

THAILAND ECONOMIC MONITOR

ADVANCED GREEN
MANUFACTURING
FOR GROWTH



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Preface

The Thailand Economic Monitor (TEM) reports on key developments in Thailand's economy over the past six months, situates these changes in the context of global trends and Thailand's longer-term economic trajectory, and updates Thailand's economic and social welfare outlook. Each edition of the TEM also provides an in-depth examination of selected economic and policy issues and an analysis of Thailand's medium-term development challenges. The TEM is intended for a wide audience, including policymakers, business leaders, financial-market participants, and the community of analysts and professionals engaged in Thailand's evolving economy.

The TEM is produced by the staff of the World Bank, consisting of Kiatipong Ariyapruchya, Warunthorn Puthong (Task Team Leaders), Csilla Lakatos, Undral Batmunkh, Sakulrat Bovornsantisuth, Anchidtha Roonguthai, Hector Pollitt, Dilaka Lathapiwat, Chanin Maniopiniwes, Phonthanat Uruhamanon, Csilla Lakatos, Katherine Anne Stapleton, Marc S. Forni, Koji Miyamoto, Waraporn Hirunwatsiri, Rattanyu Dechjaruwat, Ou Nie, and Panayiotis Nicolaides. The team is grateful to Melinda Good, Marco Hernandez, Habib Rab, and Lalita Moorty for overall guidance. The team is grateful to Ergys Islamaj and Penelope Ann Mealy for their constructive peer review comments. Kanitha Kongrukreatiyos, Piathida Poonprasit, and Nattanan Charoentana are responsible for external communications related to the TEM, as well as the production and design of this edition.

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ABBREVIATIONS

AI	Artificial Intelligence
ASEAN	Association of Southeast Asian Nations
BOT	Bank of Thailand
EAP	East Asia and Pacific
EMDEs	Emerging Market and Developing Economies
EU	European Union
EV	Electric Vehicle
FDI	Foreign Direct Investment
FY	Fiscal Year
GDP	Gross Domestic Product
GEP	Global Economic Prospects
GFS	Government Fiscal Statistics
GVC	Global Value Chain
IMF	International Monetary Fund
MSME	Micro, Small, and Medium Enterprises
NPL	Non-Performing Loan
NESDC	National Economic and Social Development Council
PRSA	Public Revenue and Spending Assessment
Q-o-Q	Quarter-on-Quarter
REER	Real Effective Exchange Rate
ROA	Return on Assets
ROE	Return on Equity
SME	Small and Medium Enterprise
SWC	Social Welfare Card
THB	Thai Baht
UMIC	Upper Middle-Income Country
VAT	Value-Added Tax
YOY	Year-on-Year

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EXECUTIVE SUMMARY

Growth is projected to slow to 1.6 percent in 2026 before edging up to about 2.2 percent in 2027 as global and domestic demand conditions stabilize while FDI in new industries begin to materialize. Thailand's 2025 downturn has brought long-standing structural constraints into sharper focus—an aging industrial base, eroding export and tourism competitiveness, high household debt, and tightening fiscal buffers—and clarified reform opportunities to support stronger investment, consumption and labor markets. While manufacturing momentum softened even as exports temporarily surged, the economy continues to benefit from solid external linkages, a current account surplus, and contained inflation. Downside risks dominate, underscoring the need to strengthen competition, upgrade skills, and rebuild fiscal space to lift productivity, boost quality investments in rising industries, such as advanced green manufacturing, and support more resilient, job-creating growth.

Thailand's deeper-than-expected downturn exposed structural vulnerabilities, creating an opportunity to address long-standing bottlenecks and strengthen the foundations for a more resilient medium-term growth trajectory. The sharp loss of momentum in 2025, marked by a 0.6 percent quarterly GDP contraction in Q3, has revealed long-standing structural constraints, including an eroded manufacturing base reliant on an aging human and capital stock and a loss of competitiveness in traditional export sectors. New constraints have also become more prominent. Fiscal space has decreased due to stimulus spending. Thailand's external position has become more fragile: a narrowing current account surplus, softening tourism receipts due to waning competitiveness and an appreciated real exchange rate have increased vulnerability to shifts in global demand and trade policy uncertainty.

Manufacturing and tourism contracted as the economy lost momentum in the second half of 2025, underscoring the need to strengthen sectoral resilience as Thailand navigates a more challenging global environment. Manufacturing contracted for the first time in six quarters, reflecting refinery maintenance, falling motor vehicle output, and weak plastics and machinery production. These sectoral contractions highlight deeper structural challenges. Thailand's manufacturing sector has struggled to upgrade to higher-value activities, leaving it vulnerable to global competition, supply chain realignment, and shifts toward more technologically sophisticated production. Electronics manufacturing remained resilient, supported by surging global demand for AI-related components. Tourist arrivals fell by 13.9 percent year on year in Q3 2025, driven largely by a 37.8 percent decline in Chinese visitors amid safety concerns, stronger regional competition, and the appreciation of the baht. The slower recovery in tourism has weighed on services exports and the overall growth momentum while underscoring competitiveness concerns.

Goods exports rebounded sharply due to front-loading and inventory drawdowns, providing an important offset to softer domestic demand, though this has yet to translate into manufacturing growth. Goods exports grew by 19 percent in September, led by electronics, auto parts, and gold. Export front-loading ahead of the entry into force of higher US tariffs boosted shipments. Electronics exports, exempt from reciprocal tariffs, continued to expand strongly, partly offsetting declines in agriculture. Strong exports were met through inventory drawdowns, but have not translated into overall manufacturing growth.

The narrowing current account surplus reflects a normalization from earlier highs and highlights the growing importance of strengthening Thailand's external resilience. The current account surplus fell to 2.2 percent of GDP in Q3 2025, down from 8 percent in Q1, due to weaker services receipts, higher income outflows, and the fading contribution of front-loaded exports. Tourist arrivals declined 13.9 percent in Q3, driven by a sharp fall in Chinese visitors amid safety concerns and currency appreciation.



Investment remained weak and increasingly focused on maintenance, pointing to the need for quality investments. Gross fixed investment growth slowed to 1.1 percent in Q3. Nearly 80 percent of capital spending now goes toward replacing aging assets, leaving little room for expansion. Thailand is investing heavily but not getting enough growth in return. Much of the capital invested in manufacturing is no longer generating positive returns, while modern services, especially ICT and professional services, continue to deliver far stronger returns.

The foreign direct investment (FDI) pipeline into new industries is improving. FDI applications nearly doubled in the first nine months of 2025, especially in digital infrastructure, batteries, electronics, and electric vehicle (EV)-related projects. The pipeline is strong but realized investment inflows have lagged regional peers such as Malaysia, the Philippines, and Viet Nam. The Board of Investment's (BOI) Thailand Fast Pass is expected to speed conversion of approvals to inflows in 2026.

The highest household debt burden among ASEAN peers and tight credit conditions weighed on private consumption. Private consumption grew by 2.6 percent in Q3, but underlying momentum remained fragile amid elevated household debt (87.8 percent of GDP) and tightening lending conditions. A large share of household debt is unsecured, contributing to rising non-performing loans and limiting the expansion of new credit. Credit to the private sector grew by only 0.4 percent in November 2025, reflecting both supply-side tightening and households' debt deleveraging.

Households are bearing a significant welfare brunt, as a combination of high debt repayment and flat real wage growth erodes domestic welfare and resilience. The persistent household debt burden has triggered a contraction in private-sector credit. Households are spending less amid rising debt servicing costs and flat wage growth. Additional underlying labor market weaknesses have surfaced as total employment contracted by 0.5 percent in late 2025. In rural areas, a spike in "quasi-unemployed", those who want to work but have stopped looking, points to a serious gap between worker skills and vacancies in new industries. These combined pressures on jobs and debt now put recent progress in reducing poverty at risk.

Inflation remained negative as the central bank eased policy rates further, providing near-term relief to households. Headline inflation remained in negative territory for nine consecutive months, reaching -0.28 percent in December 2025, driven by a relative rather than a broad decline in prices, declining global energy prices, electricity tariff cuts, as well as subdued domestic demand. Core inflation stayed positive at 0.6 percent, indicating modest underlying pressures. The Bank of Thailand cut the policy rate to 1.25 percent, the fifth cut in 14 months, to support fragile consumption and tighten credit conditions. However, monetary policy transmission is constrained by ongoing debt deleveraging and tight credit conditions.

Fiscal policy remains countercyclical, while public debt continues to rise but remains sustainable. The central-government deficit widened to 2.9 percent of GDP in FY2025, driven by higher capital spending and energy subsidies. Public debt rose to 65.1 percent of GDP, up by more than 20 percentage points from pre-pandemic levels but still below the 70 percent ceiling. Fiscal space is tightening as debt service reaches its highest level since 2006, underscoring the need for medium-term consolidation as outlined in the 2026–2030 Medium-Term Fiscal Framework.

