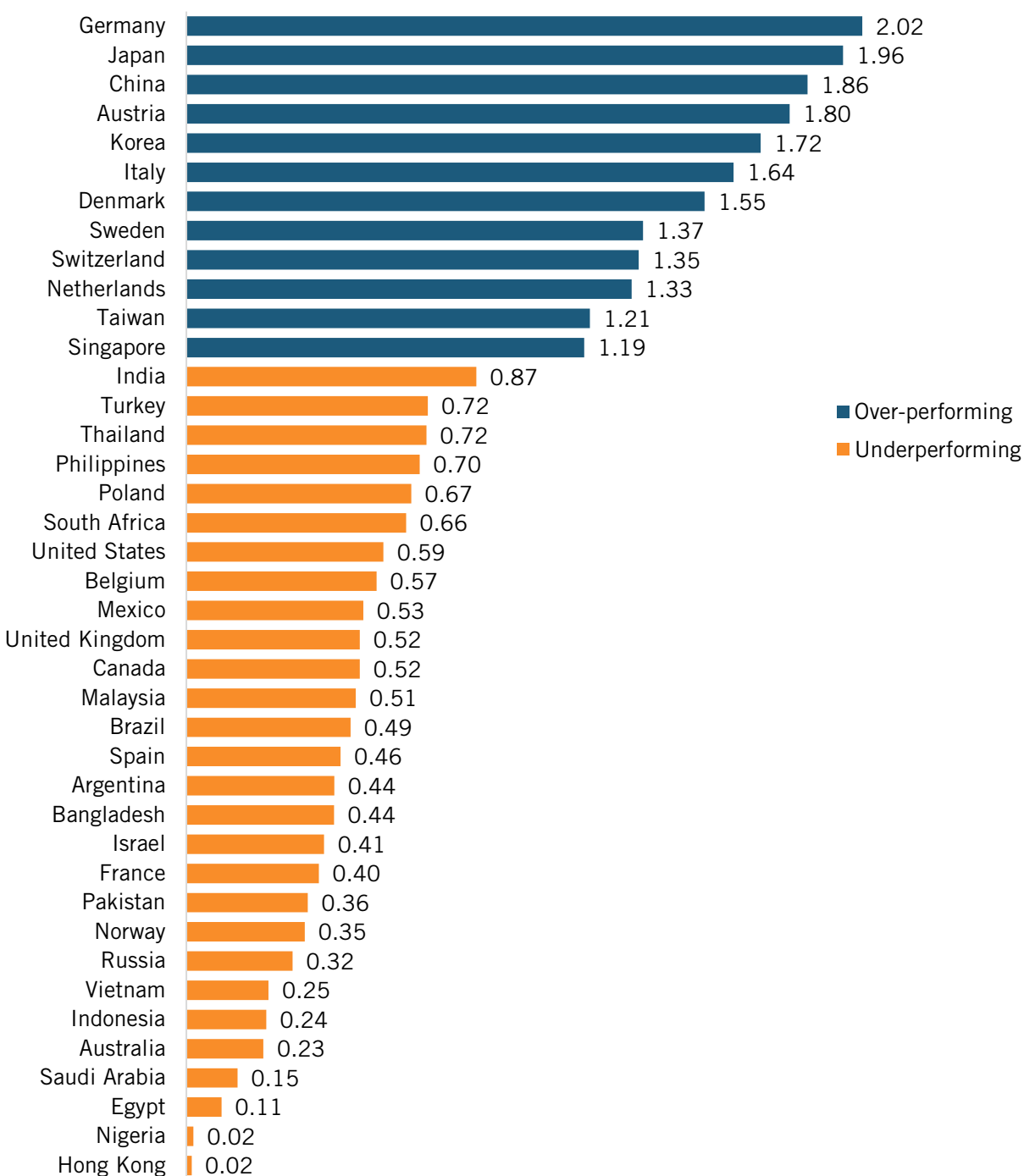
The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was Germany, with an LQ of 2.02. Among the other high-ranking nations were Japan (LQ of 1.96), China (1.86), Austria (1.80), South Korea (1.72), Italy (1.64), and Denmark (1.55). Among the worst-performing developed countries were the United States

(0.59), Belgium (0.57), Canada (0.52), Great Britain (0.52), Spain (0.46), Israel (0.41), France (0.40), Norway (0.35), and Australia (0.23).

Lagging nations were mostly developing countries: Hong Kong, Nigeria, Egypt, and Saudi Arabia each had an LQ less than 0.20.

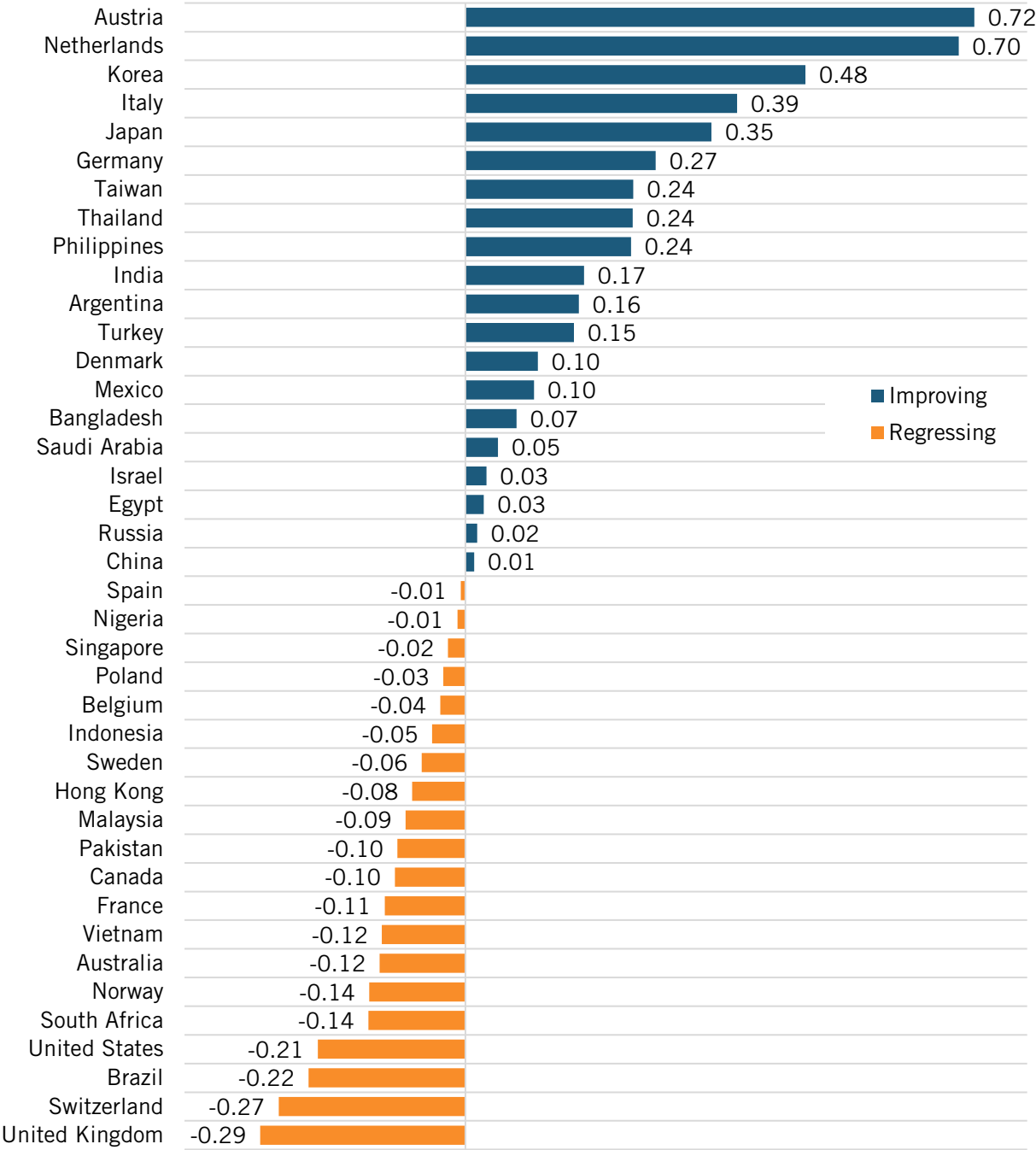
### Specialization Rankings

**Figure 36: Relative performance in machinery and equipment (2020 LQ)**

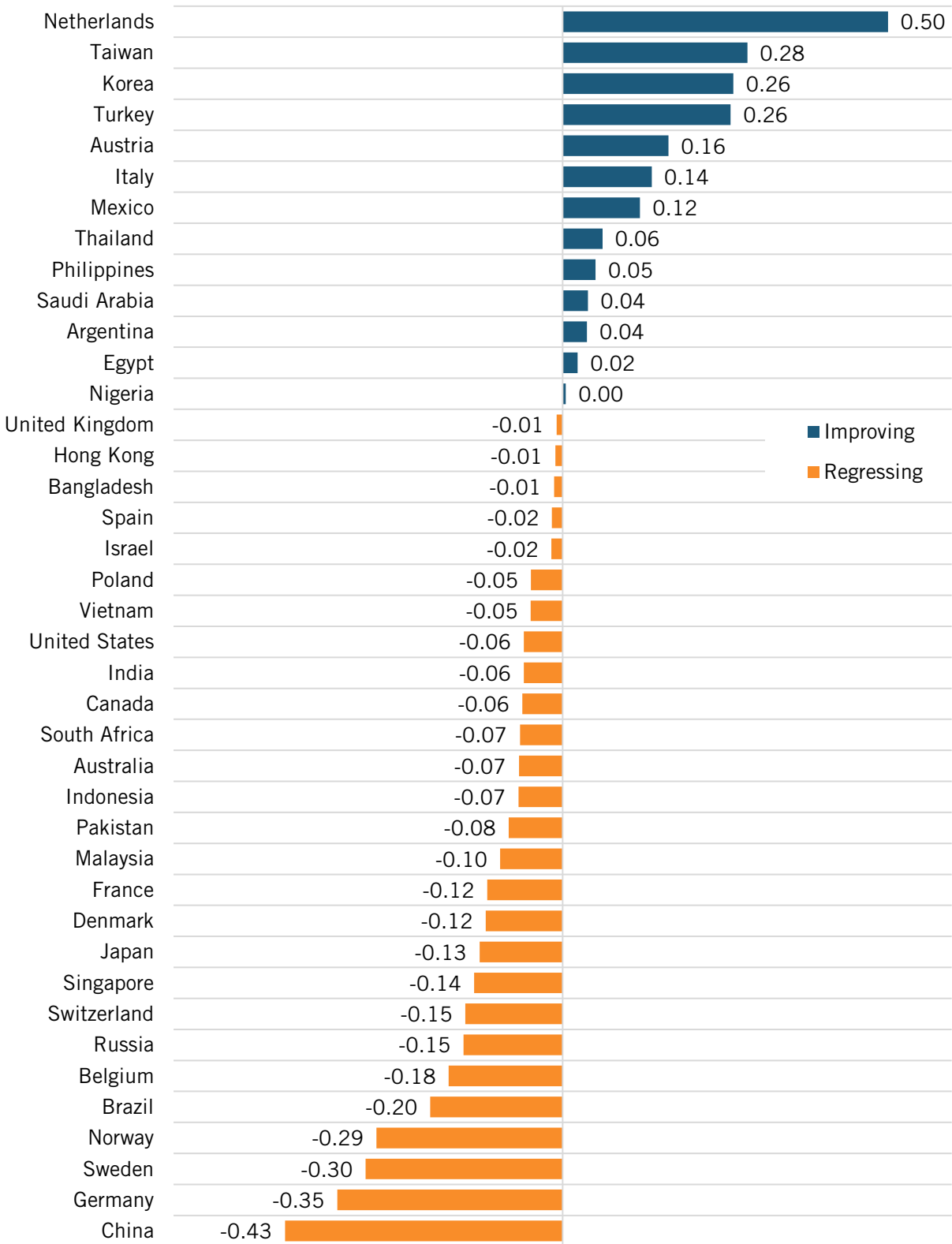


Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were the Netherlands (+50 percentage points), Taiwan (+28 percentage points), South Korea (+26 percentage points), and Turkey (+26 percentage points). Overall, OECD nations saw a decline in their average LQ by 9 percentage points, while the EU saw a decline of 3 percentage points. Notable among those that lost ground were China (-43 percentage points), Germany (-35 percentage points), Sweden (-30 percentage points), and Norway (-29 percentage points).

**Figure 37: Net change in relative performance in machinery and equipment, 1995–2020 (LQ difference)**



**Figure 38: Net change in relative performance in machinery and equipment, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the Belt & Road region had an LQ of 1.30, up 11 percentage points from 2008. The EU-17 came in second for industrial specialization in machinery and equipment. That group's LQ averaged 1.13 in 2020. The Quad had an LQ of 0.83 in 2020, which was down 15 percentage points from 2008.

## **Fabricated Metals**

The fabricated metals sector comprises the manufacturing of metal parts. It is a strategically important sector because these products often serve as intermediate goods for manufacturers in advanced industries.

Globally, the sector grew slower than world GDP: 115 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP.

About 59.8 percent of the sector's output was concentrated in OECD countries in 2020, down from about 88.1 percent in 1995.

China led the world in 2020 with 25.6 percent of fabricated metals production— significantly up from just 2.3 percent in 1995. The next highest-ranking nations were the United States (18.5 percent, down from 25.1 percent), Germany (6.9 percent, down from 11.7 percent), and Japan (5.5 percent, down from 18.3 percent). The Quad lost significant market share in this industry, largely driven by the United States' and Japan's losses. Its global share was 27.6 percent, down from 45.4 percent. The EU also lost significant market share, which was mainly concentrated in the EU-17 (excludes EU-10 that joined in 2004). Its global share was 25.7 percent, down from 36.8 percent.

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**China led the world in 2020 with 25.6 percent of fabricated metals production—significantly up from just 2.3 percent in 1995.**

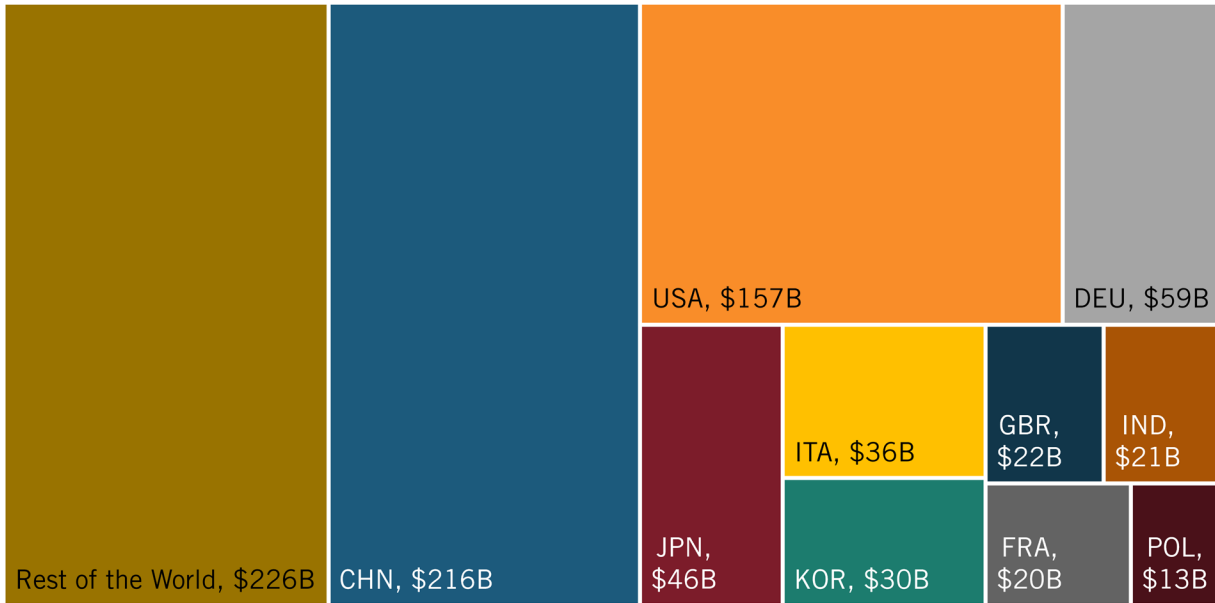
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Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 23.3 percentage points), South Korea (up 1.5 percentage points), and India (1.5 percentage points). As a group, the Belt & Road nations together started from a share of about 17 percent in 1995 but more than doubled their share (170 percent), largely because of China's growth in fabricated metals. More recently from 2015 to 2020, China experienced the most growth in global share (up 7.6 percentage points), with Taiwan up about 0.3 percentage points.

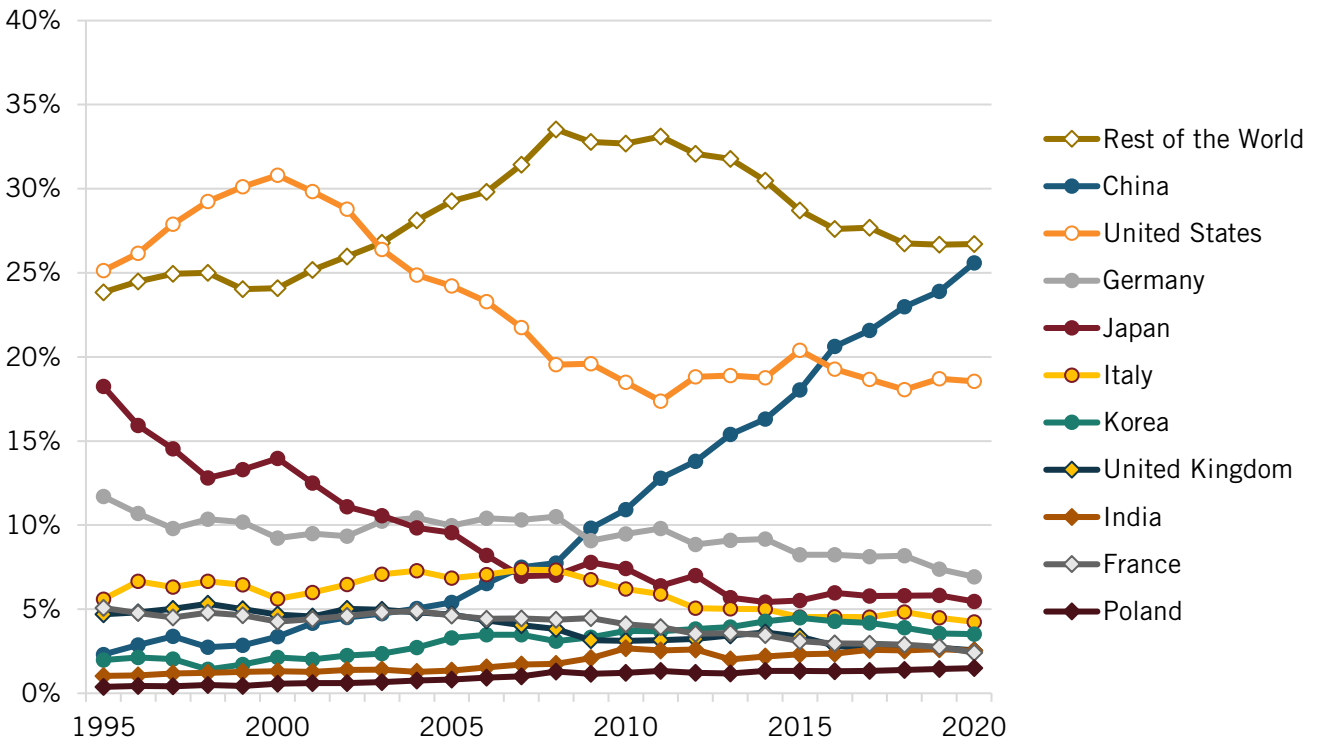
Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 12.8 percentage points). As a group, the OECD (down 28.3 percentage points) and the Quad (down 17.9 percentage points) lost significant shares. By contrast, the Belt & Road countries gained a significant share (up 28.8 percentage points).

## Top 10 Producers

**Figure 39: Global output in fabricated metals by the top 10 producers in 2020 (\$620 billion out of \$846 billion)**



**Figure 40: Top 10 producers' historical shares of global output in fabricated metals**



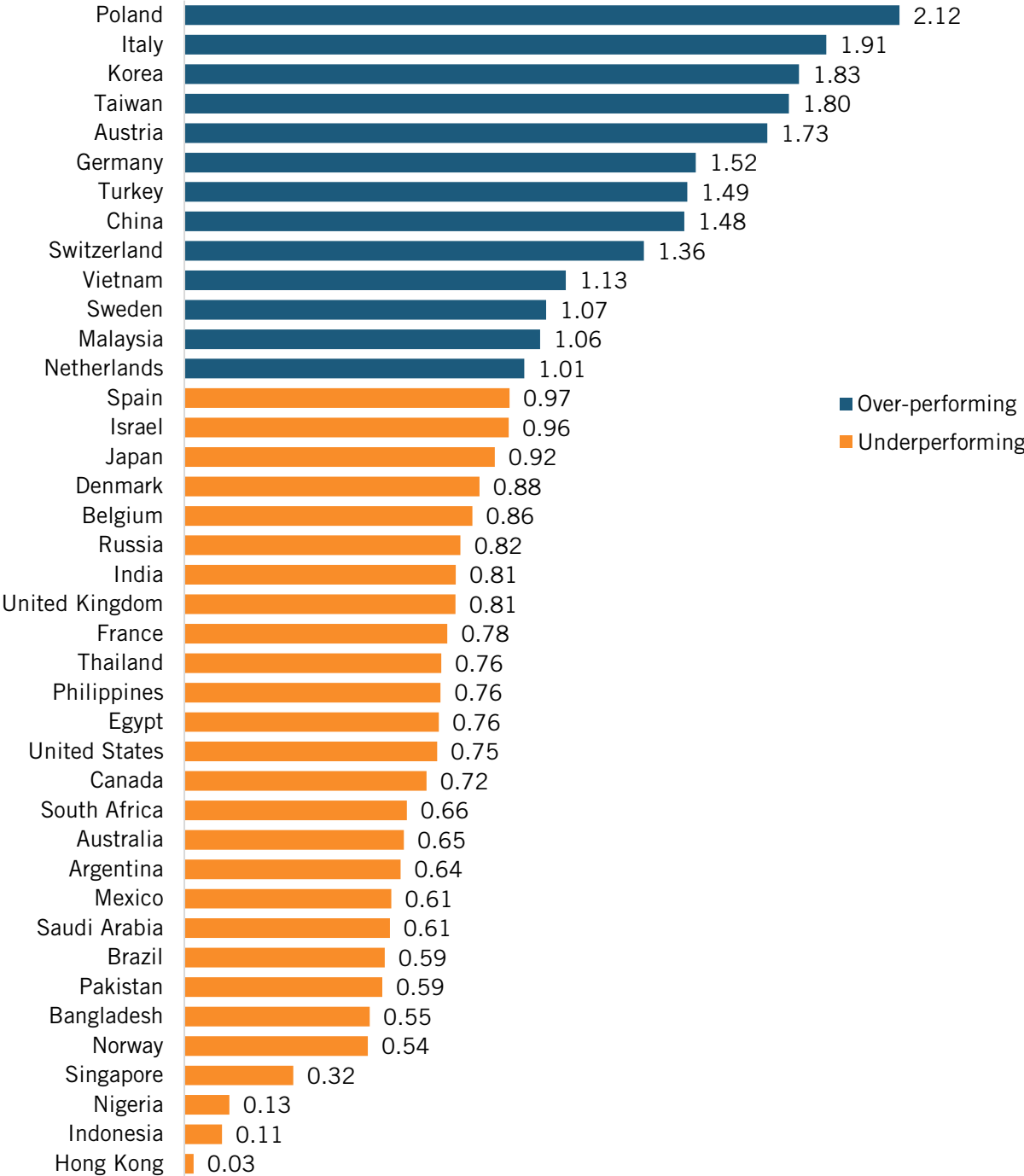
The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was Poland, with an LQ of 2.12. Other high-ranking countries were Italy (1.91), South Korea (1.83), Taiwan (1.80), Austria (1.73), Germany (1.52), and Turkey (1.49). The United States significantly underperformed in this sector, with an LQ of 0.75. That was

lower than the LQ for Denmark (0.88), Belgium (0.86), Russia (0.82), Great Britain (0.81), India (0.81), France (0.78), Egypt (0.76), and the Philippines (0.76).

Nations with a relatively low LQ in this industry include Singapore (0.32), Nigeria (0.13), and Indonesia (0.11), and Hong Kong (0.03).

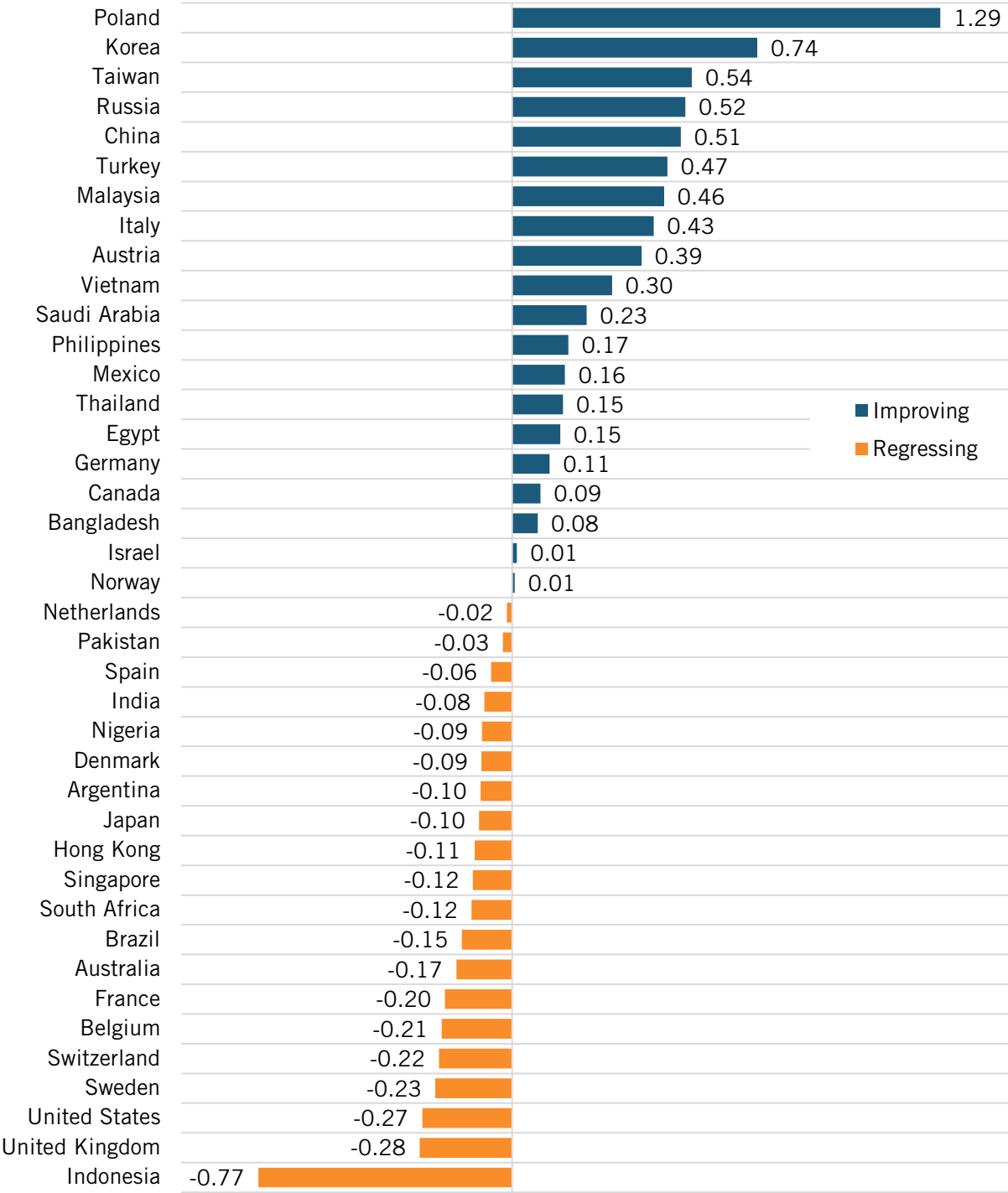
### Specialization Rankings

**Figure 41: Relative performance in fabricated metals (2020 LQ)**



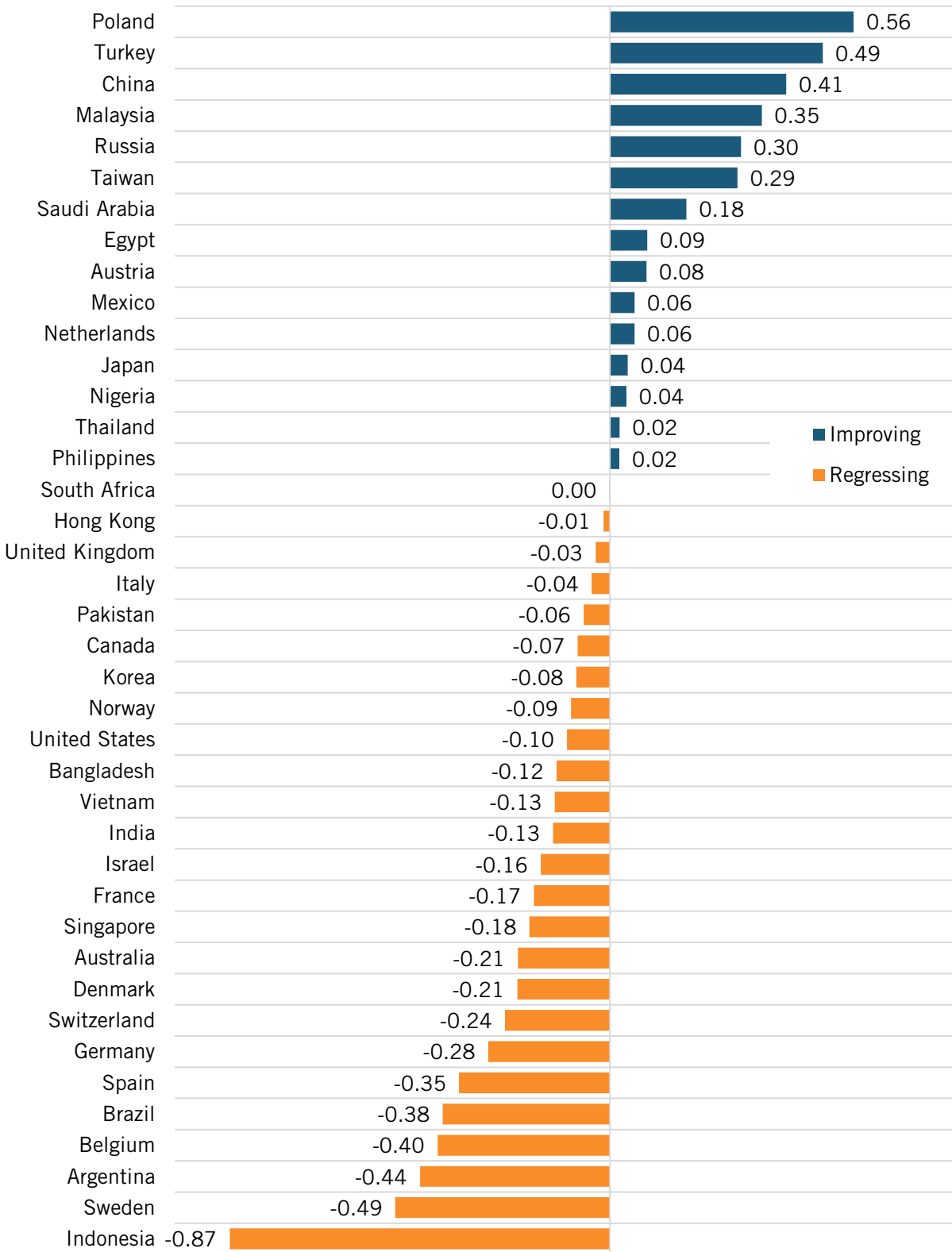
Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Poland (+56 percentage points) and Turkey (+49 percentage points). Overall, OECD nations saw a decline in their average LQ by 11 percentage points. Notable among those that lost ground were Indonesia (-87 percentage points), Sweden (-49 percentage points), Argentina (-44 percentage points), and Belgium (-40 percentage points).

**Figure 42: Net change in relative performance in fabricated metals, 1995–2020 (LQ difference)**





**Figure 43: Net change in relative performance in fabricated metals, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the China and the Belt & Road nations slightly surpassed the EU-27. The former group's LQ averaged 1.29 in 2020, which was up 15 percentage points since 2008. At the same time, the latter group's LQ averaged 1.24 in 2020, which was down 13 percentage points since 2008.

## Motor Vehicles

The motor vehicles sector comprises both the assemblers and suppliers of cars and trucks. It has become a more innovative sector due to new developments in electric vehicles and self-driving cars.

Globally, the sector grew slower than world GDP: 130 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP.

Like many other sectors, production shifted significantly outside the OECD (mostly to China) with 59 percent of the sector's output concentrated in OECD countries in 2020, down from 87 percent in 1995.

China led the world in 2020 with 24.3 percent of motor vehicles production, up significantly from just 2.5 percent in 1995. The next highest-ranking nations were the United States (14 percent, down from 22), Germany (12.6 percent, down from 14.8), and Japan (10 percent, down significantly from 24). The Quad lost significant market share in this industry, as its global share was 27.3 percent, down from 47.4 percent.

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**China led the world in 2020 with 24.3 percent of motor vehicles production, up significantly from just 2.5 percent in 1995.**

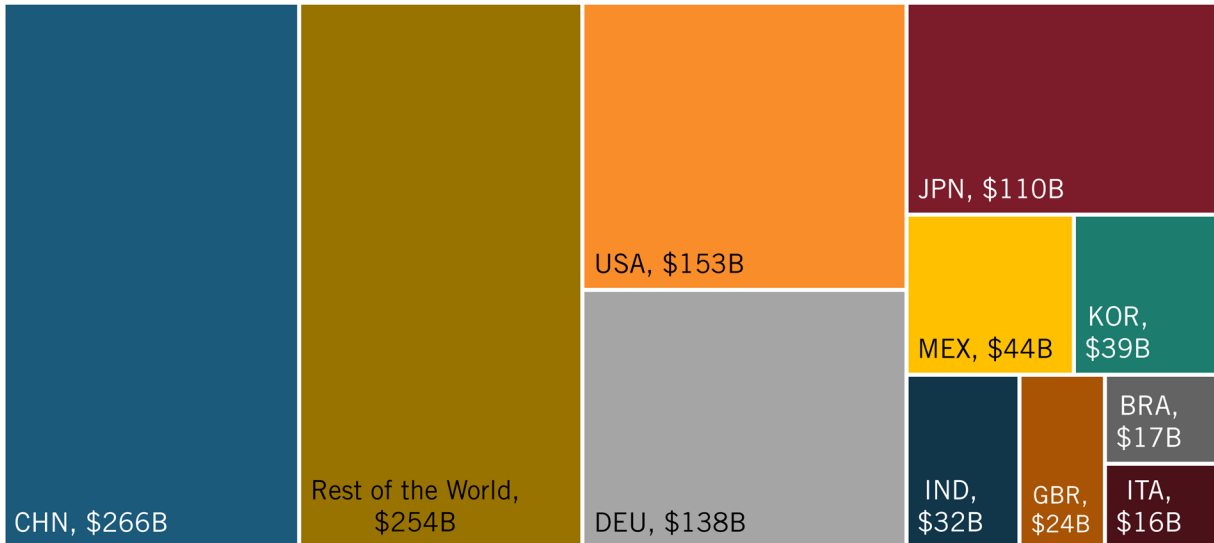
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Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 21.8 percentage points), Mexico (up 2.5 percentage points), and India (up 2.1 percentage points). As a group, the Belt & Road nations together started from a small share but saw dramatic growth in percentage growth (196 percent), largely because of China's growth in motor vehicles. More recently from 2015 to 2020, India experienced the most growth in global share (up 0.6 percentage points), with China up 0.4 percentage points.

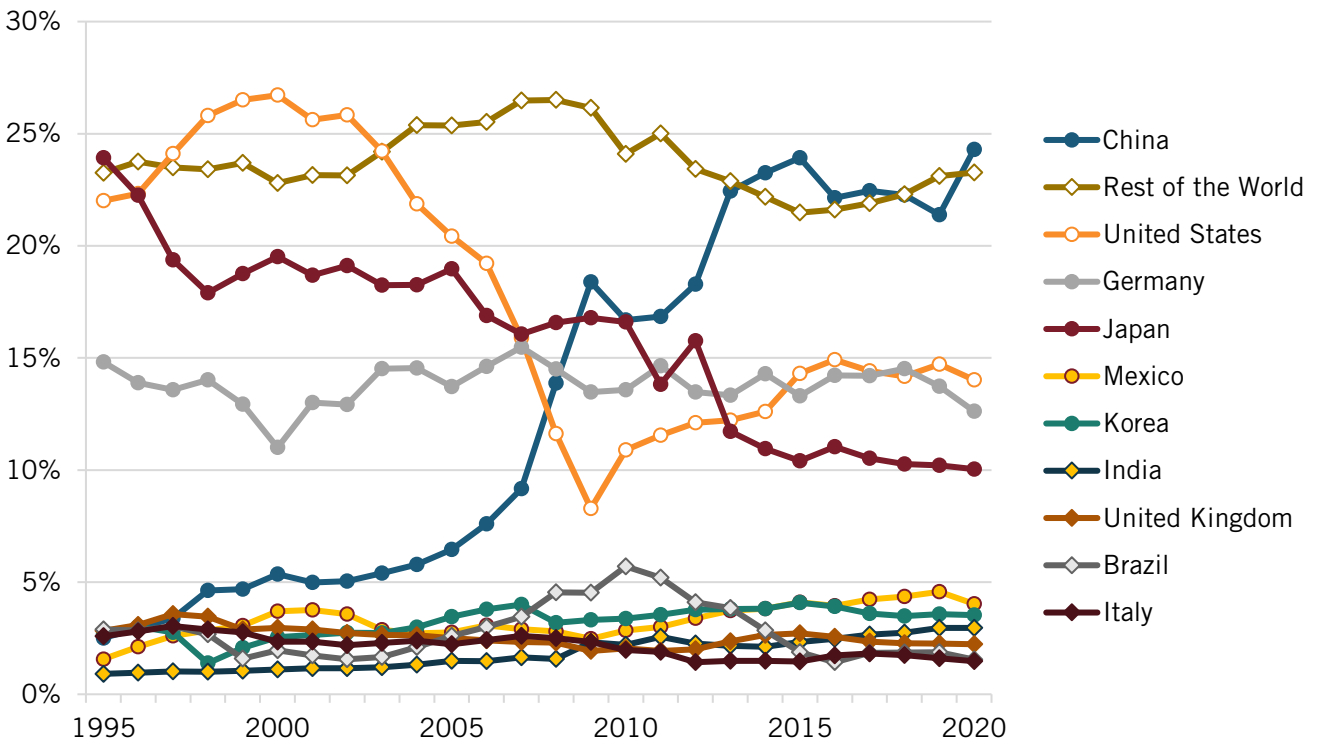
Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 13.9 percentage points). As a group, the OECD (down 28 percentage points) and the Quad (down 20.1 percentage points) lost significant shares. By contrast, the Belt & Road countries gained a significant share (up 27 percentage points).

## Top 10 Producers

**Figure 44: Global output in motor vehicles by the top 10 producers in 2020 (\$839 billion out of \$1.1 trillion)**



**Figure 45: Top 10 producers' historical shares of global output in the motor vehicles industry**

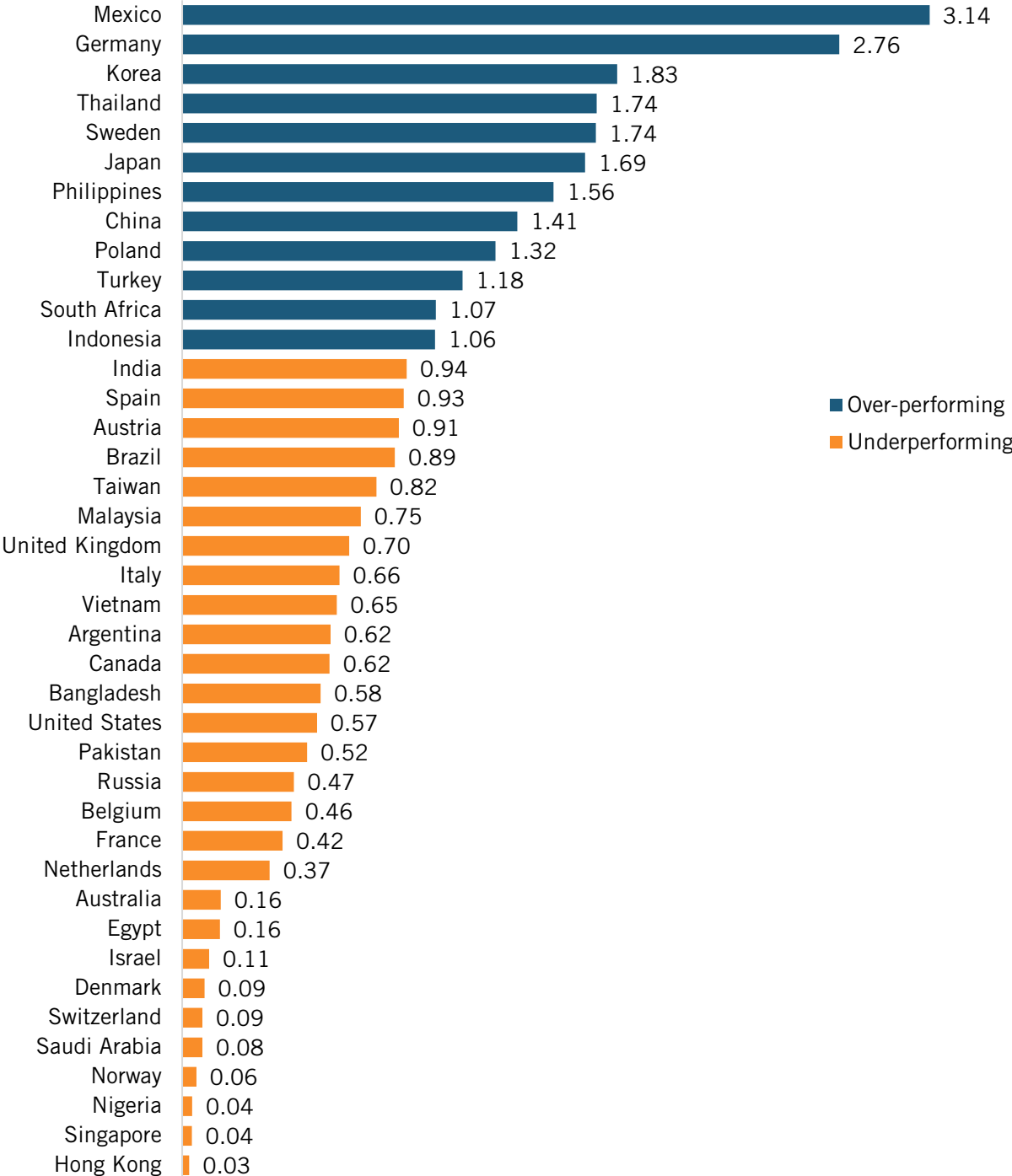


The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was Mexico, with an LQ of 3.14, benefiting from the economic integration of North America and vastly lower production wages than for U.S. workers, coupled with relatively high productivity and a weak peso vis-à-vis the dollar.<sup>5</sup> The United States (LQ of 0.57) was significantly behind other high-ranking nations such as Germany (2.76), South Korea (1.83),

Sweden (1.74), and Japan (1.69). The United States also ranked behind Great Britain (0.70), Italy (0.66), and Canada (0.62). Lagging nations include developed and developing countries. Australia, Denmark, Israel, Egypt, Nigeria, Saudi Arabia, Singapore, and Hong Kong all had an LQ below 0.20.