Outlook and Risks

Looking ahead, Thailand's growth outlook remains subdued in the near term before gradually firming over the medium term. GDP growth is projected to ease to 1.6 percent in 2026, reflecting the unwinding of 2025's export front-loading, persistent global trade policy uncertainty, and the drag from elevated household debt and tight credit conditions, which continue to weigh on domestic demand. Tourism is expected to recover only gradually. Growth is expected to strengthen modestly in 2027, rising to around 2.2 percent as global conditions stabilize, private investment improves, and major FDI projects begin converting into actual production and employment gains.



Exports are expected to face headwinds in 2026. Goods export growth is expected to slow significantly in 2026, following the 2025 surge driven by front-loading. Sectors most exposed to US tariffs (automotives, parts, and selected machinery) are expected to contract modestly, while electronics, especially AI-related components, remain a bright spot. The current account surplus is expected to ease to 2 percent of GDP in 2026 as the goods balance weakens, though lower oil prices and a gradual tourism recovery will support the overall balance.

Downside risks dominate. Heightened trade-policy uncertainty remains the principal external risk, as further escalation could reduce exports, disrupt supply chains, and weaken investor sentiment. Tourism also faces risks stemming from safety concerns, intensifying regional competition, and shifting travel preferences, particularly among Chinese visitors. In addition, political uncertainty surrounding the election cycle may delay the approval and execution of the FY2027 budget, affecting public spending plans. Upside risks, however, remain: stronger-than-expected FDI, especially in EVs, electronics, and digital infrastructure, could lift manufacturing activity and productivity, while easing global trade tensions could help restore industrial momentum.

Policy Focus

Strengthening Thailand’s foundations for growth and jobs will require reforms focused on competition, skills, and fiscal rebalancing. Boosting competition in services, digital infrastructure, logistics, and other backbone sectors is essential to raise productivity and attract higher-return investment. Upgrading skills through industry-aligned training and reskilling programs is critical to address rising mismatches and prepare workers for fast-growing sectors such as EVs, advanced electronics, digital services, and green manufacturing. Fiscal rebalancing, by reducing the deficit in line with the Medium-Term Fiscal Framework, pivoting towards efficient public investment and targeted social protection, as well as broadening the revenue base, will help rebuild fiscal space. Household debt can be addressed through a coordinated, system-wide approach: targeted debt restructuring, a centralized approach with Asset Management Companies to manage debt, and social protection and reskilling to raise incomes. Together, these reforms would shift capital toward productive activities, strengthen labor-market resilience, and position Thailand to capture emerging opportunities in green and advanced industries.

Reform Pillar	Policy Direction	Impact
Competition	Advance competition-enhancing reforms in services, digital infrastructure, logistics, and other backbone sectors; streamline and update regulations that currently hinder market entry, scale-up, and innovation.	Improves efficiency, lowers costs, and unlocks domestic and foreign investment in high-value activities.
Skills	Expand industry-aligned training and reskilling to address mismatches and prepare workers for fast-growing sectors (EVs, advanced electronics, digital services, green manufacturing).	Reduces skill gaps, increases employability, and strengthens workforce readiness for structural transformation.
Fiscal Rebalancing	Reduce the deficit in line with the Medium-Term Fiscal Framework; prioritize efficient public investment and targeted social protection; broaden the revenue base, including through VAT normalization and strengthening digital tax administration.	Rebuilds fiscal space, supports productive investment, and enhances resilience to shocks.



Advanced Green Manufacturing

Manufacturing has been central to Thailand's growth model, but its contribution is increasingly constrained by low domestic value added and limited upgrading. In 2024, manufacturing accounted for 25 percent of GDP and 16 percent of employment, absorbing more than 6.2 million Thai workers. Its share of GDP has declined from a peak of 31 percent in 2010, as productivity gains have stalled, and participation in global value chains has remained concentrated in assembly and final-stage production. Looking ahead, global megatrends, including climate change, rapid technological change, and increasing trade fragmentation, are reshaping production and trade patterns. With a trade-to-GDP ratio close to 140 percent, Thailand is highly exposed to shifts in global demand, trade policies, and value-chain dynamics, reinforcing the importance of upgrading to support medium-term growth and resilience.

Thailand could build on its existing strengths to reposition toward more advanced and green manufacturing, develop these as industries of the future, and new engines of growth. Thailand's exports of green goods have been steadily rising, accounting for close to 10 percent of total exports in 2024. Thailand could further benefit from strengthening green competitiveness, as green products are, on average, more technologically sophisticated than non-green products, reflecting higher knowledge intensity and greater scope for domestic value addition. Thailand has significant scope to narrow the gap with structural and higher-income peers in green competitiveness, creating opportunities to capture a larger share of expanding global markets for green goods and technologies.

Thailand has significant untapped green potential. Thailand's Green Complexity Index of 0.7 remains well below its Green Complexity Potential of 1.4, suggesting strong latent capabilities to expand into more complex green value chains. Realizing this potential will require shifting from volume-driven assembly toward innovation, component manufacturing, system integration, and services that embed higher domestic value-added and skilled employment.

Based on global market growth, existing comparative advantages, and product complexity, several green manufacturing value chains stand out with strong potential. Thailand shows strong competitiveness in energy-efficient cooling technologies, particularly reverse-cycle air conditioners, accounting for close to a third of the global market, at par with China. Thailand is also well positioned to benefit from fast-growing global demand for solar photovoltaic products, with competitiveness in select components such as optical appliance parts and mounted optical elements. Emerging low-carbon and resource-efficient technologies, including carbon capture, wastewater management, and air pollution control, also show promising export potential.

Thailand's existing strengths in the automotive sector offer significant opportunities for building competitiveness in electric vehicles. Accounting for 3.1 percent of GDP and employing more than 570,000 workers, the automotive sector has faced declining production amid the global shift from internal combustion engine vehicles to electric vehicles. Thailand's strong base in auto parts, electrical and electronics, and chassis manufacturing provides a solid foundation for the transition to electric vehicles. EV-related value chains (under a broad definition) already account for 4.3 percent of total exports, exceeding those of most ASEAN peers. Firm-level analysis indicates that more than 80 percent of auto parts sales in Thailand could continue to be used in EVs, with a large share (58 percent of sales) being unaffected and 19 percent requiring only limited modification, suggesting considerable potential to preserve domestic employment while upgrading production.

Thailand is also competitive in other green value chains, notably solar photovoltaic and energy-efficient electronic appliances. Solar PV exports have risen rapidly, from 0.5 percent of total exports in 2018 to 1.9 percent in 2023, outpacing the regional average and mirroring recent trends in Viet Nam. However, production remains concentrated in module assembly, with limited participation



in higher value-added segments such as cells, inverters, and upstream materials. Additionally, Thailand is already a global hub for energy-efficient cooling technologies and ranks among the world’s largest exporters of air conditioners. It is the world’s third-largest exporter of air conditioners, accounting for around 10 percent of global exports, and a leading base for R-32 inverter models, led by Daikin, Mitsubishi, and Toshiba. Sustaining competitiveness in these sectors will require continued upgrading in skills, components, and innovation as global competition intensifies.

Scaling up green manufacturing, particularly electric vehicles and parts, solar PV components, and energy-efficient cooling, could raise GDP by an additional 2.9 percent by 2035. Model-based simulations suggest that over the next ten years, expansion in green manufacturing could boost annual real GDP growth by an average of 0.3 percentage points above the baseline, with employment around 0.6 percent higher by 2035, provided that domestic value-added and supply-chain linkages deepen.

Realizing these gains will require clear price and market signals to support decarbonization and mitigate risks from climate-related trade measures, including the EU Carbon Border Adjustment Mechanism. Introducing effective carbon pricing, reforming fossil fuel and electricity subsidies, accelerating renewable energy deployment, and modernizing power markets and grids would incentivize low-carbon investment and strengthen export competitiveness.

Complementary policies are also needed to ensure that Thailand’s green manufacturing opportunities translate into sustainable growth and quality job creation. Policies should ensure that FDI in green industries supports local supplier development, knowledge and technology transfers, and workforce upgrading across the value chain. While recent incentives have accelerated early adoption of select green technologies, these would need to be complemented with targeted support for reskilling, technology diffusion, and SME integration. Such policies could enable Thailand’s participation in regional and global value chains, shifting from assembly to higher-value-added activities, such as solar PV, where upstream research and development, midstream system integration, and digital services, and downstream deployment supported by grid modernization and building-integrated PV show potential. Addressing skills shortages in engineering, digital, and sustainable manufacturing through industry-aligned education, training, and demand-driven innovation support will be critical to sustaining Thailand’s shift toward advanced, high-value green manufacturing.