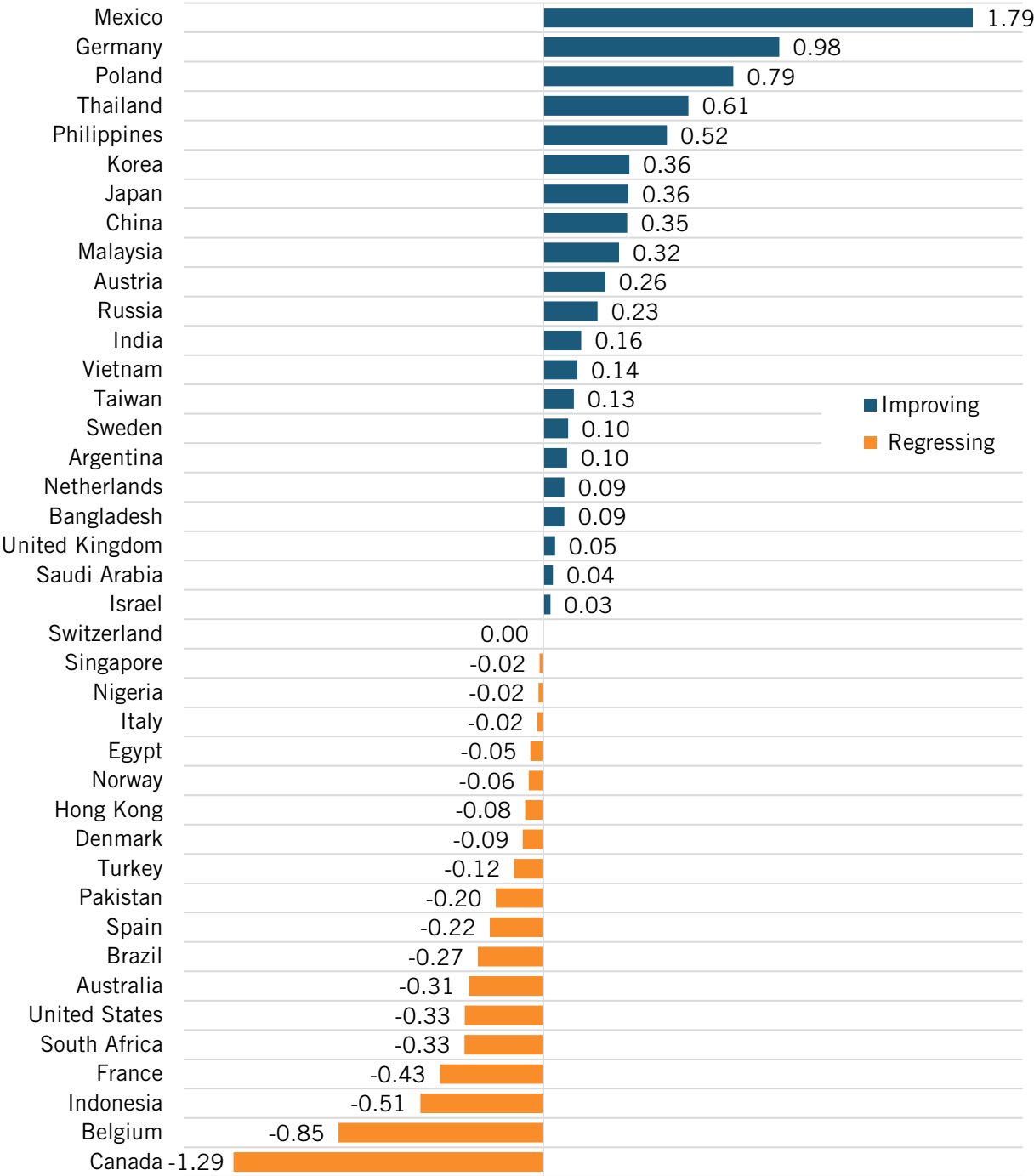
### Specialization Rankings

**Figure 46: Relative performance in motor vehicles (2020 LQ)**

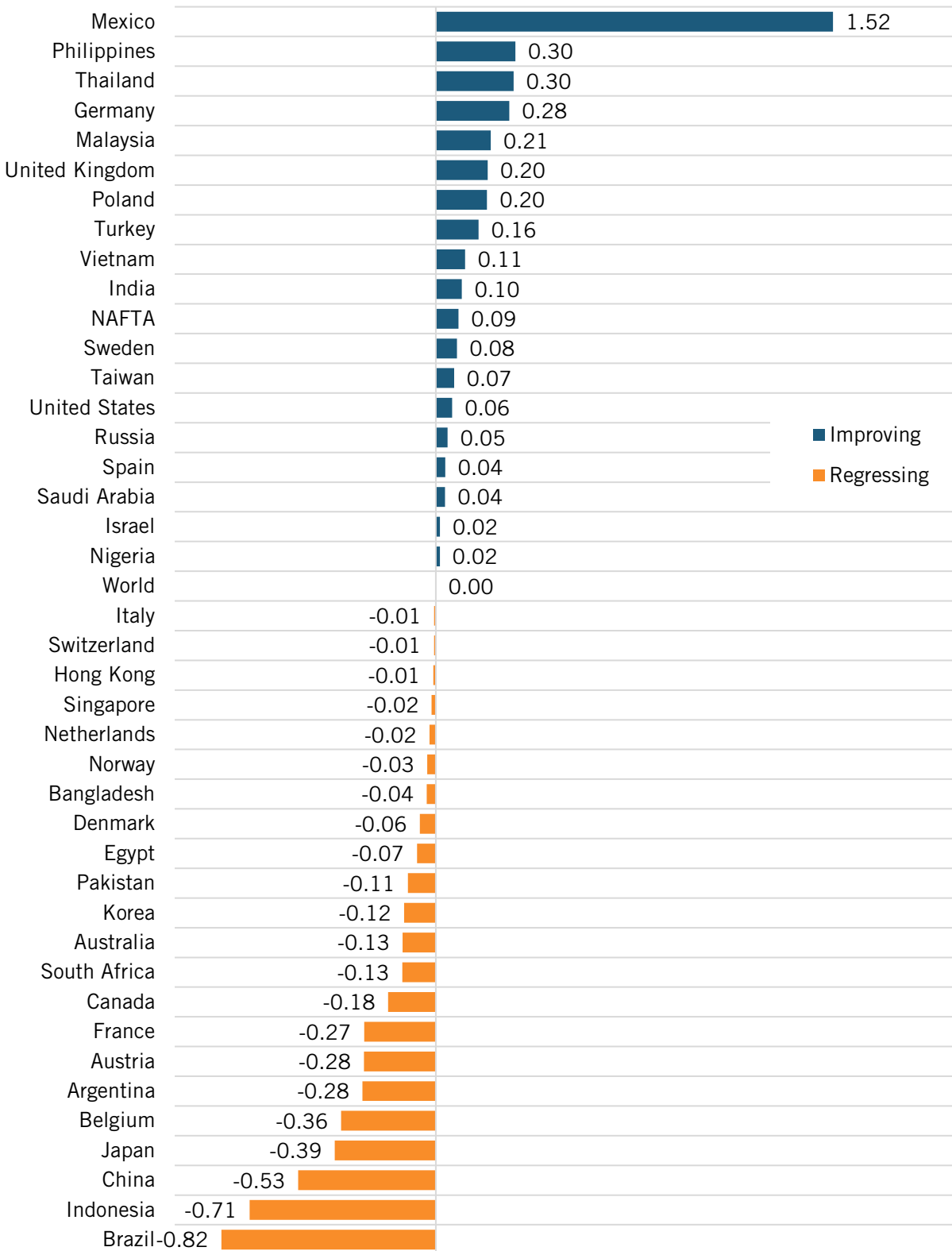


Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Mexico (+152 percentage points), the EU-10 (+37 percentage points), and Thailand (+30 percentage points). Overall, OECD nations saw their average LQ decline by 2 percentage points. Notable among those that lost ground were Brazil (-82 percentage points), Indonesia (-71 percentage points), China (-53 percentage points), and Japan (-39 points).

**Figure 47: Net change in relative performance in motor vehicles, 1995–2020 (LQ difference)**



**Figure 48: Net change in relative performance in motor vehicles, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the EU-27 surpassed China and the Belt & Road nations in their levels of industrial specialization. The former group's LQ averaged 1.24 in 2020, up 13 percentage points from 2008. This was largely due to growth in the EU-10 countries. The latter group's was 1.15 in 2020, up 1 percentage point from 2008.

## Other Transportation Equipment

The other transportation sector comprises rail, air, and sea transportation equipment.

Globally, the sector grew slower than world GDP: 157 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP. The OECD lost market share, down from 87 percent in 1995 to 68 percent in 2020.

Due to Boeing and Lockheed Martin, coupled with GE and Pratt and Whitney, the United States led the world in 2020 with 34.5 percent of other transportation production, down slightly from 35 percent in 1995. The next highest-ranking nation was China (15.1 percent, up significantly from 1.7), largely boosted by expansion in high-speed rail and shipping. Other nations were France (5 percent, up from 4.9 percent), Germany (4.7 percent, down from 5.2), and Japan (4 percent, down significantly from 16.1). The Quad lost significant market share in this industry. Its global share was 43.1 percent, down from 54.1 percent.

Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 13.4 percentage points), India (up 2.2 percentage points), and Russia (up 1.6 percentage points). As a group, the Belt & Road nations together (e.g., Southeast, Central, and Western Asian nations) started from a small share but almost doubled their share, largely because of China. More recently from 2015 to 2020, China experienced the most growth in global share (up 3.3 percentage points), with India up 0.9 percentage points. The United States would have likely seen growth, had it not been for production cuts at Boeing due to difficulties with its 737 jet. But strong production in the last three years suggests that the U.S. LQ will increase.

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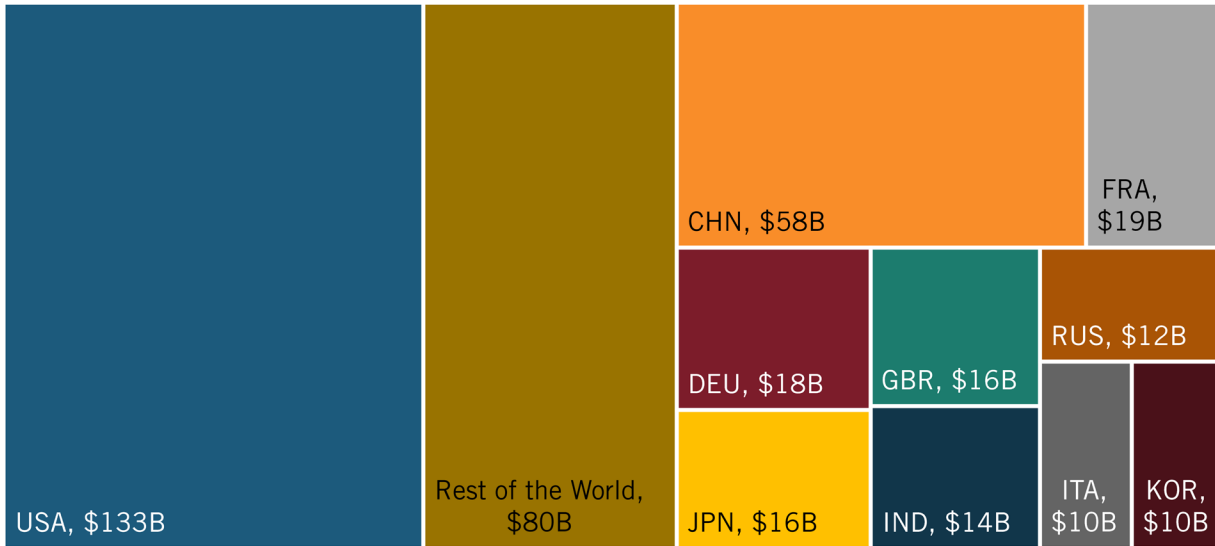
**Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 13.4 percentage points), India (up 2.2 percentage points), and Russia (up 1.6 percentage points).**

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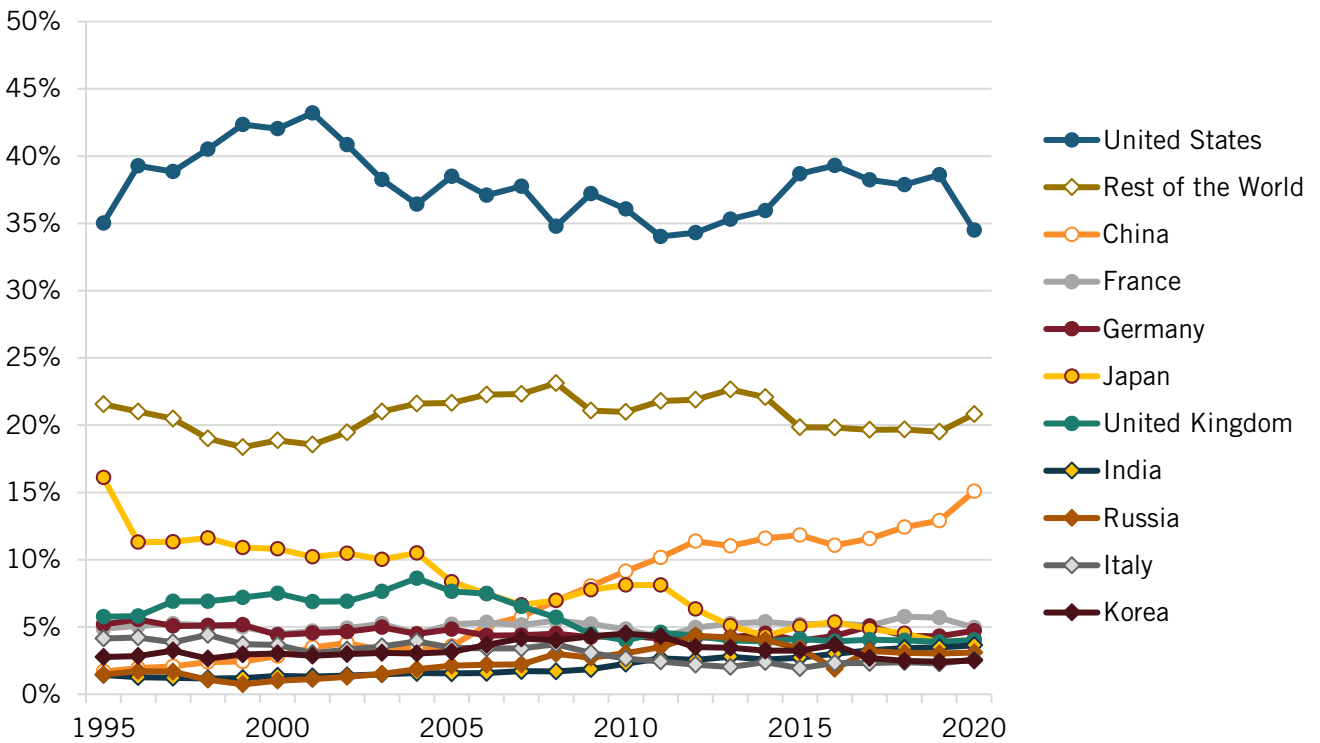
Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 12.1 percentage points) in part because of losses in all three major sectors: aerospace, rail, and shipbuilding. As a group, the OECD (down 18.3 percentage points) and the Quad (down 11 percentage points) lost significant shares. By contrast, the Belt & Road countries gained a significant share (up 14.9 percentage points).

## Top 10 Producers

**Figure 49: Global output in other transport equipment by the top 10 producers in 2020 (\$305 out of \$386 billion)**



**Figure 50: Top 10 producers' historical shares of global output in other transportation equipment**



The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was Singapore, with an LQ of 3.52. The United States, with an LQ of 1.40, was on par with Taiwan (1.40), but behind Russia (1.77) and France (1.60). While China had an LQ of 0.88 in 2020, that was up from 0.71 in 1995. With China's continued production of military aircraft and ships, coupled with its likely significant expansion through COMAC

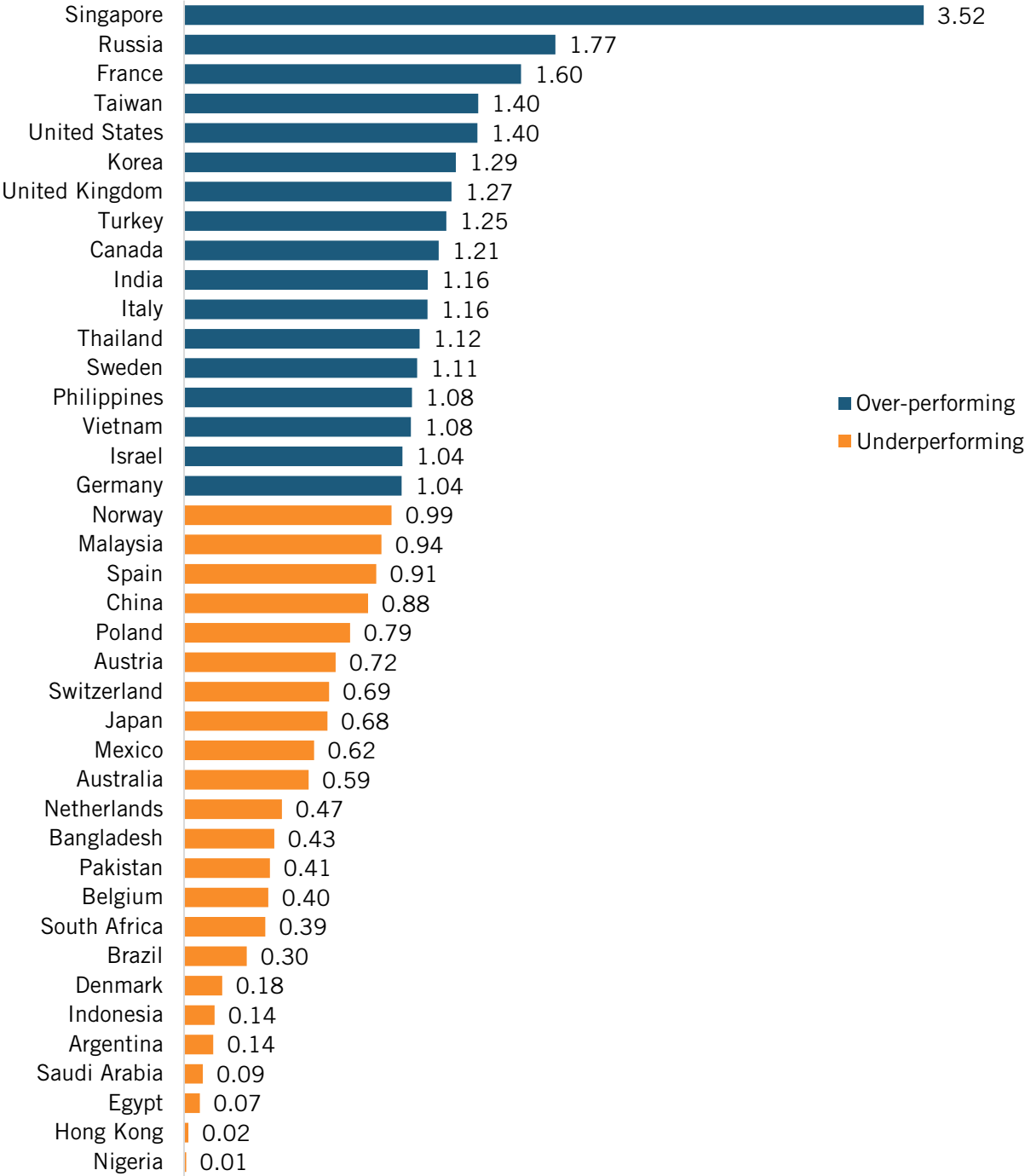


(Commercial Aircraft Corporation of China, Ltd.) in commercial aviation, it's LQ will likely soon be above 1.

Lagging nations consist of both developed and developing countries. Denmark, Argentina, Indonesia, Nigeria, and Saudi Arabia all had an LQ under 0.20.

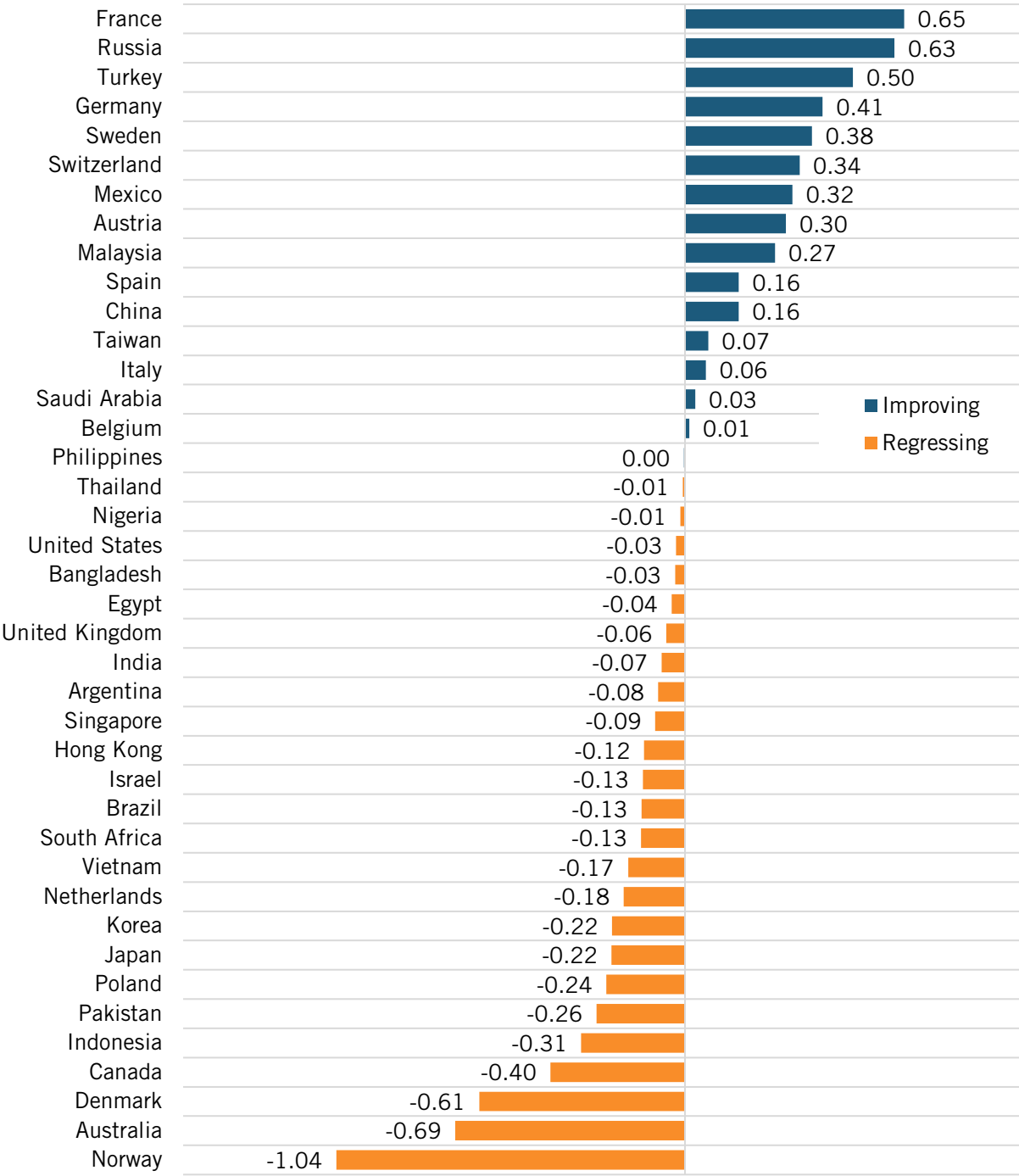
Specialization Rankings

Figure 51: Relative performance in other transportation equipment (2020 LQ)

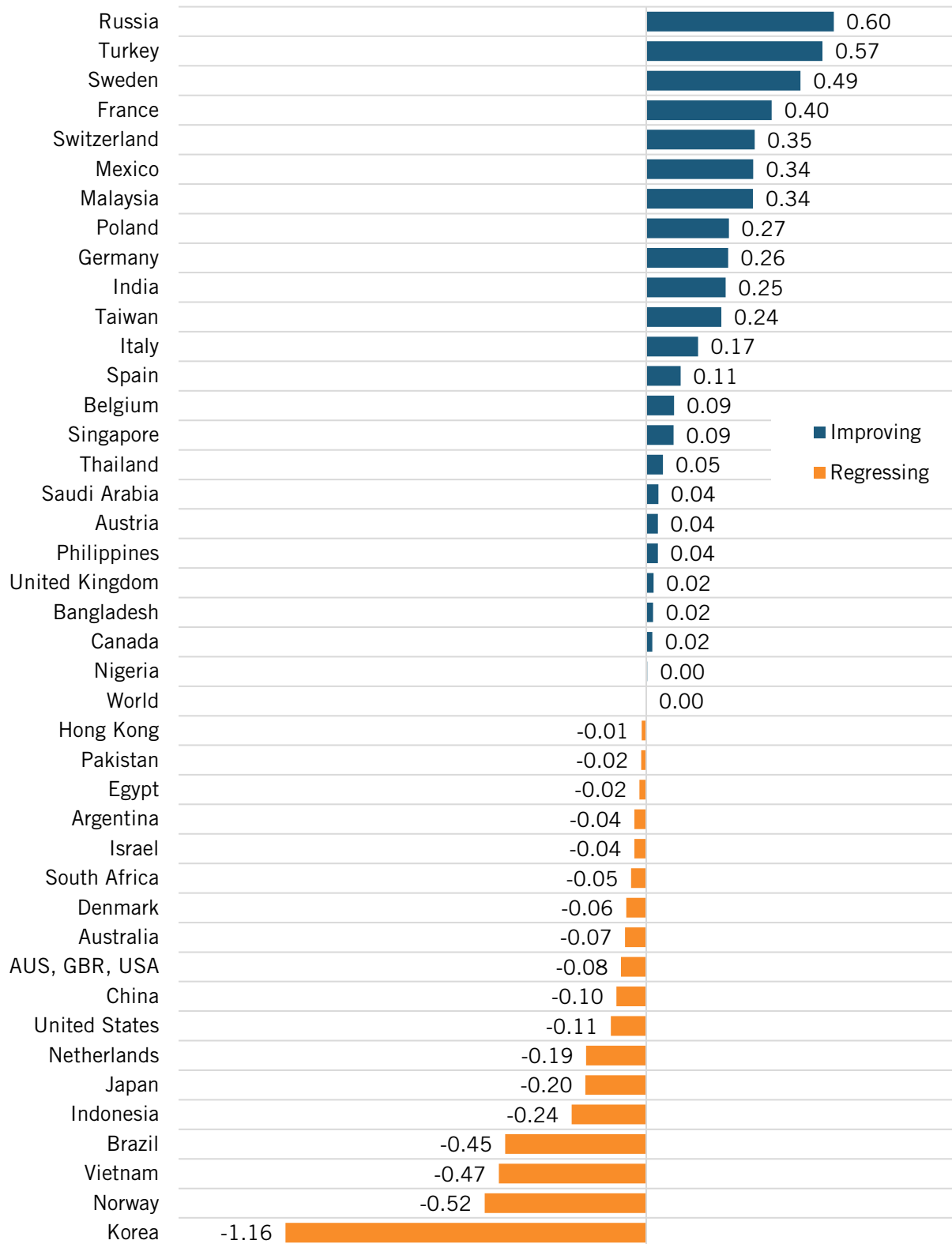


Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Russia (+60 percentage points), Turkey (+57 percentage points), and Sweden (+49 percentage points). Overall, OECD nations saw an increase in average LQ by 2 percentage points. Notable among those that lost ground were South Korea (-116 percentage points), Norway (-52 percentage points), Vietnam (-47 percentage points), and Brazil (-45 percentage points).

**Figure 52: Net change in relative performance in other transportation equipment, 1995–2020 (LQ difference)**



**Figure 53: Net change in relative performance in other transport equipment, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, NAFTA and the Quad surpassed China and the Belt & Road nations in their levels of industrial specialization in other transportation. This was largely due to the United States' membership in each of the first two groups. The LQs in 2020 averaged 1.35 for NAFTA and 1.22 for the Quad, respectively. However, those were each down 6 and 7 percentage points, respectively, since 2008. The latter group's LQ also declined to 0.88 in 2020, down 5 percentage points from 2008.

## Basic Metals

The basic metals sector comprises metals commonly used in industry such as copper, aluminum, and iron. It is a strategically important sector because other advanced industries use these metals to manufacture their own products.

Globally, the sector grew about the same as world GDP: 175 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP. About 31 percent of the sector's output was concentrated in OECD countries in 2020, down significantly from 77 percent in 1995.

China led the world in 2020 with a massive 45.6 percent of basic metals production—significantly up from 6.1 percent in 1995. This was due in part to rapid increases in metals consumption in China, but also due to massive domestic production subsidies. The next highest-ranking nations were Japan (7.6 percent, down significantly from 25 percent), the United States (7.5 percent, down significantly from 17 percent), and India (6 percent, up from 3.1 percent). The Quad lost significant market share in this industry, largely driven by the United States' and Japan's losses. Its global share was 21.6 percent, down from 46.9 percent. The EU also lost significant market share. Its global share was 8.7 percent, down from 23.9 percent.

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**China led the world in 2020 with a massive 45.6 percent of basic metals production—significantly up from 6.1 percent in 1995.**

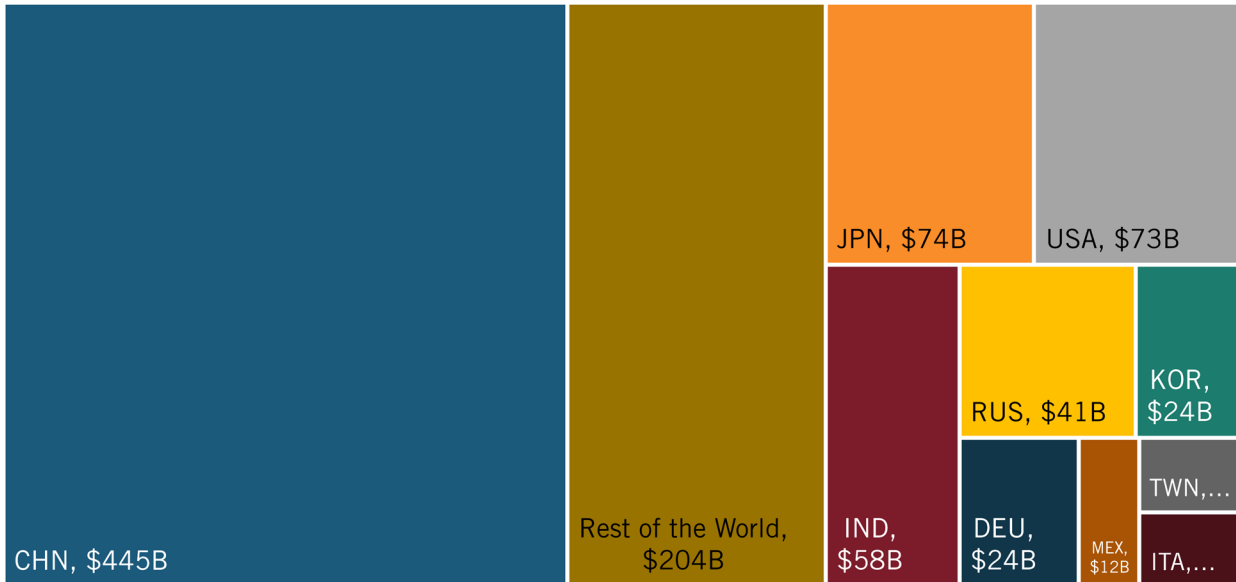
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Countries that saw the most growth in their global share of the industry from 1995 to 2020 were China (up 39.5 percentage points), India (up 2.8 percentage points), and Russia (1.3 percentage points). As a group, the Belt & Road nations together (e.g., Southeast, Central, and Western Asian nations) started from a share of 25 percent in 1995 but more than doubled their share (148 percent), largely because of China's growth in basic metals. More recently from 2015 to 2020, China experienced the most growth in global share (up 7.6 percentage points), with Russia and India up about 0.3 and 0.2 percentage points, respectively.

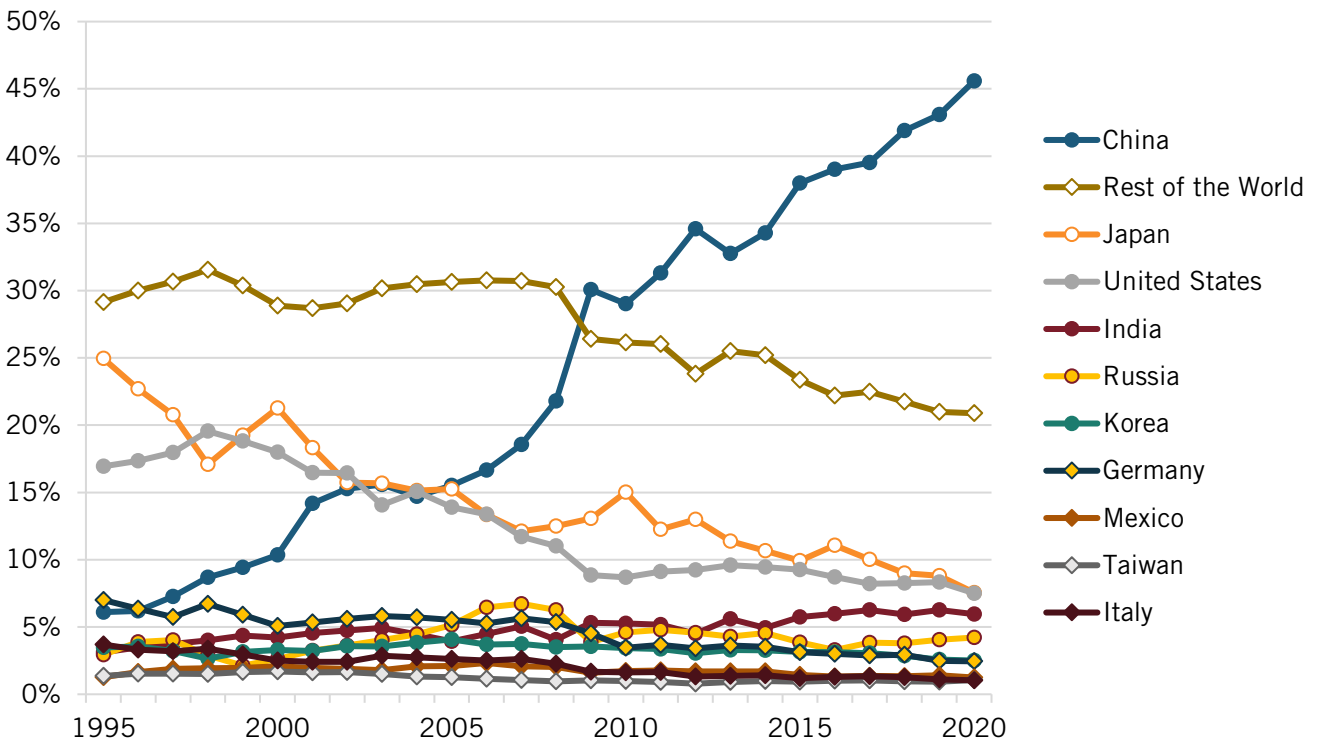
Japan experienced the greatest loss of market share in the period from 1995 to 2020 (down 17.4 percentage points). As a group, the OECD (down 46.1 percentage points) and the Quad (down 25.3 percentage points) lost significant shares. By contrast, the Belt & Road countries gained a significant share (up 36.9 percentage points).

## Top 10 Producers

**Figure 54: Global output in basic metals by the top 10 producers in 2020 (\$772 billion out of \$976 billion)**



**Figure 55: Top 10 producers' historical shares of global output in basic metals**



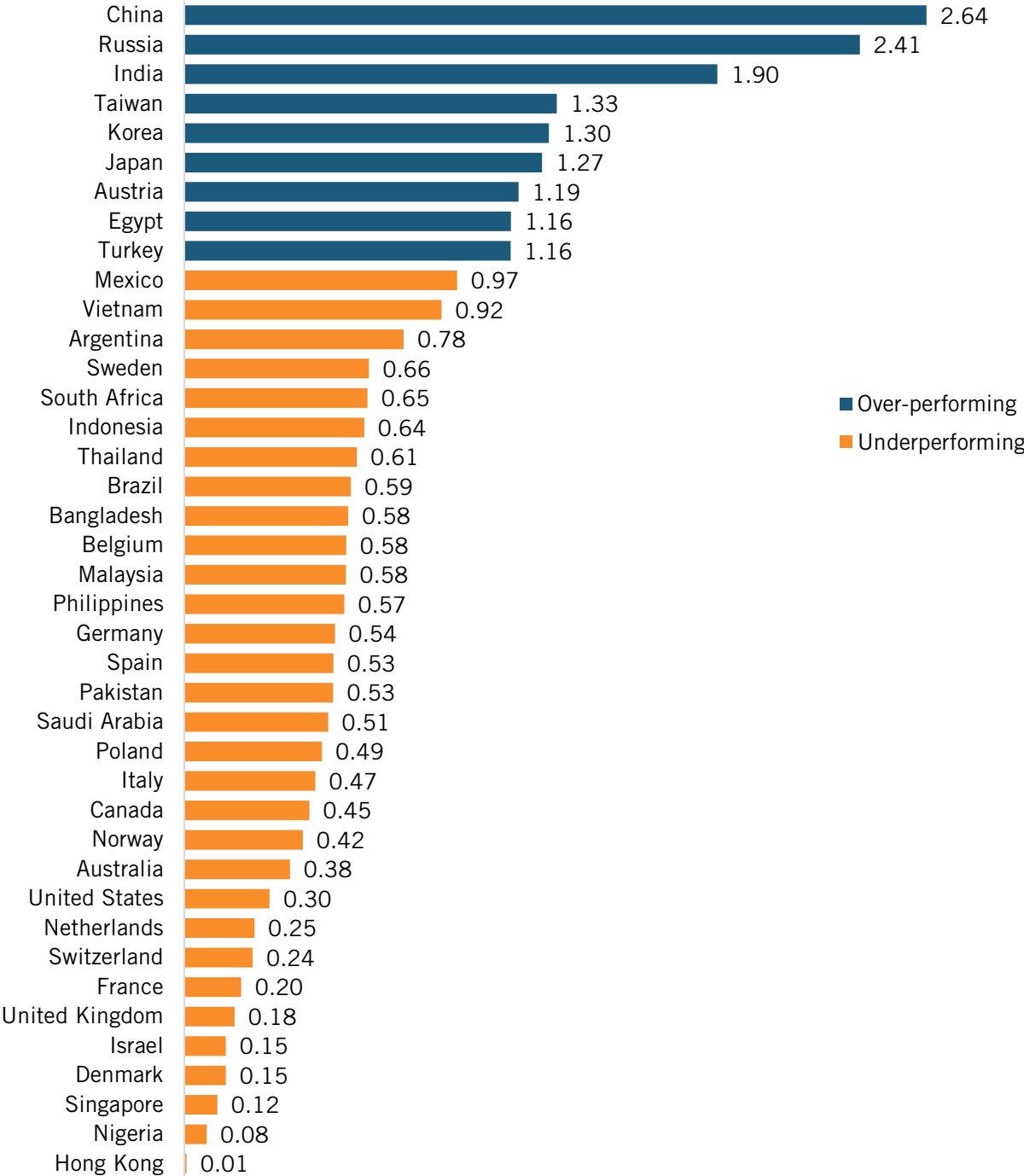
The picture is quite different when it comes to industrial specialization. The nation with the highest LQ in 2020 was China, with an LQ of 2.46. Other high-ranking countries were Russia (2.41), India (1.90), Taiwan (1.33), China (1.69), South Korea (1.30), and Japan (1.27). The

United States significantly underperformed in this sector, with an LQ of 0.30. That was lower than the LQ for Canada (0.45), Norway (0.42), and Australia (0.38).

Nations with a relatively low LQ in this industry include the United Kingdom (0.18), Denmark (0.15), Israel (0.15), Nigeria (0.08), and Hong Kong (0.01).

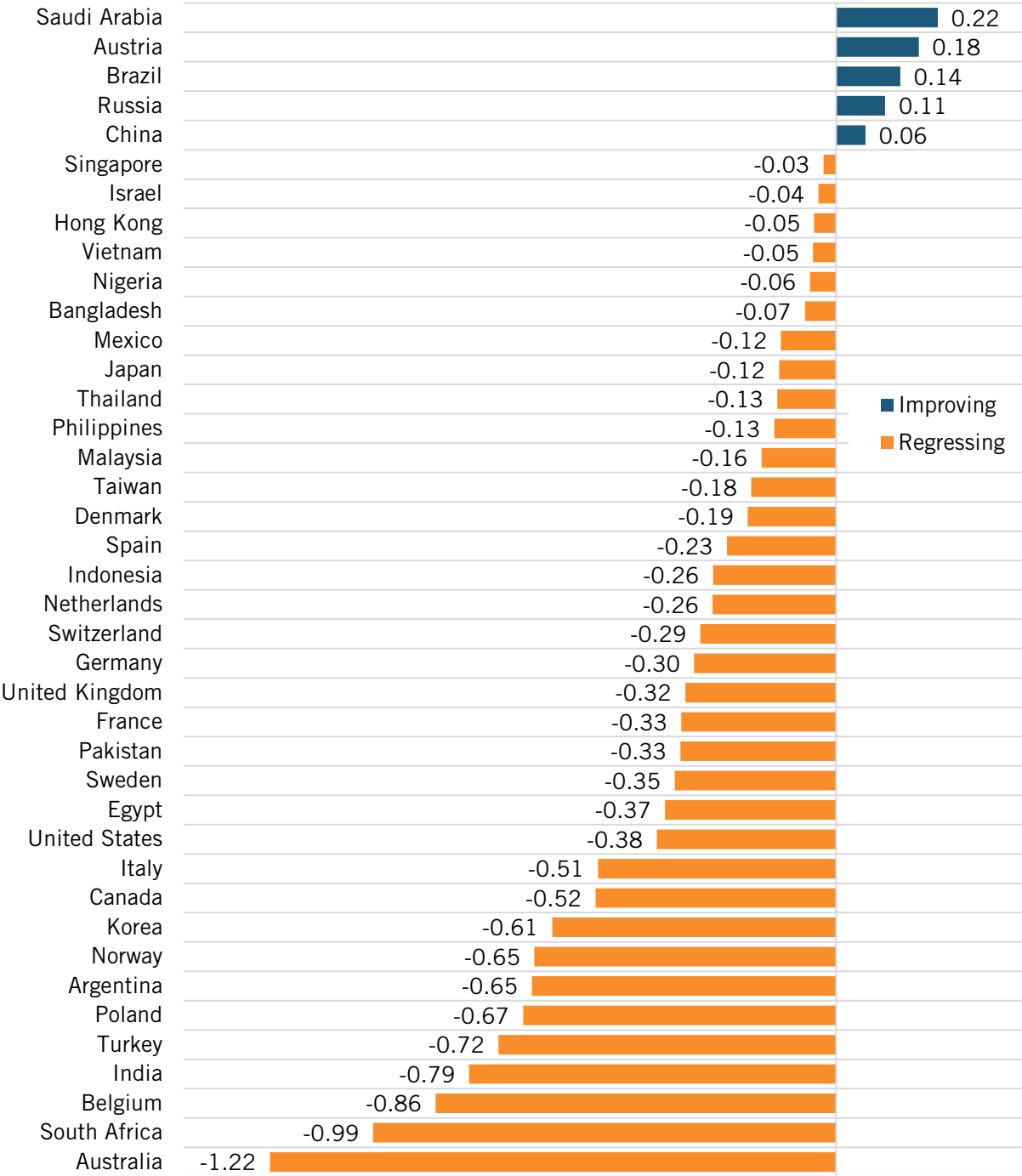
**Specialization Rankings**

**Figure 56: Relative performance in basic metals (2020 LQ)**

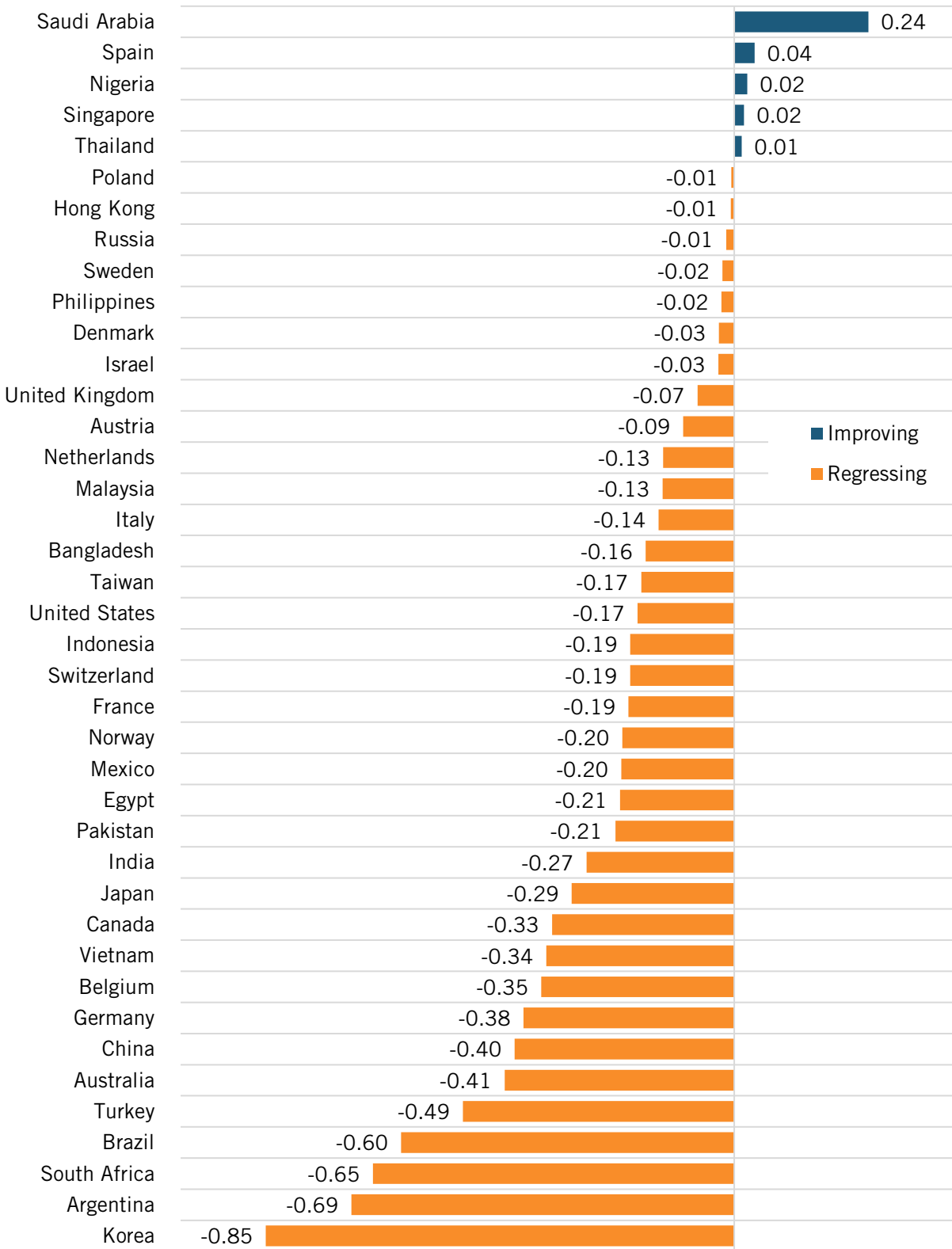


Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Saudi Arabia (+24 percentage points) and Spain (+4 percentage points). Overall, OECD nations saw a decline in their average LQ by 24 percentage points. Notable among those that lost ground were Korea (-85 percentage points), Argentina (-69 percentage points), South Africa (-65 percentage points), and Brazil (-60 percentage points).