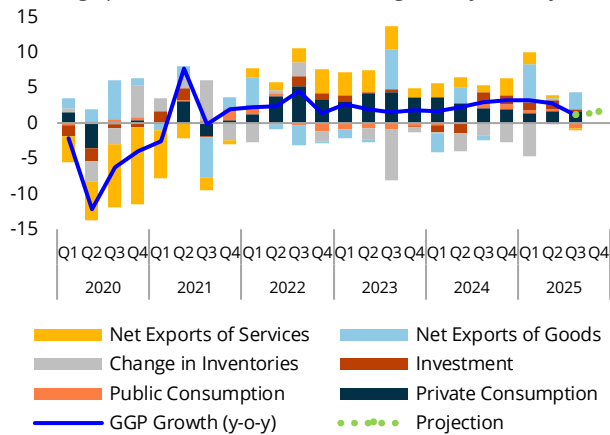
Reform Pillar	Policy Direction	Impact
Pricing signals	Create clear market signals by pricing carbon, gradually reducing fuel and energy subsidies, and developing competitive power generation and electricity markets to support clean energy	Raises demand for low-carbon technologies and processes
Domestic supply chains and skills	Build high-tech capabilities by strengthening education and training in engineering, advanced manufacturing, and sustainable production, while upgrading SMEs through targeted skills, finance, and technology support	Enhances local supplier capacity, increases domestic value added, and supports quality job creation in higher-skill segments
Industrial policy for local upgrading	Align investment incentives and industrial policy to promote local supplier integration, technology transfer, and workforce upgrading	Ensures FDI drives productivity, IP creation, R&D capability, and skill upgrading



Recent Developments and Medium-Term Outlook

Figure ES 1: Growth recovery remained uneven as export front-loading offset slowing domestic demand

(Percentage-point contribution to real GDP growth, year-on-year)

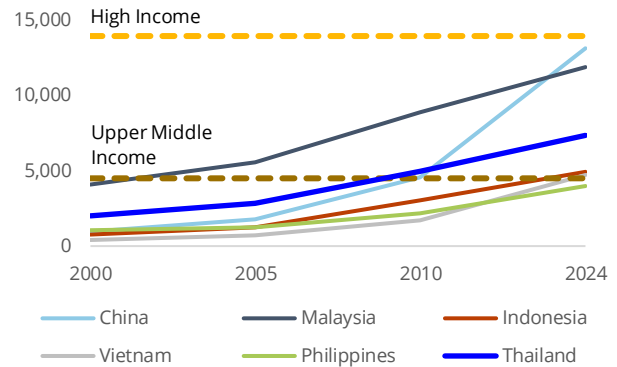


Note: Change in inventories include statistical discrepancies; 2025 Q4 is estimated.

Source: NESDC.

Figure ES 2: Thailand achieved upper- middle income in 2011, but its growth trajectory has slowed

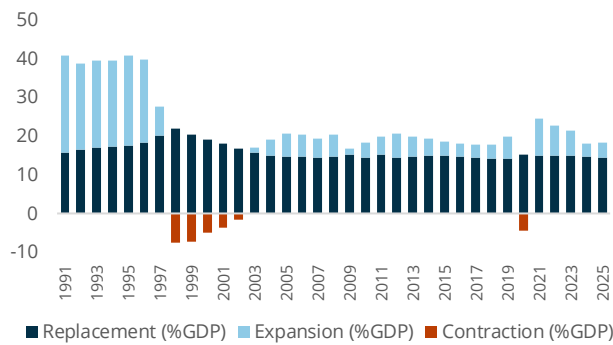
(GNI per capita)



Source: NESDC; World Bank staff calculations.

Figure ES 3: Investment remained low and focused on maintenance

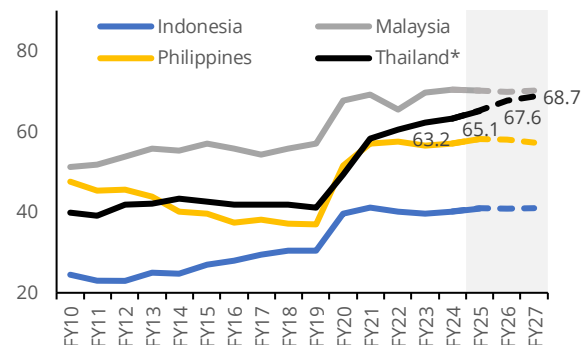
(Percentage of GDP)



Source: NESDC; World Bank staff calculations.

Figure ES 4: Public debt is projected to increase but remain sustainable

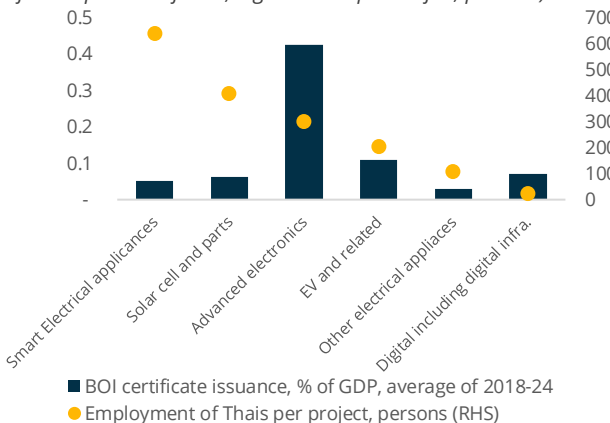
(Percentage of GDP)



Source: IMF; *World Bank staff projections.

Figure ES 5: Investment applications in green industries have risen

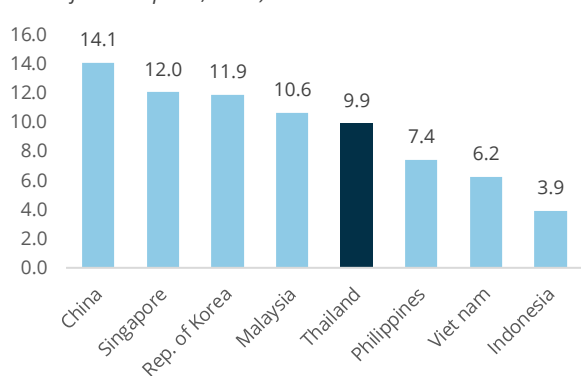
(Left axis: percent of GDP, Right axis: expected job, persons)



Source: BOI; World Bank staff projections.

Figure ES 6: Green products accounted for one-tenth of Thailand's exports

(Percent of total exports, 2023)



Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations



Table ES 1: Macroeconomic Indicators

	2021	2022	2023	2024	2025e	2026f	2027f
Real GDP Growth Rate (at constant market prices)	1.6	2.6	2.0	2.5	2.2	1.6	2.2
Private Consumption	0.6	6.2	6.9	4.4	2.4	1.9	2.3
Government Consumption	3.7	0.1	-4.7	2.5	0.3	1.3	1.9
Gross Fixed Capital Investment	3.1	2.2	1.2	0.0	2.4	1.2	3.3
Exports of Goods and Services ¹	11.1	6.2	2.4	7.8	8.9	1.4	2.7
Imports of Goods and Services	17.9	3.4	-2.5	6.3	7.2	1.6	3.4
Real GDP Growth Rate (at constant factor prices)							
Agriculture	2.6	1.2	2.0	-1.1	3.1	1.6	1.8
Industry	5.9	4.1	-5.7	0.8	-0.2	-0.4	2.0
Services	-0.3	3.3	4.6	5.7	3.2	2.5	2.3
Inflation (Consumer Price Index)	1.2	6.1	1.2	0.4	-0.1	0.7	1.7
Current Account Balance (percent of GDP)	-2.1	-3.5	1.4	2.1	2.1	2.0	1.8
Fiscal Balance (General Government, percent of GDP)	-6.7	-4.4	-2.0	-1.3	-2.7	-2.7	-2.2
Debt (percent of GDP)	57.7	59.7	62.0	62.6	65.1	67.6	68.7

Note: 1/ Exports of goods and services accounted for 73 percent of GDP in 2024. See more details in the outlook section.

Source: NESDC; World Bank staff calculations.

Part 1. Recent Economic Developments and Outlook: Slower Growth, Rising Risks



1. Recent Economic Developments

i. The global economy has shown notable resilience

The global economy has been markedly more resilient than expected, despite last year's historic escalation in trade tensions and policy uncertainty.¹

Global growth is estimated to have averaged 2.7 percent in 2025, 0.4 percentage points above June 2025 projections. This resilience reflected significant front-loading of trade, supply-chain adjustments, limited tariff pass-through, easier global financial conditions, and a surge in AI-related investment. As these supports fade, global activity and job creation are set to ease (Figure 1). The modest slowdown comes on the heels of a post-pandemic rebound over 2021–25 that represented the strongest recovery from a global recession in more than six decades. However, this rebound was uneven across countries and coincided with higher inflation and rising debt.