**Figure 57: Net change in relative performance in basic metals, 1995–2020 (LQ difference)**



**Figure 58: Net change in relative performance in basic metals, 2008–2020 (LQ difference)**





Finally, from a geopolitical perspective, China and the Belt & Road nations surpassed the EU-27, NAFTA, and the Commonwealth (United Kingdom, Canada, Australia, New Zealand) in their levels of industrial specialization in basic metals. China and the Belt & Road nations' LQ averaged 1.75 in 2020, which was up 10 percentage points since 2008. However, the EU-27's, NAFTA's, and the Commonwealth's LQs declined to 0.42, 0.34, and 0.30, respectively.

## Electrical Equipment

The electrical equipment sector comprises an array of electrical products including batteries, electrical cables, relays, switchgears, and household appliances.

Globally, the sector grew more slowly than global GDP: 107 percent from 1995 to 2020 in nominal U.S. dollars, compared with 174 percent for global GDP. About 48 percent of the sector's output was concentrated in OECD countries in 2020, down significantly down from 88 percent in 1995.

China led the world in 2020 with 36.1 percent of electrical equipment production, up slightly from just 3.8 percent in 1995. The next-highest-ranking nations were the United States (11 percent, down significantly from 16.1), Japan (9.9 percent, down significantly from 33.9), and Germany (8.1 percent, down from 15.1). The EU lost significant market share: 19.1 percent, down from 31.8 percent.

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**China led the world in 2020 with 36.1 percent of electrical equipment production, up slightly from just 3.8 percent in 1995.**

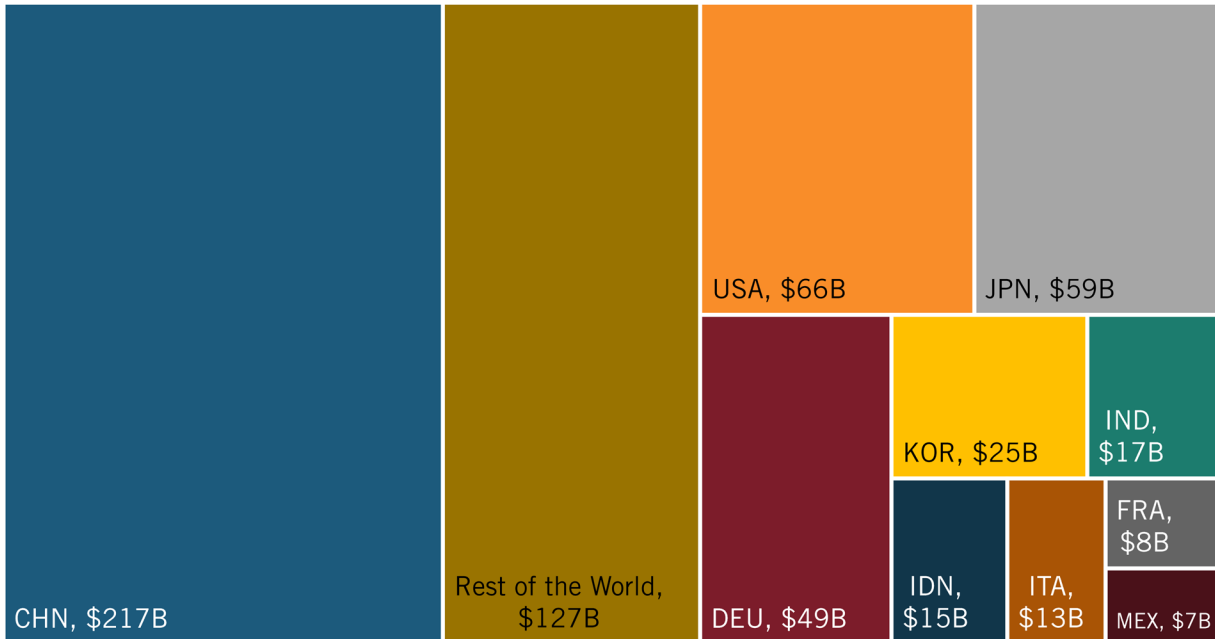
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China saw the most growth in global market share of the industry from 1995 to 2020, up 32.4 percentage points. Korea (up 2.5 percentage points), India (up 2.1 percentage points), and Indonesia (1.98) also saw modest growth in their global share. As a group, the Belt & Road nations together (e.g., Southeast, Central, and Western Asian nations) started from a small share but saw dramatic growth in percentage growth (267 percent), largely because of China's growth.

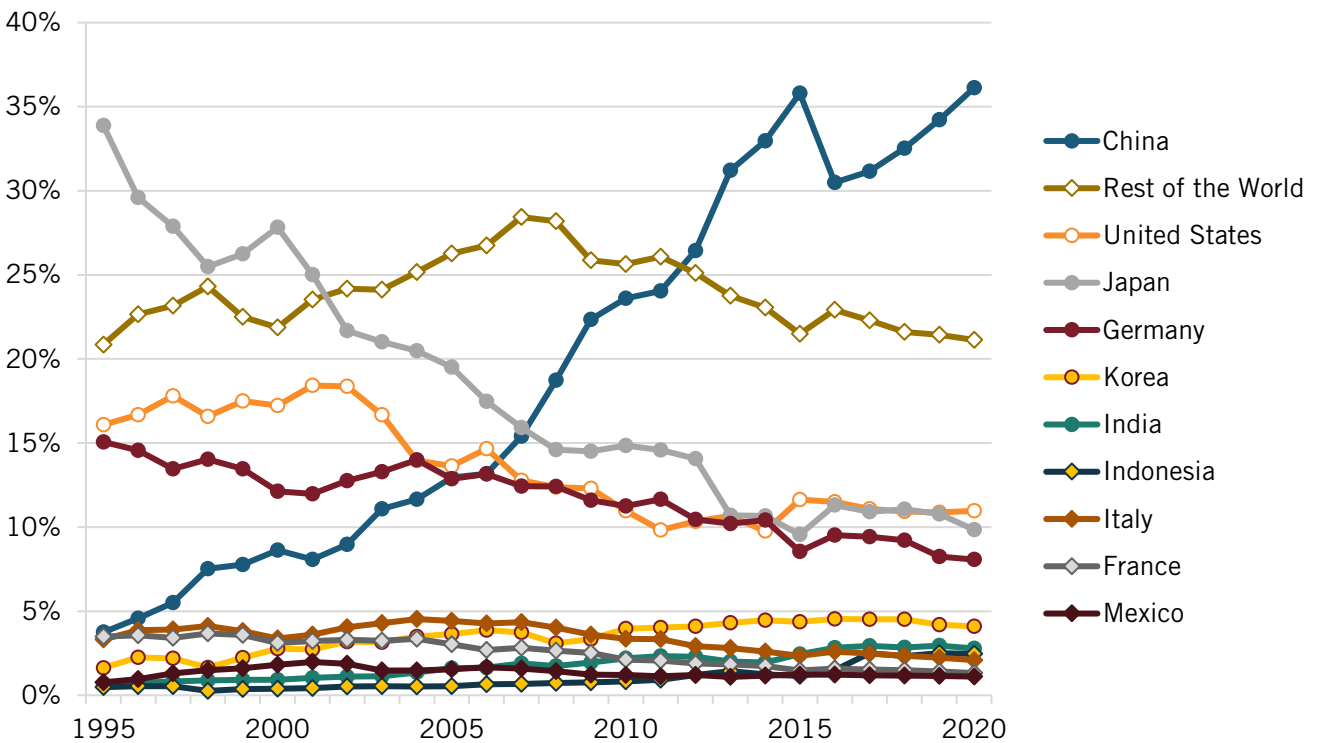
Japan experienced the greatest loss of market share from 1995 to 2020 (down 24 percentage points). As a group, the OECD (down 40.1 percentage points) and EU (down 12.6 percentage points) lost significant shares, with the EU's loss concentrated in the EU-17 (down 14.1 percentage points).

## Top 10 Producers

**Figure 59: Global output in electrical equipment by the top 10 producers in 2020 (\$475 out of \$602 billion)**



**Figure 60: Top 10 producers' historical shares of global output in the electrical equipment industry**

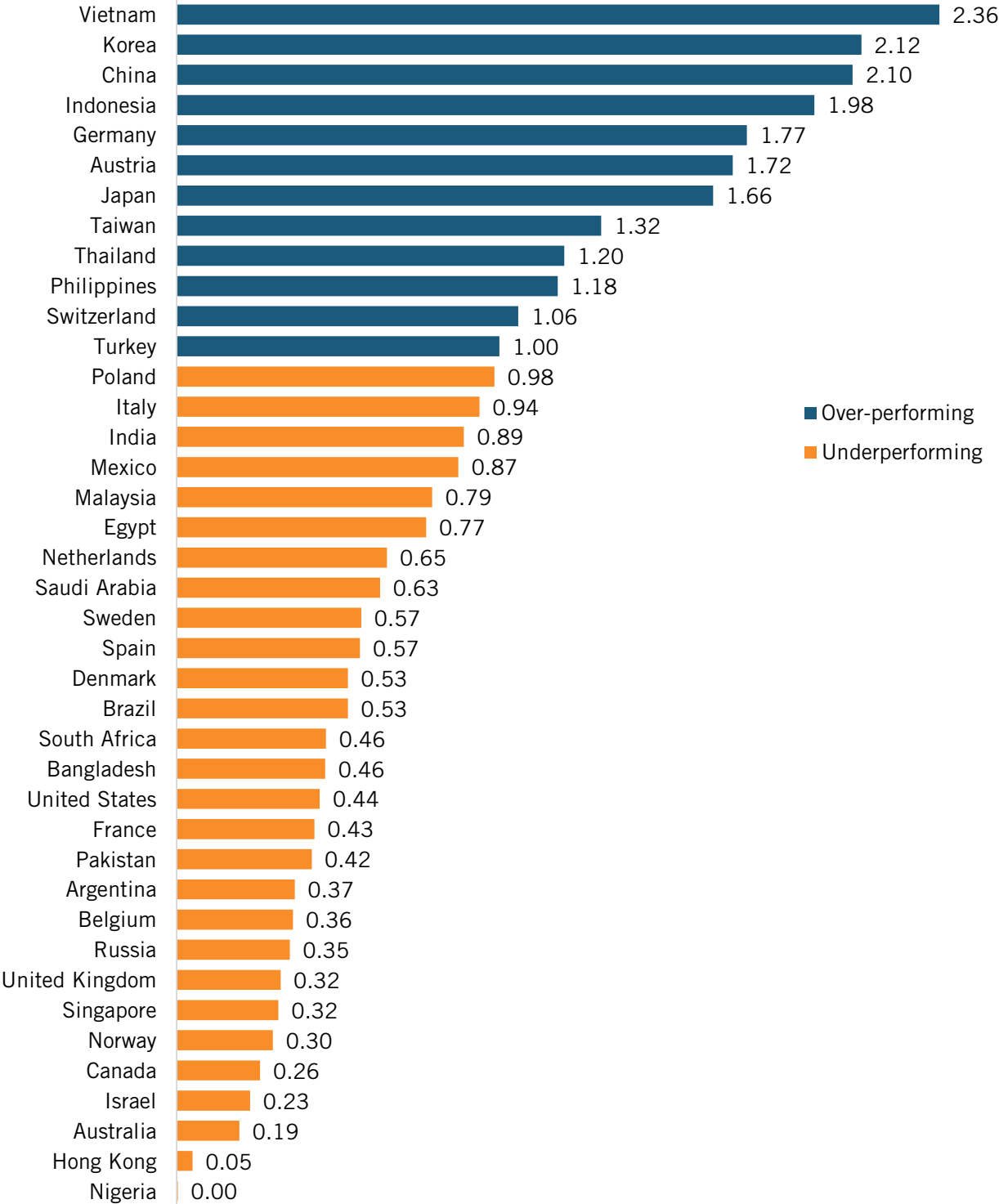


The picture is different when it comes to industrial specialization. The nations with the highest LQ in 2020 were Vietnam (LQ of 2.36) and South Korea (2.12). The United States, with an LQ of 0.44, was behind other high-ranking nations such as Indonesia (1.98), Germany (1.77),

Austria (1.72), and Japan (1.66). Among the worst-performing developed countries were France (0.43), Belgium (0.36), Great Britain (0.32), Canada (0.26), Israel (0.23), and Australia (0.19).

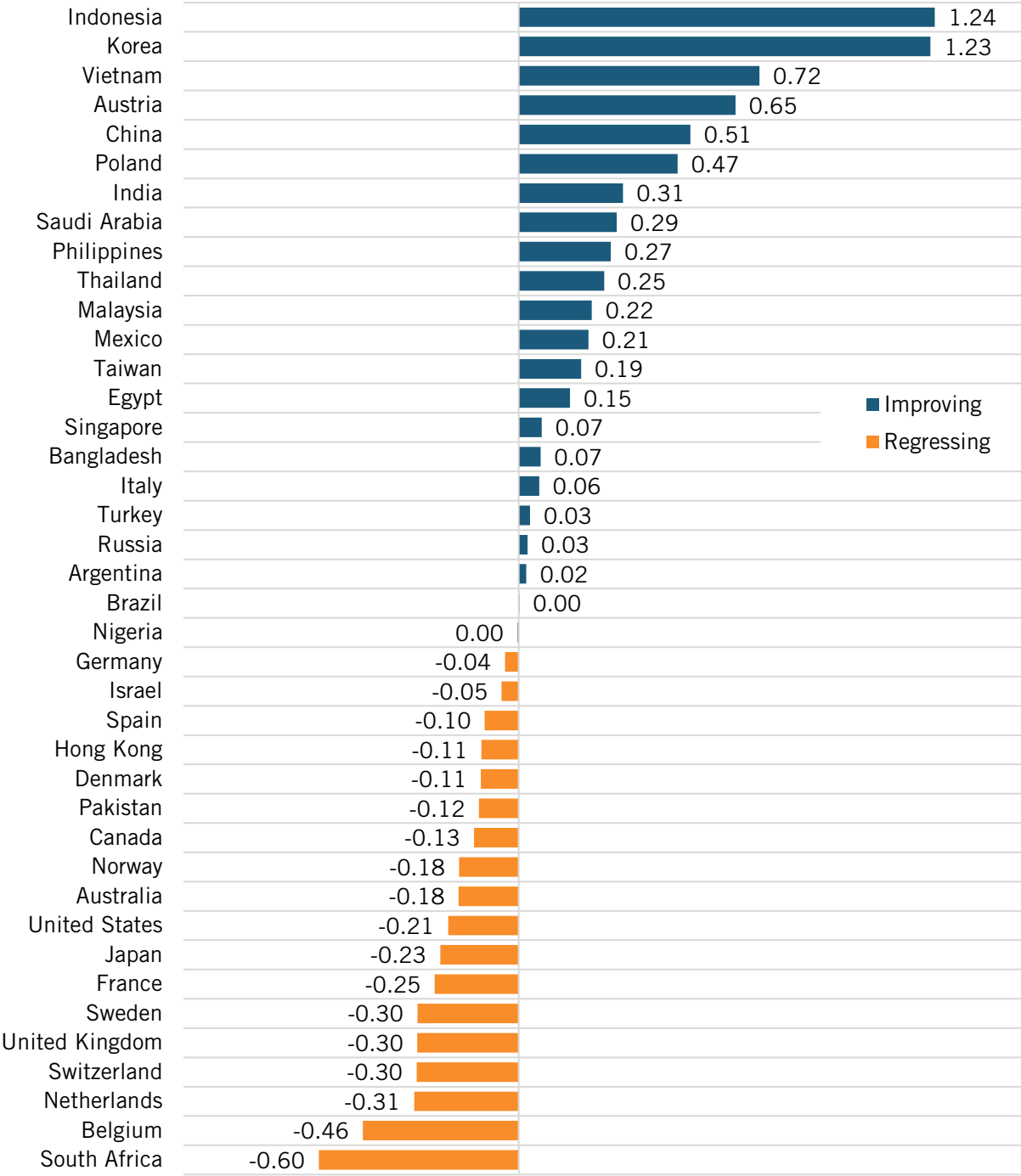
Specialization Rankings

Figure 61: Relative performance in electrical equipment (2020 LQ)

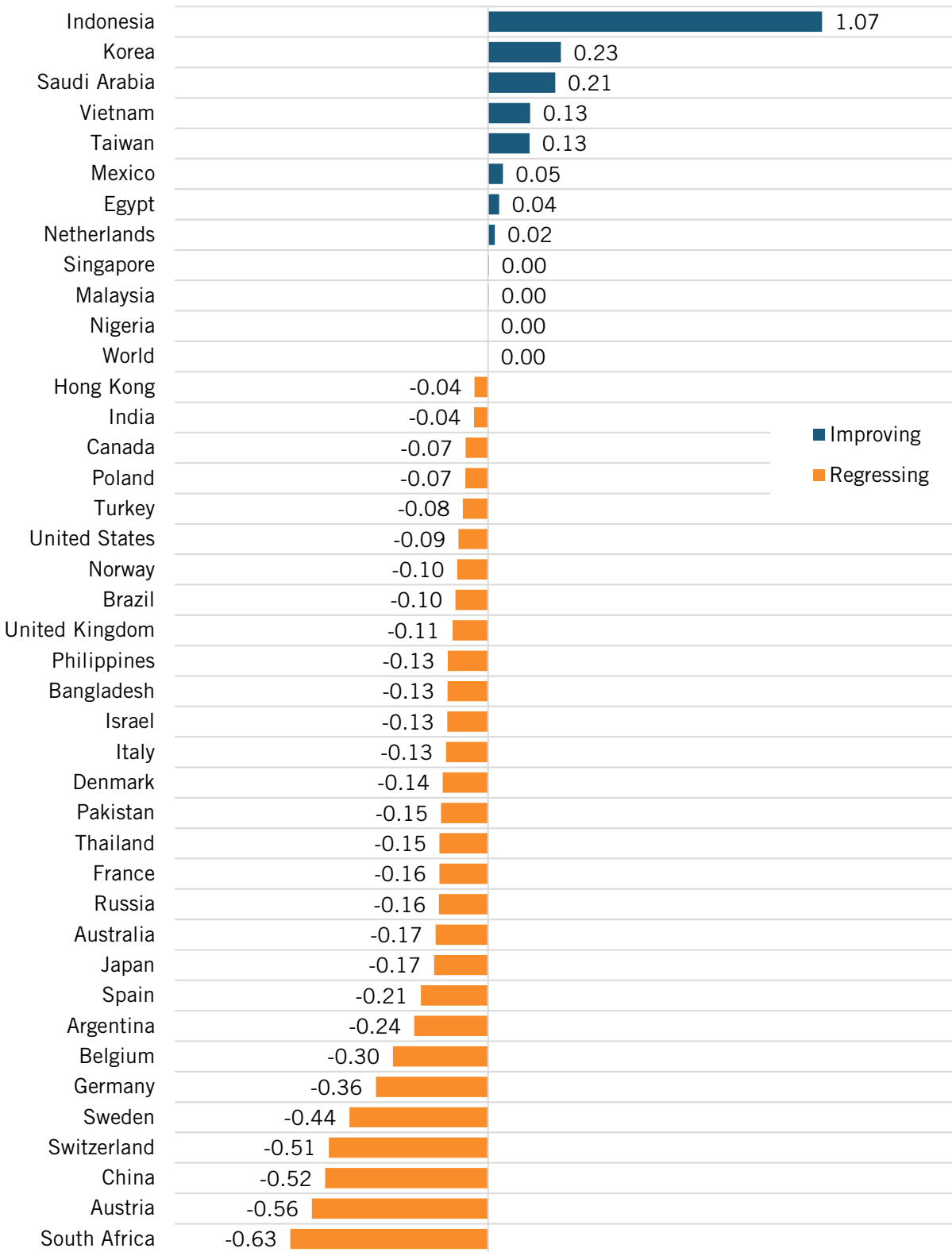


Since the global financial crisis, the nations with the fastest percentage point growth in their LQs from 2008 to 2020 were Indonesia (+107 percentage points), Korea (+23 percentage points), and Saudi Arabia (+21 percentage points). Overall, OECD nations saw a decline in their average LQ by 16 percentage points, while the EU-27 saw a decline of 15 percentage points. Notable among those that lost ground were South Africa (-63 percentage points), Austria (-56 percentage points), China (-52 percentage points), and Switzerland (-51 percentage points).

**Figure 62: Net change in relative performance in electrical equipment, 1995–2020 (LQ difference)**



**Figure 63: Net change in relative performance in electrical equipment, 2008–2020 (LQ difference)**



Finally, from a geopolitical perspective, the Belt & Road region had an LQ of 1.56, up 14 percentage points from 2008. The EU-10 nations (joined EU in 2004) came in second for industrial specialization in electrical equipment. That group’s LQ averaged 1.43 in 2020. The LQ for the remaining EU-17 was just 0.88 in 2020, down 17 percentage points from 2008.

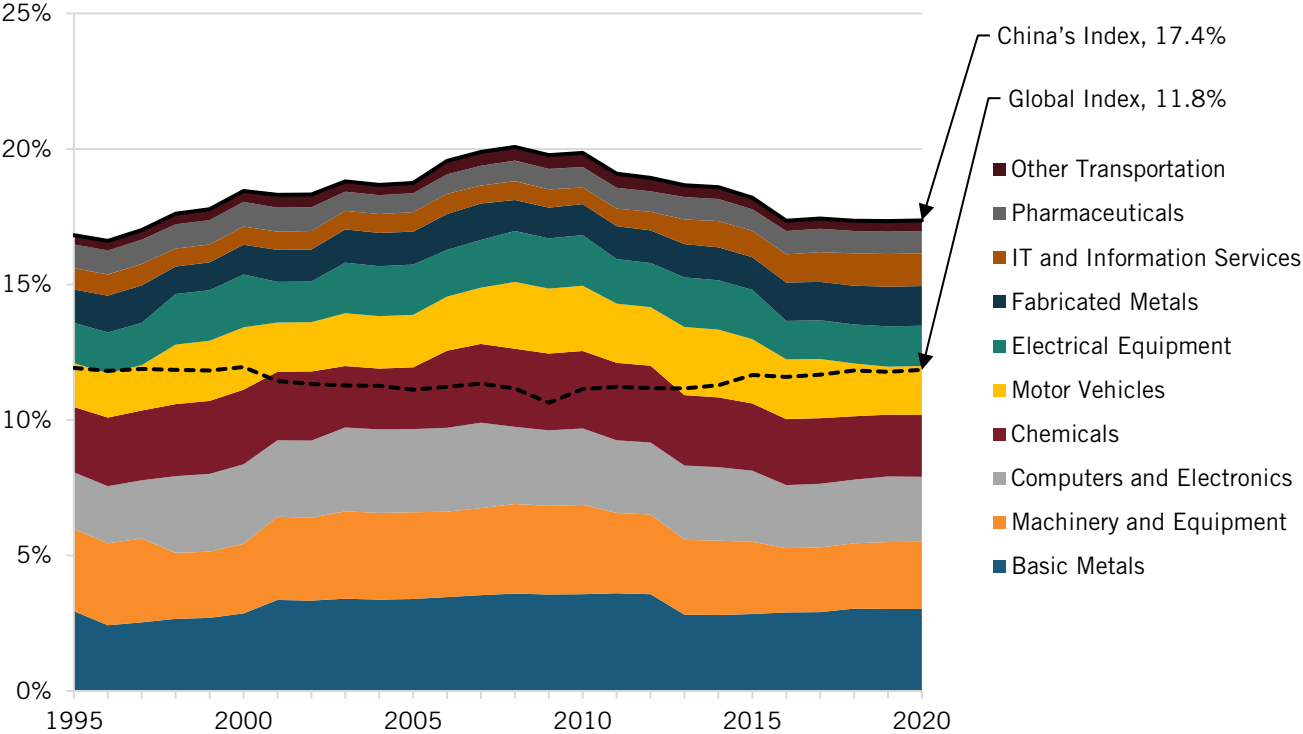
**TOP 10 PRODUCER PROFILES**

This section examines the top ten nations in terms of aggregate advanced industry output in 2022, in order of output.

**No. 1: China**

China: seeking and gaining global dominance in all advanced industries. As recently as 2011, U.S. advanced industry output exceeded China’s. Now China leads the United States and the world.

**Figure 64: Hamilton Index industries’ shares of China’s economy**

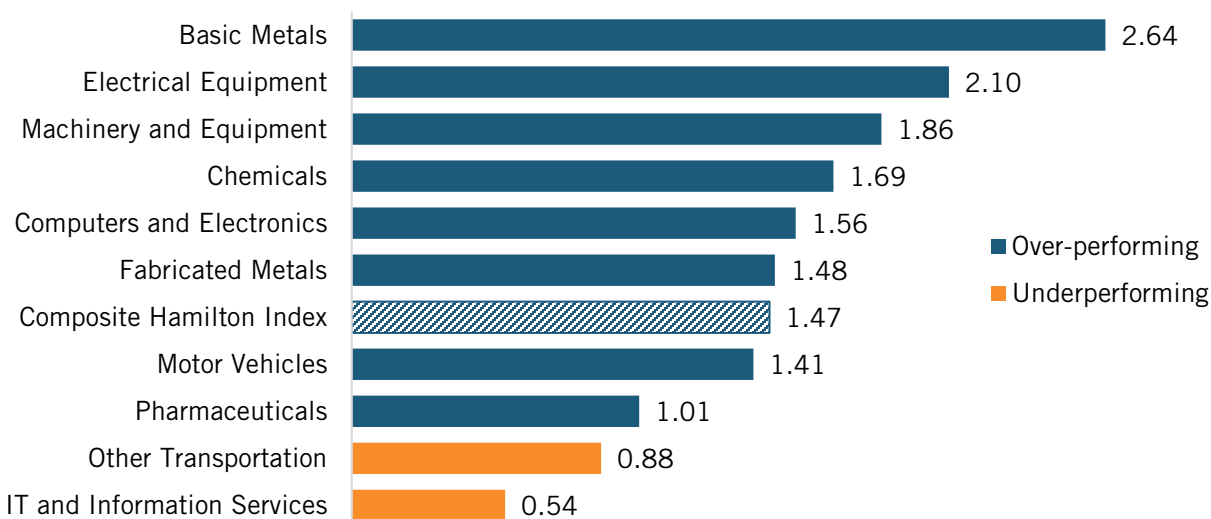


In terms of industry strength, China is above average on all industries except other transportation (which it is trying to fix with the development of COMAC’s jet aircraft business) and IT and information services (China remains weak in software). (See figure 65.) China’s strongest industry is basic metals, including steel production, an industry China has long and massively subsidized, where it has an LQ of 2.64.<sup>6</sup> It is also strong in electrical equipment, machinery equipment, chemicals, and computers and electronics.

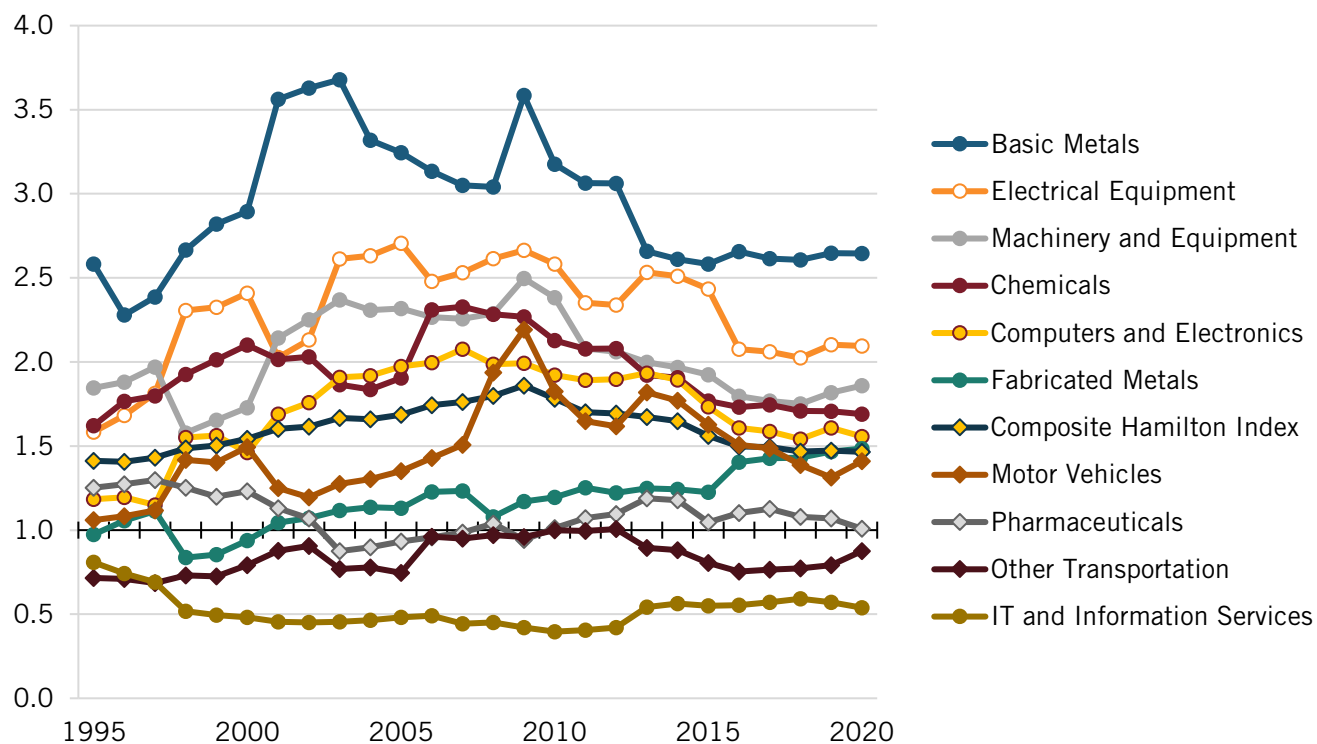
From the early 2000s until 2020, the LQs for all the industries declined, except for IT and information services (due to growth of companies such as Baidu and Alibaba) and fabricated metals. As noted, this is because of the incredibly fast growth of the Chinese economy. It is striking that since President Xi put in place his Made in China 2025 plan, China’s advanced

industry LQ in the Made in China 2025-targeted sectors grew 30 percent more slowly between 2015 and 2020 than between 2010 and 2015. Figure 67 shows the net improvement or regression in relative performance of China’s Hamilton industries since 1995, scaled to their output in 2020.

**Figure 65: China’s relative performance in Hamilton Index industries (2020 LQ)**



**Figure 66: China’s relative historical performance in Hamilton Index industries (LQ trends)**



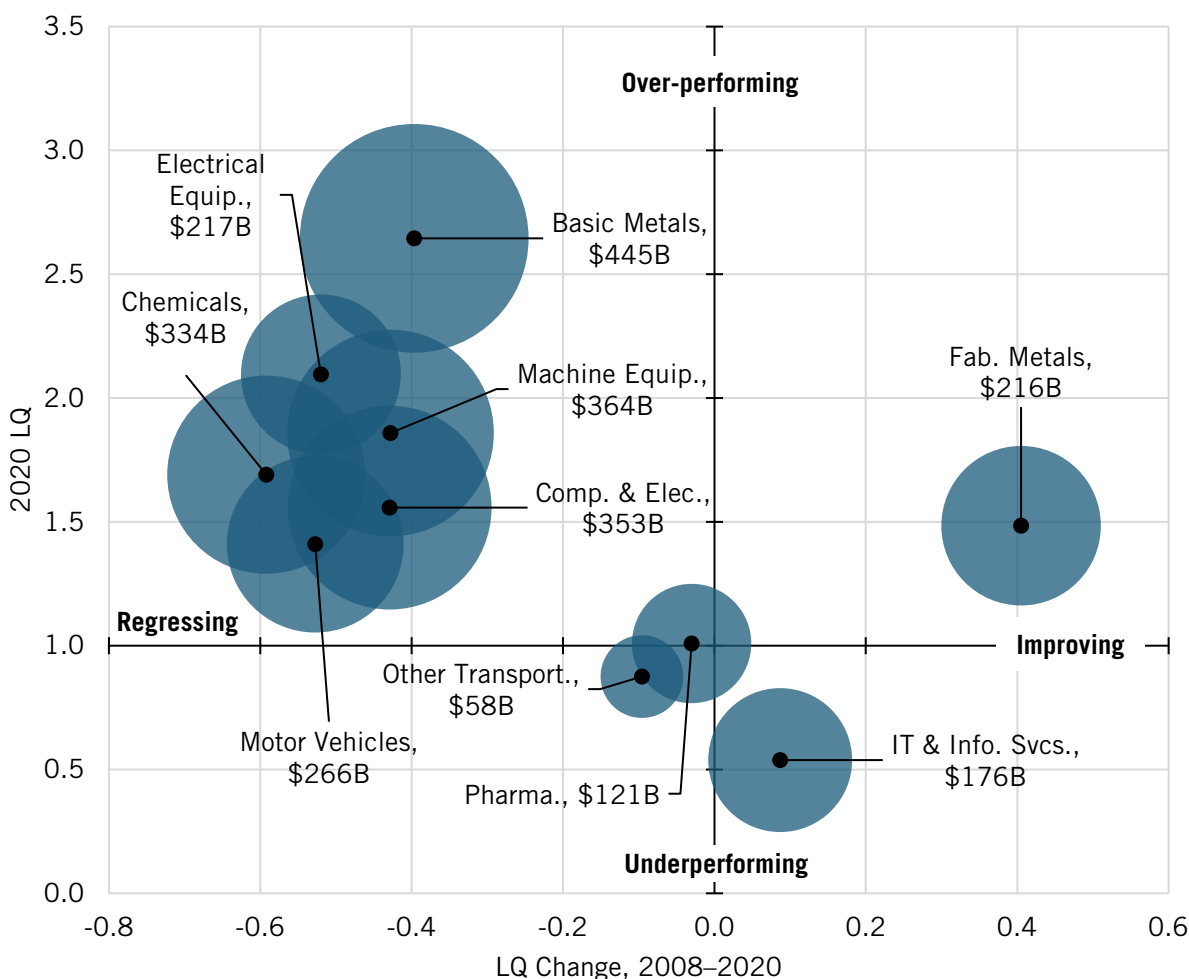
Each of the 10 industries can be classified by its LQ, change in LQ, and industry size. (See figure 67.) Industries in the upper right quadrant (an LQ above 1 in 2020, and a positive change

in LQ from 2008 to 2020) are strong and fast growing. Industries in the lower left quadrant are the opposite. China has only one industry in the “strong, growers” quadrant: fabricated metals, with output of \$216 billion. It has one industry in the “weak, growers” quadrant: IT and information services. Relative to the United States and the rest of world, China’s IT sector is weak. Surprisingly, given the strength of the Chinese shipbuilding and rail industries, this industry is in the “weak, declining” quadrant. However, given that Chinese domestic airlines will be forced to purchase COMAC airplanes, at least for domestic travel, we can expect to see that industry move to the left and top in the next decade.

**Since President Xi put in place his Made in China 2025 plan, China’s advanced industry LQ in the Made in China 2025-targeted sectors grew 30 percent more slowly between 2015 and 2020 than between 2010 and 2015.**

The remainder of China’s industries are in the “strong, decliners” category. This is not to say that these industries are not growing, it’s that they are not growing as fast as the overall Chinese economy. Overall, China’s momentum score is 257, lower than leaders such as Taiwan, Singapore, Switzerland, and Korea, but more than twice as much as that of the United States.

**Figure 67: China’s net performance in Hamilton industries since 2008 (scaled to 2020 output)**

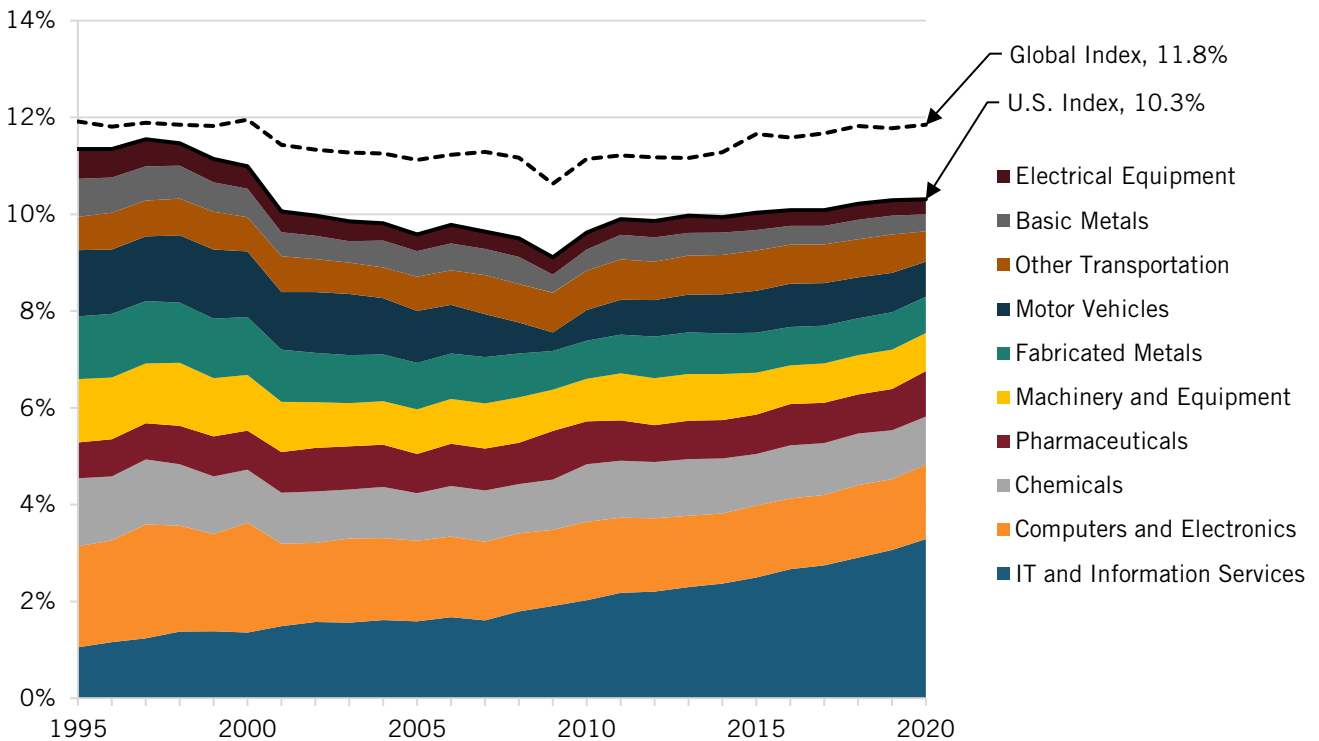




## No. 2: United States

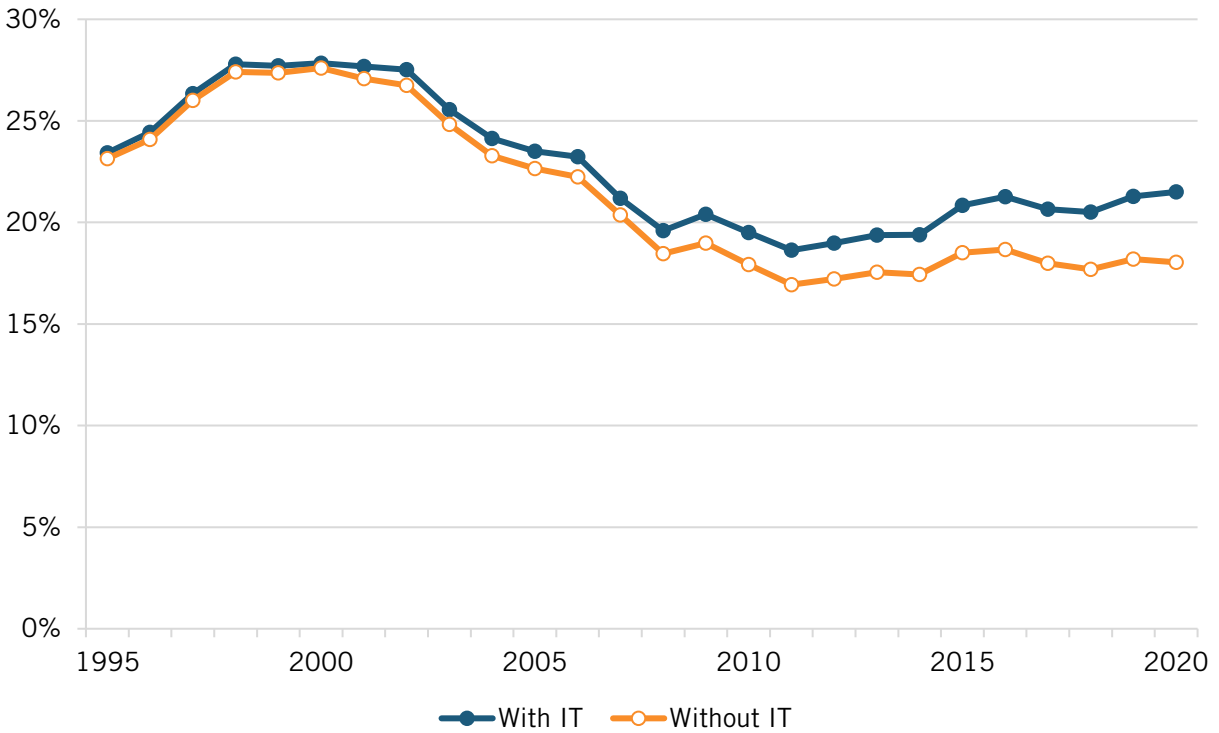
The United States used to be great; and mostly thinks it still is. The industries in the Hamilton Index together accounted for 10.3 percent of the U.S. economy in 2020—13 percent less than the global average of 11.8 percent (see figure 71). And that share fell from 1995 to the end of the 2000s, and has slowly risen since, although all that rebound has been in one sector: information and communication services. Leaving out this sector, U.S. output fell from 7.6 percent of the U.S. economy in 2010 to 7 percent in 2020.

**Figure 68: Hamilton Index industries' shares of the U.S. economy**

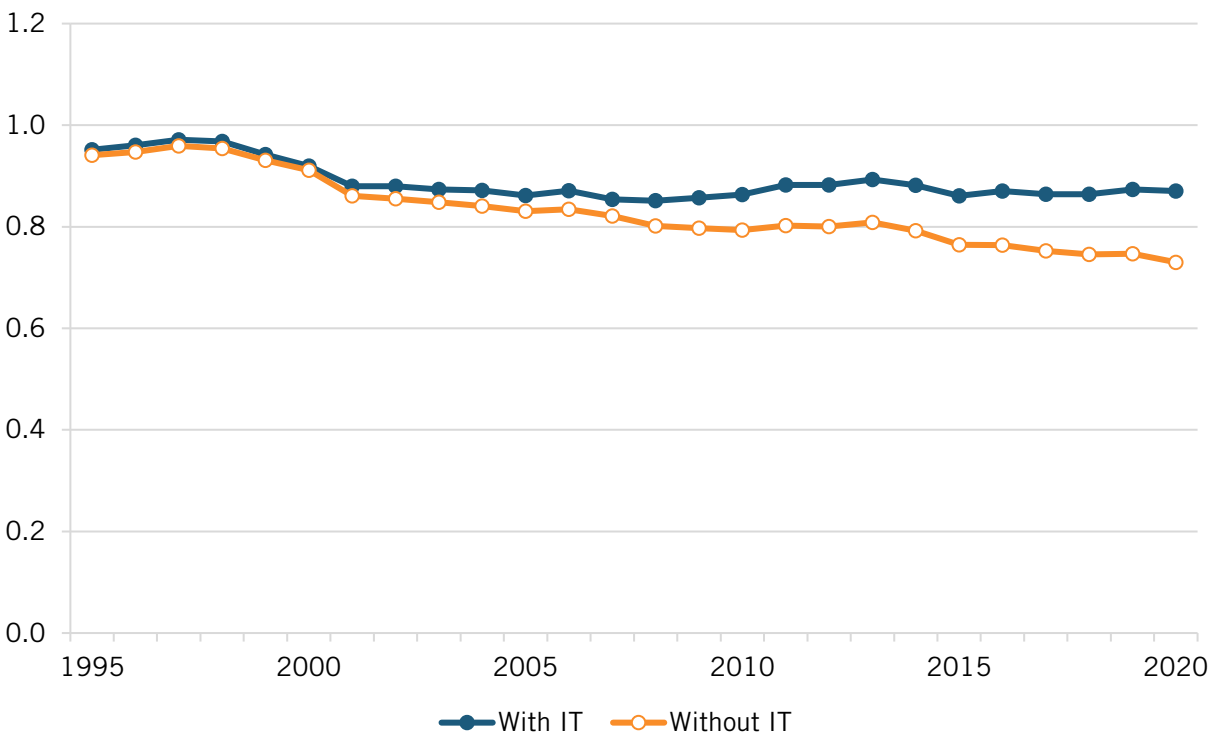


In terms of overall global share, U.S. output fell from a peak of 27.8 percent in 2000 to 21.5 percent in 2020. However, from 2011 to 2020, that share increased from a low of 18.6 percent, but this was all because of IT services growth. When leaving out this sector, U.S. global share peaked in 2000 (at 27.6 percent), just as offshoring to China began to take off. However, after reaching a low of 16.9 percent in 2016, it gradually grew to 18.0 percent in 2020. (See figure 69.) As such, the U.S. strength in IT services masks a real, structural weaknesses in advanced manufacturing. Advanced industry production minus IT and other services fell from roughly 28 percent in the early 2000s to around 18 percent by the end of the 2010s.