Global growth is projected to edge down to 2.6 percent this year as several

The outlook for global growth remains dampened by elevated trade tensions. After global trade growth was propped up last year by the front-loading of goods trade ahead of tariff increases (Figure 2), it is projected to decelerate in 2026, as stockpiling fades and the impact of tariff measures builds. In 2027,

¹ World Bank Global Economic Prospects January 2026.

Part 1. Recent Economic Developments and Outlook: Slower Growth, Rising Risks

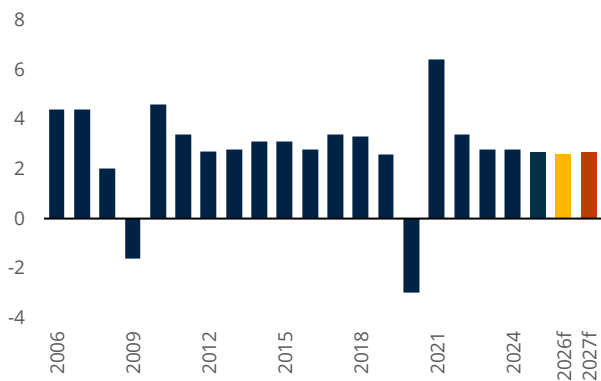
supportive factors fade.

trade growth is expected to firm, as trade flows adjust to tariff hikes and policy uncertainty recedes.

Growth in the East Asia and Pacific (EAP) region moderated to 4.8 percent in 2025, from 5 percent in 2024, but remained stronger than envisaged in June.

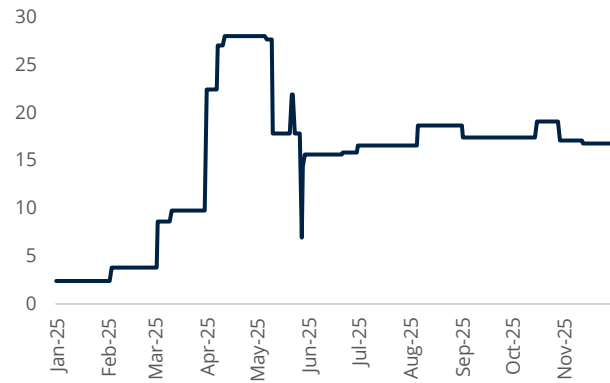
The growth moderation reflected a smaller, delayed impact from higher trade barriers and associated uncertainty. In China, the slowdown was partly offset by fiscal stimulus in the form of consumer subsidies, which supported consumption growth. Export performance remained strong, reflecting front-loading ahead of the implementation of higher tariffs and increased shipments to non-U.S. markets. Investment growth slowed, driven by a continued contraction in real estate investment, as property sales and prices fell further. Growth in the region is projected to decelerate to 4.4 percent in 2026 and 4.3 percent in 2027, as the slowdown in China outweighs a pickup in the rest of the region.

Figure 1: Global output growth
(Percentage change)



Source: World Bank staff calculations.

Figure 2: Average effective U.S. tariff rate
(Percent)



Source: The Budget Lab; World Bank.

ii. The Thai economy slowed despite strong exports

Despite a surge in goods exports, the economy lost momentum in Q3 2025 as tourism remained weak and domestic activity softened.

In Q3, growth slowed to 1.2 percent, down from 2.8 percent in the previous quarter. In quarterly terms, GDP contracted by 0.6 percent in Q3 2025, below market consensus (Figure 3). Manufacturing output declined by 1.6 percent, the first contraction in six quarters. This reflected a temporary shutdown of oil refineries for maintenance and a decline in production of motor vehicles, plastics, and machinery. In contrast, computers and electronics output continued to expand, consistent with strong global demand for components used in data centers and related digital infrastructure. Services activity also weakened as tourism contracted. Private consumption growth stabilized at 2.6 percent, while investment weakened, driven by a contraction in public investment.

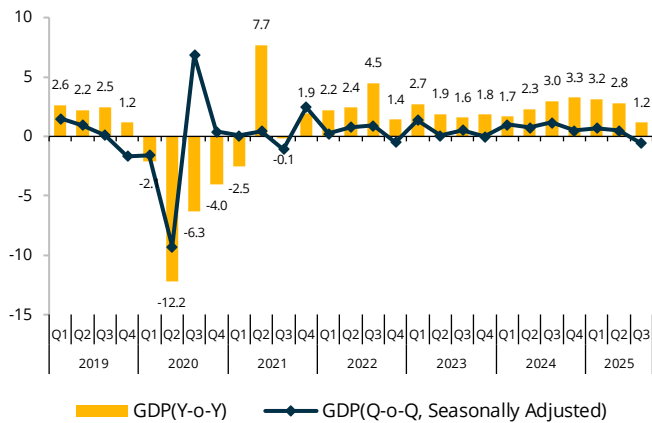
Goods exports rebounded sharply, led by strong growth in electronics, automobiles, and gold.

Goods exports rebounded in September 2025, rising 19 percent from the previous month's 5.8 percent (Figure 4). This stronger-than-expected export growth was supported by increased exports of electronics, automobiles, and gold. Automotive exports were supported by strong deliveries of pickup trucks to the Middle East and auto parts to ASEAN, Japan, and the US. Exempted from US reciprocal tariffs, electronics exports continued to grow, benefiting from

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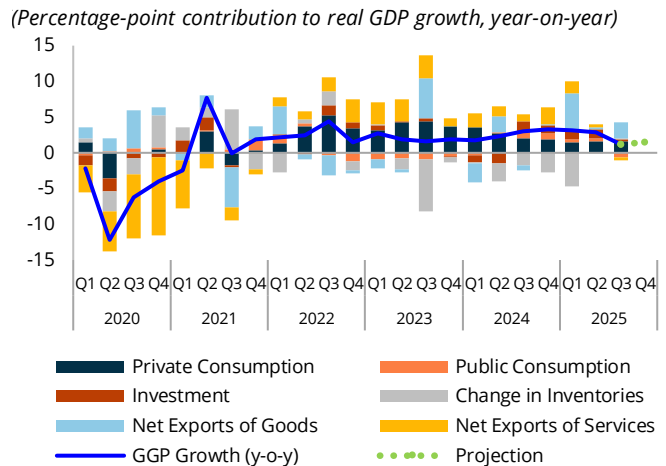
rising global AI-related demand. Gold exports increased due to profit-taking by traders, following a more than 90 percent surge in prices over the past two years. By contrast, falling exports of durian and rice due to external demand and rising global competition contributed to a contraction in agricultural output.

Figure 3: Growth performed below expectations in Q3 2025 amid ongoing subdued momentum
(Percentage change)



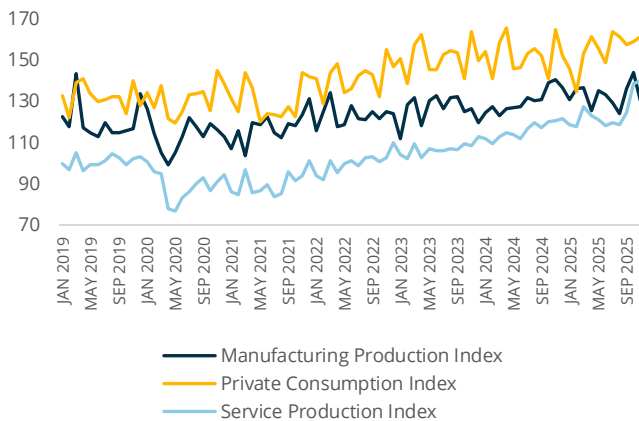
Source: NESDC.

Figure 4: Strong goods exports partially offset slowing domestic demand
(Percentage-point contribution to real GDP growth, year-on-year)



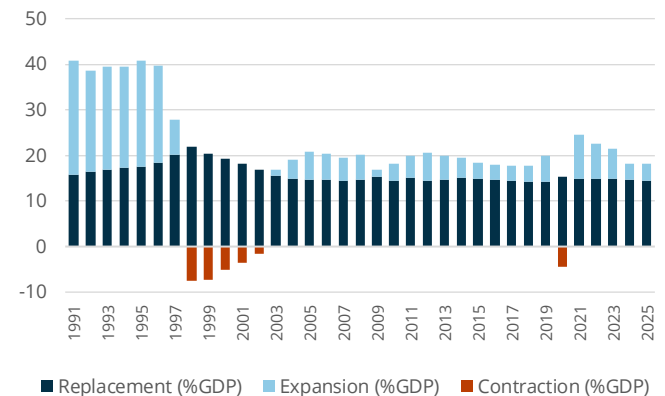
Note: Change in inventories include statistical discrepancies; 2025 Q4 is estimated. Source: NESDC.

Figure 5: Manufacturing activity remained subdued
(Index, sa)



Source: CEIC; World Bank staff calculations.

Figure 6: Investment was largely directed toward maintenance of the capital stock
(Percent of GDP)



Source: NESDC; World Bank staff calculations.

Private consumption grew by 2.6 percent in Q3 2025, but underlying momentum remained fragile amid household deleveraging.

Growth was broadly stable across durables, semi-durables, non-durables, and services sectors. However, household debt remained persistently elevated at 87.8 percent of GDP in Q3 2025, well above the 60–80 percent of GDP threshold identified in BIS research, beyond which debt burdens start to meaningfully constrain consumption growth. This debt overhang is further compounded by necessary adjustments such as tight lending conditions and continued deleveraging, as households prioritize debt repayment and limit discretionary spending.

Part 1. Recent Economic Developments and Outlook: Slower Growth, Rising Risks

Investment growth slowed to 1.1 percent in Q3 2025, as the focus shifted to maintaining an aging, less productive capital stock.

While the moderation in investment growth reflects cyclical headwinds from a slowing export cycle and weak domestic demand, it also underscores a structural productivity challenge. Thailand's gross capital stock exceeds 410 percent of GDP, yet it has not generated growth due to sectoral misallocation. Thailand's Incremental Capital Output Ratio (ICOR) stands at 8.7, implying that it requires nearly double the capital investment of Malaysia and Philippines to generate the same unit of economic growth. The manufacturing sector shows a negative marginal product of capital (MPK) while modern services sectors² remain more dynamic, boasting an MPK exceeding 30 percent. Yet, nearly 80 percent of aggregate investment has been directed toward maintenance to offset depreciation in aging industrial assets. This leaves net expansionary investment at 20 percent of GDP. Improving growth outcomes will require a reallocation of investment from sunset toward higher-return industries supported by increased greenfield FDI.³

Foreign direct investment incentive applications surged in higher-productivity digital, electronics and EV sectors.

Board of Investment (BOI)-approved investment incentives point to a strengthening private-investment outlook, with applications nearly doubling to reach THB 1.3 trillion in the first nine months of 2025, an increase of 94 percent from the same period last year, across 2,622 projects. Approvals were concentrated in digital industries, particularly data centers and software platforms, as well as electronics, EV battery cells, energy-storage systems, and electrical appliances, consistent with rising global demand for advanced technologies (See Box 1). This pipeline signals strong investor interest in Thailand's prospects in the digital and high-tech economy. In the past, approved investment applications translated only partially into actual FDI inflows (Figure 9). Further, the BOI is accelerating the conversion of approvals into actual investment through the Thailand Fast Pass mechanism, which should support private investment growth in the near term (Figure 8 and 9). Nevertheless, FDI inflows to Thailand have lagged regional peers, such as the Philippines, Malaysia, and Viet Nam (Figure 7).

Figure 7: FDI inflows in 2021-2024 improved but remained behind Philippines, Malaysia, and Vietnam
(Percent of GDP)

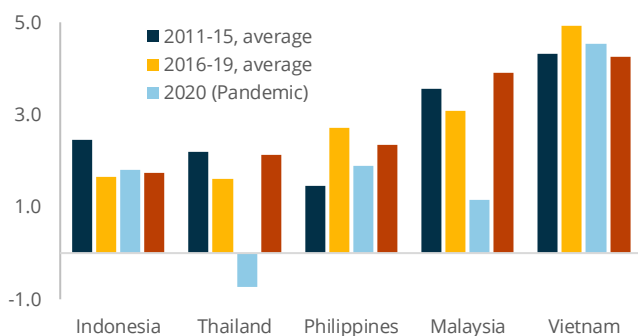
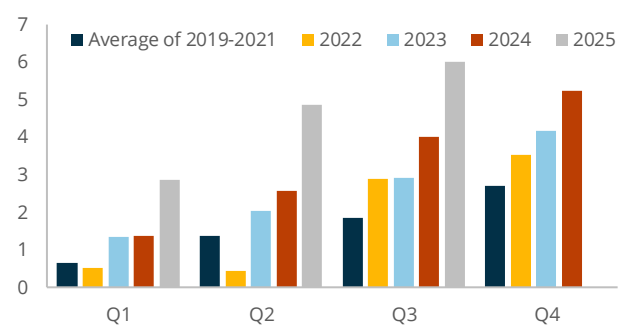


Figure 8: Applications for investments in targeted sectors surged
(Percent of GDP, quarterly)



² Information and Communication (ICT), Financial and Insurance Activities, Professional, Scientific, and Technical Activities, Business Services.

³ World Bank Thailand Systematic Country Diagnostic (SCD) Update finds that achieving the aspirational 5 percent long-term growth scenario is contingent upon breaking this accumulation ceiling. Specifically, the SCD scenarios highlight that TFP growth alone is insufficient; it must be accompanied by a doubling in the investment-to-GDP ratio—to transition Thailand from a middle-income trap to high-income status by 2037.

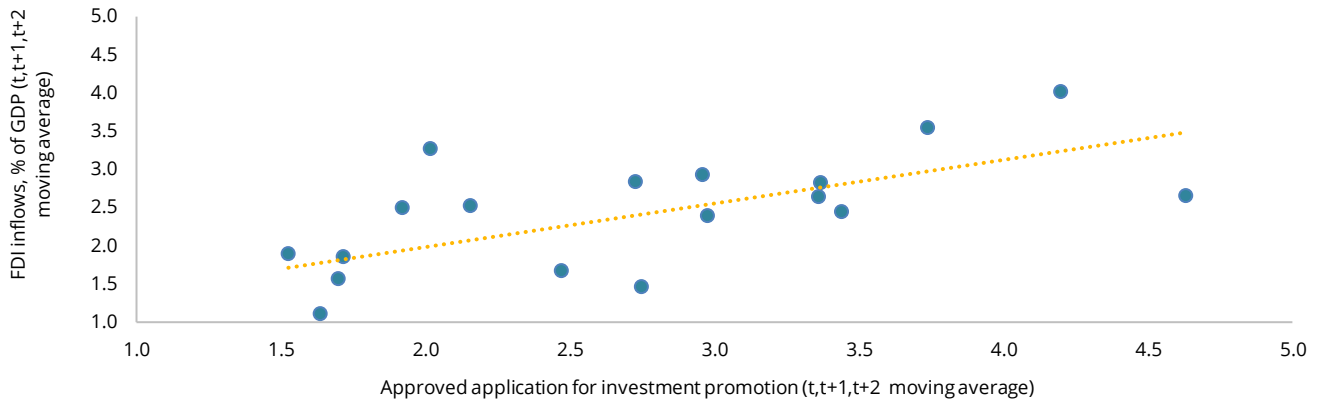
Part 1. Recent Economic Developments and Outlook: Slower Growth, Rising Risks

Source: CEIC; World Bank staff calculations.

Source: Board of Investment; World Bank staff calculations.

Figure 9: Approved investment applications were partially translated into actual FDI inflows

(Percent of GDP, 2011-2023)



Source: Board of Investment; Bank of Thailand; World Bank staff calculations.

Box 1: Recent FDI Trends in Thailand

Greenfield FDI brings fresh capital, technology, and know-how, fostering job creation and structural transformation. Unlike brownfield investments (i.e., maintenance, rehabilitation, restructuring of existing facilities), greenfield projects establish new facilities and operations, which can catalyze innovation, upgrade productivity, and support countries' integration into global value chains. Cross-country studies find that greenfield projects contribute directly to capital formation and employment, explaining up to 0.5–1 percentage point of annual GDP growth in emerging markets during peak inflow periods (IMF World Economic Outlook 2023). Greenfield FDI projects are also found to have created 2.3 million jobs in their host countries in 2018 (World Bank 2020).⁴

While Thailand holds the largest stock of FDI relative to its economy among ASEAN countries, new greenfield FDI will be particularly important to accelerate the transition toward higher-value-added sectors (Figure Box 1.1). Recent trends show that Thailand's greenfield FDI approvals surged in 2024, reaching 202 projects with a total value of US\$9.5 billion, signaling renewed investor confidence. However, compared to regional peers, Thailand's share of global greenfield FDI flows remains modest, capturing only about 1 percent of the US\$1 trillion of new global greenfield investments announced each year between 2023-2025 (Figure Box 1.2).⁵ This highlights the need for competitive policies, skilled labor, and green infrastructure to capture opportunities in industries such as semiconductors and AI infrastructure.

The sectoral composition of greenfield FDI into Thailand aligns well with global trends. At the global level, large investors, particularly from the US, UK, and China, focused on industries such as semiconductors, data centers (AI infrastructure), EVs and batteries, and advanced manufacturing (Figure Annex 1). In Thailand, greenfield FDI in electric vehicles from China surged during 2020-22. More recently, the largest investment announcements have continued to come from China, particularly in the communications sector, including data processing, hosting, and related services (Figure Annex 2). For

⁴ Foreign Direct Investment and Employment Outcomes in Developing Countries

⁵ Hornstein (2024) found a high correlation between approved and actual FDI inflows in selected Asian countries, including Thailand, and on average, 78.5 percent of announcements are realized within two years of announcement.