**Figure 69: America's global share with and without IT**

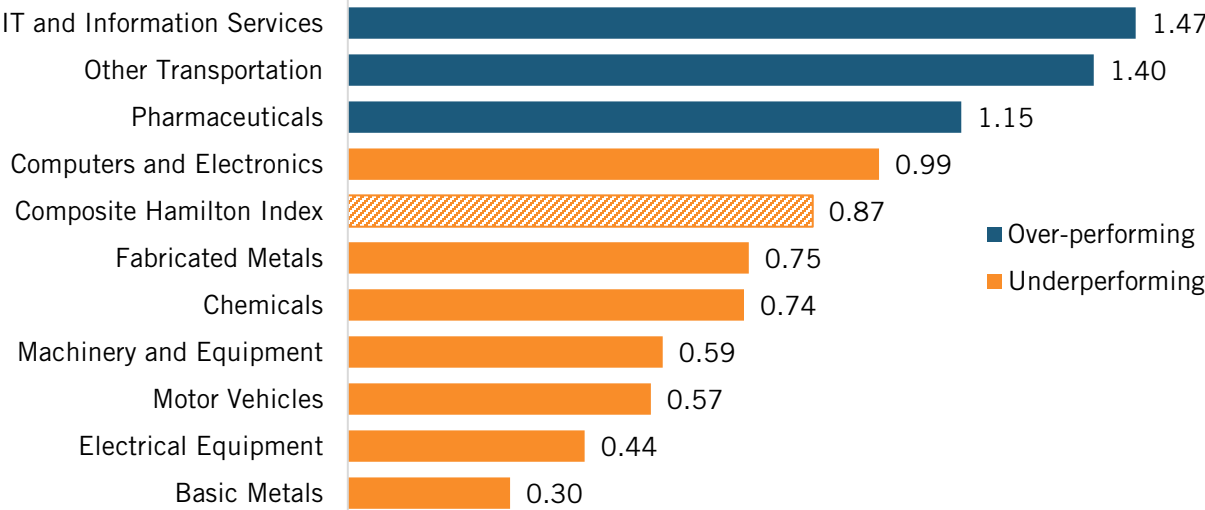


**Figure 70: America's LQ with and without IT**



The United States has just three industries with an LQ of above 1: IT and information services (1.47); other transportation (1.40), which reflects U.S. strength in aerospace; and pharmaceuticals (1.15). The computer and electronics industry is essentially at 1 (0.99). The other sectors are all 0.75 or below.

**Figure 71: America’s relative performance in Hamilton Index industries (2020 LQ)**



Only two industries saw an increase in their global LQ since 2008: IT and other information services (+27 percent) and motor vehicles (+12 percent). The former is because of the strength in the U.S. software sector and the light-touch regulatory system adopted by the United States (compared with the more heavily regulated EU system and the more hardware-focused East Asian system). With the across-the-board systematic attacks on large IT firms and a push by the federal government to restrict and regulate the industry, strength in America’s leading advanced industry sector is under threat. The United States also gained in motor vehicles, but that was only because of the beginning of the steep cyclical decline in 2008. Its 2020 LQ is below 2007 levels.

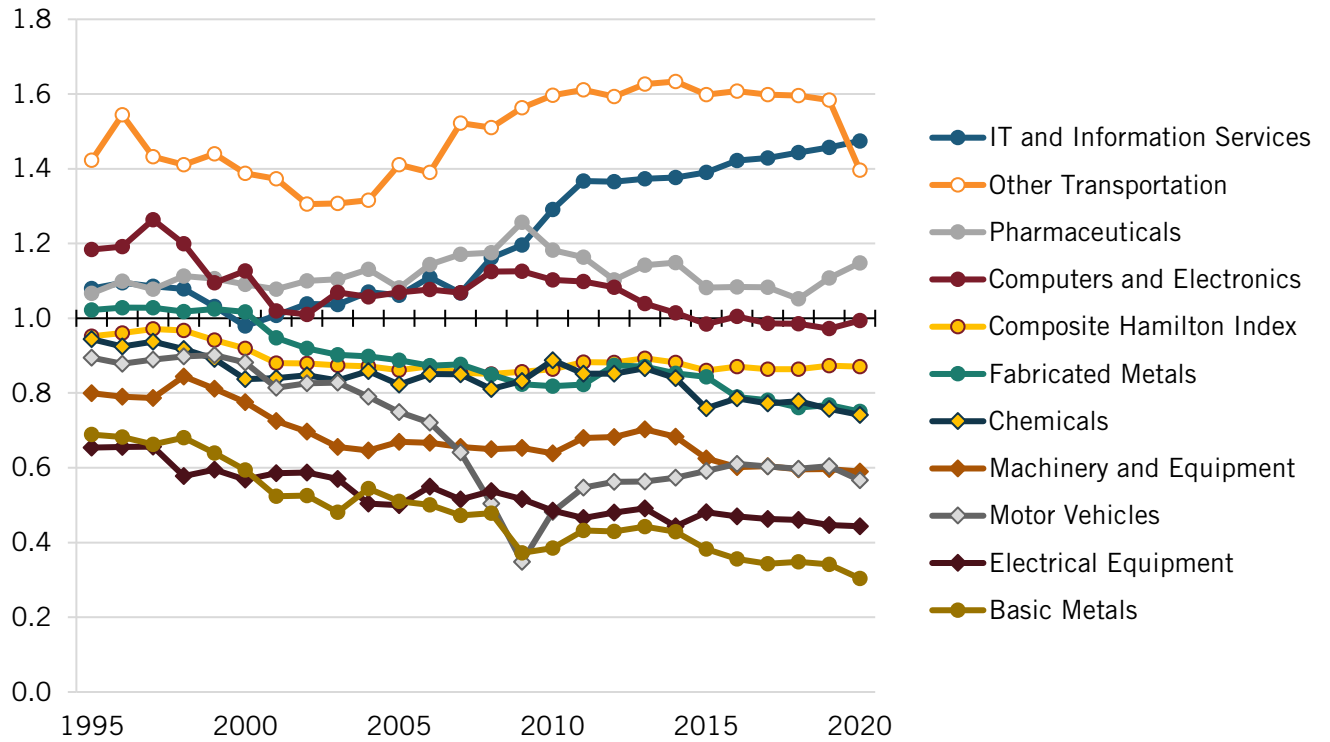
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**With the across-the-board systematic attacks on large IT firms and a push by the federal government to restrict and regulate the industry, strength in America’s leading advanced industry is under threat.**

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In contrast, the United States significantly deindustrialized since 1995 in other industries, including basic metals (-56 percent); motor vehicles (-37 percent); electrical equipment (-32 percent); fabricated metals (-27 percent), machinery and equipment (-26 percent), and chemicals (-21 percent). Computers and electronics, which include semiconductors, saw a 16 percent decline in LQ. Despite the fracking revolution and the decline in natural gas prices, the U.S. chemical industry continued to decline, with its LQ falling from 0.89 in 2010 to 0.74 in 2020.

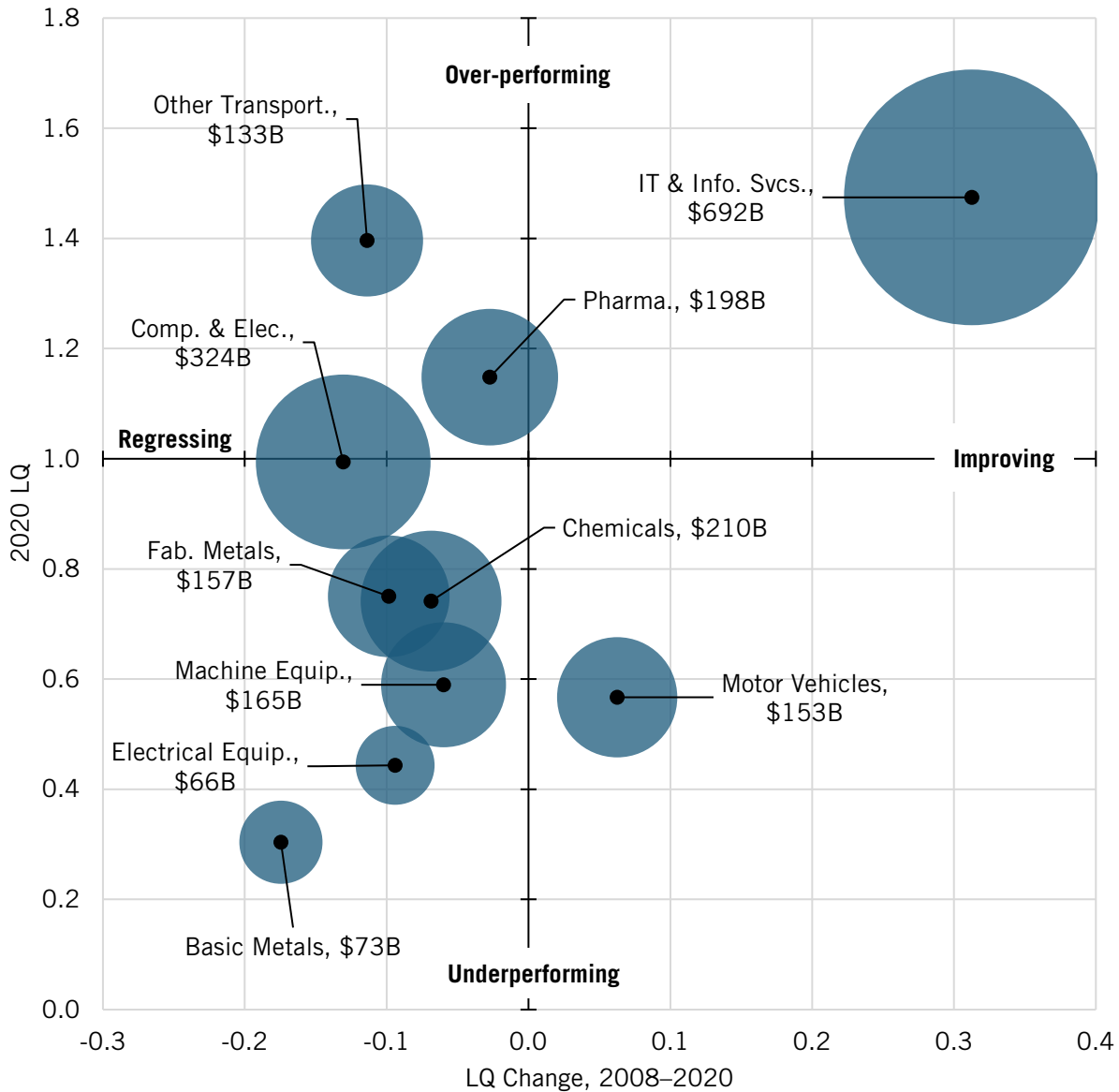
**Figure 72: America's relative historical performance in Hamilton Index industries (LQ trends)**



The United States had only one industry in the “strong growth quadrant” (an LQ above 1 and an increase in LQ since 1995): IT and information services. Fortunately, it is also America’s largest advanced industry sector. The United States has two sectors in the “strong declining” quadrant, other transportation and pharmaceuticals. The pharmaceuticals industry is strong because of the optimal mix of policy (strong patent protection, robust National Institutes of Health funding, effective drug approval, and reasonable drug pricing policies). All those factors are now under threat from federal policy. It also is declining because of the movement of drug production offshore. Other transportation is high but has been falling in part from the challenge from Europe’s Airbus and, in the future, China’s unfair COMAC competition.

The motor vehicles industry is in the “weak, growing” quadrant, but that is only because 2008 was such a weak year for production. If we used 2007 as the base year, it would be in the weak-declining sector, where the rest of the sectors are. Except for motor vehicles, all sectors are facing intensive competition from China. Overall, the U.S. momentum score is 116, lower than the average for the 40 nations.

**Figure 73: America's net performance in Hamilton industries since 2008 (scaled to 2020 output)**



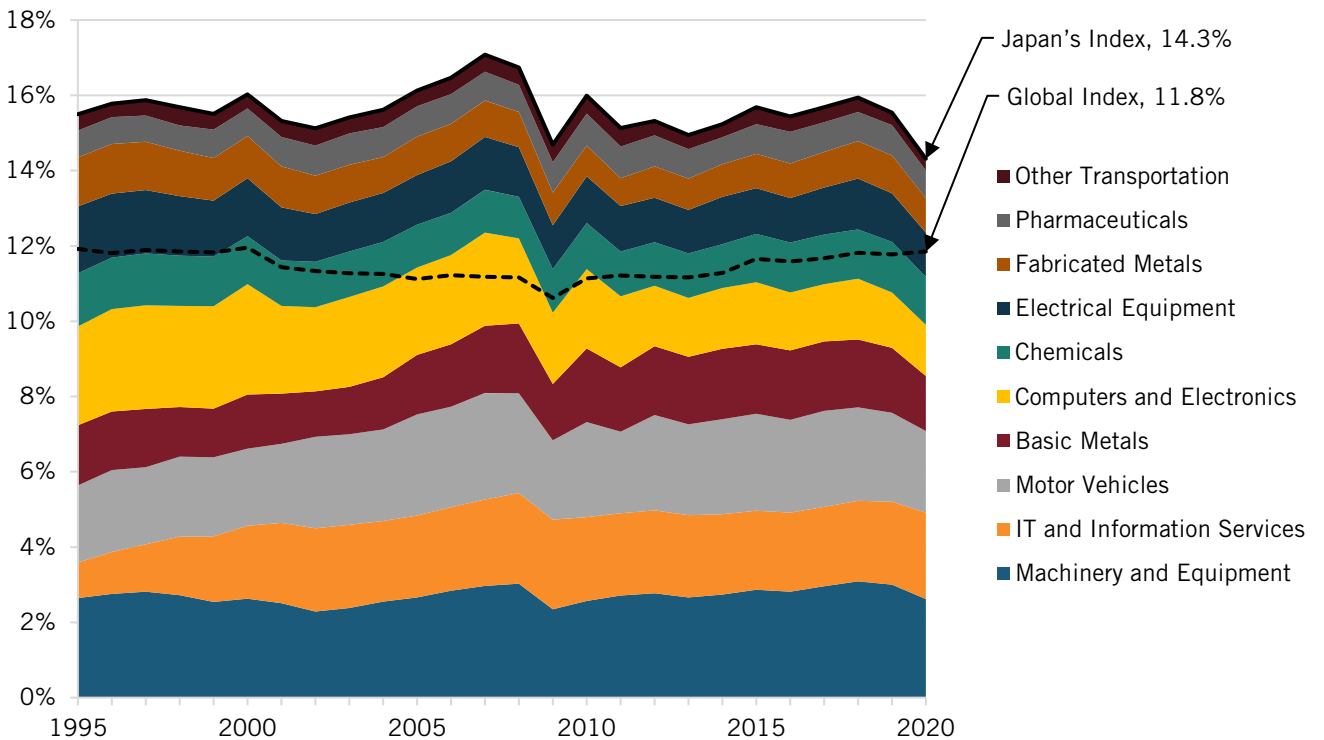
Finally, if policymakers wanted U.S. advanced industries to constitute the same share of the U.S. economy as they do in China, annual U.S. advanced-industry output would have to expand by about \$1.5 trillion, or 69 percent. This would require doubling U.S. output in pharmaceuticals, electrical equipment, machinery and equipment, motor vehicles, other transportation, computers, electrical and optical, chemicals, basic metals, and fabricated metals. Doing so would be like adding around \$149 billion in output every year for the next 10 years (assuming the U.S. GDP continues to grow). To put that in perspective, this would require capturing 48 percent of the global increase in advanced industry value-added output every year.<sup>7</sup> The United States did not get into this desperate situation overnight and it won't get out of it tomorrow, but a journey must begin with a single step.

### No. 3: Japan

Can Japan compete with China? The story of Japan in advanced industry output is the story of one long decline. In 1995, near the peak of the “Japan Challenge,” Japan’s advanced industry output was nearly equal to that of the United States’ (\$859 billion versus \$867 billion). By 2010, China had overtaken Japan and now has 72 percent more production. By 2020, its output in Hamilton Index industries was only one-third of U.S. output (\$723 billion versus \$2.6 trillion). Nonetheless, and in contrast to much of the conventional wisdom about the failure of the Japanese economy, it retains real strengths in the machinery and equipment, motor vehicles, and electrical equipment industries.

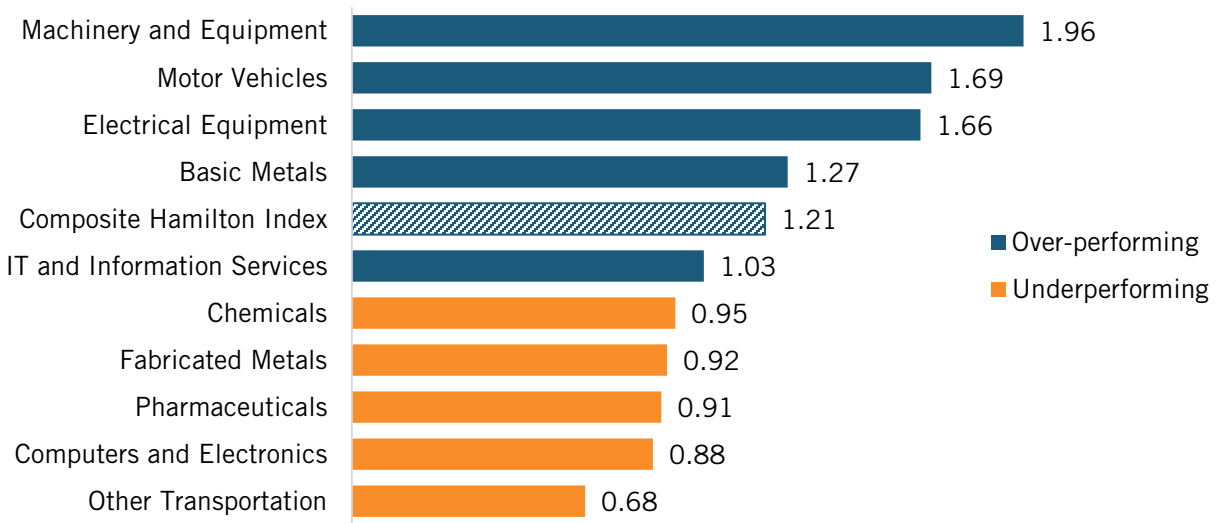
However, because of the relative decline in the size of the Japanese economy, Japan’s LQs are quite strong and were generally stable until 2018, after which they fell. Japan’s output in machinery and equipment fell \$14 billion from 2017 to 2020, during which Chinese output increased \$69 billion. Its basic metals sector output fell \$17 billion, while Chinese output increased \$86 billion.

**Figure 74: Hamilton Index industries’ shares of Japan’s economy**



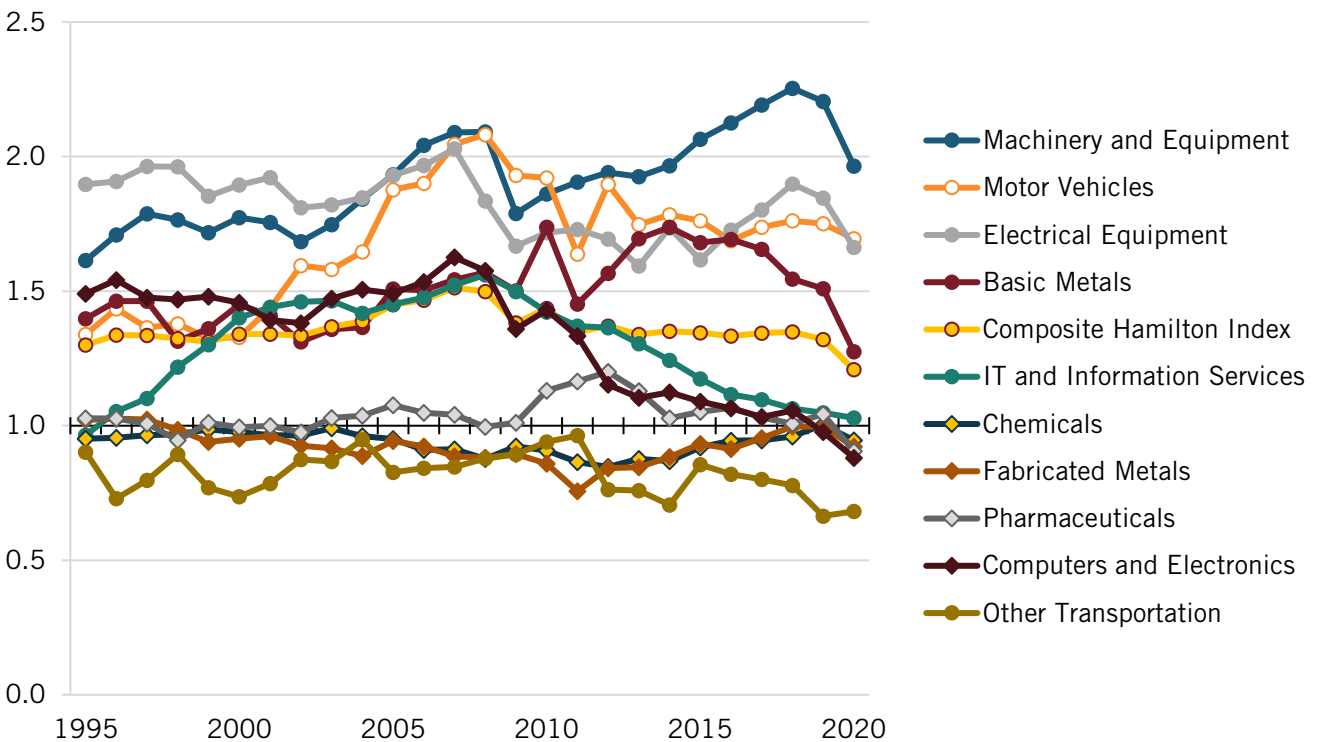
In terms of industry strength, Japan is above average in machinery and equipment, motor vehicles, electrical equipment, basic metals, and IT and information services. (See figure 75.) Japan’s strongest industry is machinery and equipment (LQ of 1.96). In contrast, Japan is below average in chemicals, fabricated metal products, pharmaceuticals, computers and electronics, and other transportation.

**Figure 75: Japan's relative performance in Hamilton Index industries (2020 LQ)**



From the early 2000s until 2020, the LQs for all the industries declined. This is because of the incredibly fast growth of the Chinese and South Korean economies. It is striking that since President Xi put in place his Made in China 2025 plan, Japan's advanced industry LQ in the Made in China 2025-targeted sectors grew 30 percent more slowly between 2015 and 2020 than between 2010 and 2015.

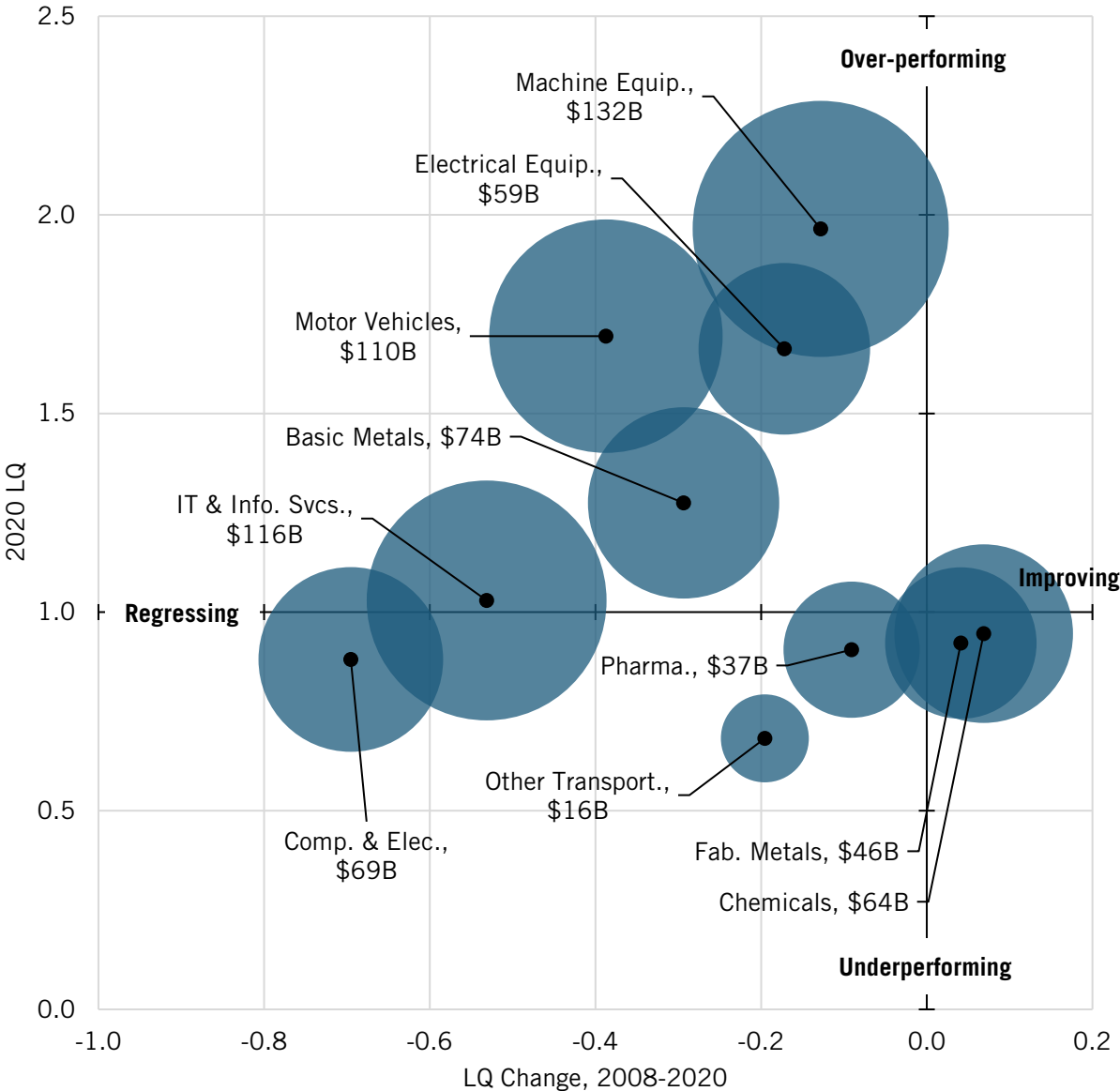
**Figure 76: Japan's relative historical performance in Hamilton Index industries (LQ trends)**



While Japan has several industries with above-average LQ, there are none that are in the “strong, growers” quadrant. It has two relatively small industries in the “weak, growers” quadrant: chemicals and fabricated metals. Pharmaceuticals, other transportation, and computers and electronics are in the “weak, declining” quadrant. The strong decline of computers and electronics is surprising, given that it was historically an industry in which Japan over-performed relative to much of the world; however, China, Korea, and Taiwan have provided formidable competition.

The remainder of Japan’s industries are in the “strong, decliners” category. This is not to say that these industries are not growing, but rather, that they are not growing as fast as the overall Japanese economy. Even with declining global share, Japan’s momentum score is still above average at 163, around 40 percent higher than America’s.

**Figure 77: Japan’s net performance in Hamilton industries since 2008 (scaled to 2020 output)**





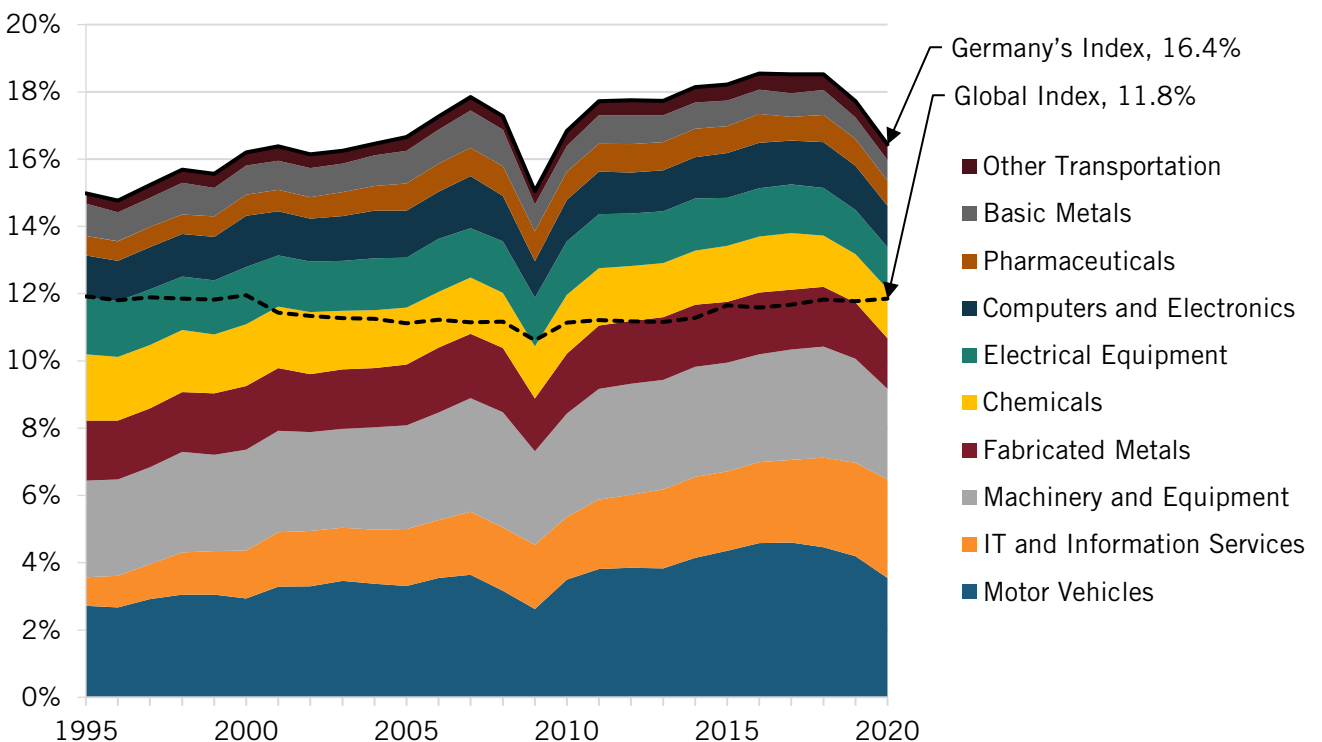
## No. 4: Germany

Can Germany adapt and wake up to the China challenge? The story of Germany in advanced industry output is like Japan's: a story of one long decline, but not as stark as Japan's.

Germany's share of global production was 10.47 percent in 1995 but fell to 6.3 percent by 2020. Before 2006, Germany's advanced industry output exceeded China's. Since then, China's lead over Germany has grown consistently. It is only a matter of time before much of Germany's net sales of advanced goods to China shrinks significantly.

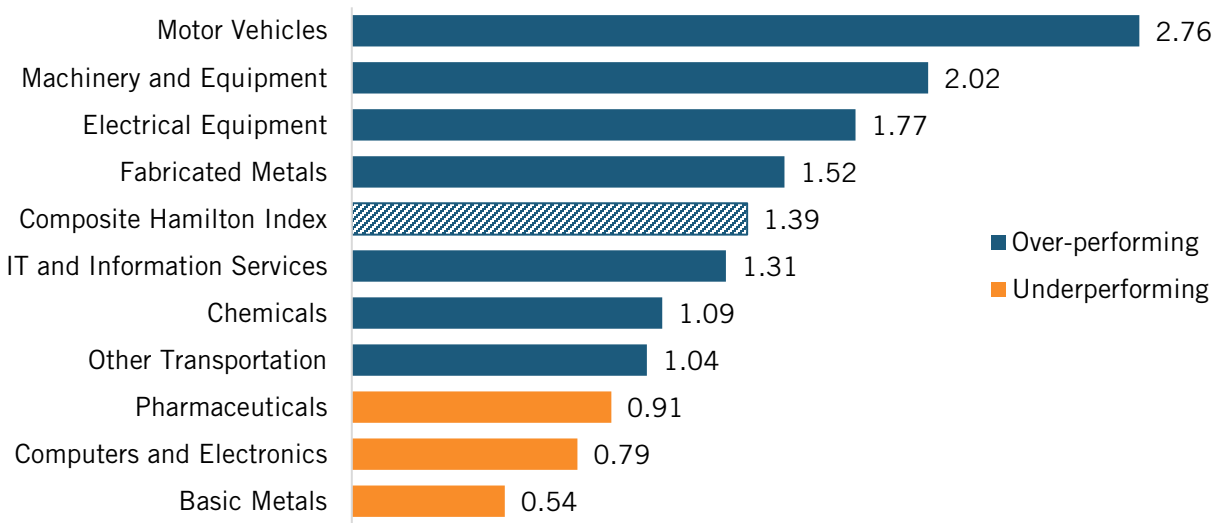
However, overall, these industries became a larger share of the German economy (leaving aside the financial crisis) until 2018 when their share began a steep decline, much of it powered by loss in the motor vehicle and machinery and equipment sectors. From 2017 to 2020, German output in the latter sector fell \$16 billion, while China's output grew \$69 billion. Given current challenges, including high energy prices, it is likely that when 2022 data is released it will show even more decline.

**Figure 78: Hamilton Index industries' shares of Germany's economy**



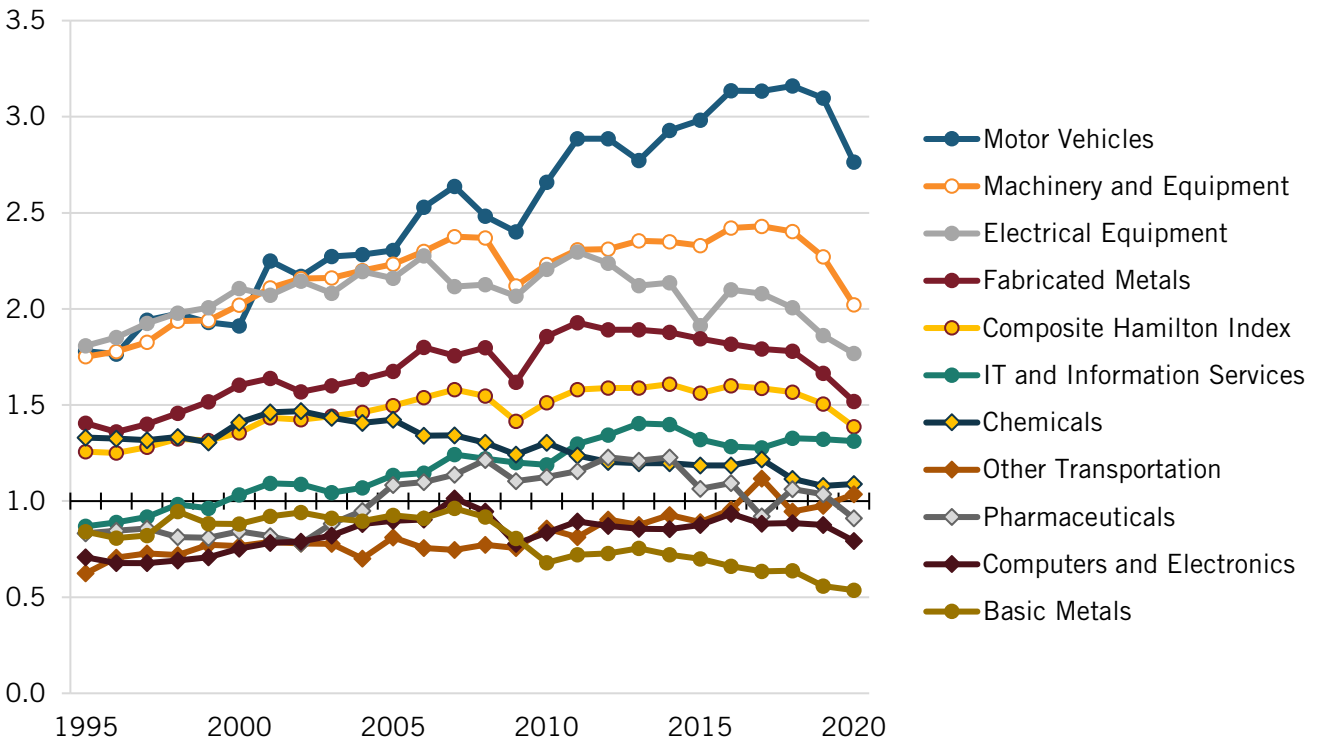
In terms of industry strength, Germany is above average in most industries except for pharmaceuticals, computers and electronics, and basic metals. (See figure 79.) Due to the presence of Volkswagen, BMW, Mercedes-Benz, and Audi, Germany's strongest industry is motor vehicles, where it has an LQ of 1.96. It is also strong in machinery and equipment, electrical equipment, chemicals, fabricated metals, IT and information services, chemicals, and other transportation. In contrast, Germany is below average in pharmaceuticals, computers and electronics, and basic metals.

**Figure 79: Germany's relative performance in Hamilton Index industries (2020 LQ)**



From the early 2000s until 2020, the LQs for 7 industries declined. Only motor vehicles showed significant increase, at least until 2018. Figure 81 shows the net improvement or regression in relative performance of Germany's Hamilton industries since 2008, scaled to their output in 2020.

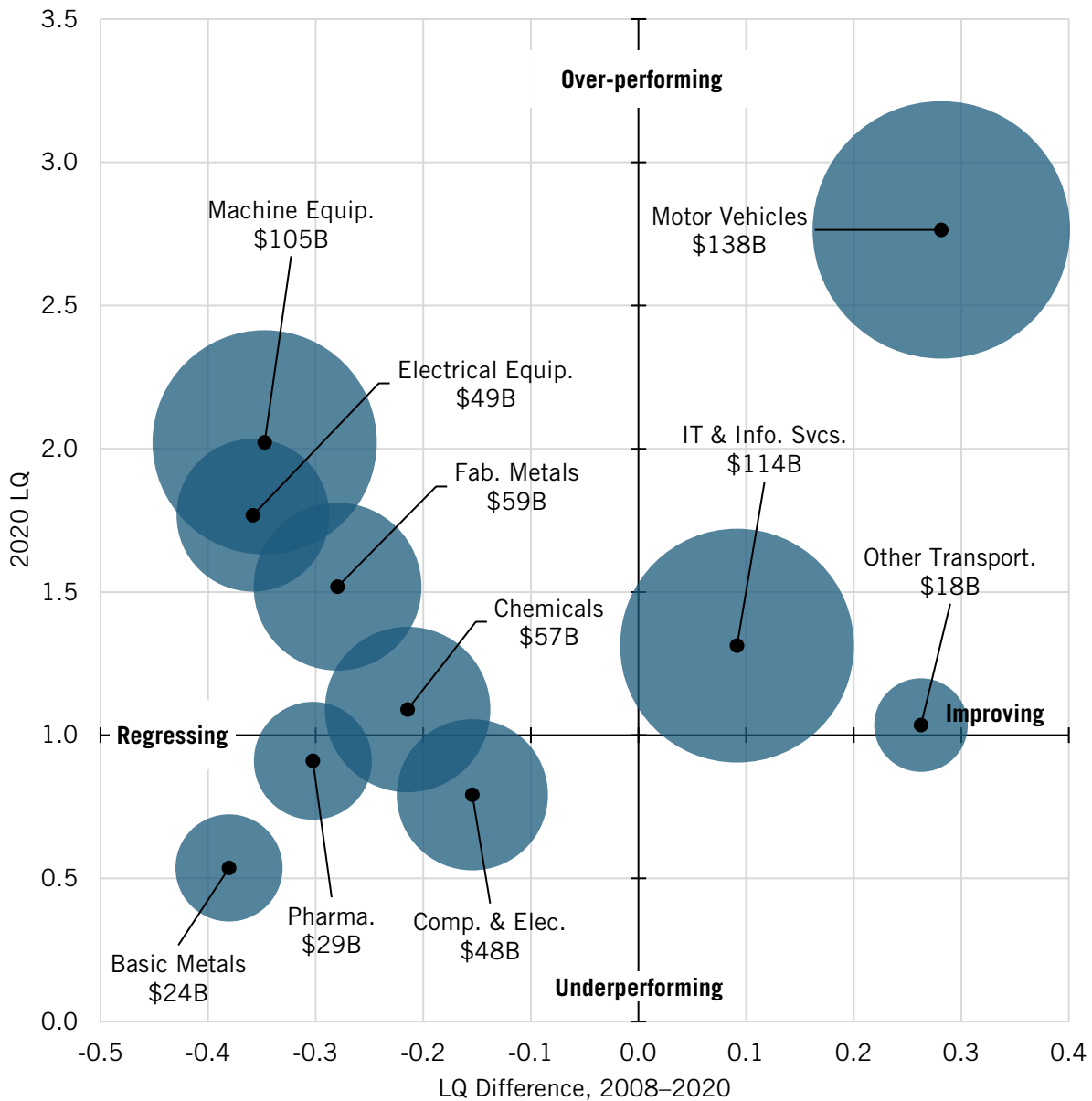
**Figure 80: Germany's relative historical performance in Hamilton industries (LQ trends)**



Germany has three industries in the “strong, growers” quadrant: motor vehicles, IT and information services, and other transportation. It has no industries in the “weak, growers”

quadrant and three industries, basic metals, pharmaceuticals, and computers and electronics in the “weak, declining” quadrant. The remainder of Germany’s industries are in the “strong, decliners” category. These are machinery and equipment, electrical equipment, fabricated metals, and chemicals. The decline in the machinery and equipment sector output (-15 percent) is troubling, given the steepness of the decline and the size of the sector. Still, Germany’s momentum score is strong (270), slightly above China and more than twice as high as the United States. Given the challenge from China in motor vehicles, it is likely that in a few years motor vehicles will move to the strong declining sector and Germany’s momentum score could very well fall below the global average.

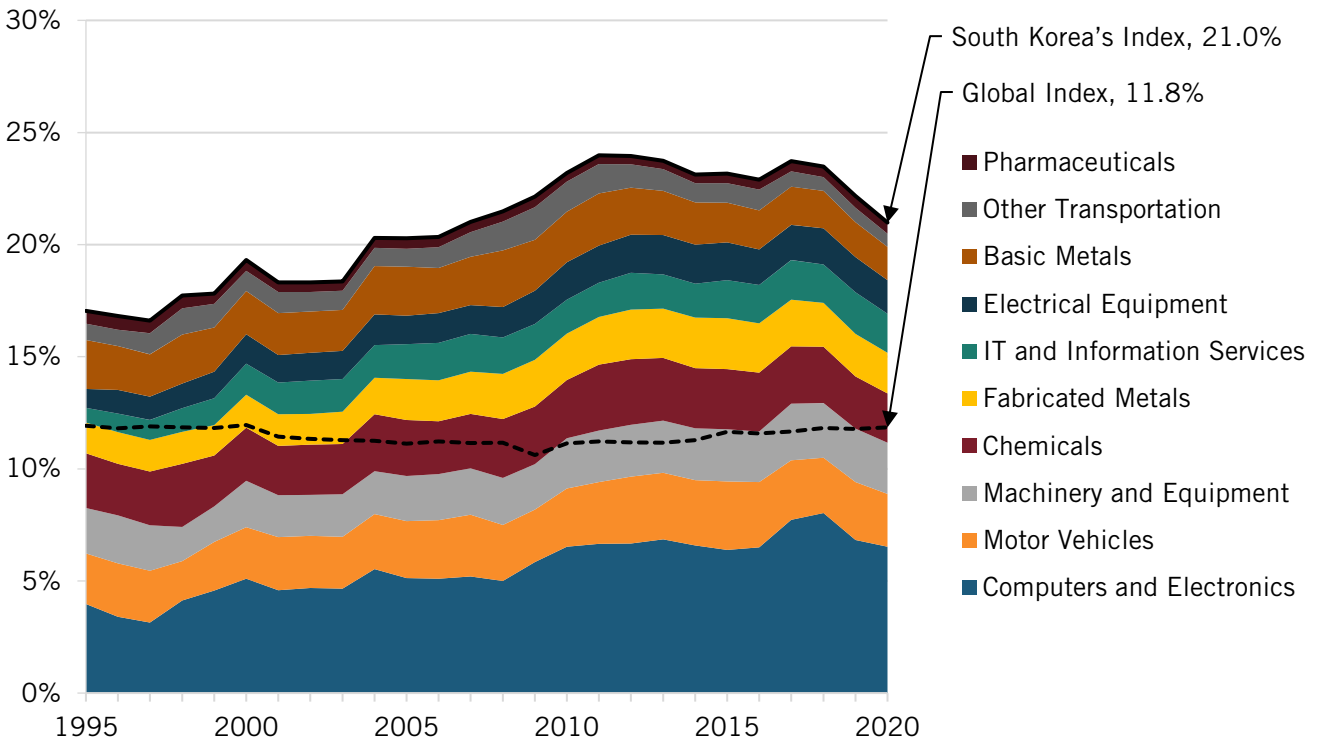
**Figure 81: Germany’s net performance in Hamilton industries since 2008 (scaled to 2020 output)**



## No. 5: South Korea

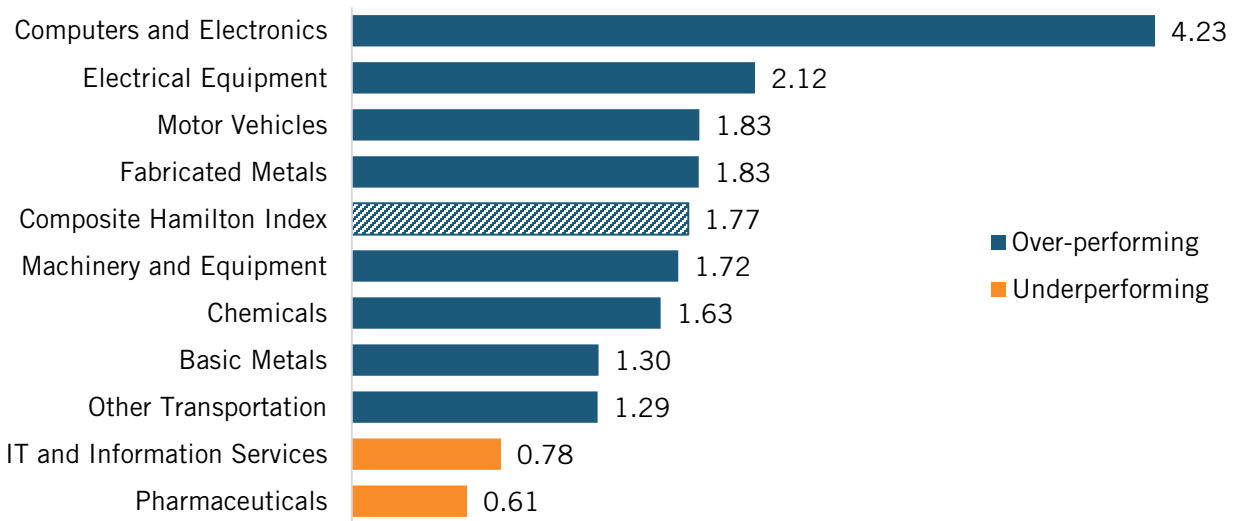
The South Korean advanced industry miracle is over; can it survive the China challenge? South Korea's global share of advanced industry output grew steadily from 1995 to 2017 (with a two-year decline in 1998 and 1999 from the Asian financial crisis). However, since 2017, its global share declined by 16 percent, with most of the decline in computers and electronics. South Korea's decline in that sector of \$18 billion was offset by China's gain of \$64.7 billion. The same picture is true in terms of these industries as a share of the South Korean economy.

**Figure 82: Hamilton Index industries' shares of South Korea's economy**



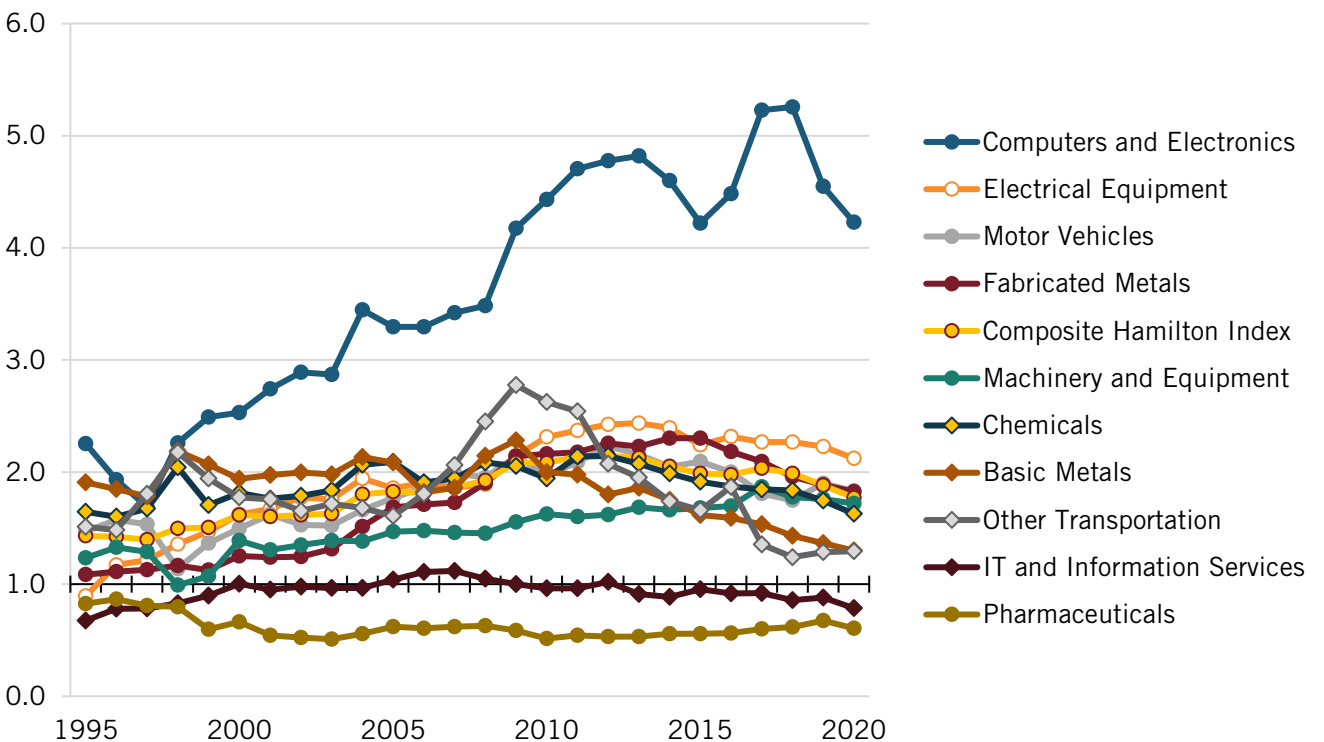
In terms of industry strength, South Korea is above average in most industries except for IT and information services and pharmaceuticals. (See figure 83.) Due to firms such as LG, Samsung, and SK Hynix, South Korea's strongest industry is computers and electronics, where it has a very high LQ of 4.23. It is also strong in electrical equipment, motor vehicles, fabricated metals, machinery and equipment, chemicals, basic metals, and other transportation. In contrast, South Korea is below average in IT and information services and in pharmaceuticals.

**Figure 83: South Korea's relative performance in Hamilton Index industries (2020 LQ)**



From the early 2000s until 2020, the LQs for all the industries declined. This is because of the incredibly fast growth of the Chinese economy. It is striking that since President Xi put in place his Made in China 2025 plan, South Korea's advanced industry LQ in the Made in China 2025-targeted sectors grew 30 percent more slowly between 2015 and 2020 than between 2010 and 2015. Figure 85 shows the net improvement or regression in relative performance of South Korea's Hamilton industries since 2008, scaled to their output in 2020.

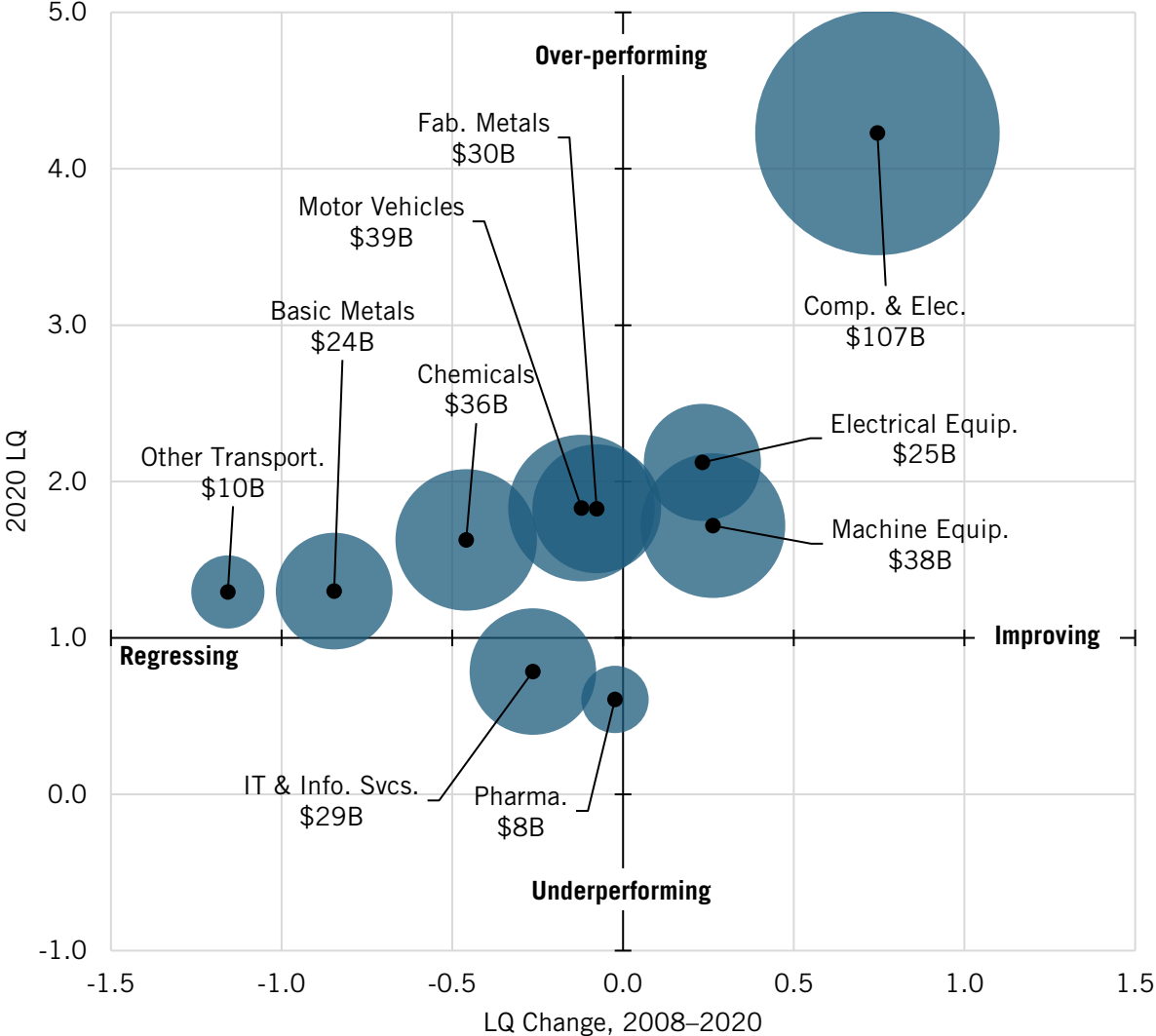
**Figure 84: South Korea's relative historical performance in Hamilton industries (LQ trends)**



Each of the 10 industries can be classified as to its LQ, change in LQ, and industry size. Industries in the upper right quadrant (an LQ above 1 in 2020, and a positive change in LQ from 2008 to 2020) are strong and fast growing. Industries in the lower left quadrant are the opposite. South Korea has three industries in the “strong, growers” quadrant. The largest and most successful is computers and electronics, followed by electrical equipment, and machinery and equipment. It has no industries in the “weak, growers” quadrant. Pharmaceuticals and IT and information services are in the “weak, declining” quadrant. The decline of computers and electronics is noteworthy, given that it was an industry in which South Korea over-performed in 2008.

The remainder of South Korea’s industries are in the “strong, decliners” category. These are fabricated metals, motor vehicles, chemicals, basic metals, and other transportation. This is not to say that these industries are not growing, but rather, that they are not growing as fast as the overall South Korean economy. Nonetheless, South Korea’s momentum score from 2008 to 2020 was quite strong (546), fourth in the world, and almost twice as strong as China’s.

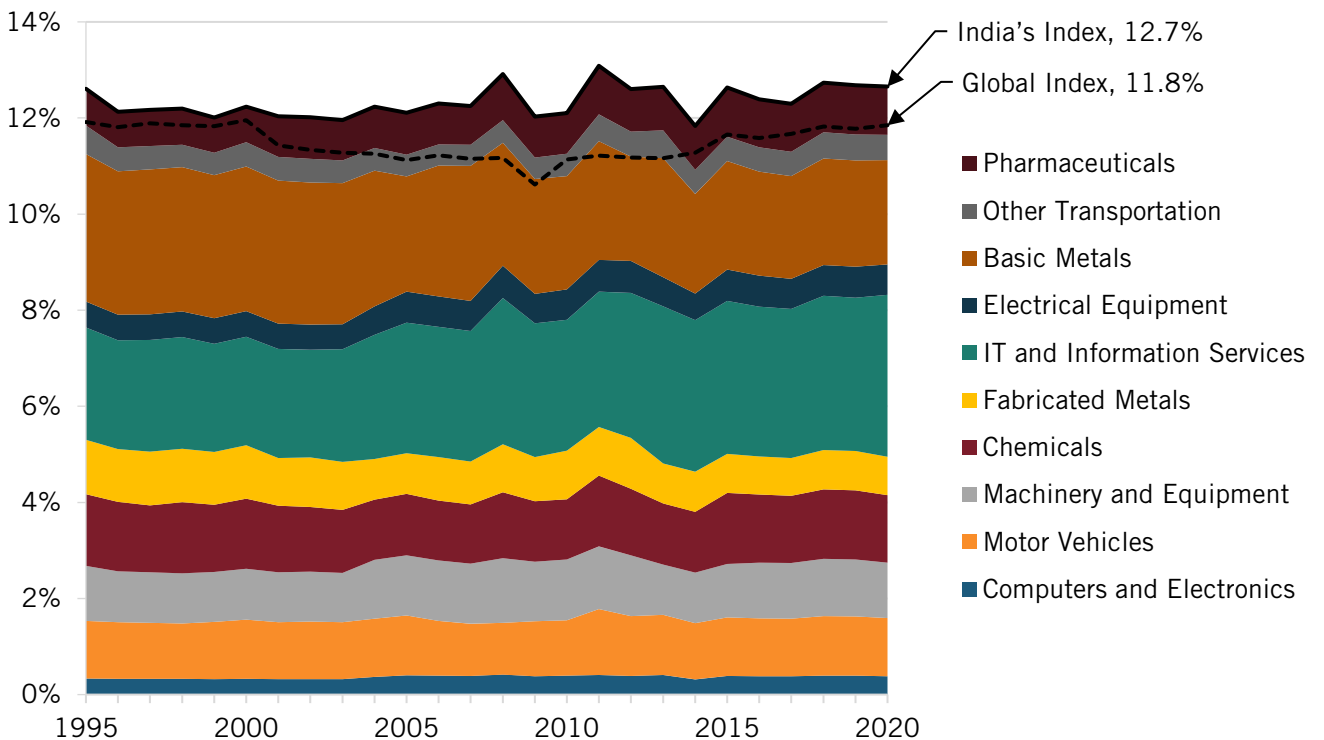
**Figure 85: South Korea’s net performance in Hamilton industries since 2008 (scaled to 2020 output)**



## No. 6: India

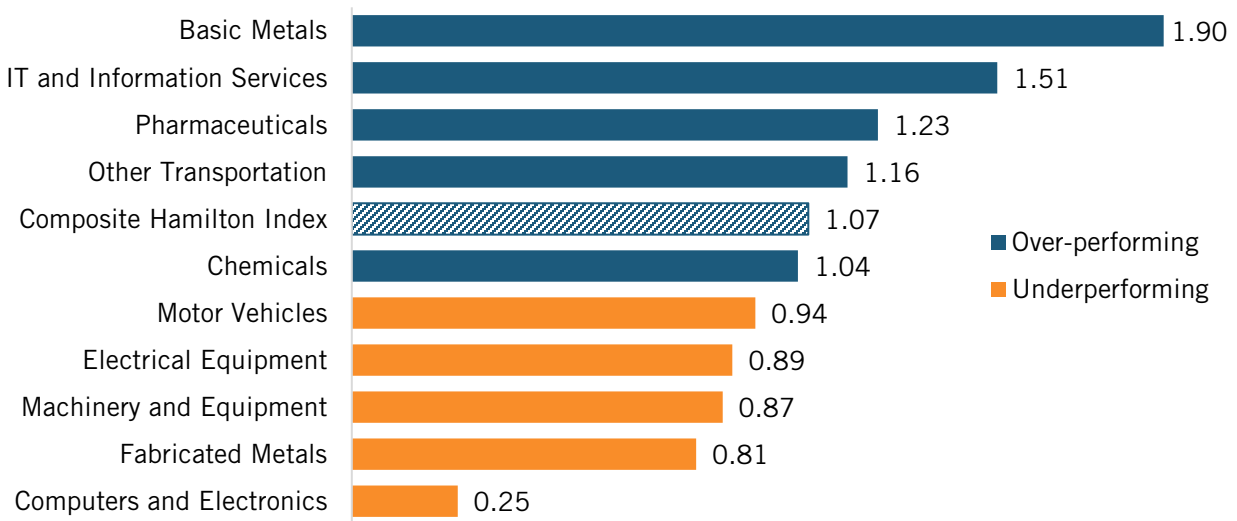
Can India get out of its own way? Despite its smaller population, China has consistently exceeded India's advanced industry output since 1995. This is due not only to China's faster economic growth but its long-standing advanced industry development policies, something India has largely lacked. Since 1995, however, India has seen modest growth in its advanced industry output, albeit from a low level.

**Figure 86: Hamilton Index industries' shares of India's economy**



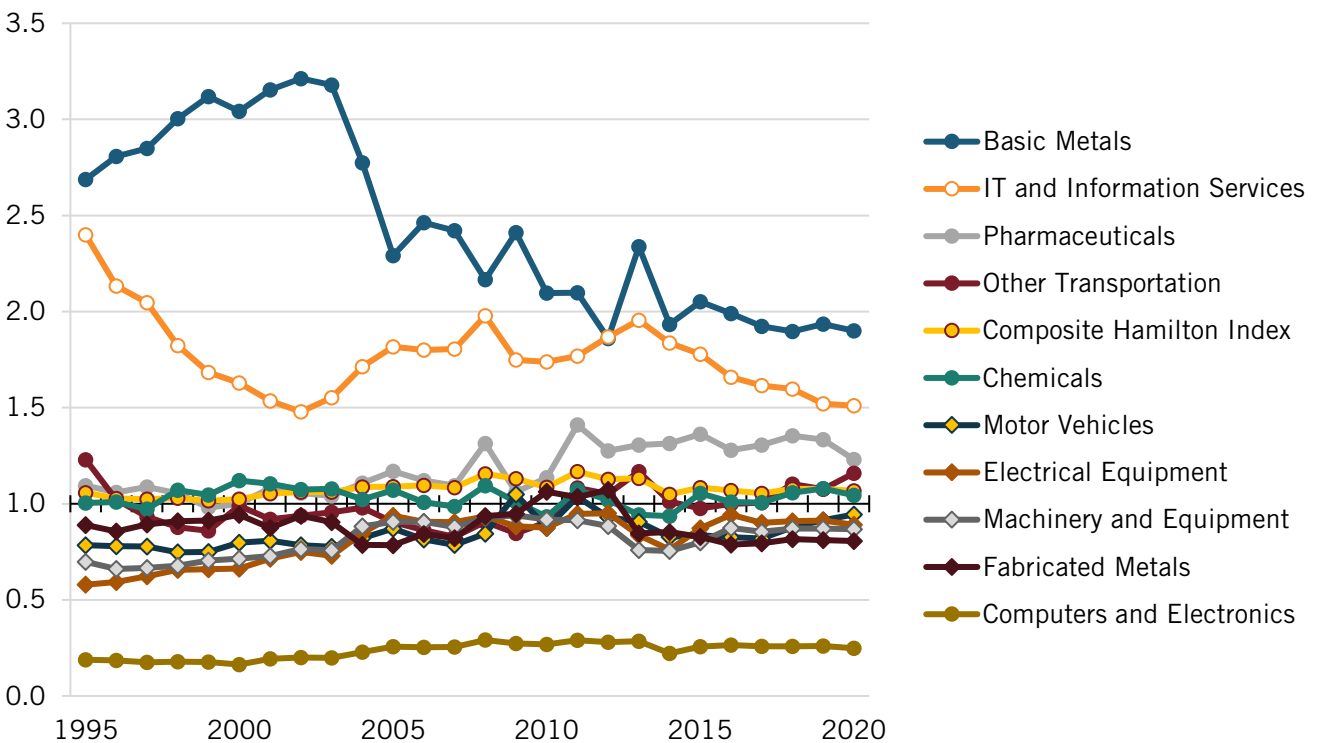
In terms of industry strength, India's strongest industry is basic metals, where it has an LQ of 1.90. It is also strong in IT and information services, pharmaceuticals, other transportation, and chemicals. (See figure 87.) In contrast, India is below average in motor vehicles, electrical equipment, machinery and equipment, fabricated metals, and computers and electronics.

**Figure 87: India's relative performance in Hamilton Index industries (2020 LQ)**



**If India could simply assure investors the basics, then the advantages it enjoys as an alternative to China that is large and has low wages should lead to massive inward foreign investment.**

**Figure 88: India's relative historical performance in Hamilton industries (LQ trends)**



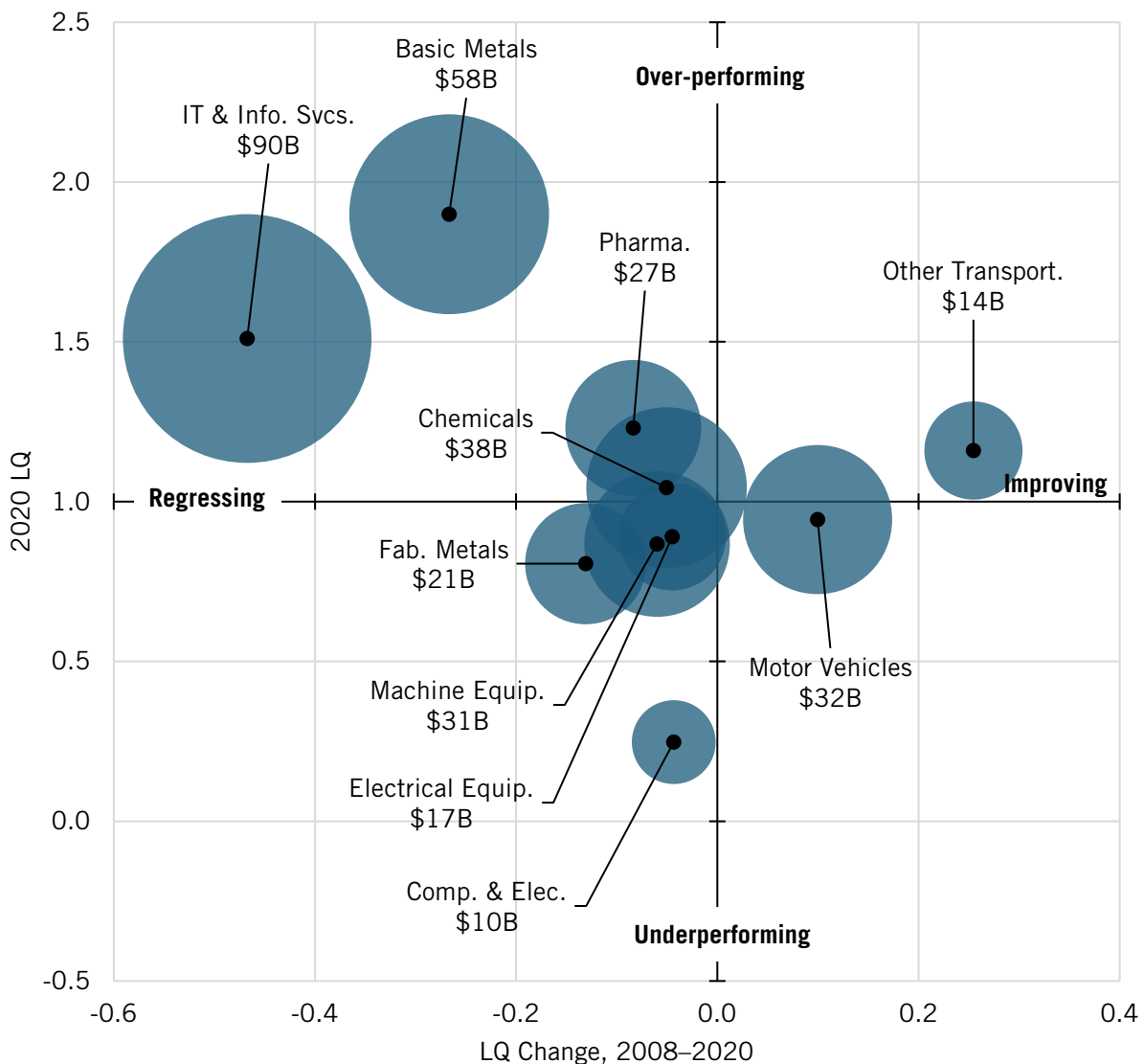
India has only one industry in the “strong, growers” quadrant: other transportation. It has one industry in the “weak, growers” quadrant—motor vehicles. Computers and electronics, electrical equipment, machinery and equipment, and fabricated metals are in the “weak, declining”



quadrant. The weakness of computers and electronics is noteworthy. However, increased concern by allied nations and companies of overdependence on China for this production, coupled with India's increased interest in growing this sector, could mean computers and electronics growth.

The remainder of India's industries are in the "strong, decliners" category. These are chemicals, pharmaceuticals, basic metals, and IT and information services. This is not to say that these industries are not growing, it's that they are not growing as fast as the overall Indian economy. Nonetheless, India's momentum score is above the global average (142), ranking 18th. Virtually every nation in the world must fight and claw to gain global market share and momentum. India is probably the only country that simply must get out of its own way. If India could assure investors of the basics (working infrastructure; a pro-business climate including reasonable taxes, regulations, and trade policy, and a modestly skilled workforce), then the advantages it enjoys as an alternative to China that is large and has low wages should lead to massive inward foreign investment. Only time will tell if India can do this.

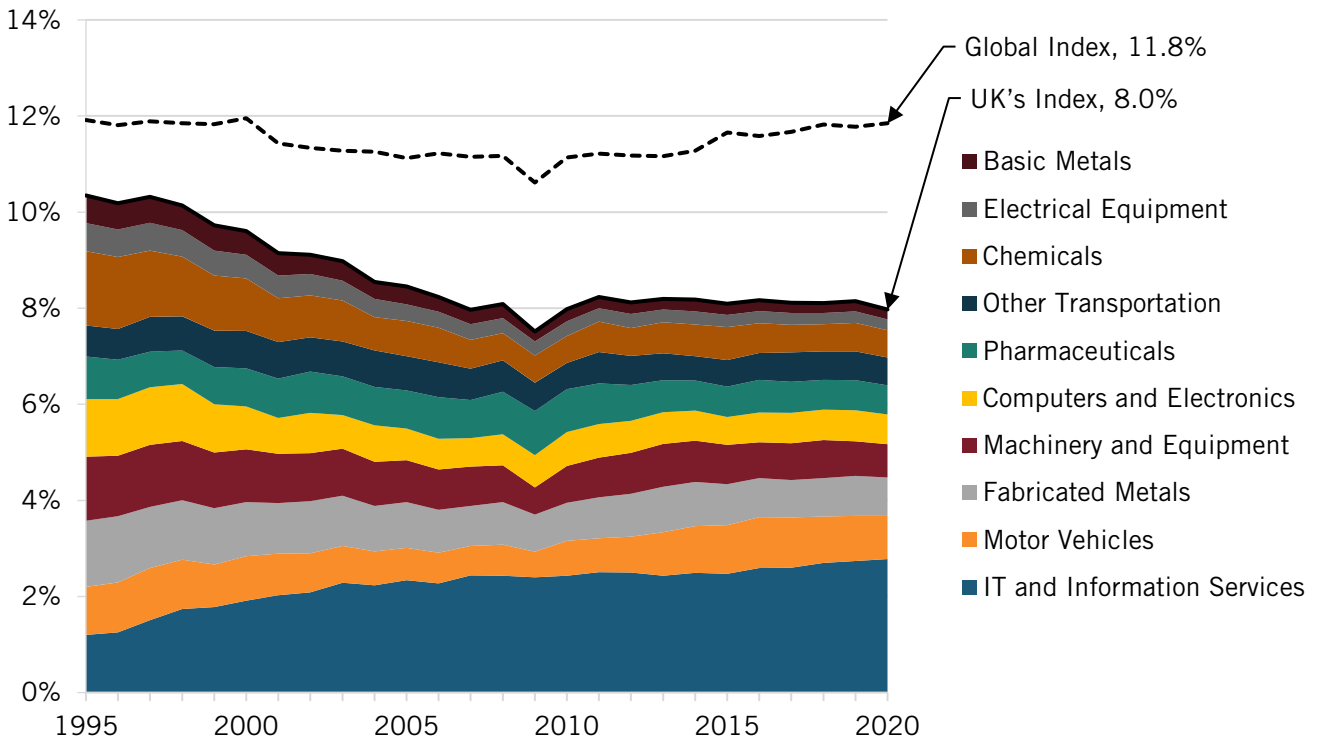
**Figure 89: India's net performance in Hamilton industries since 2008 (scaled to 2020 output)**



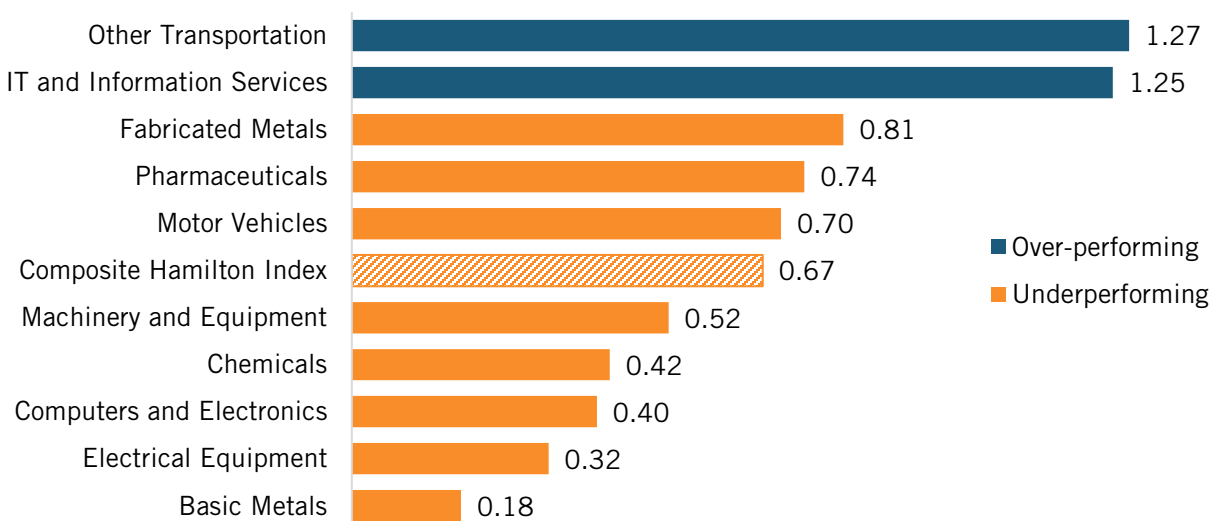
## No. 7: United Kingdom

Long, steady decline. That is the United Kingdom. Its strongest industry is other transportation, where it has an LQ of 1.27, largely due to a strong aerospace industry. (See figure 91.) It is also strong in IT and information services. In contrast, the UK is below average in all other advanced industries and has been falling. Despite a lot of talk, so far, there has been limited action to turn around the United Kingdom's fortunes in advanced industries.

**Figure 90: Hamilton Index industries' shares of the United Kingdom's economy**

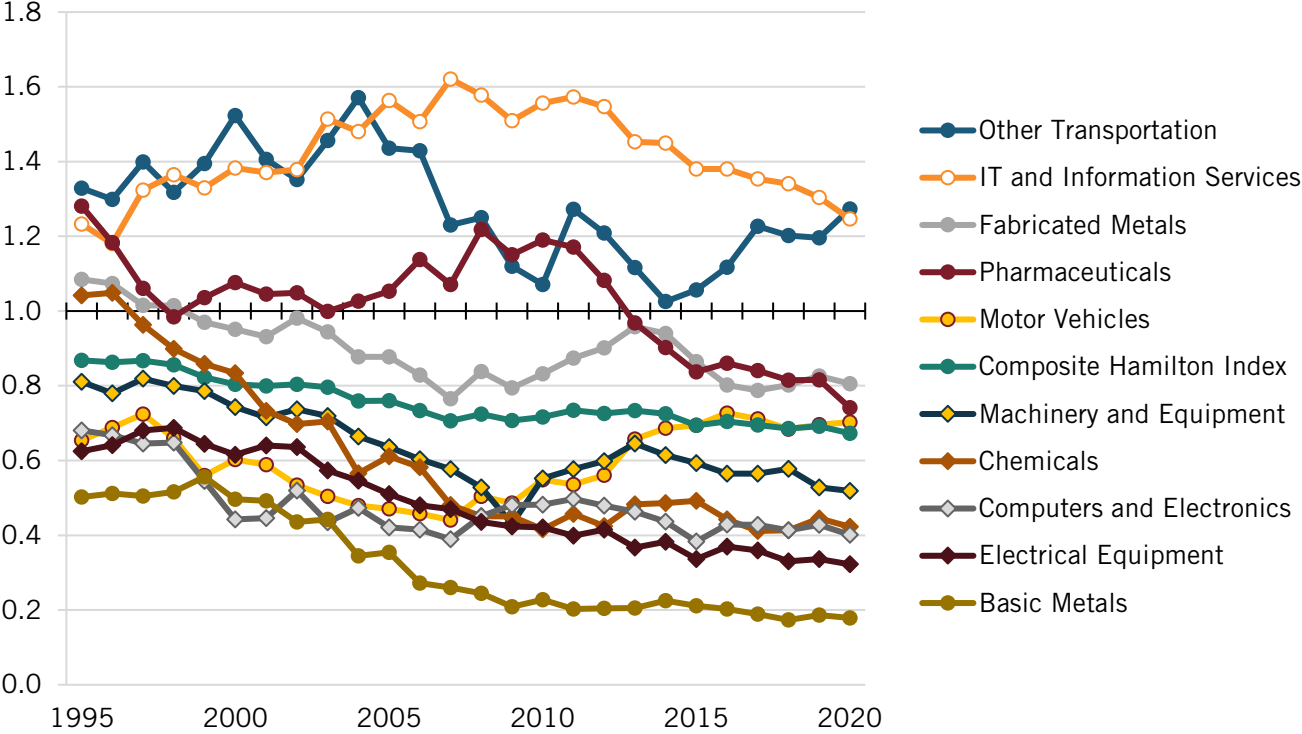


**Figure 91: The United Kingdom's relative performance in Hamilton Index industries (2020 LQ)**



From the mid-2000s until 2020, the LQs for all industries declined, although in recent years, other transportation has rebounded somewhat. Pharmaceuticals, an industry of long-standing strength, showed the steepest decline, in part as UK companies moved production overseas.

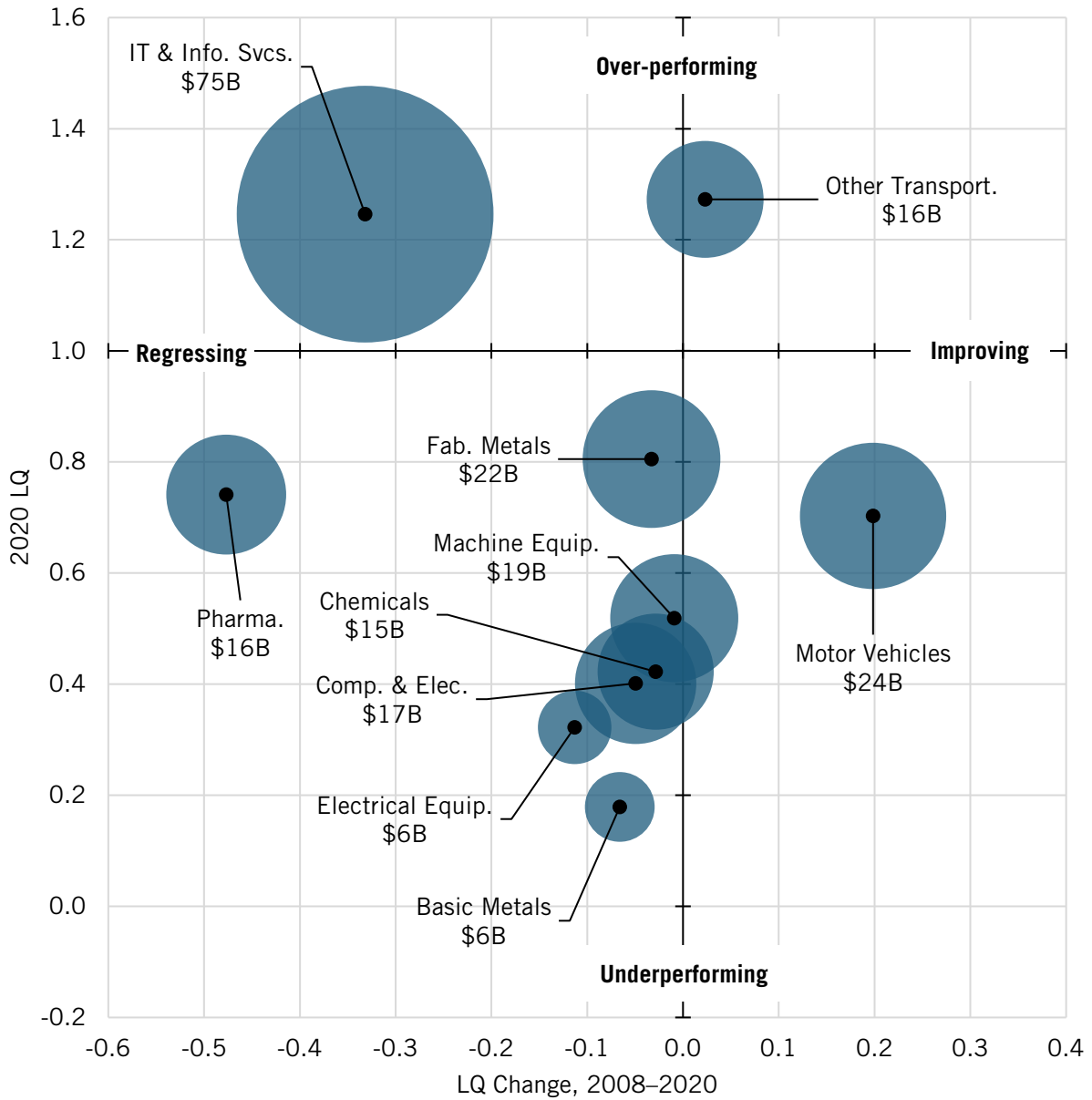
**Figure 92: The UK's relative historical performance in Hamilton industries (LQ trends)**



The UK has only one industry in the “strong, growers” quadrant, other transportation, but its growth has been modest. It has one industry in the “weak, growers” quadrant: motor vehicles, where foreign investment has helped the industry rebound. IT and information services is the only industry in the “strong, declining” quadrant. The United Kingdom’s apparent recent interest in copying much of the anti-innovation IT policy from continental Europe may not bode well for moving this industry to the right (e.g., growing). This is not to say that these industries are not growing, but rather, that they are not growing as fast as the overall British economy.

The remainder of the United Kingdom’s industries are in the “weak, decliners” category. These are pharmaceuticals, basic metals, electrical equipment, computers and electronics, chemicals, machinery and equipment, and fabricated metals. In particular, the declines in pharmaceuticals, chemicals, and fabricated metals are noteworthy, as the United Kingdom used to over-perform in those industries. In terms of industry momentum, the United Kingdom is significantly below the global average with a score of just 61, just below France and just above Canada. Despite the long recognition of the United Kingdom’s advanced industry difficulties, strategic action has been largely lacking. There appears to be little political will to cut spending and increase investment to support advanced industry output, and to the extent there is, it appears focused narrowly on green industries or expensive and sometimes wasteful large individual company subsidies.

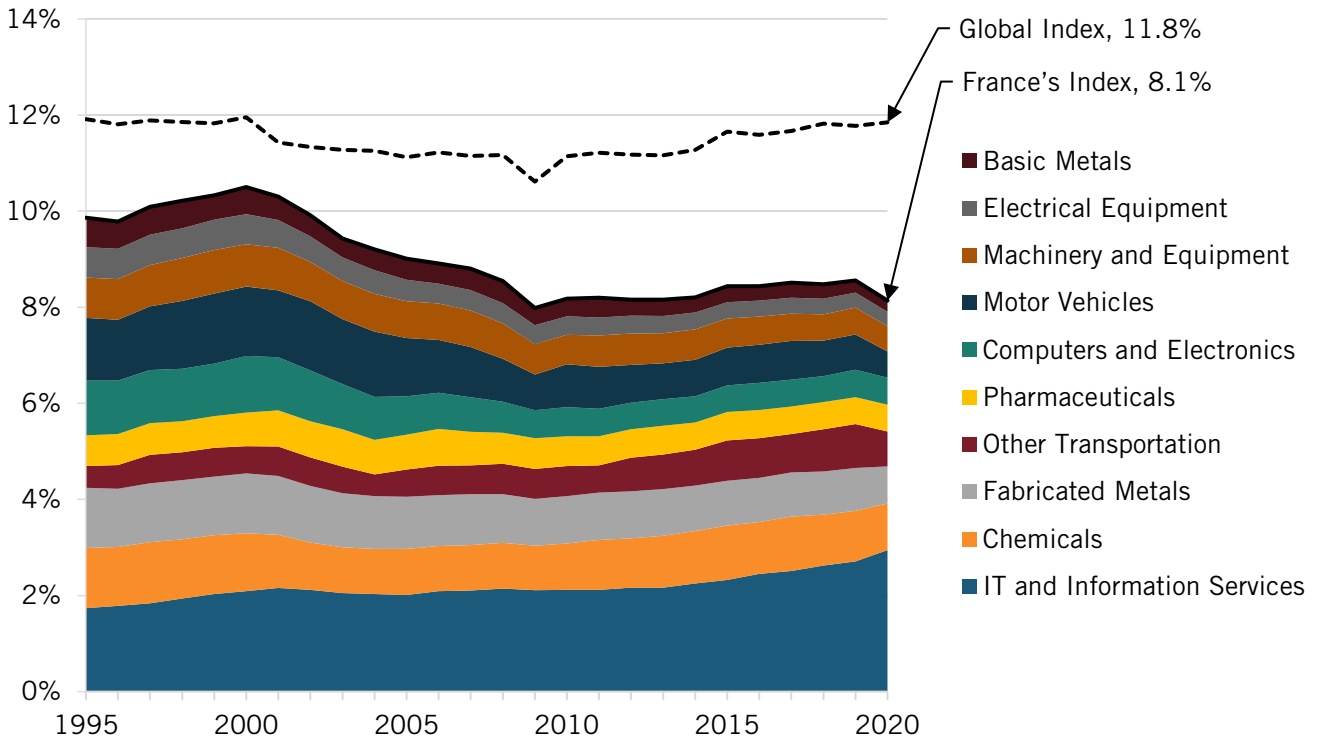
**Figure 93: The UK's net performance in Hamilton industries since 2008 (scaled to 2020 output)**



## No. 8: France

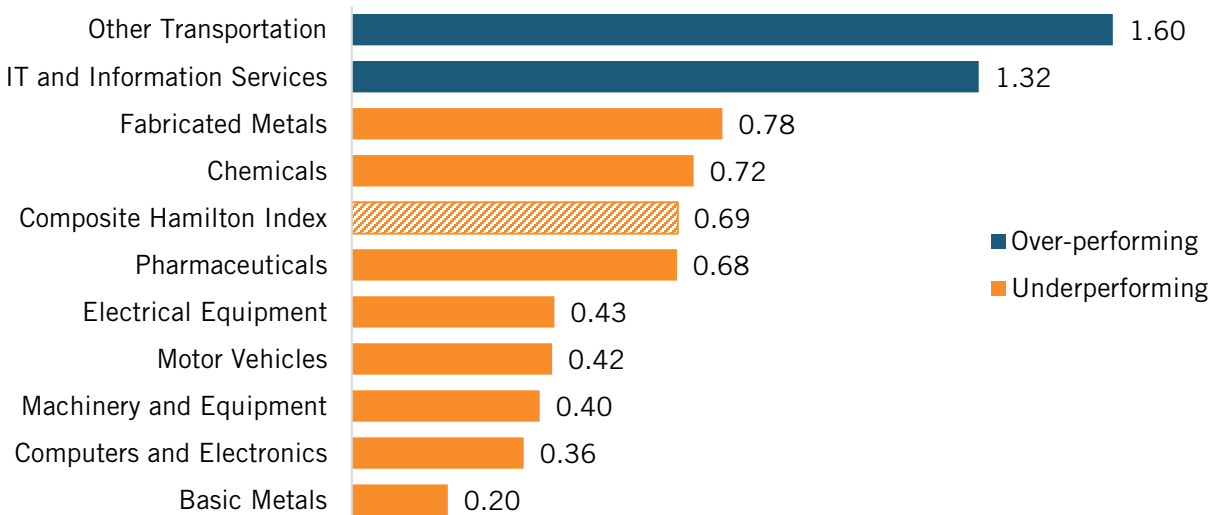
Time to wake up? France refuses to accept that it cannot resist the reality of the global economy, and no longer has the freedom to regulate and tax in response to domestic protectionist interests that have exceeded France's advanced industry output since 1997.

**Figure 94: Hamilton Index industries' shares of France's economy**



In terms of industry strength, France is above average in only two industries: other transportation and IT and information services. (See figure 95.)