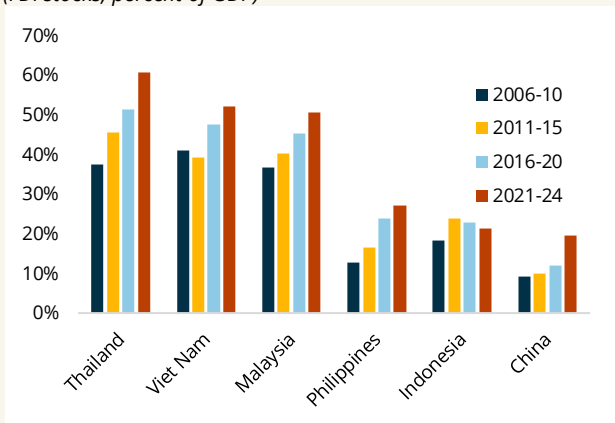
Box 1: Recent FDI Trends in Thailand

example, Thailand recorded 21 greenfield project announcements in data processing, hosting, and related services worth US\$9.5 billion over 2023–2025.

Attracting greenfield investment is becoming increasingly difficult amid rising fragmentation in global FDI, a trend evident even before recent trade policy uncertainty. Patterns of friendshoring and nearshoring have accelerated following recent trade tensions and geopolitical developments. FDI flows between geopolitical blocs fell about 12 percent more than flows within blocs, defined by similarity in UN voting patterns. These effects are strongest for outward investment from advanced Western economies. Some countries, such as Mexico and Viet Nam, have emerged as ‘connectors,’ intermediating US–China linkages since 2018.

Figure Box 1.1: Thailand’s FDI stock is large compared to peers ...

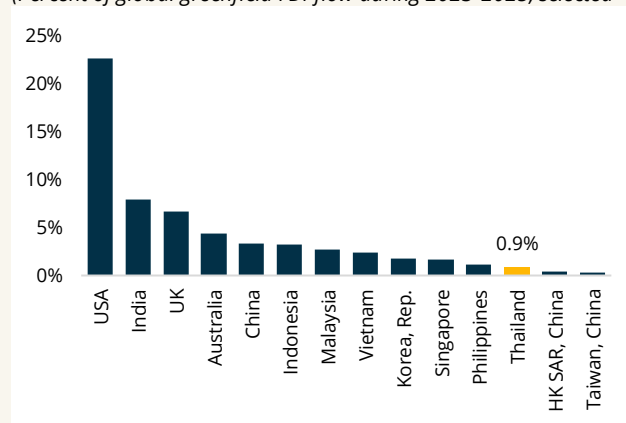
(FDI stocks, percent of GDP)



Source: UNCTAD, World Bank staff calculation.

Figure Box 1.2: ... but Thailand captured a smaller share of recent global greenfield FDI announcements

(Percent of global greenfield FDI flow during 2023-2025, selected)



Note: Selected destinations are shown only.

Source: fDi Markets database, World Bank staff calculation.

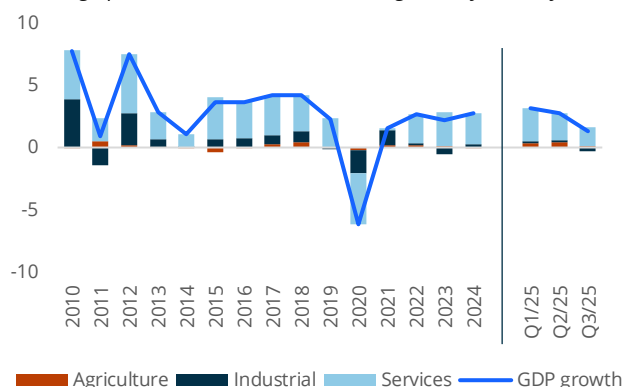
Services activity slowed but remained the dominant driver of growth in Q3 2025.

Recovery continued to be uneven across sectors. Services—particularly *accommodation and food services*—remained the dominant contributor to growth, expanding by 2.3 percent, though momentum softened as tourism weakened. Manufacturing growth stayed contracted by 1.6 percent (Figure 10), as export-oriented industries such as electronics, computers, and related equipment were weighed down by inventory destocking following the front-loading of shipments ahead of tariff measures. Meanwhile, agriculture expanded by 1.9 percent as output rebounded from earlier drought conditions, but falling global commodity prices constrained farmer incomes and dampened price gains (Figure 11).

Part 1. Recent Economic Developments and Outlook: Slower Growth, Rising Risks

Figure 10: Manufacturing contracted and set back the services-led recovery

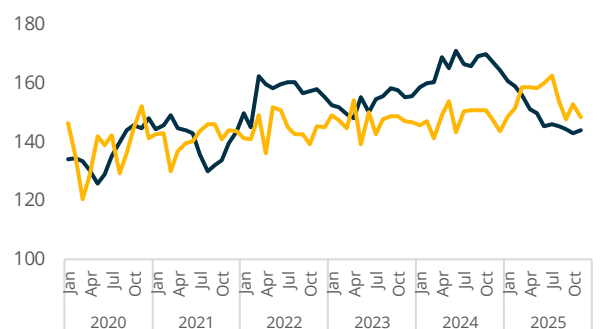
(Percentage-point contribution to real GDP growth, year-on-year)



Source: NESDC.

Figure 11: Agricultural prices dropped as global commodity markets softened

(Base year 2005 = 100, seasonally adjusted)



Source: Office of Agricultural Economics, Ministry of Agriculture and Cooperatives.

iii. Inflation remained negative and the lowest amongst peers

Inflation remained in negative territory due to relative price developments, including low global oil prices and government price administration, alongside weak domestic demand.

By December 2025, headline consumer prices had declined by 0.28 percent, marking the ninth consecutive month of negative inflation. This was driven primarily by the continued decline in energy-related *relative* prices, including electricity and fuel, amid falling global energy costs and government cost-of-living measures. The reduction in electricity costs—following earlier tariff freezes in 2025—has been reinforced by the government's decision to cut electricity tariffs to 3.88 THB per unit for January–April 2026, further easing household energy burdens and keeping inflation subdued in the near term. Despite a partial rollback of fuel subsidies in preceding months, additional measures—including reductions in benzine, diesel, and gasohol prices effective late December—continued to limit upward pressure on energy inflation.

Core inflation remained positive, reflecting subdued demand pressures.

Non-food, non-beverage prices fell by -1.43 percent, reflecting lower electricity and fuel prices as well as ongoing promotional activity for personal care and household products. In contrast, food and non-alcoholic beverage prices increased by 1.53 percent, driven by higher prices for fresh vegetables and prepared foods. Core inflation remained positive at 0.59 percent, supported by rising prices in prepared food and other non-energy components, highlighting that underlying demand-side inflation pressures, while subdued, remained present. Despite prolonged negative headline readings, Thailand continues to record the lowest inflation rate among ASEAN economies, reflecting both policy interventions and persistently soft domestic demand. Core inflation, an indicator of underlying demand, remained moderate at 0.6 percent, supported by rising prices of prepared food and non-alcoholic beverages.⁶ Long-term inflation expectations remain anchored within the Bank of Thailand's 1–3 percent target range (Figure 15), although the BOT now

⁶ Core inflation includes prices of processed food and beverages (excluding fresh food), housing and rental costs, transportation services (excluding fuel), medical and healthcare services, education services, personal care and household goods and recreation and culture services.

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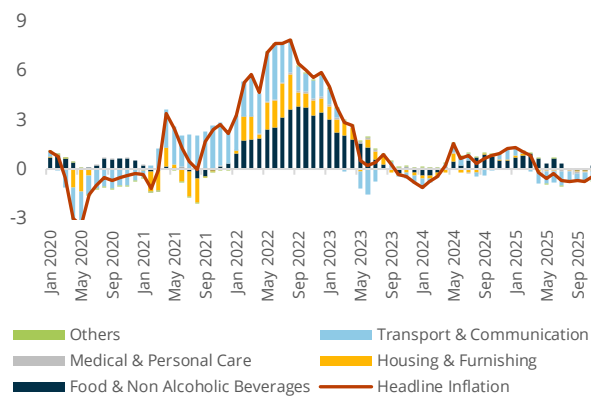
projects headline inflation to gradually rise to 0.3 percent in 2026 as temporary energy-related drags dissipate.

The Bank of Thailand cut interest rates to 1.25 percent.