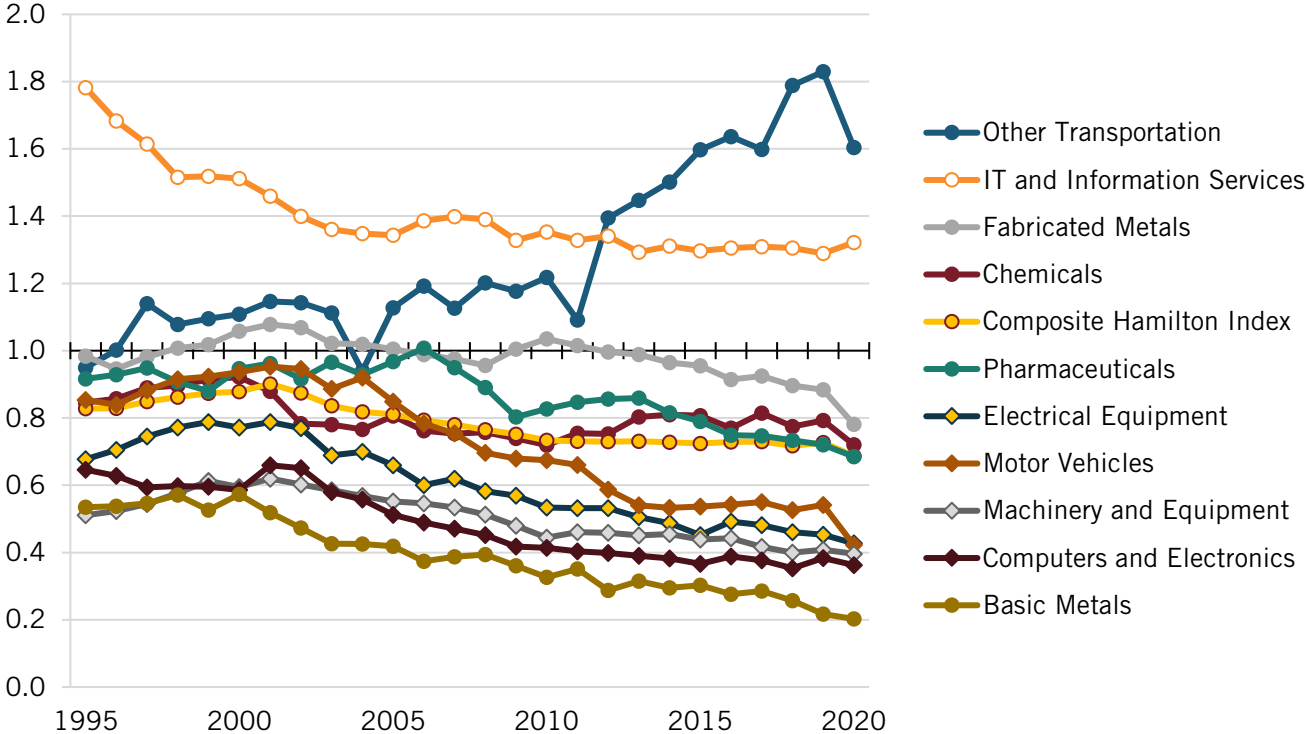
**Figure 95: France's relative performance in Hamilton Index industries (2020 LQ)**



France’s strongest industry is other transportation, where it has an LQ of 1.60. IT and information services is second with an LQ of 1.32. In contrast, France is below average in all other advanced industries. Basic metals is the worst-performing industry with an LQ of only 0.20.

From the early 2000s until 2020, the LQs for all industries except other transportation (presumably Airbus strength), declined. Figure 97 shows the net improvement or regression in relative performance of France’s Hamilton industries since 2008, scaled to their output in 2020.

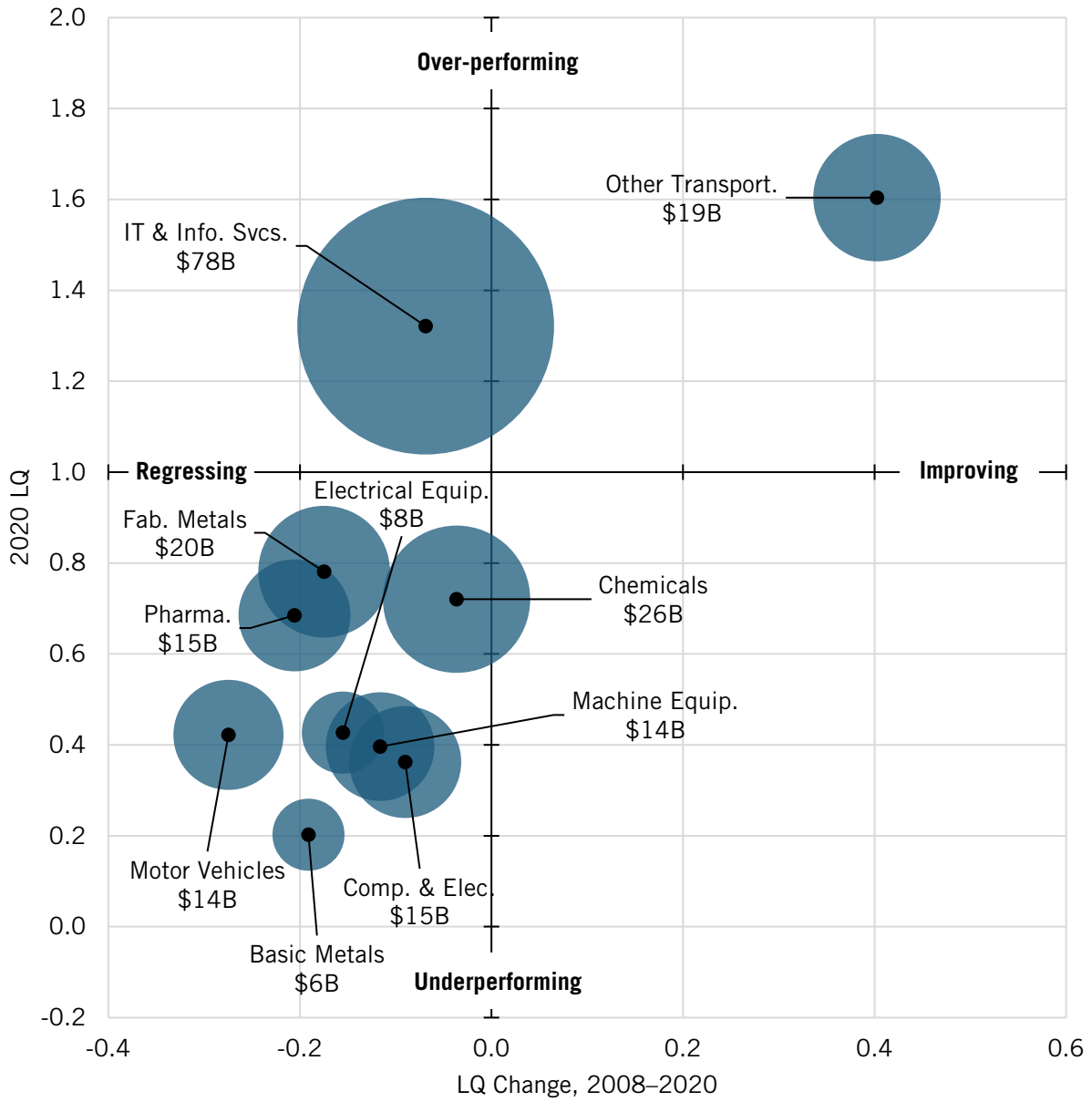
**Figure 96: France’s relative historical performance in Hamilton industries (LQ trends)**



France has only one industry in the “strong, growers” quadrant: other transportation. It has no industries in the “weak, growers” quadrant. IT and information services is the only industry in the “strong, declining” quadrant, but it is France’s largest advanced industry. This is not to say that the industry is not growing, but rather, that it is not growing as fast as the overall French economy.

The remainder of France’s industries are in the “weak, decliners” category. These are pharmaceuticals, basic metals, electrical equipment, computers and electronics, chemicals, machinery and equipment, and fabricated metals. In each of those industries, France has never over-performed in any year since 1995. As a result, its momentum score (73) is below the global average.

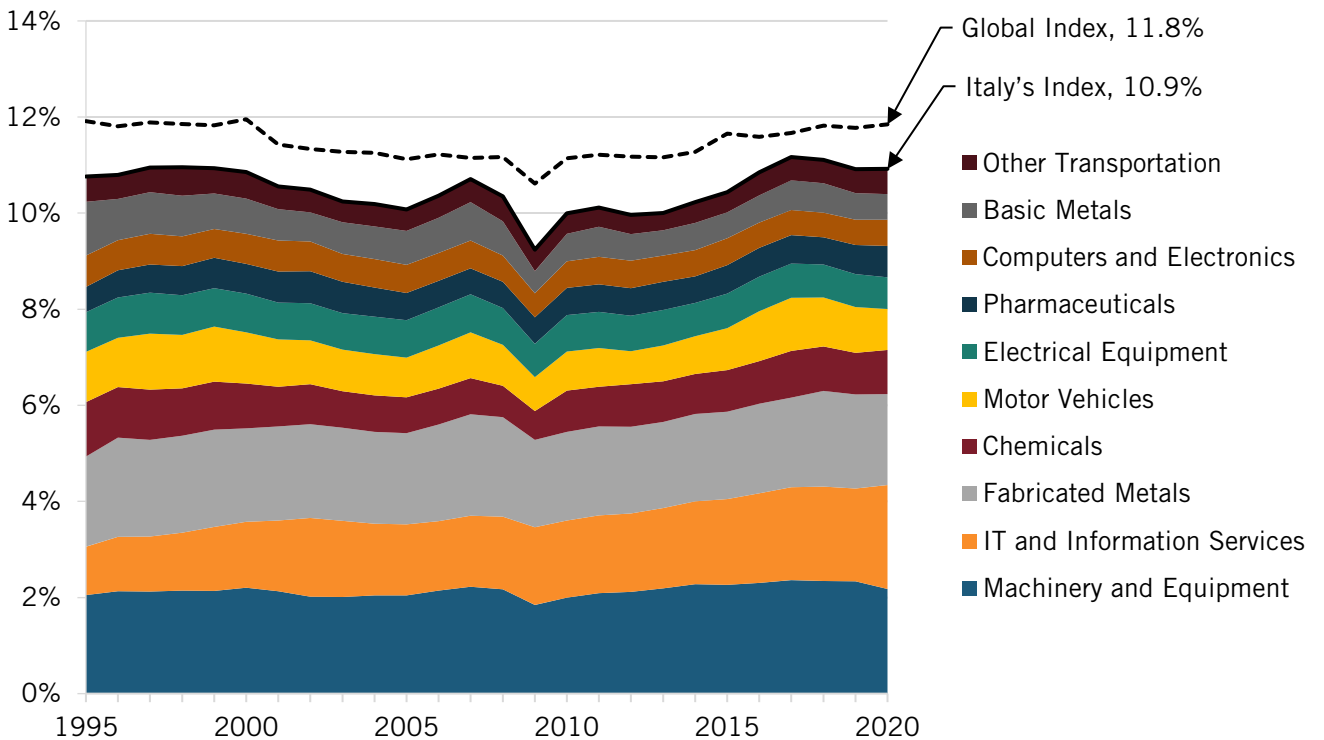
**Figure 97: France's net performance in Hamilton industries since 2008 (scaled to 2020 output)**



## No. 9: Italy

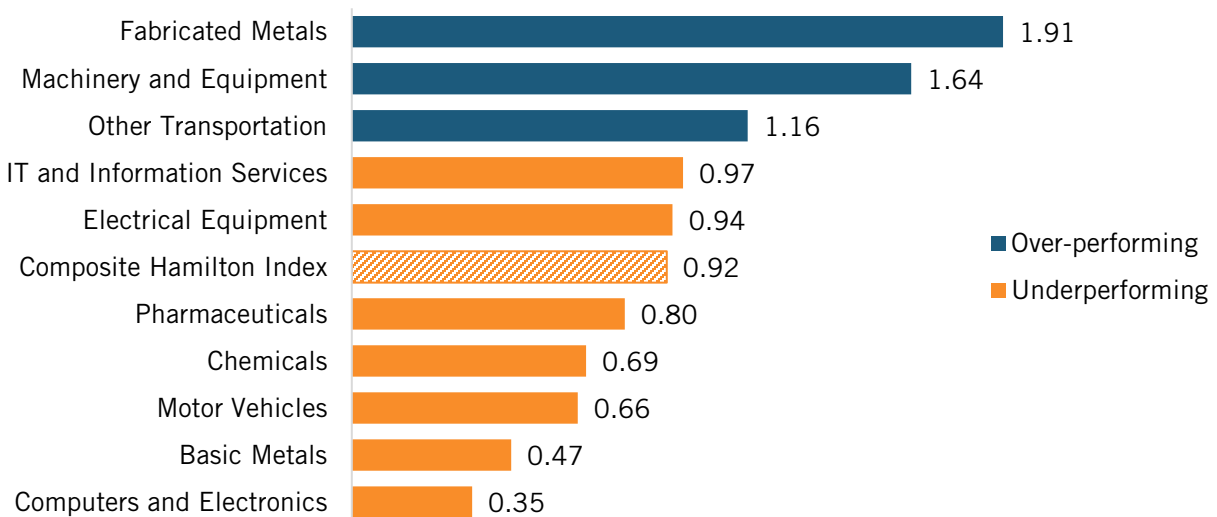
Some world-class strengths, but overall weaknesses. Italy has consistently underperformed. While Italy's overall LQ was 0.90 in 1995, it has marginally improved to 0.92 in 2020. However, that is still slightly below the overall LQ for the EU-17 at 0.93 and the EU-10 at 1.07.

**Figure 98: Hamilton Index industries' shares of Italy's economy**



In terms of industry strength, Italy is above average in only three industries: fabricated metals, machinery and equipment, and other transportation. (See figure 99.)

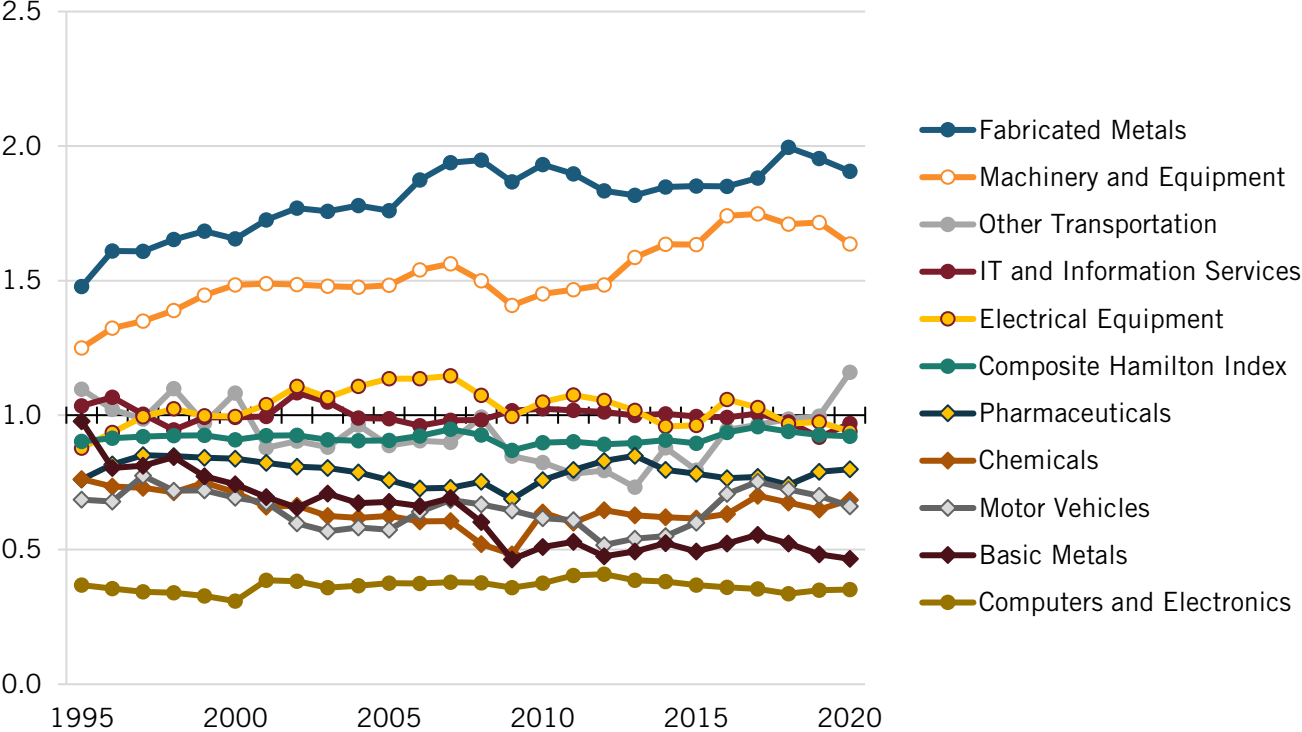
**Figure 99: Italy's relative performance in Hamilton Index industries (2020 LQ)**





Italy's strongest industry is other transportation, where it has an LQ of 1.91. Additionally, the LQs for machinery and equipment and other transportation are 1.64 and 1.16, respectively. In contrast, Italy is below average in all other advanced industries. The computers and electronics industry is the worst-performing industry, with an LQ of only 0.35.

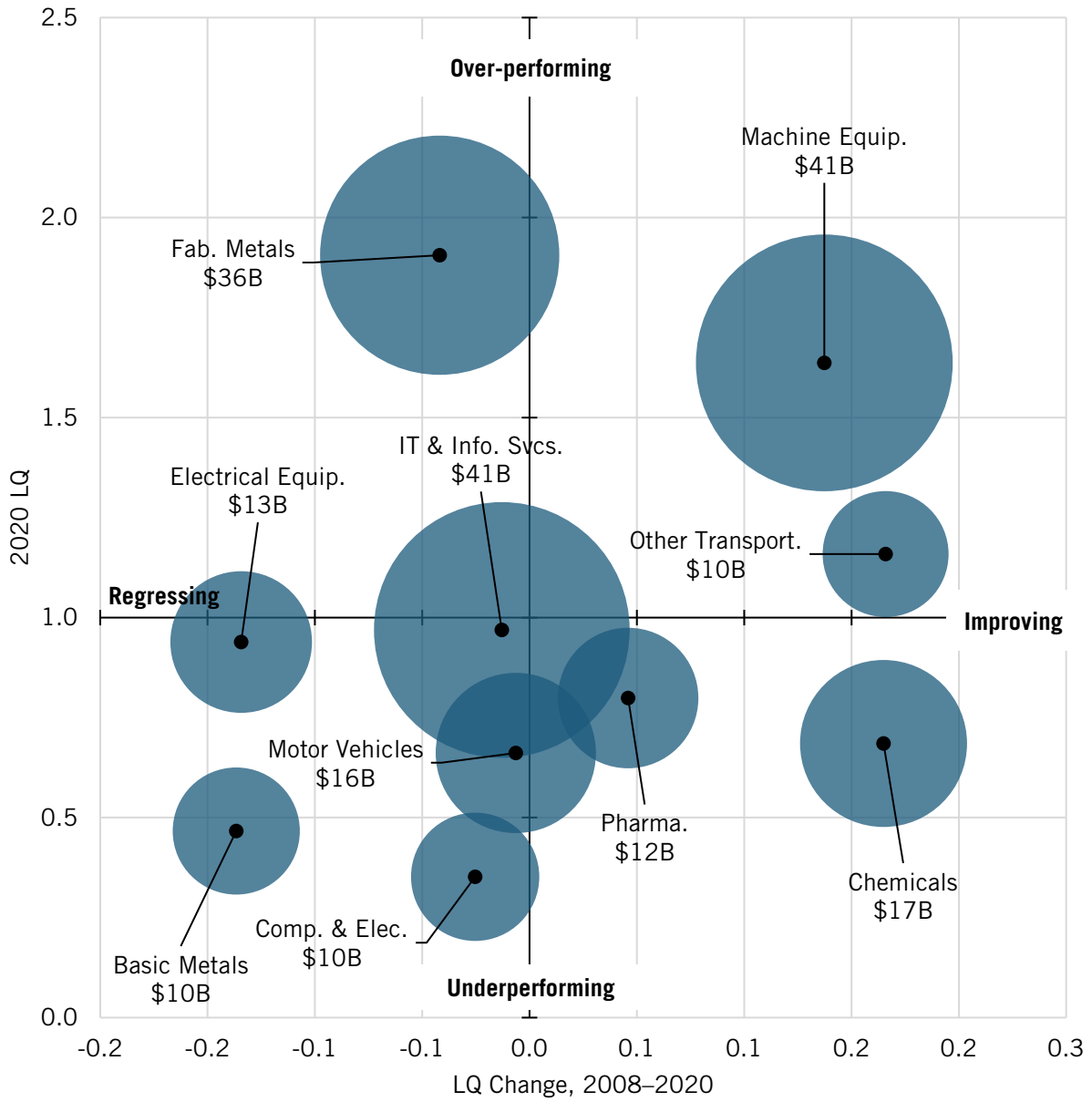
**Figure 100: Italy's relative historical performance in Hamilton industries (LQ trends)**



Italy has only two industries in the “strong, growers” quadrant: machinery and equipment (its largest industry), and other transportation. It has two industries in the “weak, growers” quadrant: chemicals and pharmaceuticals. Fabricated metals are in the “strong but declining” sector.

The remainder of Italy's industries are in the “weak, decliners” category. Notwithstanding, Italy's momentum score (131) is a bit above the global average largely because of its very strong machinery industry.

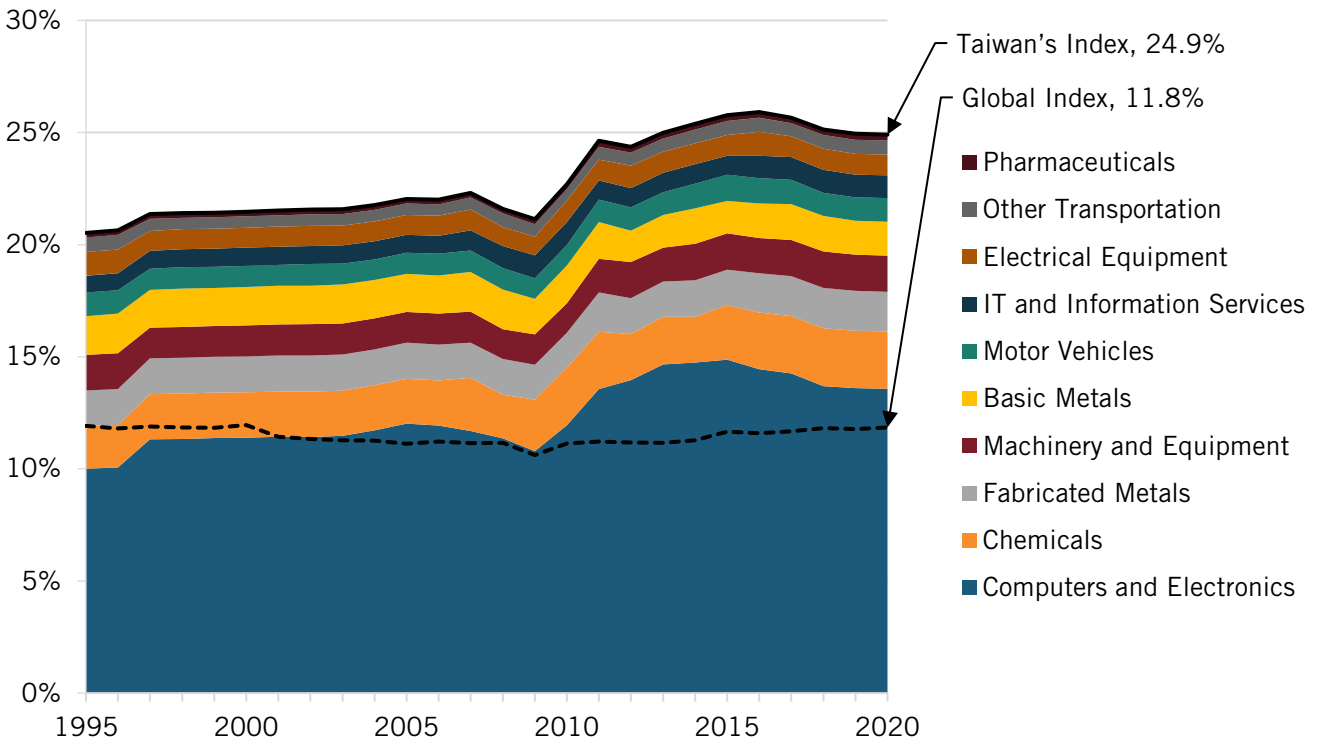
**Figure 101: Italy's net performance in Hamilton industries since 2008 (scaled to 2020 output)**



## No. 10: Taiwan

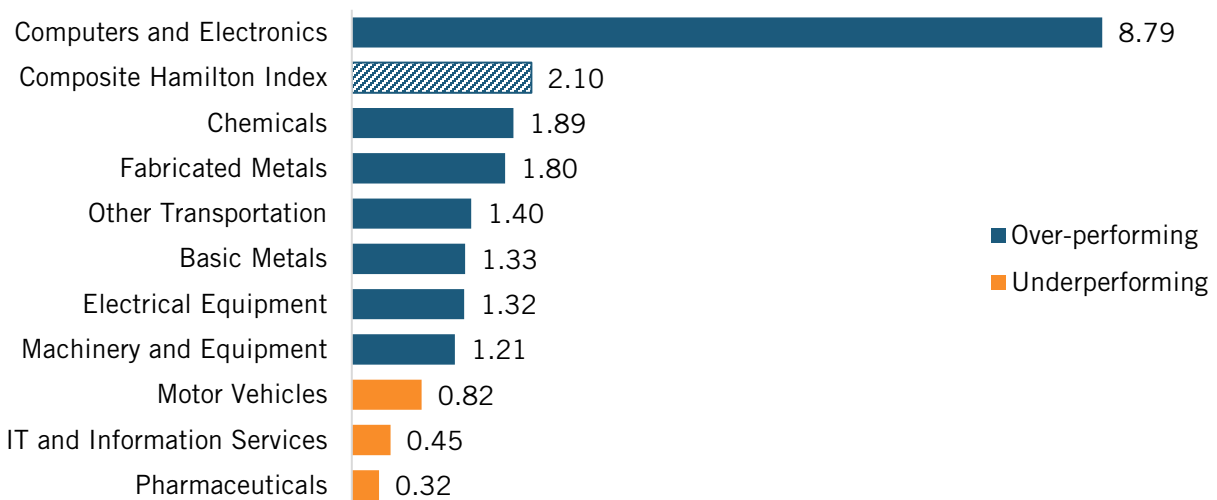
A semiconductor giant at risk? Taiwan has had a higher LQ than China since 1995. Furthermore, the divergence between Taiwan's and China's performance has grown. Between 1995 and 2020, China's overall LQ increased from 1.41 to 1.47, while Taiwan's overall LQ increased from 1.72 to 2.10, the highest in the world.

**Figure 102: Hamilton Index industries' shares of Taiwan's economy**



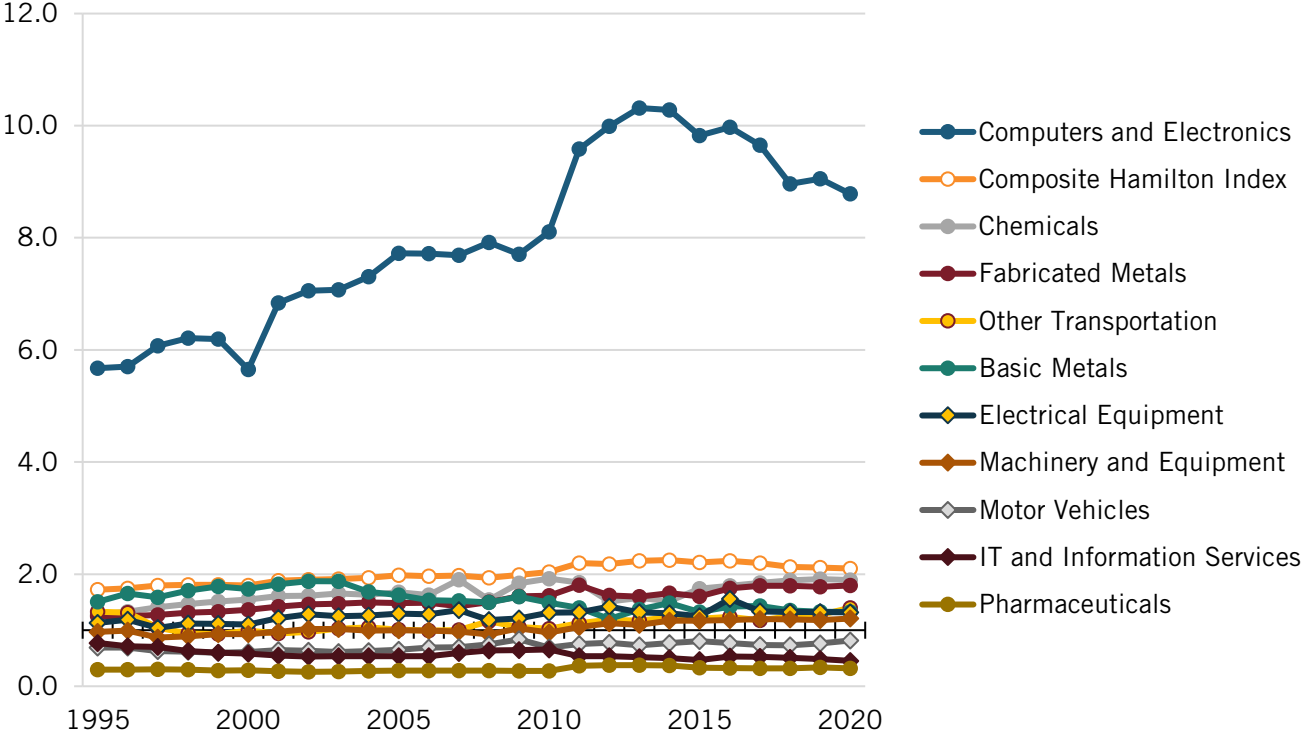
In terms of industry strength, Taiwan is above average in most industries except for motor vehicles, IT and information services, and pharmaceuticals. (See figure 103.)

**Figure 103: Taiwan's relative performance in Hamilton Index industries (2020 LQ)**



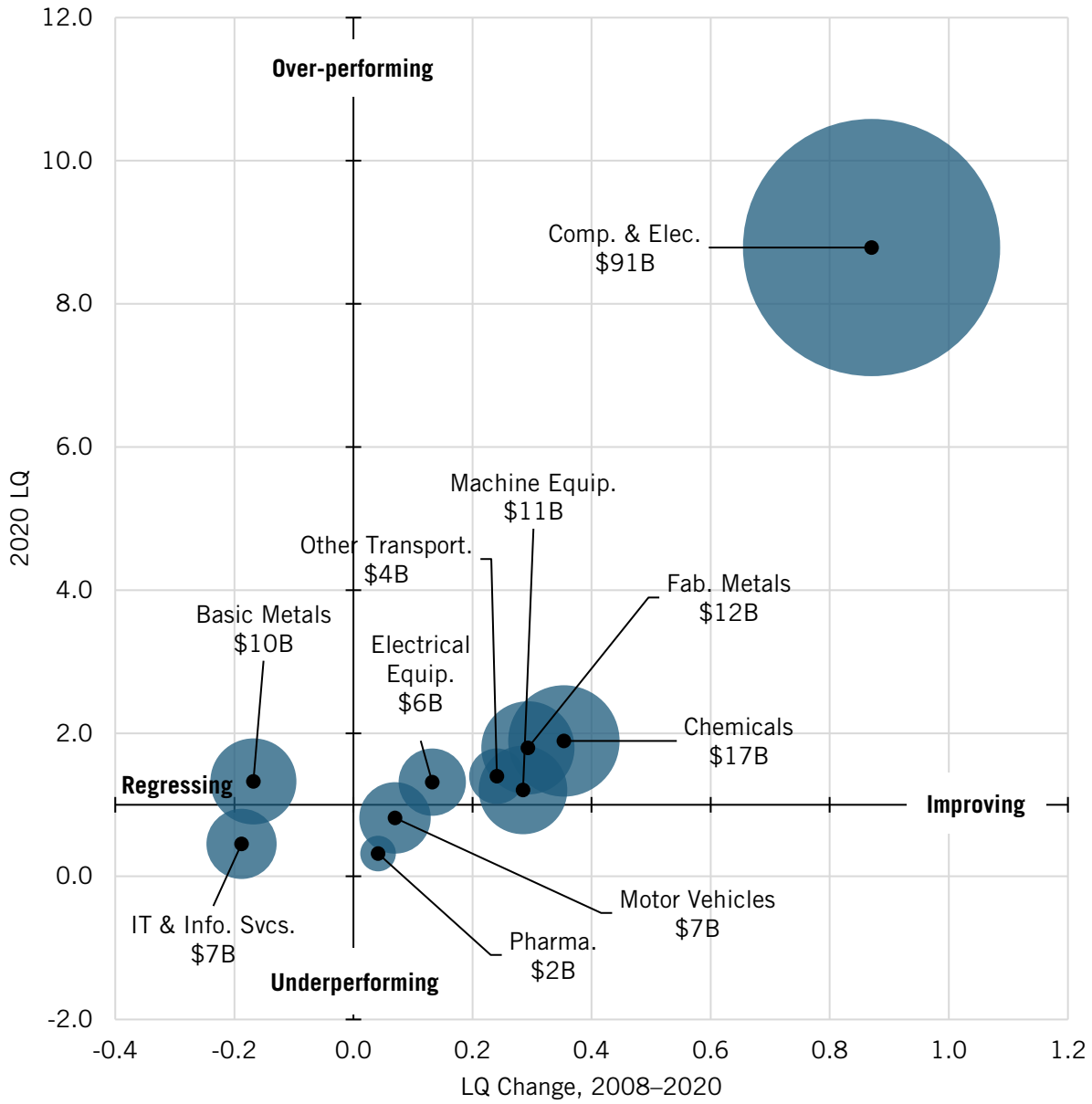
Due to the presence of TSMC, Taiwan’s strongest industry is computers and electronics, where it has an extremely high LQ of 8.79. It is also strong in chemicals, fabricated metals, other transportation, basic metals, electrical equipment, and machinery and equipment. In contrast, Taiwan’s worst-performing industry is pharmaceuticals, with an LQ of only 0.32.

**Figure 104: Taiwan’s relative historical performance in Hamilton industries (LQ trends)**



Taiwan has six industries in the “strong, growers” quadrant. Of those, computers and electronics has improved the most. Other industries in that quadrant are electrical equipment, other transportation, machinery and equipment, fabricated metals, and chemicals. It has two industries in the “weak, growers” quadrant, pharmaceuticals and motor vehicles. The IT and information services industry is in the “weak, declining” quadrant. Basic metals is the only industry in the “weak, decliners” category. This is not to say that the industry is not growing, but rather, that they are not growing as fast as the overall Taiwanese economy. Taiwan’s momentum score is far ahead of any other nation’s (1,503), 13 times that of the United States. Most of this stems from Taiwan’s truly outstanding growth in computers and semiconductors. However, given global tensions regarding China’s future actions regarding Taiwan that have spurred reshoring activities such as the U.S. CHIPS Act, it’s unlikely that this sector will continue to enjoy the growth rates it has in past years.

**Figure 105: Taiwan's net performance in Hamilton industries since 2008 (scaled to 2020 output)**

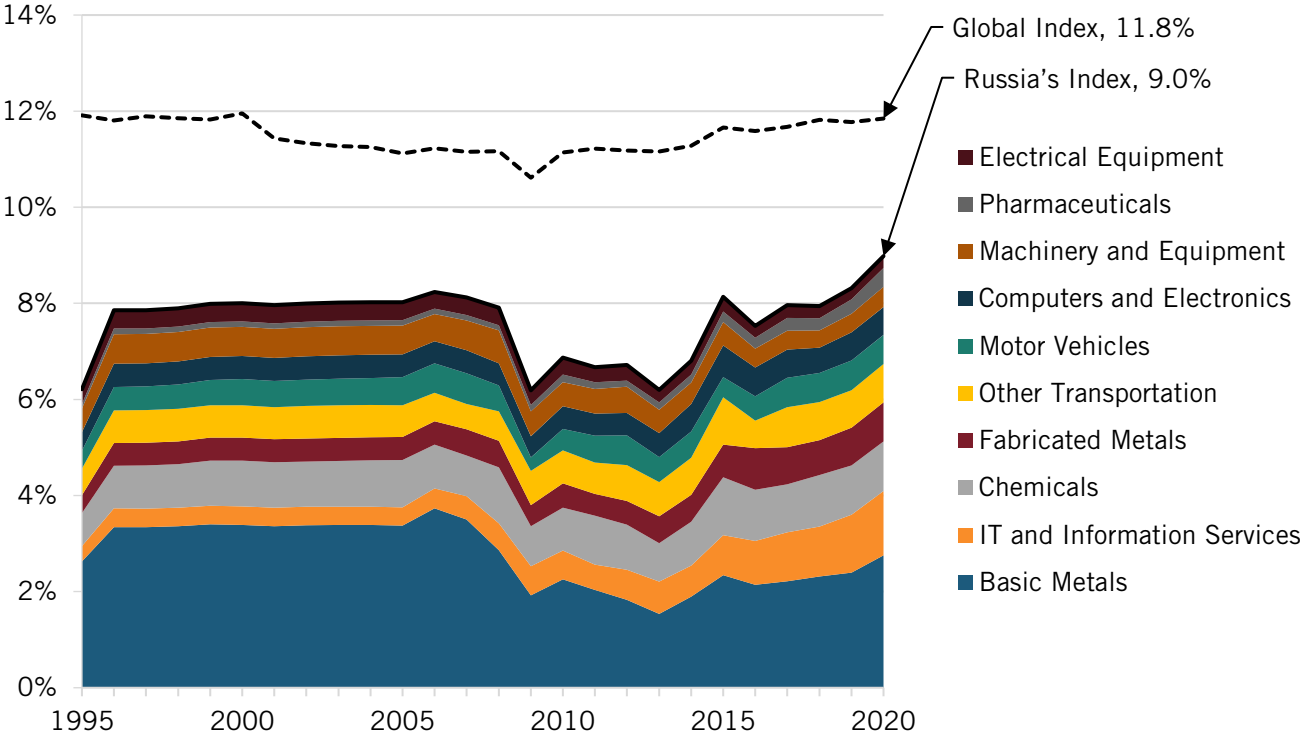


# OTHER NOTEWORTHY PRODUCERS

## No. 11: Russia

Stronger than it appears? Russia has consistently underperformed relative to the world and to the EU. While its overall LQ was 0.52 in 1995, it improved to 0.76 in 2020. However, that is still significantly below the overall LQ for the EU-17 at 0.93 and the EU-10 at 1.07. But Russia is strong in metals and other transportation production, both of which are critical to its military.

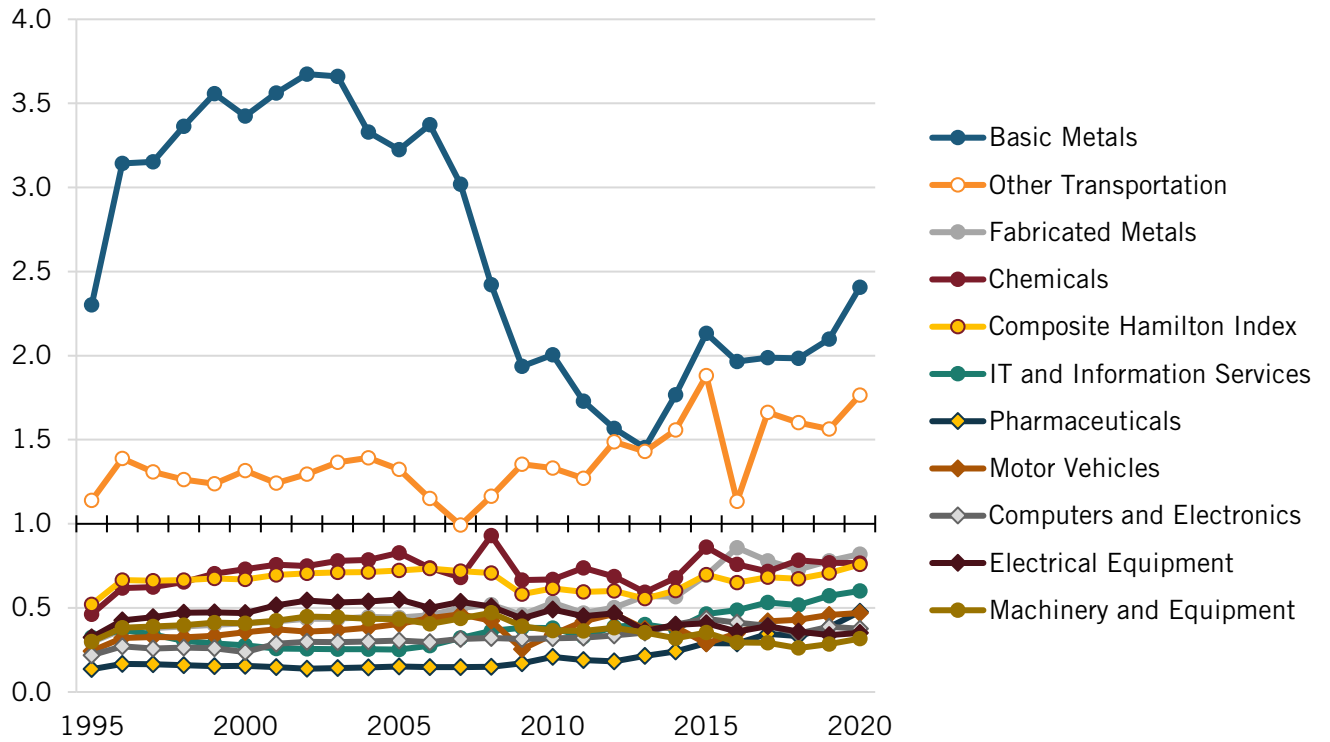
**Figure 106: Hamilton Index industries' shares of Russia's economy**



In terms of industry strength, Russia is above average in only two industries. (See figure 107.) Consistent with its long-standing investment in metals refining, Russia's strongest industry is basic metals, where it has an LQ of 2.41. Among the big producers of metals are RUSAL in aluminum and Norilsk in nickel. Additionally, the LQ for other transportation is 1.77, which may reflect military production.

In contrast, Russia is below average in all other advanced industries. Machinery and equipment and electrical equipment are the worst-performing industries, with LQs of only 0.32 and 0.35, respectively.

**Figure 107: Russia's relative historical performance in Hamilton industries (LQ trends)**



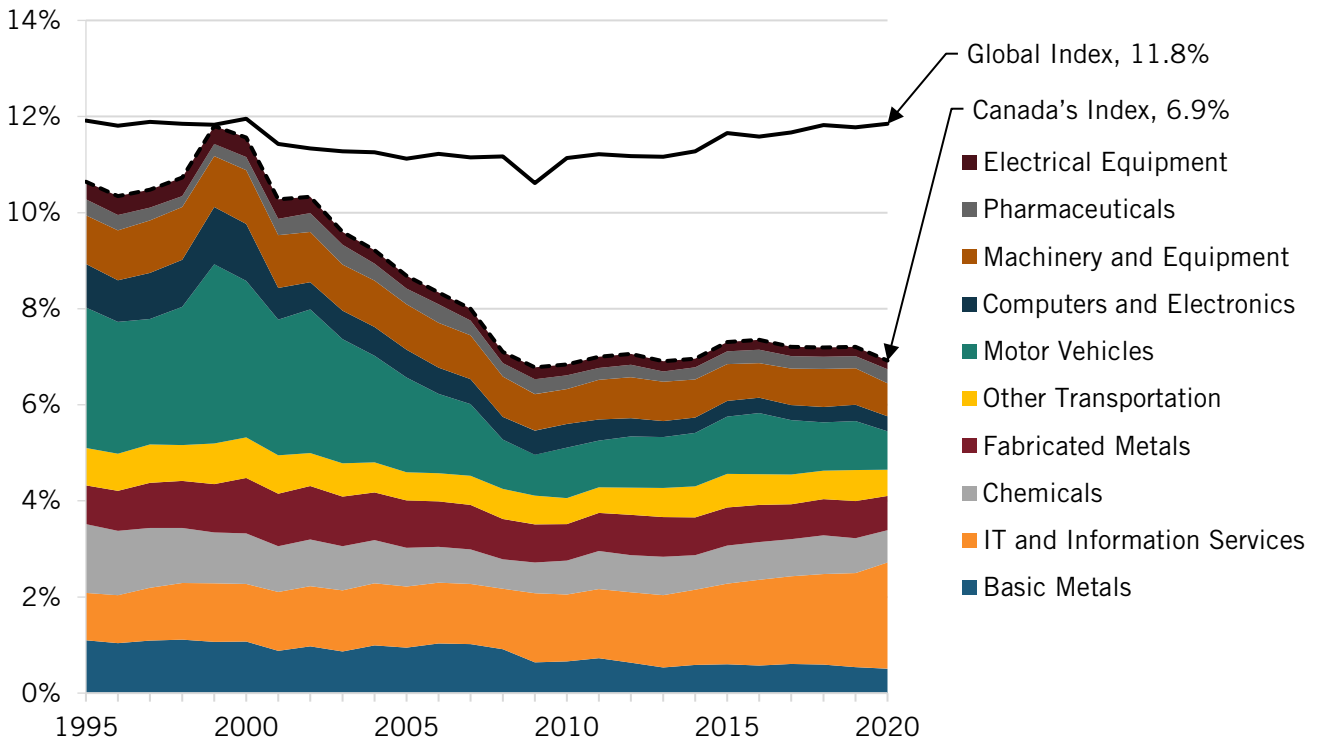
Basic metals is the only industry that is strong but declining compared to 2008. This is not to say that the industry is not growing, but rather, that it is not growing as fast as the overall Russian economy. Despite this, Russia's momentum score (131) is slightly above the global average. Of course, the impact the Russia-Ukraine war, and the associated sanctions, is likely to continue negatively impacting Russia's advanced industry output.

The remainder of Russia's industries have long been underperformers. These are electrical equipment, machinery and equipment, and chemicals.

## No. 13: Canada

A natural resource economy? Not only has Canada consistently underperformed relative to the world, but it has also continued to lose ground. While its overall LQ was 0.89 in 1995, it significantly fell to 0.58 in 2020. That puts Canada behind all OECD countries except Australia and Norway, two economies that specialize in mining.