On December 17, the Monetary Policy Committee unanimously cut the policy rate by 25 basis points to 1.25 percent, marking its fifth rate cut in fourteen months. The decision aimed to support the economy amid continued weakness in private consumption, contracting credit, subdued inflation, and emerging headwinds from U.S. trade policies. The BOT expects growth to soften further, with risks tilted to the downside given sluggish demand, external uncertainty, and ongoing pressures on vulnerable households and SMEs. While the softening economy and the persistent positive output gap create room for further monetary accommodation, ongoing deleveraging may weaken transmission and create counter-effects such as new borrowing.⁷

Figure 12: Headline inflation remained negative due to lower global oil prices and energy subsidies

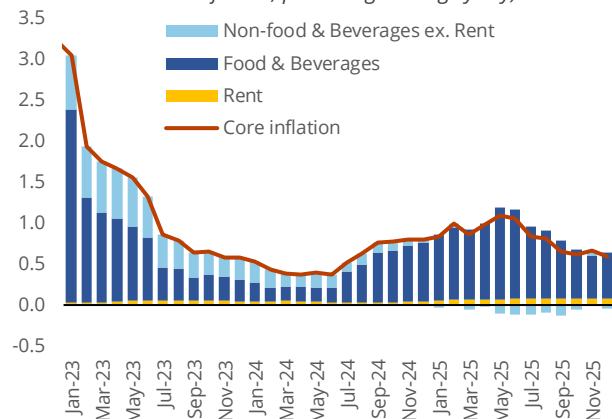
(Contribution to headline inflation, percent change y-o-y)



Note: Headline inflation includes raw food and energy.
Source: CEIC; World Bank staff calculations.

Figure 13: Core inflation remained positive due to prepared food prices

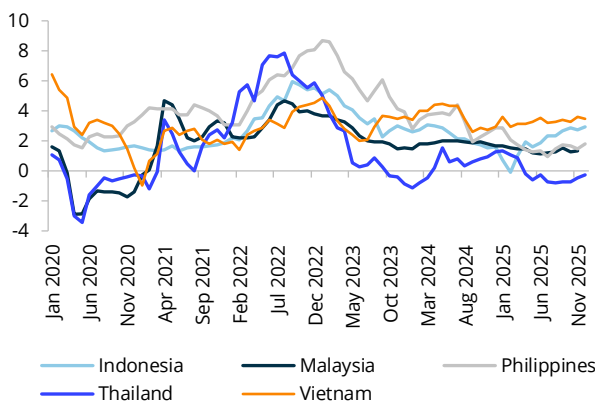
(Contribution to core inflation, percentage change y-o-y)



Source: Haver Analytics; World Bank staff calculations

Figure 14: Inflation remained negative and remained well below other ASEAN economies

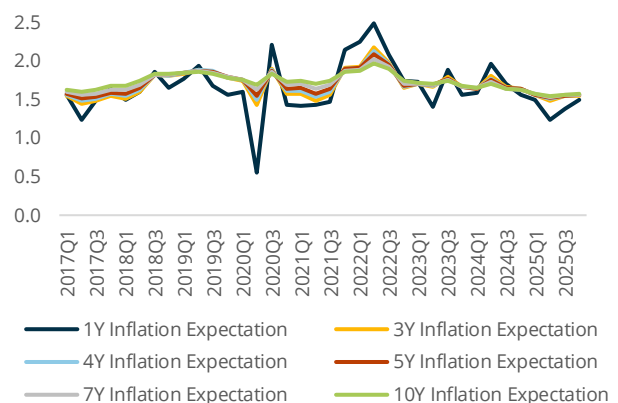
(Percent year-on-year)



Source: MOC; CEIC; World Bank staff calculations.

Figure 15: Long-term inflation expectations remained within the target range

(Expectations inflation index-linked bonds, percent year-on-year)



Source: Puey Ungphakorn Institute for Economic Research, Bank of Thailand.

⁷ Teerapap Pangsapa, Thanaphol Kongphalee, and Maneerat Gongsang (2025). A Brief Note on Thailand Household Debt Dynamics, Fisher Effects, and Monetary Policy Transmission. Bank of Thailand.

iv. The uneven recovery in labor markets set back household welfare

Thailand's exceptionally low unemployment rate—at approximately 0.76 percent as of late 2025—masks an erosion in the quantity and quality of jobs.

Quantity. The number of quasi-unemployed workers—those available for work but not actively seeking—surged by 8.7 percent. This increase is predominantly anchored in the agricultural sector, which acted as a buffer for labor displaced by contractions in urban construction (-5.4 percent) and hospitality (-0.6 percent). This trend points to a reverse migration pattern: workers are retreating from high-cost urban centers to rural homes, where they become “available but discouraged”. This movement is a direct result of the rising costs of living and debt servicing as well as a lack of strong safety nets⁸ as urban workers with almost-zero discretionary income return to family farms to lower costs of living.

Quality. Over the last few years, overall real wage growth has been stagnant; real incomes in 2024 were only 3.2 percent higher than pre-COVID levels, representing an average annual increase of just 0.8 percent. Overall flat wage growth masks a divergence at the sectoral level. Real wages in the digital sector (software, digital services, and telecommunications) grew by an estimated 5.1 percent in Q3 2025 (Digital Economy Promotion Agency, National Statistical Office). Conversely, the majority of the informal and rural workforce is experiencing a real-term contraction. Real wages for self-employed workers declined by 2.9 percent, while agricultural wages fell by 2.6 percent. For these segments, nominal income gains have failed to keep pace with the rising costs of essential necessities.

Vacancies and employment contraction point to a skills mismatch.

While the services and tourism sectors continue to drive marginal employment gains, structural weaknesses have surfaced as total employment contracted by 0.5 percent in Q3 2025, particularly in agriculture and traditional manufacturing. Despite a high level of job vacancies—specifically a projected gap of 70,000 digital workers and a surge in FDI-related job openings in the EV and electronics sectors—the number of quasi-unemployed individuals in rural areas increased significantly. This suggests that new industries are ready to expand but a significant skills mismatch prevents workers from sunset industries from filling these roles, threatening the sustainability of recent poverty reduction gains and long-term debt alleviation.

Flat wage growth and rising debt obligations have increased the vulnerability of many Thai households.

The World Bank identifies approximately 40 percent of Thailand's population as vulnerable—a critical socioeconomic segment situated between the upper-middle-income poverty line (\$6.85 PPP/day) and the threshold for economic security (\$15.00 PPP/day; World Bank *Thailand Public Revenue and Spending Assessment*). While average real income remains anchored at THB 27,500, unavoidable expenses (THB 15,500) and debt service (THB 12,000) have effectively converged to exhaust these households' total monthly budget. Little to no savings remain, leaving these households exposed to even small

⁸ Thailand's social safety net is characterized as having high coverage but low adequacy (World Bank Thailand PRSA 2023). While a large percentage of the population receives some form of assistance, the benefit levels are often too low to protect against major shocks, particularly for those in the middle of the income distribution. Social spending is low compared to peers at similar income levels (spending approx. 3.7 percent of GDP vs. 6.3 percent in Viet Nam or China).

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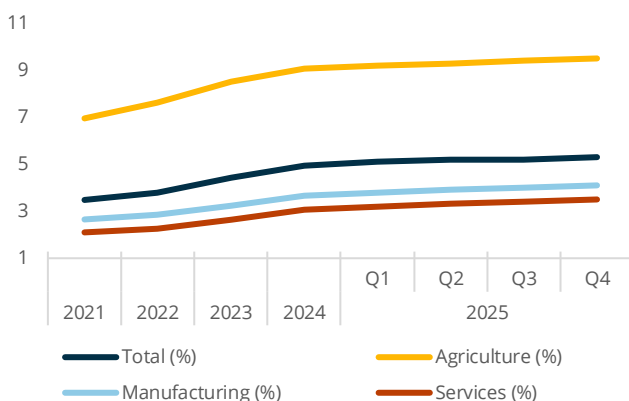
shocks. While this income level technically places them above the upper-middle-income poverty line (around THB 16,500 for a three-person household), their remaining disposable income now sits close to the national poverty threshold. In practical terms, vulnerable households have come to resemble the poor in their limited capacity to absorb economic shocks. Any additional setback—such as job loss, higher prices, or tighter credit—could quickly push many into poverty, reversing hard-won progress in social mobility.

Poverty declined in 2025, underpinned by modest economic growth and fiscal support.

Poverty in Thailand is estimated to have declined to 7.1 percent in 2025 using the upper-middle-income poverty line (updated to \$8.30/day, 2021 PPP), down from 8.2 percent in 2024, reflecting the continued but moderate economic growth and targeted fiscal support. Poverty reduction in 2024 was aided by large-scale cash transfers, including the Digital Wallet program. Without these transfers, poverty rates would likely have remained broadly unchanged due to weak underlying income growth. The slowdown in GDP growth in 2025, limited further progress. Labor market pressures are expected to weigh on household welfare as employment losses in agriculture and manufacturing continue into 2025. Combined with deteriorating credit quality and high household indebtedness, these dynamics raise concerns about the sustainability of poverty reduction gains over the medium term.