**Figure 108: Hamilton Index industries' shares of Canada's economy**

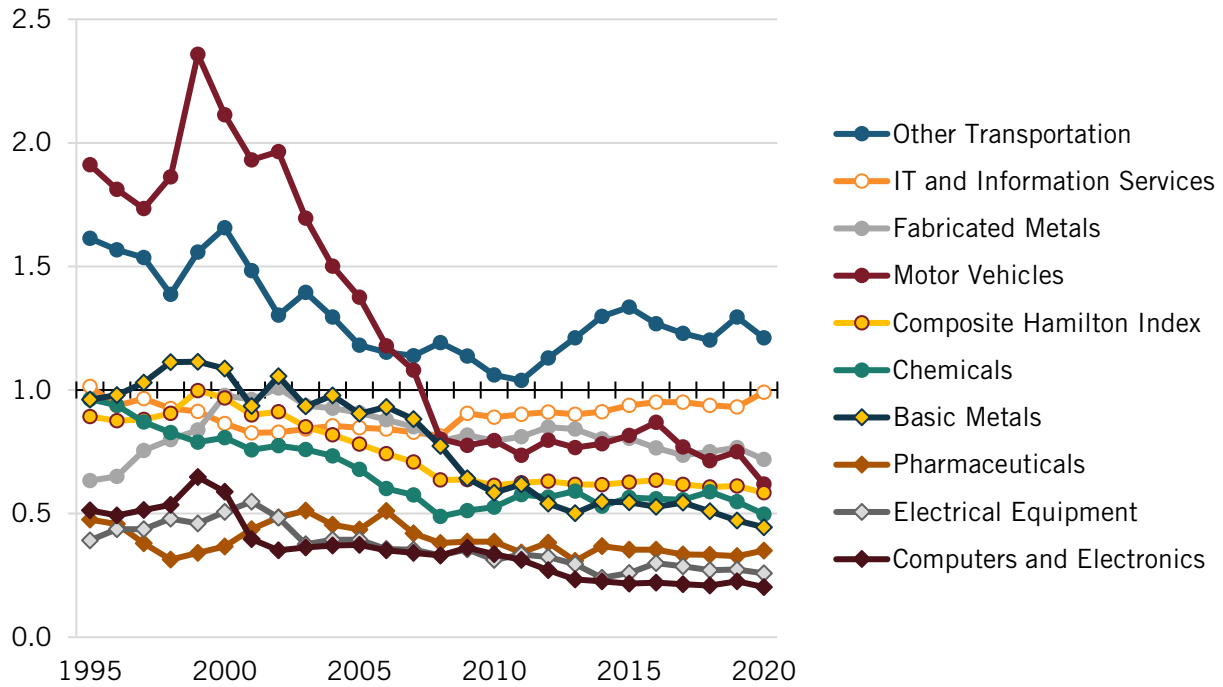


In terms of industry strength, Canada is above average in only one industry: other transportation, where it has an LQ of 1.21, presumably based on the strength of plane maker Bombardier. (See figure 109.) Canada is about average in IT and information services, although recent Canadian government regulatory actions and proposals may reduce Canada's competitiveness in this industry.

In contrast, Canada is below average in all other advanced industries. Electrical equipment and computer and electronics are the worst-performing industries, with LQs of only 0.26 and 0.20, respectively.



**Figure 109: Canada's relative historical performance in Hamilton industries (LQ trends)**



From the early 2000s until 2020, the LQs for all the industries, except other transportation and IT and other information services, declined. Other transportation is Canada's only industry that is both strong and improving since 2008.

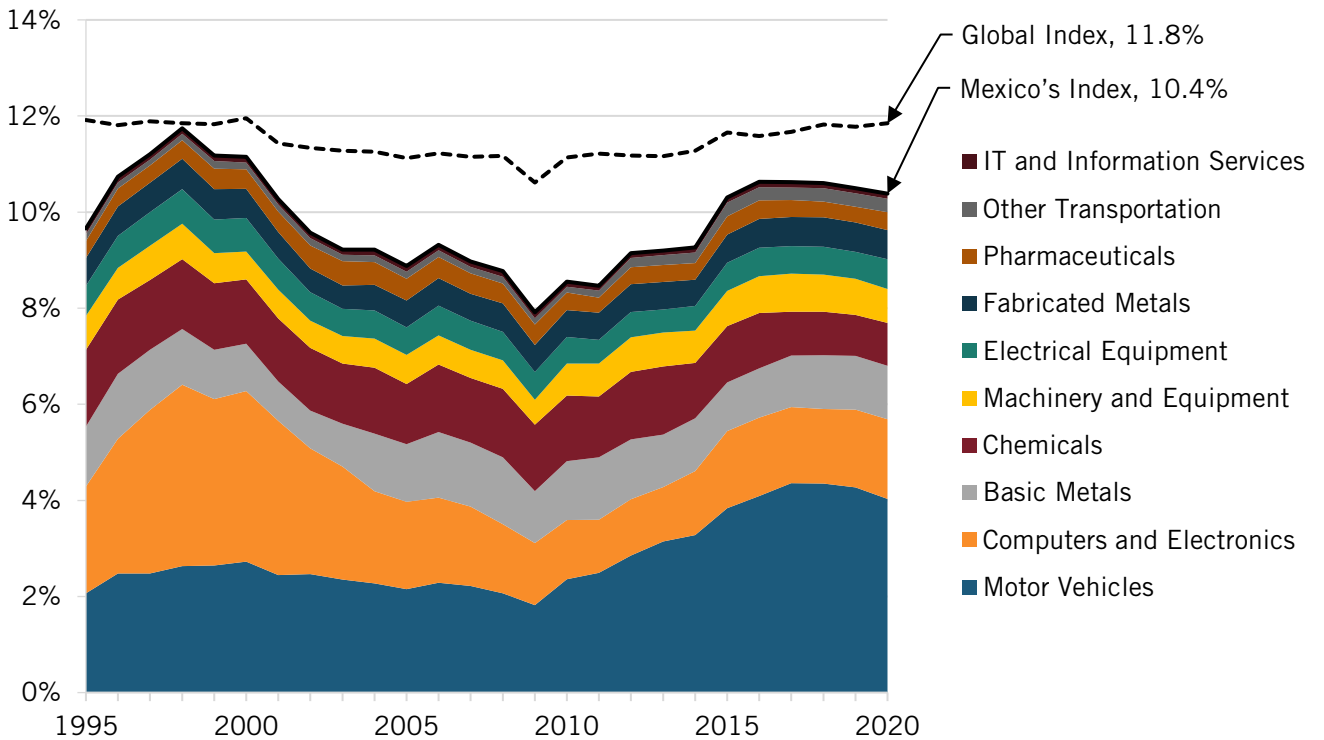
IT and information services and chemicals are the only two industries that are weaker than the global average but improving since 2008. The remainder of Canada's industries are both weak and declining: basic metals, motor vehicles, computers and electronics, electrical equipment, machinery and equipment, fabricated metals, and pharmaceuticals.

The decline in motor vehicles is especially noteworthy, as it was an industry in which Canada over-performed prior to the 2008 financial crisis. As such, Canada's momentum score is quite low (51).

## No. 14: Mexico

A one trick pony (autos)? While Mexico has consistently underperformed relative to the world, it has also continued to show improvement. Its overall LQ was 0.81 in 1995, but it increased modestly to 0.88 in 2020. That puts Mexico slightly ahead of the United States, along with other OECD countries such as Turkey, the United Kingdom, France, Spain, Canada, Australia, and Norway.

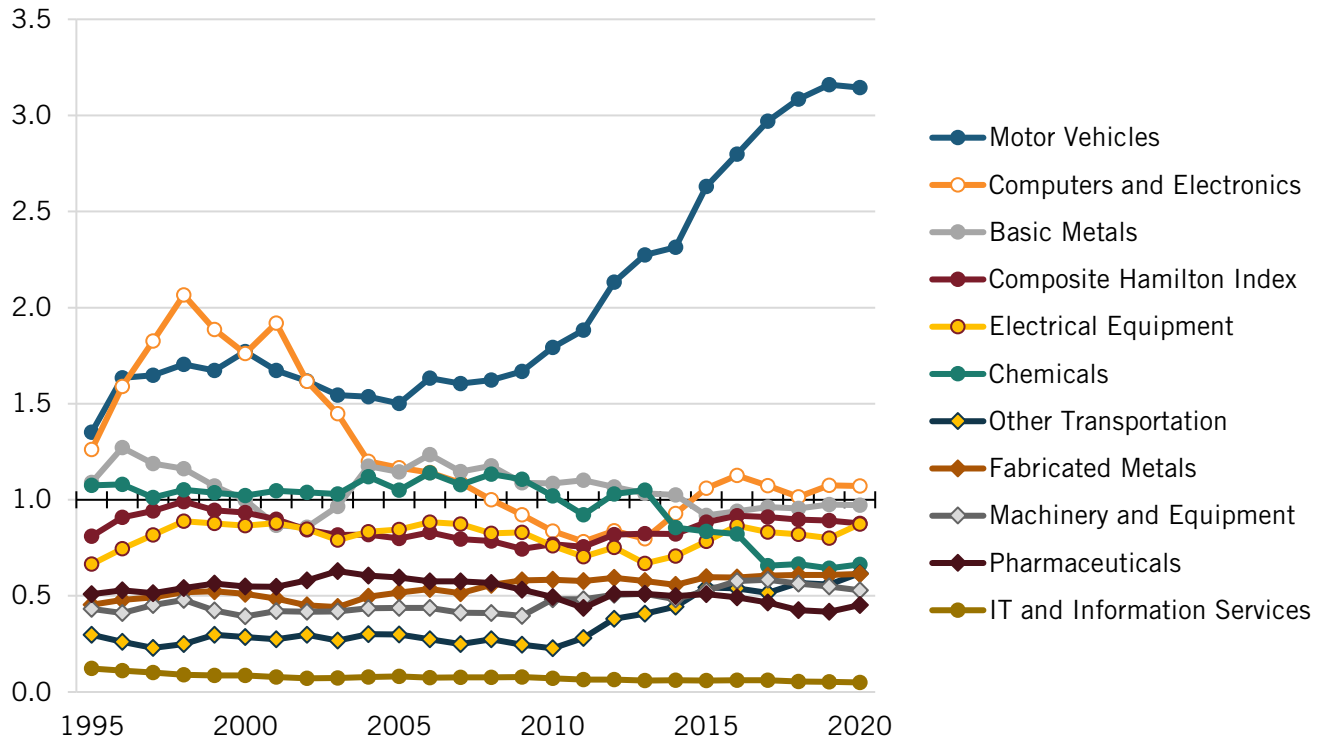
**Figure 110: Hamilton Index industries' shares of Mexico's economy**



In terms of industry strength, Mexico is above average in only two industries. (See figure 111.) As a result of NAFTA, its strongest industry is motor vehicles, where it has an LQ of 3.14. Mexico also performs above average in computers and electronics, where it has an LQ of 1.07. In contrast, Mexico is below average in all other advanced industries. Pharmaceuticals and IT and information services are the worst-performing industries, with LQs of only 0.45 and 0.05, respectively.

Mexico's major growth has been in motor vehicles, as it has gained production from the relocation of production from the United States and Canada. It is striking that its LQ in computers and electronics peaked in the late 1990s, before China joined the WTO.

**Figure 111: Mexico's relative historical performance in Hamilton industries (LQ trends)**



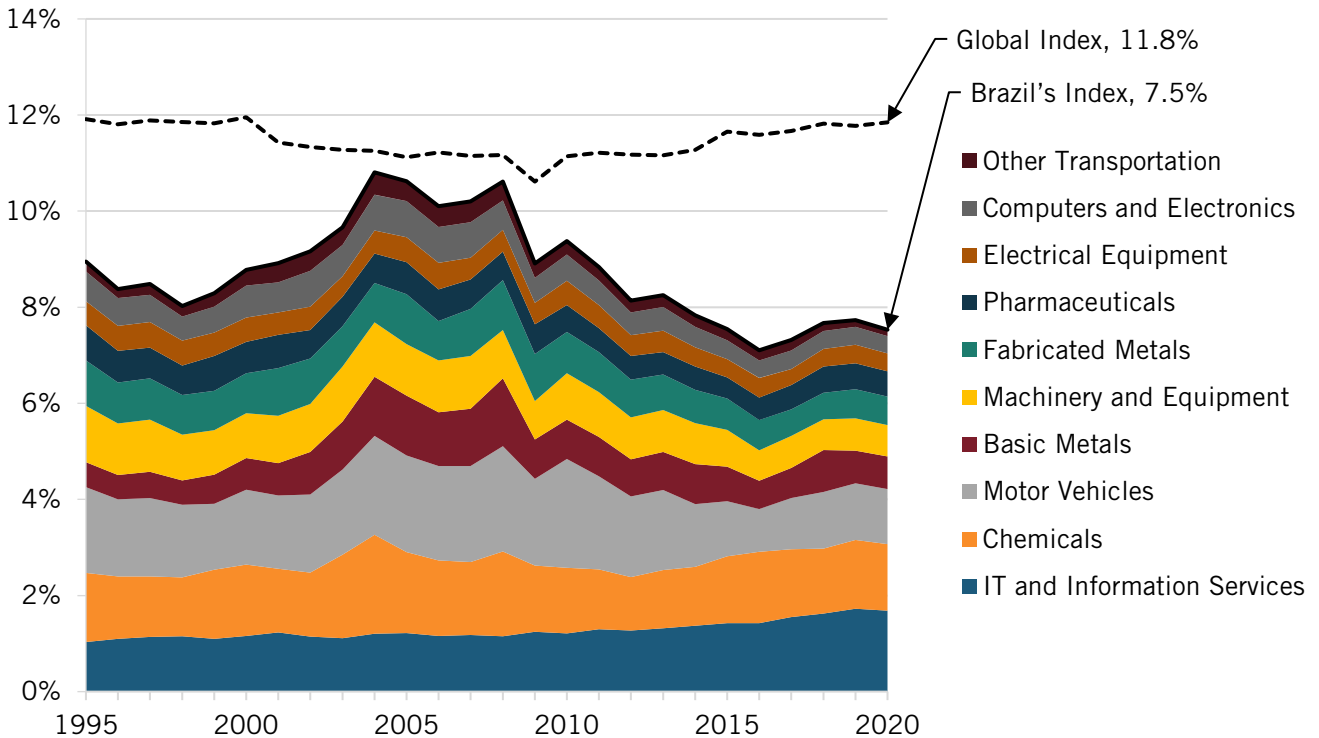
Mexico has only two industries that are both comparatively strong and growing: motor vehicles, which grew by 152 percentage points, and computers and electronics. It has four industries that are comparatively weak, but growing: other transportation, machinery and equipment, fabricated metals, and electrical equipment.

The remainder of Mexico's industries are comparatively weak and declining: basic metals, chemicals, pharmaceuticals, and IT and information services. The declines in basic metals and chemicals are noteworthy, as they were both industries in which Mexico used to over-perform. Nonetheless, Mexico's momentum score is quite high (297), almost all based on strong performance in motor vehicles.

## No. 15: Brazil

A country of the past, and always will be? Brazil has consistently underperformed relative to the world, and it has only continued to lose ground since 2008. While its overall LQ increased from 0.75 in 1995 to 0.95 in 2008, it fell to 0.64 in 2020.

**Figure 112: Hamilton Index industries' shares of Brazil's economy**



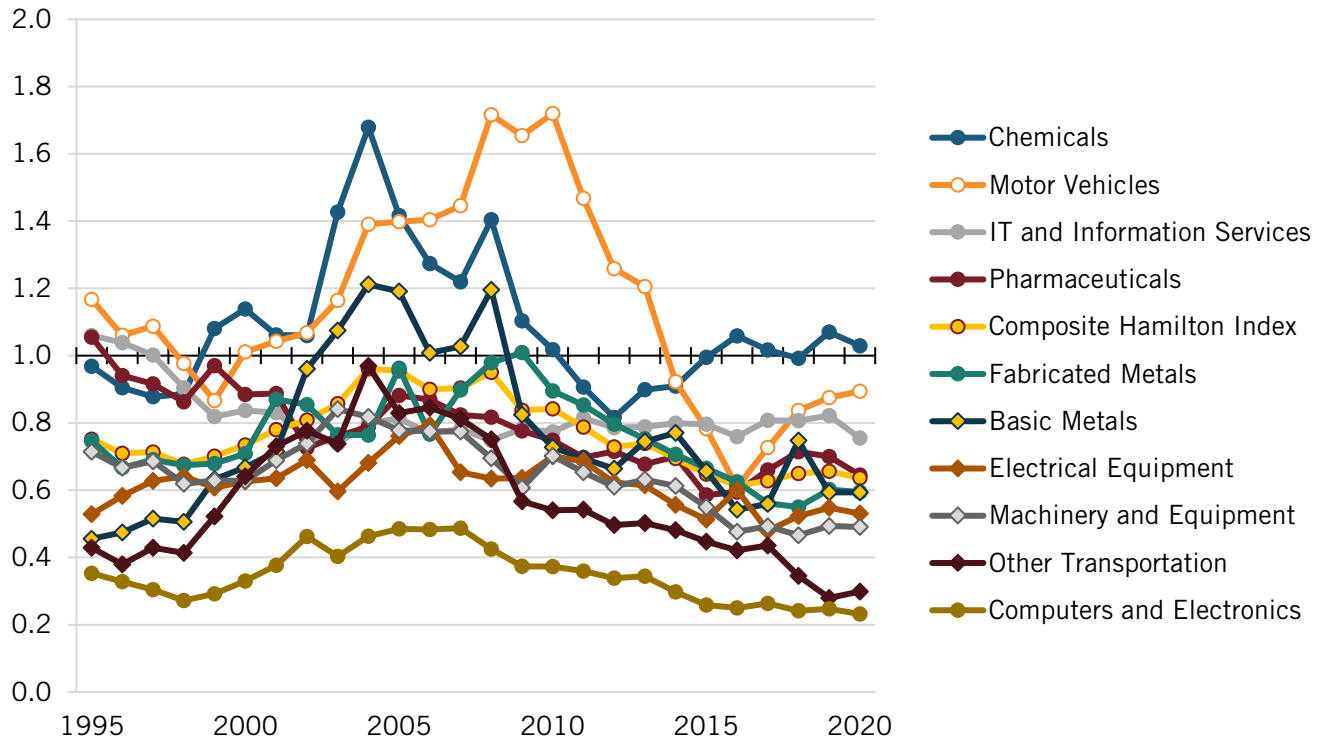
In terms of industry strength, Brazil is above average in only one industry, chemicals. (See figure 113.) Brazil underperforms in all other industries. Its next-best-performing industries are motor vehicles and IT and information services, where it has LQs of 0.87 and 0.76, respectively. Other transportation and computers and electronics are the worst-performing industries, with LQs of only 0.30 and 0.23, respectively.

Brazil has no industries that are both comparatively strong and growing since 2008. Its only comparatively strong industry, chemicals, has declined.

All its other industries are comparatively weak, and just one has been growing—namely, IT and information services, whose LQ barely grew from 0.75 in 2008 to 0.76 in 2020. This is not to say that the industry is not growing, but rather, that it is not growing as fast as the overall Brazilian economy.

The remainder of Brazil's industries are both comparatively weak and declining. The declines in motor vehicles, basic metals, and fabricated metals are noteworthy, as they were both industries in which Brazil used to over-perform.

**Figure 113: Brazil's relative historical performance in Hamilton industries (LQ trends)**

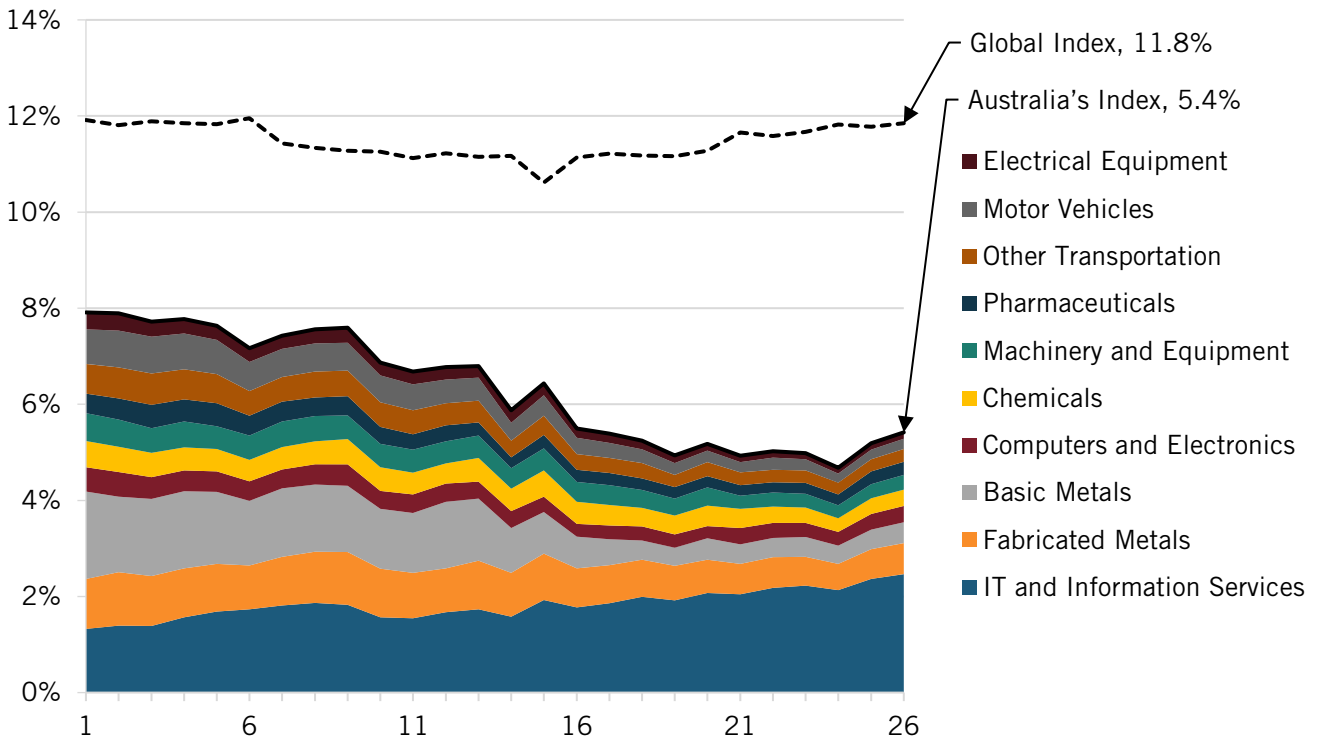


Brazil faces two main challenges. First, many of its key sectors compete head-to-head with China and generally lose. Second, Brazilian politics have been unstable, leading to a poor business climate. As such, it's not a surprise that its momentum score is very low (40).

## No. 19: Australia

Mines are us. Australia has consistently underperformed relative to the world, and relative to most other OECD nations. While its overall LQ was 0.66 in 1995, it only continued to fall to 0.46 in 2020. That puts Australia slightly behind almost all other OECD countries except for Norway. Additionally, it also puts Australia behind many developing and non-OECD countries including China, India, Malaysia, the Philippines, Singapore, and Thailand.

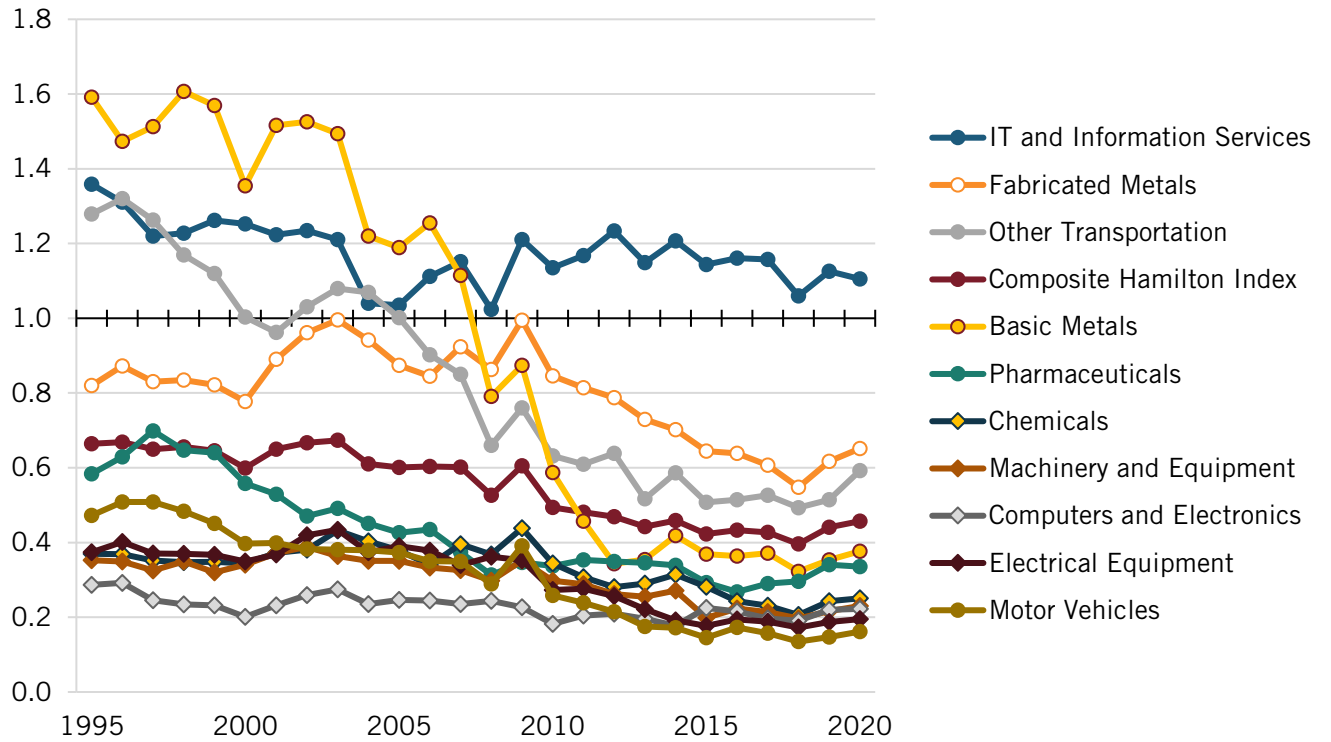
**Figure 114: Hamilton Index industries' shares of Australia's economy**



In terms of industry strength, Australia is above average in only one industry: IT and information services, where it has an LQ of 1.10. (See figure 115.) That is also only one of two industries in which Australia is seeing improvement. In contrast, Australia is below average in all other advanced industries. Electrical equipment and motor vehicles are the worst-performing industries, with LQs of only 0.19 and 0.16, respectively.

Australia has only one industry that is both comparatively strong and growing since 2008—IT and information services. All the rest of its advanced industries are comparatively weak, and just one is improving: pharmaceuticals. The remainder of Australia's industries are both comparatively weak and declining. The declines in basic metals and other transportation are noteworthy, as they were both industries in which Australia used to over-perform. As such, Australia's momentum score is among the lowest in the world (38).

**Figure 115: Australia's relative historical performance in Hamilton industries (LQ trends)**

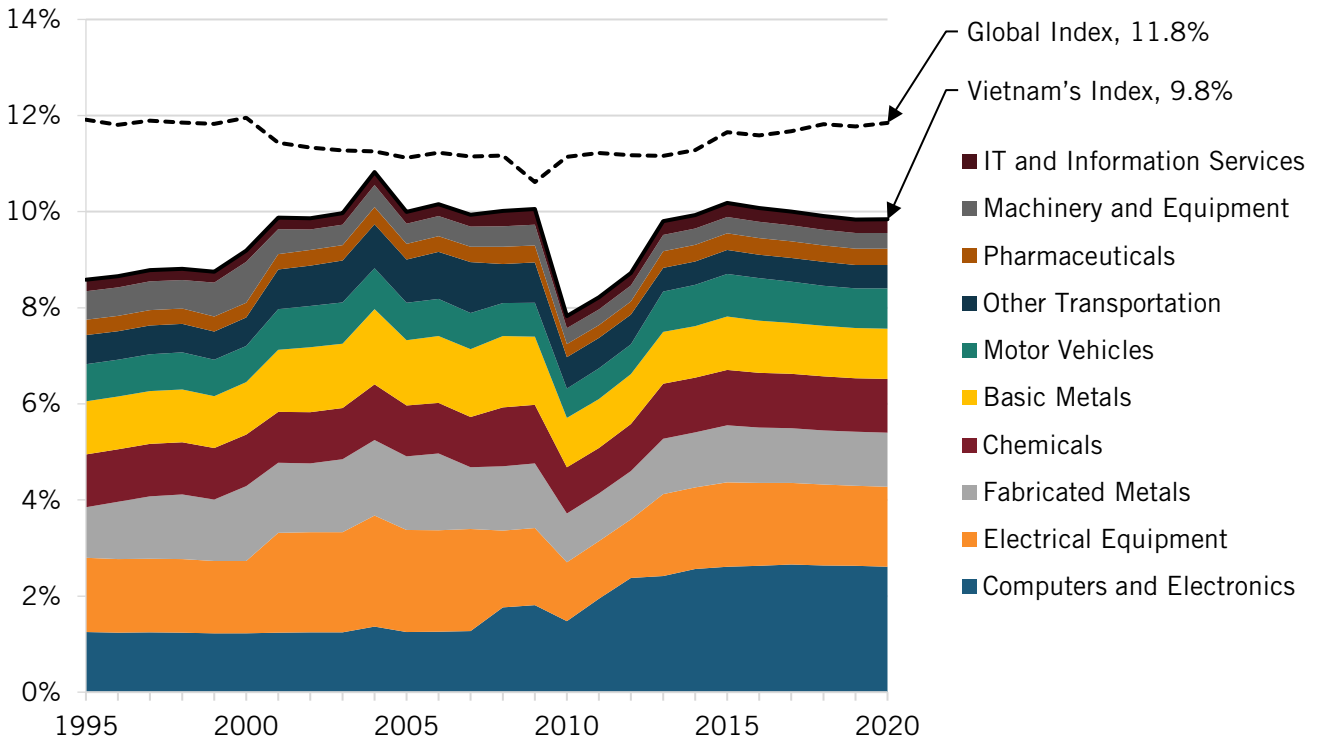


Australia has had the luxury of living off a China-fueled minerals boom, but that came at the cost of advanced industry degradation. It is striking that policy toward its one above-average industry (information technology and other services) is largely negative and out of sync with global best practices.

## No. 32: Vietnam

An alternative to China? Vietnam has consistently underperformed relative to the world and to the EU. While its overall LQ was 0.72 in 1995, it marginally improved to 0.83 in 2020.

**Figure 116: Hamilton Index industries' shares of Vietnam's economy**



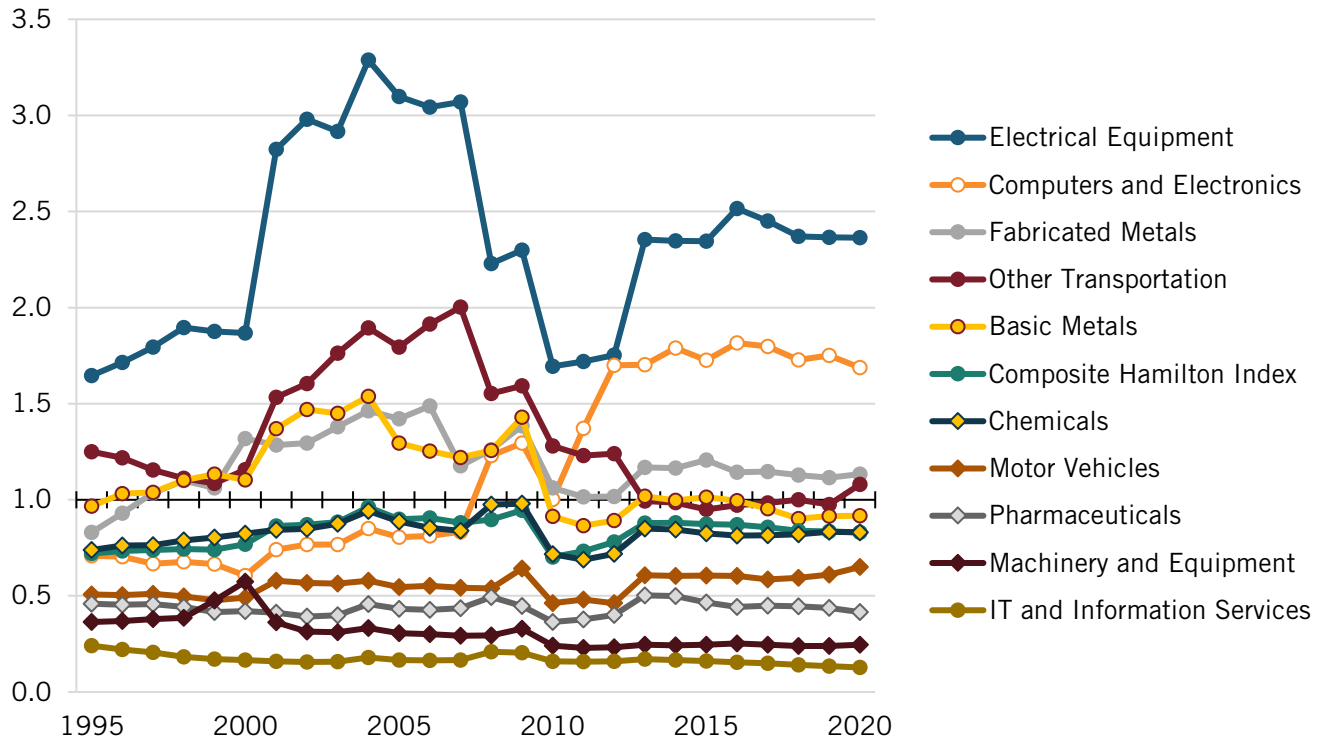
In terms of industry strength, Vietnam is above average in only two industries. (See figure 117.) Its strongest industry is electrical equipment, where it has an LQ of 2.36. Additionally, the LQ for computers and electronics is 1.69. In contrast, Vietnam is below average in all other advanced industries. Machinery and equipment and electrical equipment are the worst-performing industries, with LQs of only 0.32 and 0.35, respectively.

Vietnam has only two industries that are both comparatively strong and have been growing since 2008—computers and electronics and electrical equipment. It has one industry that is comparatively weak but growing: motor vehicles. Fabricated metals and other transportation are comparatively strong but have declined since 2008. This is not to say that these industries are not growing, but rather, that they are not growing as fast as the overall Vietnamese economy.

The remainder of Vietnam's advanced industries are both comparatively weak and declining. These are basic metals, chemicals, pharmaceuticals, machinery and equipment, and IT and information services.



**Figure 117: Vietnam's relative historical performance in Hamilton industries (LQ trends)**

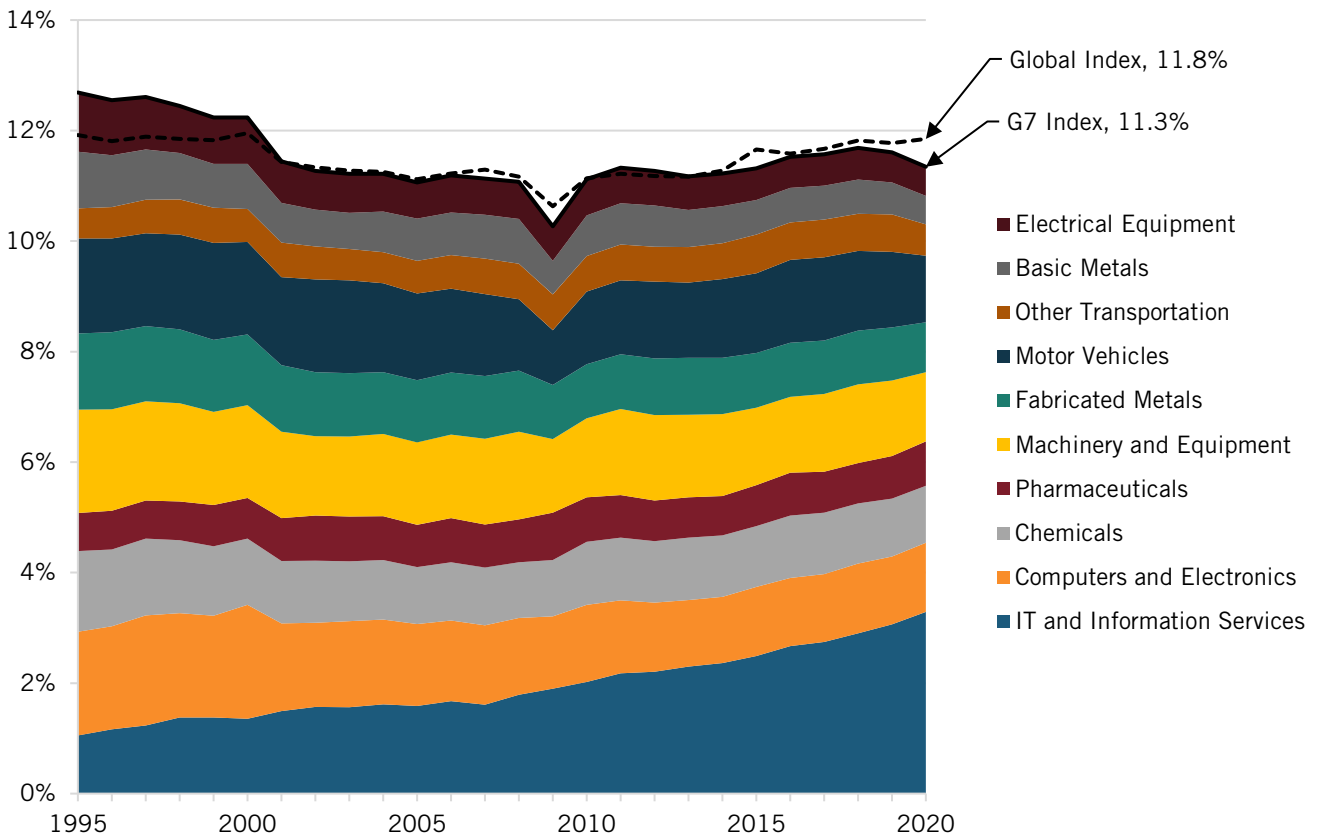


## SELECT REGIONAL GROUPINGS

### The Group of Seven

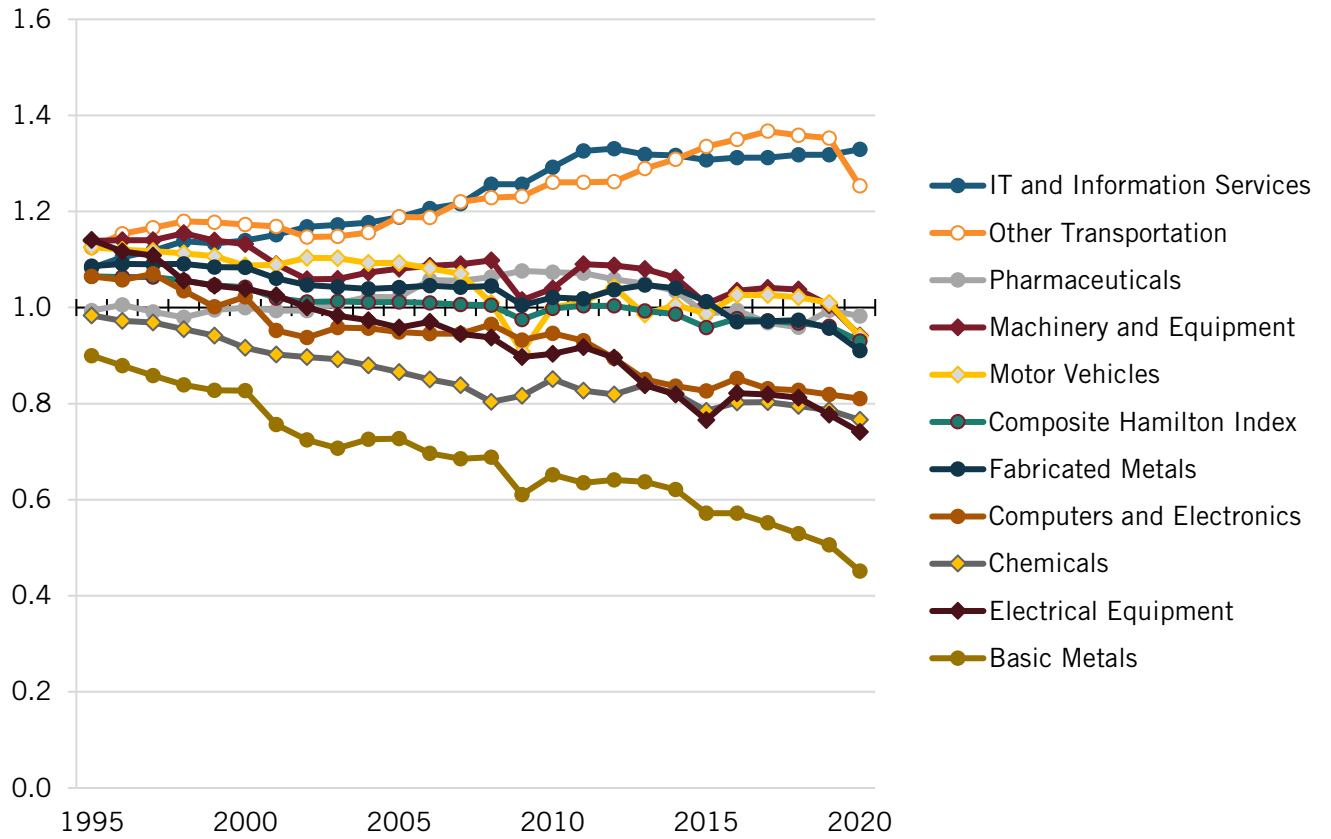
The G7 bloc of the capitalist world's leading industrial economies—including the United States, the United Kingdom, Germany, Japan, France, Italy, and Canada—has held sway globally for most of the post-World War II era. But it is losing global market share in all 10 of the advanced industries in the Hamilton Index, largely to the benefit of China. (See figure 11 and figure 12.)

**Figure 118: Hamilton Index industries' shares of G7 economies**



In relative terms, G7 countries now outperform the global average only in IT and information services and other transportation. (See figure 119.) In all other Hamilton industries, the G7 underperforms.

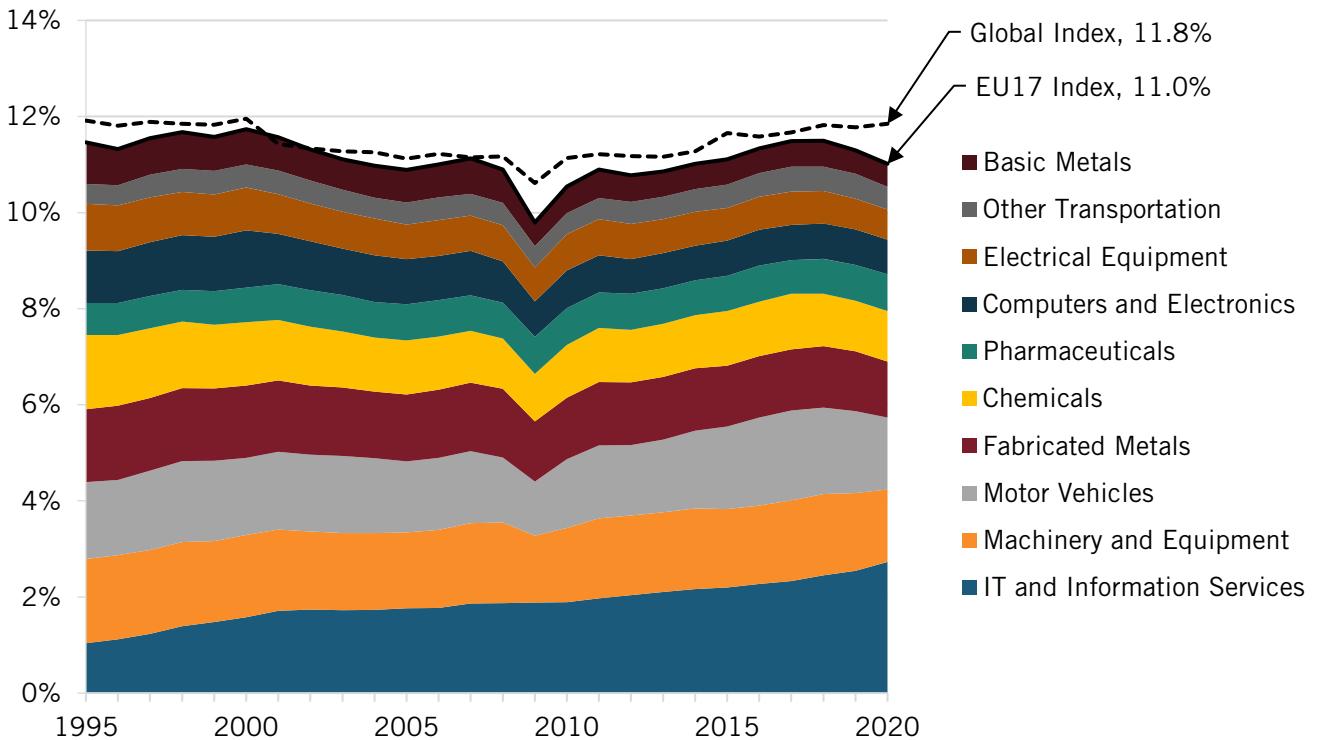
**Figure 119: G7 economies' relative historical performance in Hamilton industries (LQ trends)**



## EU-17

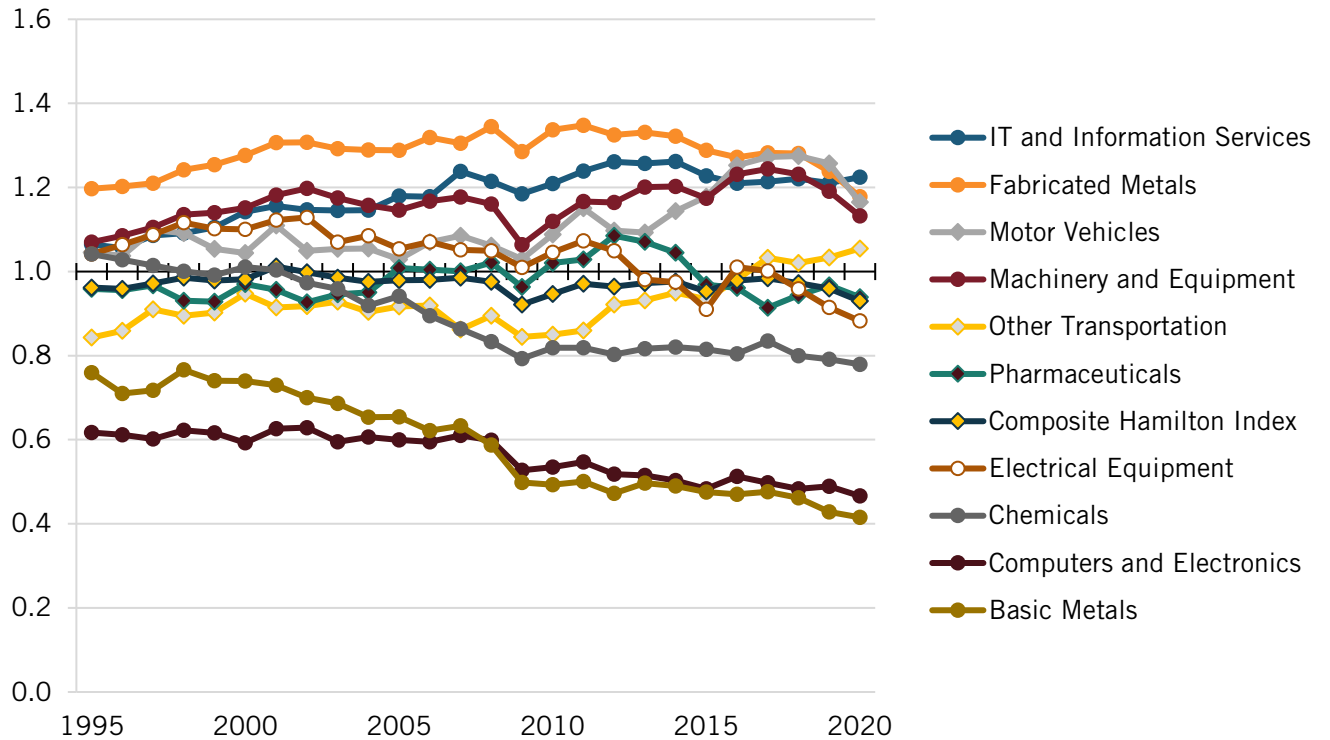
The EU-17 (countries that were EU members prior to 2004) has consistently underperformed relative to the world and to the EU as a whole. While its overall LQ was 0.96 in 1995, it fell slightly to 0.93 in 2020. However, that is still slightly below the overall LQ for the EU-27 at 0.94 and the EU-10 at 1.07.

**Figure 120: Hamilton Index industries' average shares of EU-17 economies**



In terms of industry strength, the EU-17 is above average in five industries. (See figure 121.) Notwithstanding the EU's pessimistic and protectionist narrative related to its supposed need for "digital sovereignty," its strongest industry is IT and information services, where it has an LQ of 1.22. Fabricated metals and motor vehicles are next at 1.18 and 1.17, respectively. In contrast, the EU-17 is below average in all other advanced industries. Computers and electronics and basic metals are the worst-performing industries, with LQs of only 0.47 and 0.42, respectively.

**Figure 121: EU-17's relative historical performance in Hamilton industries (LQ trends)**



The EU-17 has only one industry that is both comparatively strong and growing since 2008—IT and information services. However, the LQ for that industry barely improved from 1.21 in 2008 to 1.22 in 2020.

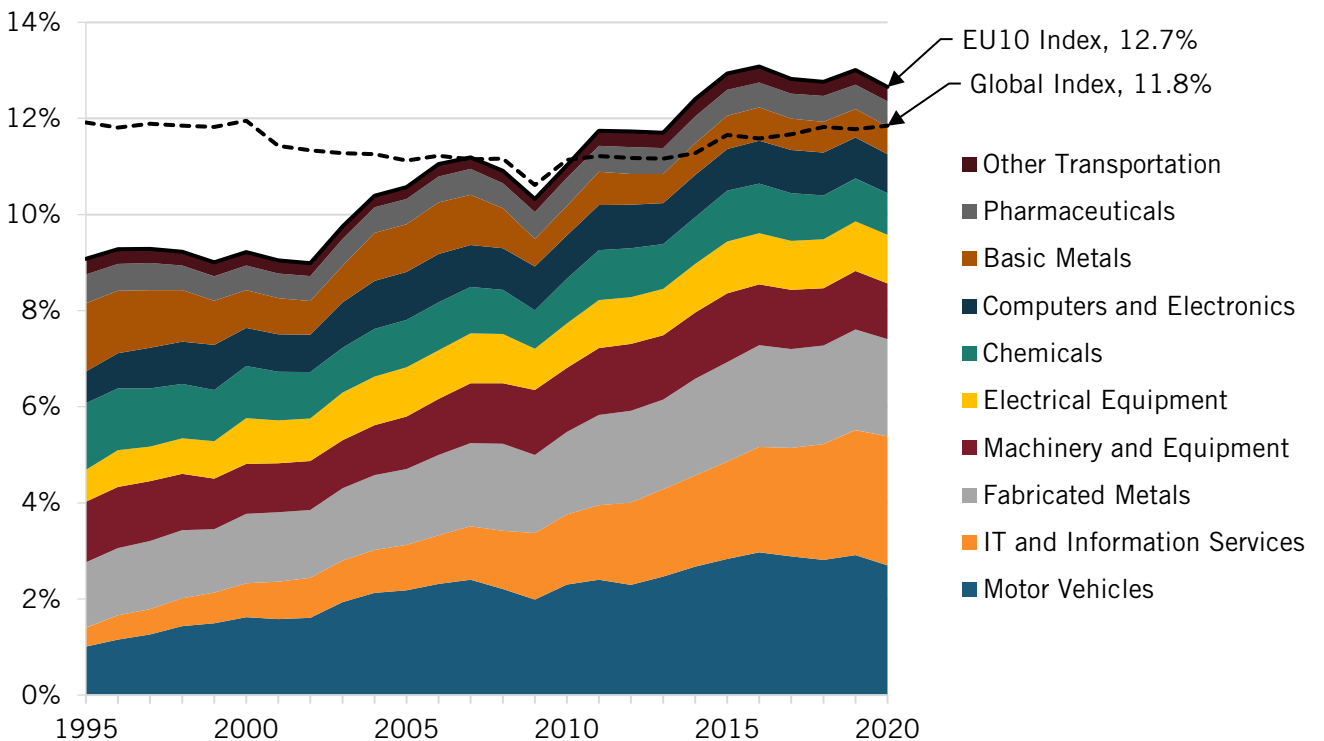
Fabricated metals, machinery and equipment, motor vehicles, and other transportation are comparatively strong, but declining since 2008. This is not to say that the industry is not growing, but rather, that it is not growing as fast as the overall combined EU-17 economy.

The remainder of the EU-17's industries are both comparatively weak and declining since 2008. These are electrical equipment, pharmaceuticals, chemicals, computers and electronics, and basic metals. The declines in electrical equipment, chemicals, and pharmaceuticals are noteworthy, as those are industries in which the EU-17 members over-performed prior to 2008.

## EU-10

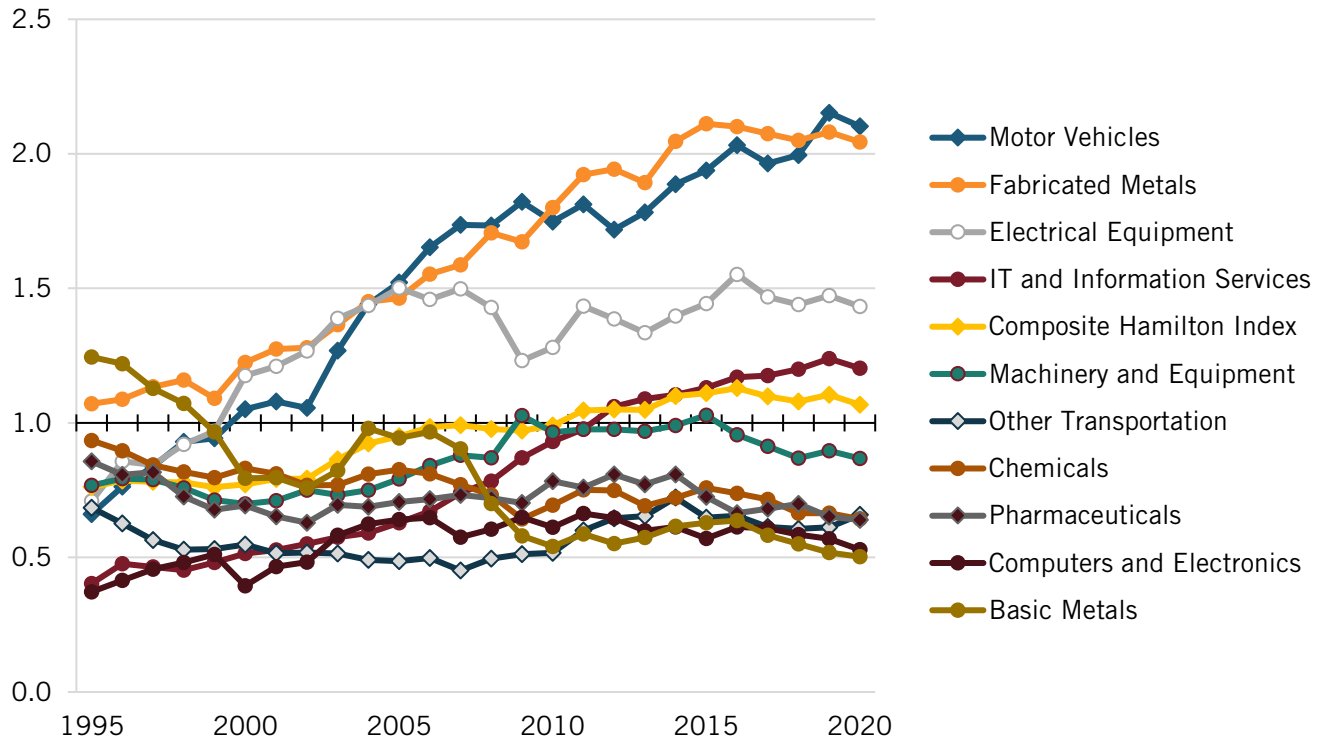
The EU-10 (EU members that joined in 2004) previously underperformed relative to the world and to the EU-17 but has seen significant improvement. While its overall LQ was 0.76 in 1995, it significantly increased to 1.07 in 2020. However, that is greater than the LQ for the EU-27 (whole EU excluding Ireland) at 0.94 and the EU-17 at 0.93. The EU 10 nations have been able to combine integration into the EU with relatively low business costs and relatively strong workforce skills to gain advantage in post-advanced industries.

**Figure 122: Hamilton Index industries' average shares of EU-10 economies**



In terms of industry strength, the EU-10 is above average in four industries. (See figure 123.) Its strongest industry is motor vehicles, where it has an LQ of 2.10. Additionally, the LQs for fabricated metals, electrical equipment, and IT and information services are 2.04, 1.43, and 1.20, respectively. In contrast, the EU-10 is below average in the remaining six of the advanced industries. Computers and electronics and basic metals are the worst-performing industries, with LQs of only 0.53 and 0.50, respectively.

**Figure 123: EU-10's relative historical performance in Hamilton industries (LQ trends)**



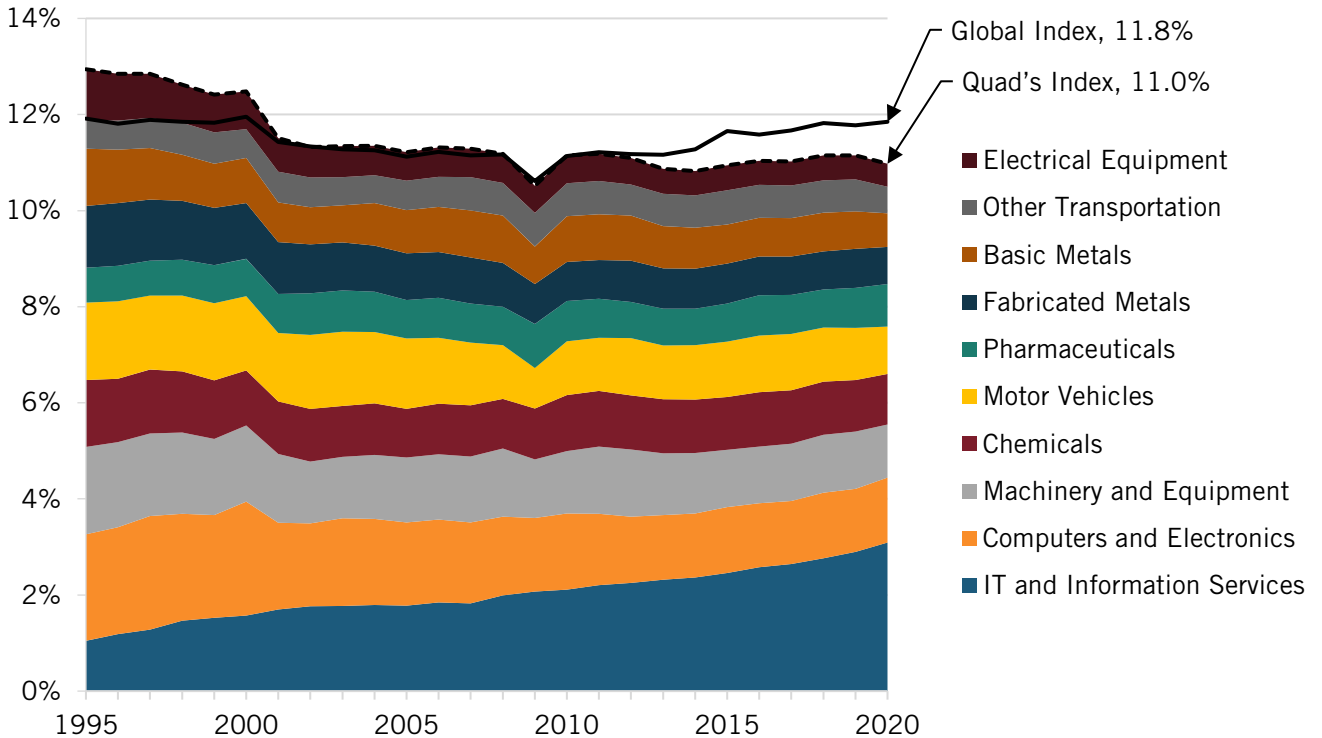
The EU-10 has three industries that are both comparatively strong and growing since 2008—motor vehicles, fabricated metals, and IT and information services. Electrical equipment and machinery and equipment are unchanged in their LQ. It has one industry that is comparatively weak but growing since 2008: other transportation.

The remainder of the EU-10's advanced industries are both comparatively weak and declining since 2008. These are pharmaceuticals, chemicals, computers and electronics, and basic metals. Basic metals used to be an industry in which the EU-10 over-performed prior to 2008.

## Quad

The Quad used to over-perform relative to the world but has steadily lost ground. While its overall LQ was 1.09 in 1995, it fell to 0.93 in 2020. That is slightly below the overall LQ for the EU-27 (excluding Ireland) at 0.94. The fall in the Quad's LQ is primarily due to the fall in LQ for the United States and Japan.

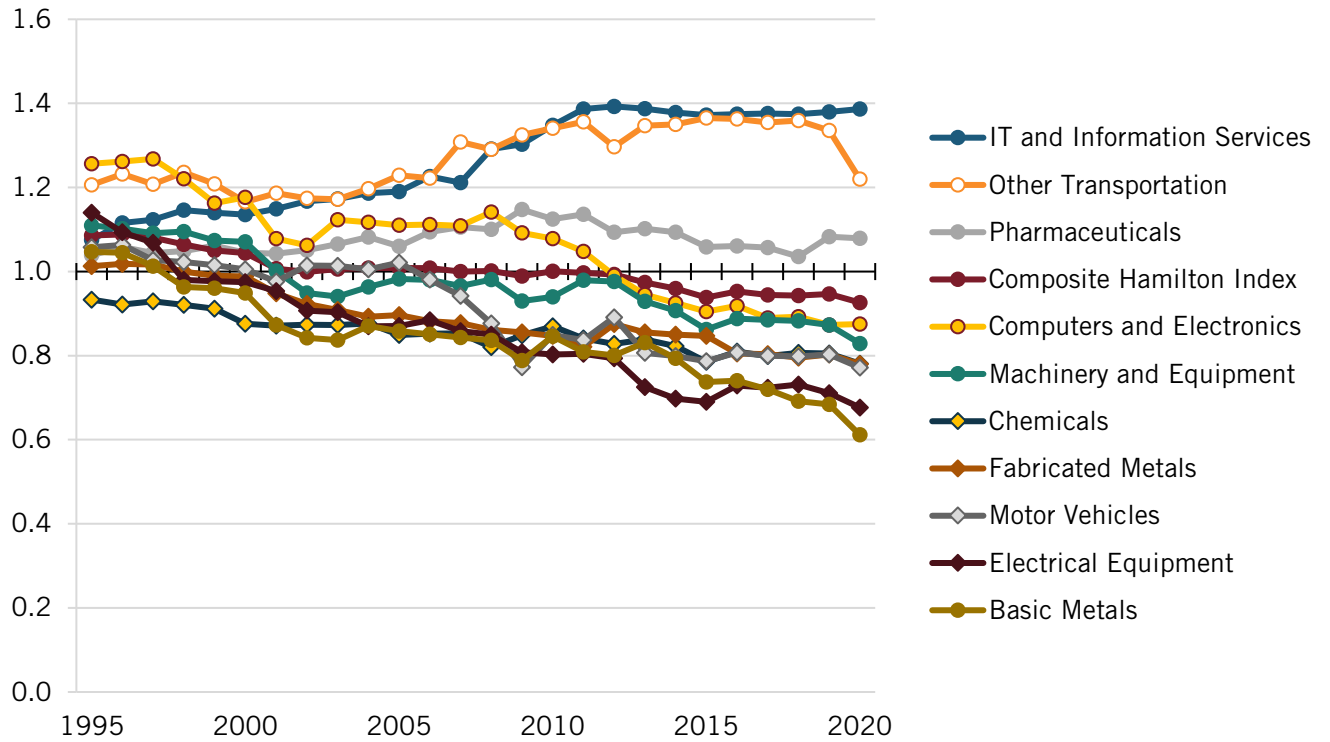
**Figure 124: Hamilton Index industries' average shares of Quad nations' economies**



In terms of industry strength, the Quad is above average in only three industries. (See figure 125.) Its strongest industry is IT and information services, where it has an LQ of 1.39. Additionally, the LQs for other transportation and pharmaceuticals are 1.22 and 1.08, respectively. In contrast, the Quad is below average in all other advanced industries. Electrical equipment and basic metals are the worst-performing industries, with LQs of only 0.68 and 0.61, respectively.



**Figure 125: Quad nations' relative historical performance in Hamilton industries (LQ trends)**



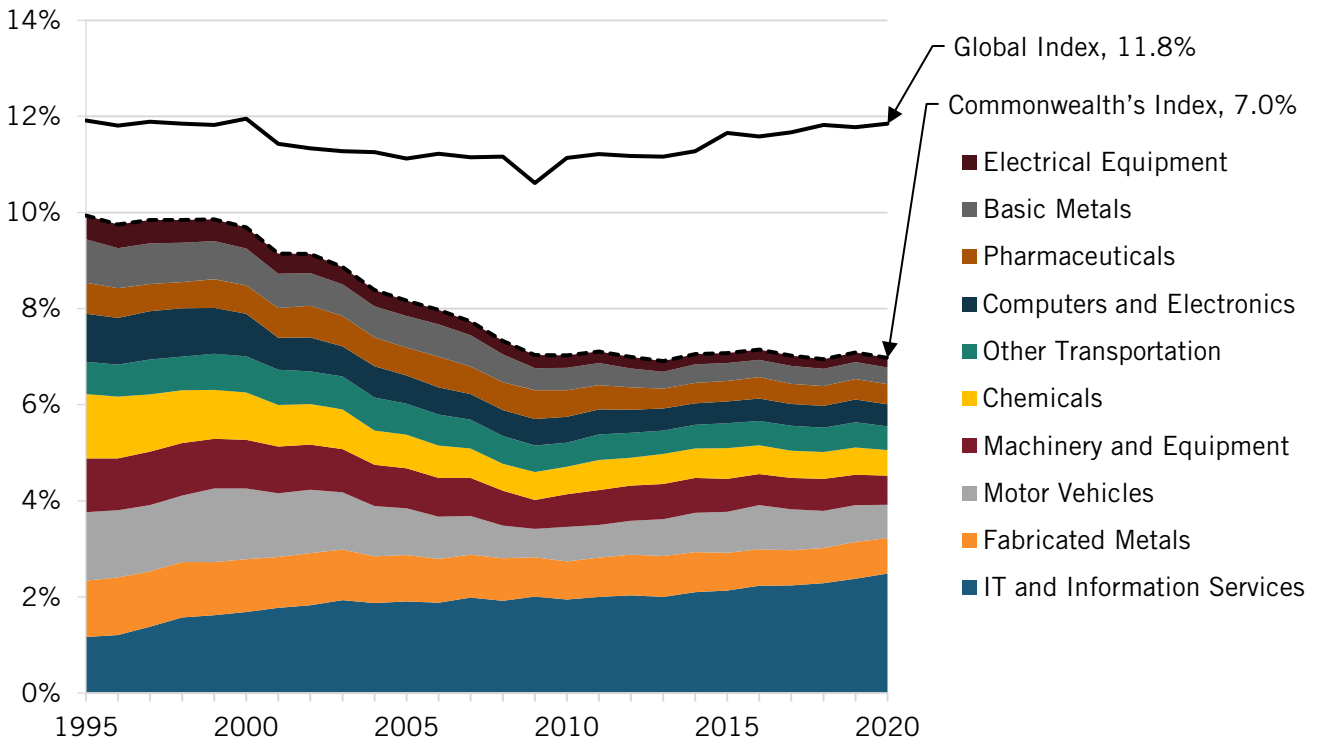
The Quad has only one industry that is both comparatively strong and growing since 2008—IT and information services. Pharmaceuticals and other transportation are comparatively strong but have been declining since 2008. This is not to say that those industries are not growing, but rather, that they are not growing as fast as the overall Quad economy.

The remainder of the Quad’s advanced industries are both comparatively weak and declining since 2008. The declines in electrical equipment, machinery and equipment, motor vehicles, computers and electronics, basic metals, and fabricated metals are all industries that the Quad used to show over-performance in. The declines in the Quad’s performance in these industries would mainly be due to the loss of competitiveness in Japan and the United States.

## Commonwealth Countries

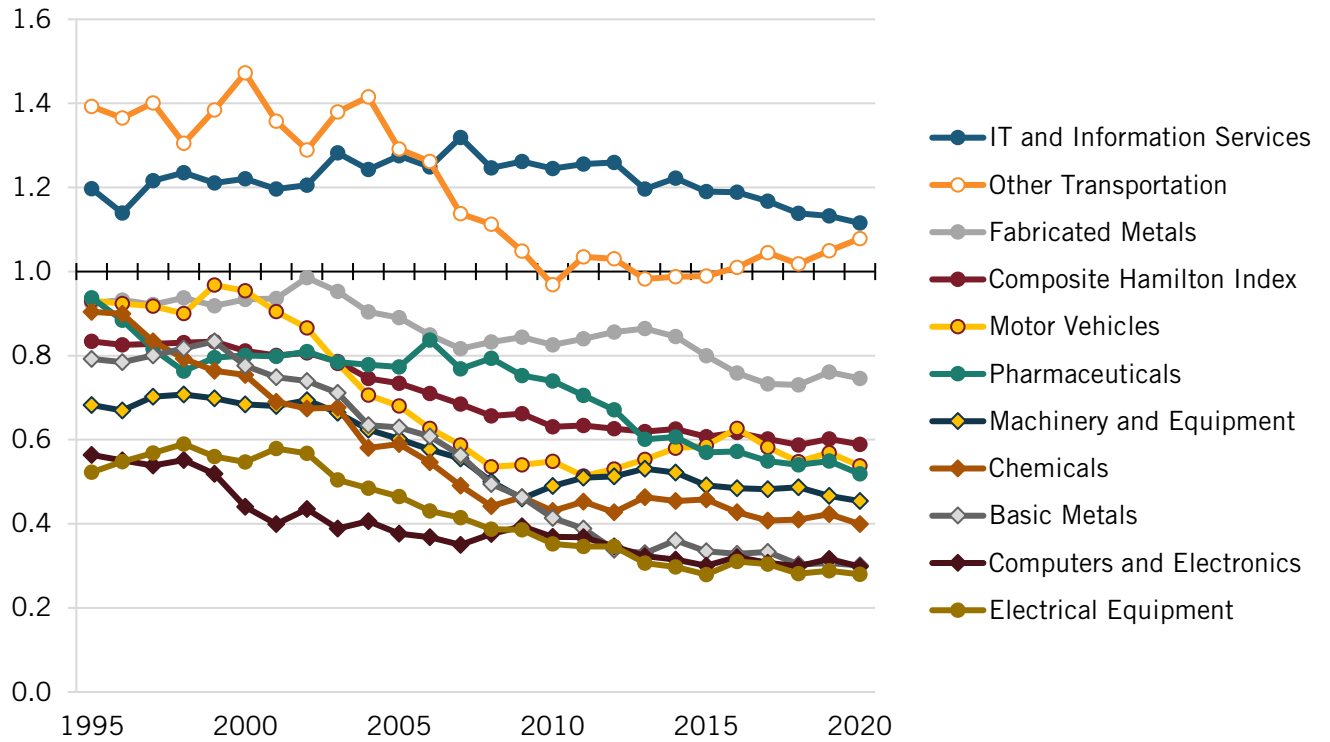
The Commonwealth (United Kingdom, Canada, Australia, and New Zealand) has consistently underperformed relative to the world and has only continued to lose ground. While its overall LQ was 0.83 in 1995, it fell significantly to 0.59 in 2020. That puts the Commonwealth members, as a group, behind the EU, the Quad, and the Belt & Road members. One important reason is the dominance of Anglo-American neoclassical economics in all four nations (as well as in the United States) that puts the development of an effective national industrial strategy off limits.

**Figure 126: Hamilton Index industries' average shares of Commonwealth economies**



In terms of industry strength, the Commonwealth is above average in only two industries. (See figure 127.) Its strongest industry is IT and information services, with an LQ of 1.12. Additionally, the LQ for other transportation is 1.08. In contrast, the Commonwealth is below average in all other advanced industries. Basic metals, computers and electronics, and electrical equipment are the worst-performing industries, with LQs of only 0.30, 0.30, and 0.28, respectively.

**Figure 127: Commonwealth nations' relative historical performance in Hamilton industries (LQ trends)**



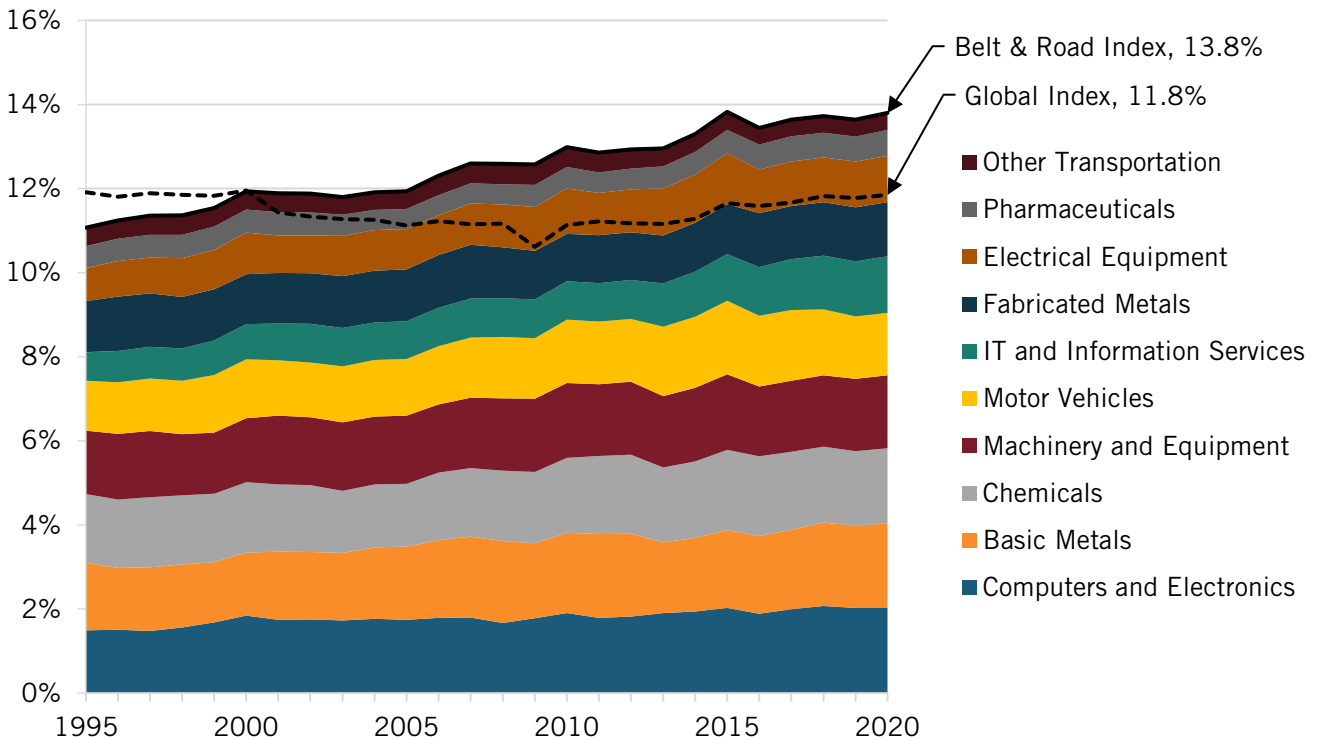
The Commonwealth has no industries that are comparatively strong and growing since 2008. Motor vehicles has had no change in its LQ. IT and information services and other transportation are comparatively strong but have been declining since 2008. This is not to say that those industries are not growing, but rather, that they are not growing as fast as the overall Commonwealth economy.

The remainder of the Commonwealth's advanced industries are both comparatively weak and declining since 2008. These are pharmaceuticals, basic metals, fabricated metals, electrical equipment, machinery and equipment, computers and electronics, and chemicals. The Commonwealth has never performed above average in any of these industries since 1995.

## Belt & Road Members

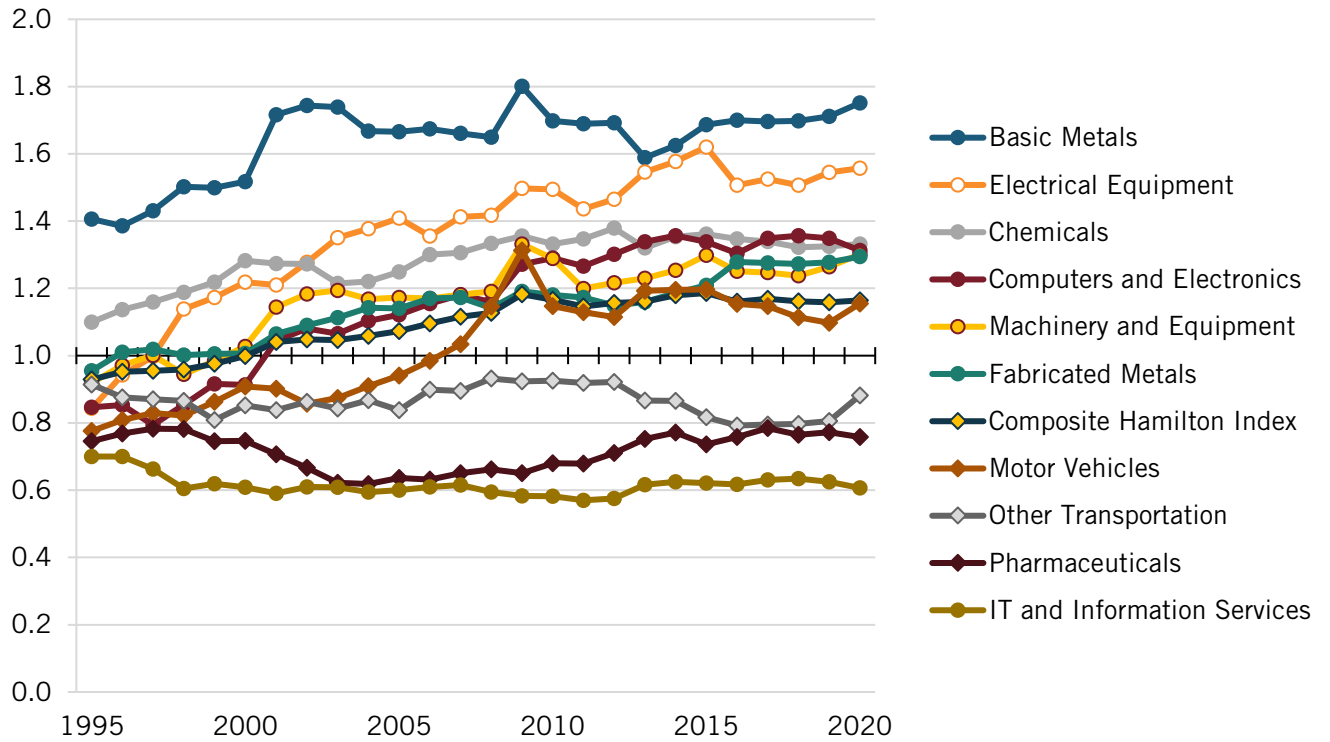
The Belt & Road members have previously underperformed relative to the world, but have improved to the point that they now, together, over-perform. (See appendix C.) While their overall LQ was 0.93 in 1995, it improved to 1.16 in 2020. That puts them above the overall LQ for the EU-10 at 1.07 and the Quad at 0.93.

**Figure 128: Hamilton Index industries' average shares of Belt & Road nations' economies**



In terms of industry strength, the Belt & Road is above average in all but three industries. (See figure 129.) Its strongest industry is basic metals, where it has an LQ of 1.75. Additionally, the LQs for electrical equipment, chemicals, and computers and electronics are 1.56, 1.33, and 1.31, respectively. The Belt & Road is below average in other transportation, pharmaceuticals, and IT and information services, with LQs of only 0.88, 0.76, and 0.61, respectively.

**Figure 129: Belt & Road nations' historical average relative performance in Hamilton industries (LQ trends)**



The Belt & Road has six industries that are both comparatively strong and growing since 2008—basic metals, fabricated metals, computers and electronics, machinery and equipment, electrical equipment, and motor vehicles. It has two industries that are comparatively weak but growing since 2008: IT and information services and pharmaceuticals.

The chemicals industry is the only industry that is comparatively strong but has been declining since 2008. This is not to say that the industry is not growing, but rather, that it is not growing as fast as the overall Belt & Road economy. Other transportation is the only industry in the “weak, declining” quadrant.

## APPENDICES

### Appendix A: Hamilton Index Industries

- **Pharmaceuticals:** Consists of medicinal and botanical products.
- **Electrical Equipment:** Includes products and tools such as batteries, fiber optics, household appliances, switchgears, and other industrial controls.
- **Machinery and Equipment:** Includes office machinery, industrial machinery, agricultural machinery, engines, and turbines.
- **Motor Vehicles:** Includes both cars and trucks.
- **Other Transportation:** Includes aerospace, rail, and sea transportation.
- **Computer, Electronic, and Optical Products:** Includes semiconductors, computer hardware, and consumer electronics (e.g., TVs, VR).
- **IT and Information Services:** Includes software and Internet companies.
- **Chemicals:** Consists of both commodity chemicals (e.g., oil and natural gas) and industrial chemicals.
- **Basic Metals:** Includes metal commodities used in industrial activities (e.g., steel, aluminum, palladium).
- **Fabricated Metals:** Includes metal products made from shaping or assembling processes.

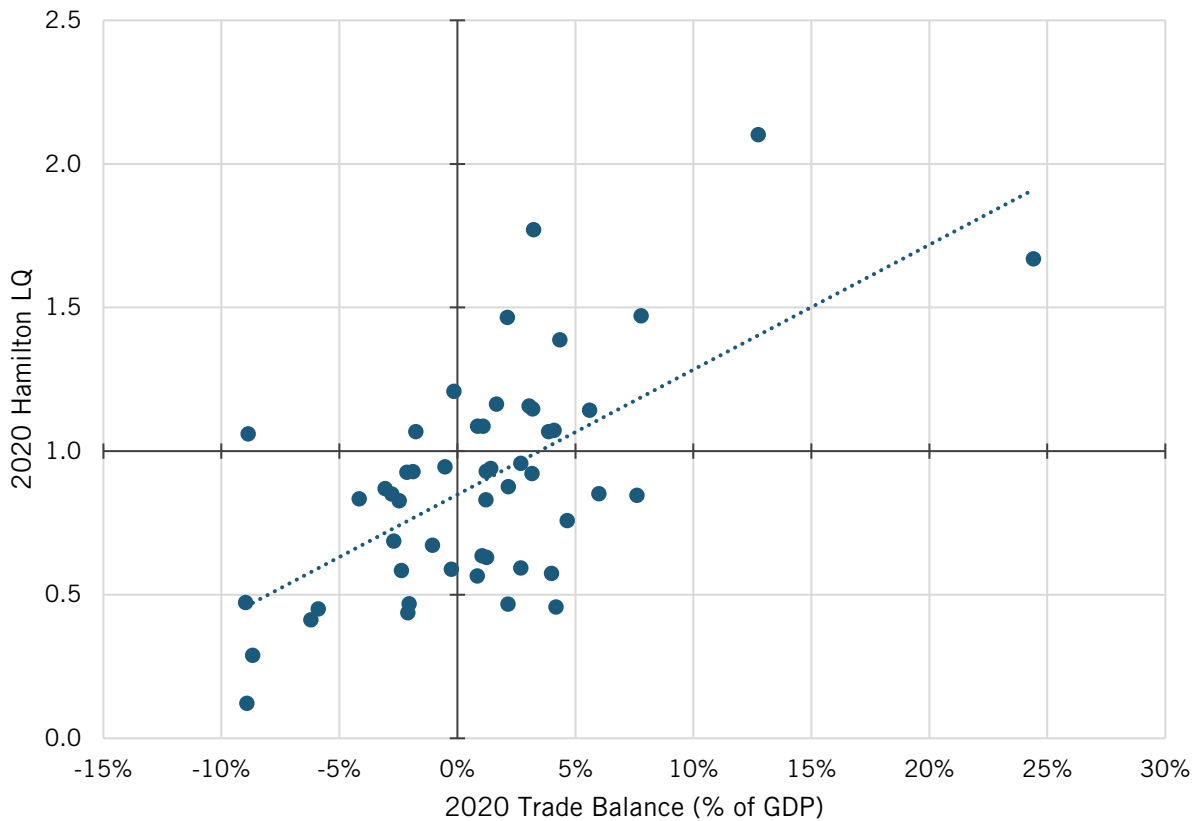
## Appendix B: Advanced Industries' Relationship to National Trade Balances

Countries that are more competitive in advanced industries can export more, thus resulting in a lower trade deficit, if not a trade surplus. Should a country lose its competitive edge in advanced industries, then its trade deficit will likely increase. This can present challenges for a nation's future, as a trade deficit represents an implicit debt it will eventually have to pay back. As ITIF has argued in other reports, this will entail lowering consumption.<sup>8</sup>

The trade balance as a percentage of GDP had a somewhat positive correlation with overall LQ in the Hamilton Index (0.31 in 2020). (See figure 130.) That is, countries that run a larger trade surplus, or smaller trade deficit, as a percentage of GDP tend to have a higher LQ. By contrast, countries with a relatively high trade deficit as a percentage of GDP have a relatively low LQ.

The United States in 2020 had a trade deficit of 3.1 percent of its GDP. This makes the U.S. an outlier among OECD members. Except for Turkey, all other OECD nations had either a smaller trade deficit or a trade surplus. Much of the U.S. trade deficit is a result of the U.S. dollar's higher value relative to other currencies. As ITIF has noted previously, this is driven by multiple factors, including the dollar's status as the world's reserve currency, exacerbated by China's currency manipulation.<sup>9</sup> Notably, the U.S. trade deficit is not merely limited to just traditional industries, such as metals. Since 2002, the United States has been running a trade deficit in advanced technology products as well.<sup>10</sup>

**Figure 130: Trade balance (% of GDP) vs. LQ**



## Appendix C: Country Groupings

This report includes profiles of selected regional groupings of countries. The members of each of the listed groups is shown as follows:

- **EU-17:** Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom, Bulgaria, Croatia, Romania
- **EU-10:** Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Malta
- **Quad:** United States, Australia, Japan, India
- **Commonwealth:** United Kingdom, Canada, Australia, New Zealand
- **Belt & Road:** Austria, Bangladesh, Belarus, Brunei Darussalam, Bulgaria, Cambodia, Cameroon, Chile, China, Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Czech Republic, Egypt, Estonia, Greece, Hungary, Indonesia, Italy, Kazakhstan, Laos, Latvia, Lithuania, Luxembourg, Malaysia, Malta, Morocco, Myanmar, New Zealand, Nigeria, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Senegal, Singapore, Slovakia, Slovenia, South Africa, South Korea, Thailand, Tunisia, Turkey, Ukraine, Vietnam<sup>11</sup>



## Appendix D: Hamilton Index Calculations

#	Metric	Source	Calculation	Example			
				Country	Sector	Year	Finding
<b>A</b>	National GDP	World Bank; IMF	=(#)	Korea	GDP	2020	\$1.6T
<b>B</b>	Global GDP	World Bank; IMF	=(#)	World	GDP	2020	\$85.2T
<b>C</b>	National Output, Single Sector	OECD	=(#)	Korea	Computers, Electronics	2020	\$107B
<b>D</b>	Global Output, Single Sector	OECD	=(#)	World	Computers, Electronics	2020	\$1.3T
<b>E</b>	National Output, Advanced Total	ITIF	=SUM(##)	Korea	All Advanced	2020	\$345B
<b>F</b>	Global Output, Advanced Total	ITIF	=SUM(##)	World	All Advanced	2020	\$10.1T
<b>G</b>	“Global Market Share”	ITIF	=(C/D)	Korea	Computers, Electronics	2020	8.16%
<b>H</b>	“Domestic Market Share”	ITIF	=(C/A)	Korea	Computers, Electronics	2020	6.53%
<b>I</b>	“Global GDP Share”	ITIF	=(D/B)	World	Computers, Electronics	2020	1.54%
<b>J</b>	“Relative Market Share” (LQ)	ITIF	=(H/I)	Korea	Computers, Electronics	2020	4.23x

## About the Authors

Dr. Robert D. Atkinson (@RobAtkinsonITIF) is the founder and president of ITIF. His books include *Big Is Beautiful: Debunking the Myth of Small Business* (MIT, 2018), *Innovation Economics: The Race for Global Advantage* (Yale, 2012), *Supply-Side Follies: Why Conservative Economics Fails, Liberal Economics Falts, and Innovation Economics Is the Answer* (Rowman Littlefield, 2007), and *The Past and Future of America's Economy: Long Waves of Innovation That Power Cycles of Growth* (Edward Elgar, 2005). He holds a Ph.D. in city and regional planning from the University of North Carolina, Chapel Hill.

Ian Tufts is a policy analyst at ITIF. His research focuses on the economic implications of innovation and technology policy. He holds a Master of Science in applied economics from The George Washington University and a Bachelor of Science in economics from George Mason University.

## About ITIF

The Information Technology and Innovation Foundation (ITIF) is an independent 501(c)(3) nonprofit, nonpartisan research and educational institute that has been recognized repeatedly as the world's leading think tank for science and technology policy. Its mission is to formulate, evaluate, and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress. For more information, visit [itif.org/about](https://itif.org/about).

## ENDNOTES

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1. Organization for Economic Cooperation and Development (OECD), Trade in Value Added (TiVA) 2022 ed. Principal Indicators (accessed September 5, 2023), [https://stats.oecd.org/Index.aspx?DataSetCode=TIVA\\_2022\\_C1](https://stats.oecd.org/Index.aspx?DataSetCode=TIVA_2022_C1).
2. Because of how companies report income for tax purposes, Ireland appears to have artificially inflated advanced industry output measures.
3. Robert D. Atkinson, "Why the United States Needs a National Advanced Industry and Technology Agency" (ITIF, July 2021), <https://itif.org/publications/2021/06/17/why-united-states-needs-national-advanced-industry-and-technology-agency/>; Robert D. Atkinson, "Why America Should Compete to Win in Advanced Industries" (ITIF, April 2022), <https://itif.org/publications/2022/04/11/why-america-should-compete-win-advanced-industries/>.
4. The momentum index is the sum of the 10 Hamilton industries divided by GDP, after first multiplying each industry's total value-added output in 2020 by its 2020 LQ and the percentage change in its LQ since 2008.
5. Steven Rattner, "The U.A.W. Is Overplaying Its Hand," *The New York Times*, September 20, 2023, <https://stevenrattner.com/article/the-u-a-w-is-overplaying-its-hand/>.
6. Usha C.V. Haley and George T. Haley, *Subsidies to Chinese Industry* (Oxford: Oxford University Press, 2013).
7. Global increase was calculated as the five-year average between 2014 and 2018.
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