Figure 16: Quasi unemployment in agriculture has risen

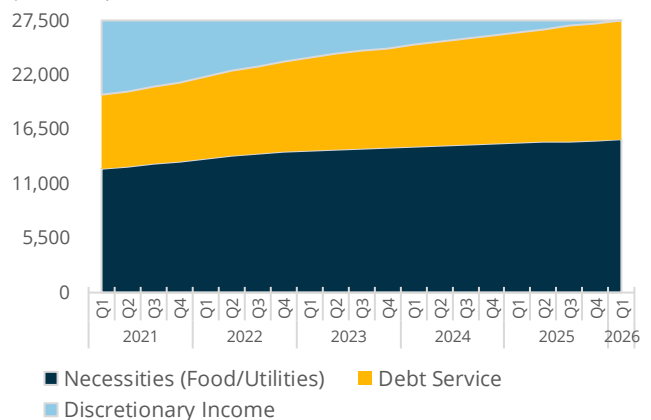
(Percentage)



Source: NSO

Figure 17: Households are facing rising debt payments and falling discretionary income

(Thai Baht)



Source: NSO

v. The current account surplus weakened in Q3 2025, following a strong performance in Q1, as expectations settled following global trade policy shifts

The current account surplus declined sharply to 2.2 percent of GDP in Q3 2025, from 8.0 percent in Q1 2025.

The sharp deterioration relative to early 2025 was driven by a narrower goods trade surplus, continued weakness in the services balance, and larger income outflows (Figure 18). These developments reflected a cooling in export activity following the front-loading ahead of the implementation of higher tariffs in August, seasonal softness in tourism receipts, dividend payments in mid-2025, and the continued appreciation of the Thai baht.

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The goods trade balance in Q3 was broadly unchanged from a year earlier, as a modest deterioration in the terms of trade was offset by increased export volumes.

The goods balance stood at 4.8 percent of GDP in Q3 2025 (down from 5 percent in Q3 2024), despite a 2.4 percent year-on-year deterioration in terms of trade. On the one hand, goods imports reached 54.7 percent of GDP in Q3 2025 (from 52.6 percent a year earlier), driven by larger imports of capital goods, raw materials, and intermediate inputs, including integrated circuits and parts, consistent with increased production of computers and electronics. On the other hand, goods exports also strengthened, reaching 59.5 percent of GDP (up from 57.6 percent in Q3 2024), primarily reflecting greater exports of non-monetary gold amid rising prices and electronics, which have been exempt from US reciprocal tariffs. Gold exports act as quasi-assets and distort trade signals. Increased US tariffs, which took effect in early August, have likely contributed to the temporary dip in trade volumes that month. However, activities rebounded quickly in September, led by increased exports of trucks to the Middle East and auto parts to ASEAN, Japan, and the United States.

The services and net income balance weakened relative to early 2025, weighing on the current account balance.

Although the combined services and net income balance in Q3 2025 was broadly unchanged from its level in Q3 2024, it shifted to a deficit of 2.6 percent of GDP, compared with a surplus of 2.2 percent in Q1 2025 (Figure 18). Tourist arrivals fell by 13.9 percent year-on-year in Q3, driven largely by a 37.8 percent drop in Chinese visitors amid security concerns, greater competition among regional destinations, and the Thai baht's nominal appreciation this year (Figure 22).

The financial account shifted to a deficit of 1.4 percent of GDP in Q3 as inflows through FDI and investments fell short of large equity outflows.

Thailand recorded considerable net FDI inflows of 2.1 percent of GDP in Q3 2025, compared to a small outflow in Q3 2024 (Figure 20). Most inflows originated from Singapore and China, increasingly directed toward manufacturing. Strengthening inward FDI aligns with improving investor sentiment captured in recent surveys by the Federation of Thai Capital Market Organizations (FETCO). Investor confidence, as surveyed, has been bolstered by expectations surrounding government stimulus measures, the domestic economic recovery, and the U.S. monetary policy. Moreover, FDI applications from major source economies—including China, Singapore, Hong Kong, and Japan—increased by 80.6 percent year-on-year in Q3 2025.

Net portfolio outflows increased, fully offsetting the gains from direct investment inflows.

Net portfolio investment outflows reached 8.1 percent of GDP in Q3 2025, up from 1.5 percent in Q3 2024, primarily driven by higher equity investments abroad by Thai financial institutions (both depository and non-depository), seeking asset diversification and higher returns. As of Q3 2025, Thailand continued to record the largest cumulative equity net outflows among its peers since early 2024 (Figure 21).

Portfolio outflows are consistent with the positive savings-investment gap.

Among upper-middle-income peers, Thailand stood out as a net lender to the rest of the world, especially in the last three years (Figure 24). Thai households and financial corporations have been key contributors to this positive gap, as they seek to diversify assets and earn high-return opportunities abroad. Population aging is also likely to have contributed to a greater propensity to save.

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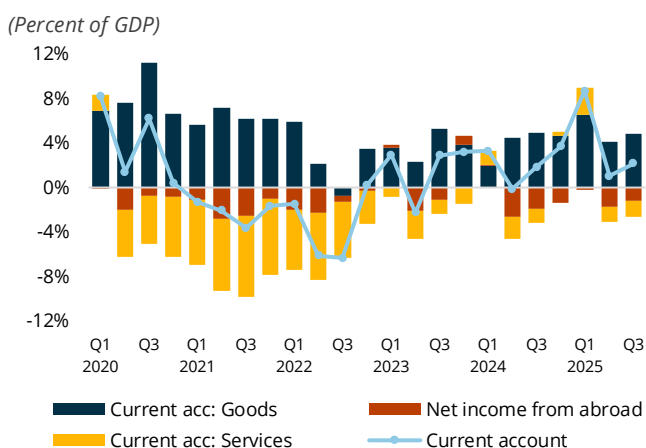
The persistent strength of the THB real effective exchange rate throughout H2 2025 was driven less by trade fundamentals and more by an exceptional surge in tourism receipts and gold-related flows.

The real effective exchange rate (REER) of the Thai baht appreciated by around 2 percent in the second half of 2025, maintaining the strength gained in mid-2024 (Figure 23). This strength was primarily fueled by a sharp nominal appreciation against the US Dollar, as a Fed interest rate lowering coincided with a surge in domestic capital inflows (Figure 22). Two “non-fundamental” factors applied significant upward pressure: a surge in tourism revenue end-2025 and record-breaking gold exports. By December 2025, gold-related settlements accounted for nearly 45 percent of all domestic US dollar sales, decoupling the THB from many regional peers and making it one of ASEAN’s most volatile currencies. This forced BOT to introduce new controls in early 2026, including a THB 50 million cap on daily gold transactions to decouple the currency from these speculative flows. The real appreciation of the THB, occurring alongside deteriorating terms of trade, underscores a growing divergence between external and internal prices; specifically, it suggests that domestic non-tradeable prices (e.g. housing and services) remained sticky even as global tradeable prices softened as reflected in positive core inflation and negative headline inflation.

The Bank of Thailand maintained a strong reserves position.

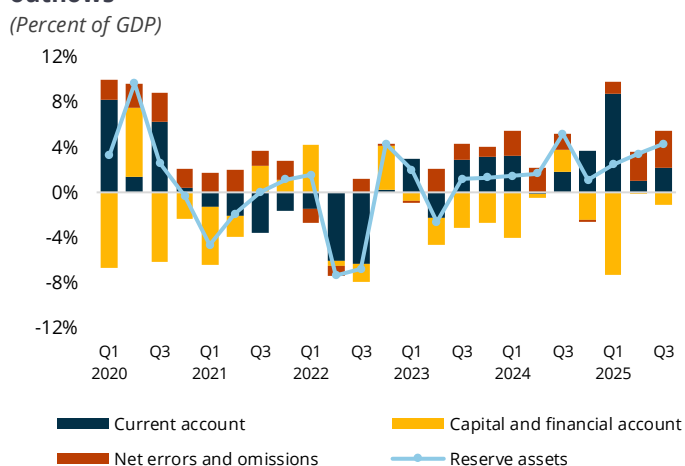
By end-2025, net international reserves reached US\$241.4 billion, equivalent to 47.1 percent of GDP and 3.8 times the level of short-term external debt (Figure 25). Much of this reserve accumulation was achieved before August, as exporters rushed to fulfill existing orders. Finally, with an import coverage of 10.3 months, international reserves provide a more-than-adequate buffer against external shocks. Although the country’s high savings relative to investment reduces its reliance on foreign financing, maintaining ample reserves remains essential as Thailand’s export-dependent economy faces increasingly uncertain global demand.

Figure 18: The current account surplus weakened in Q3 compared to early 2025



Source: Bank of Thailand; World Bank staff calculations

Figure 19: Thailand continued to accumulate reserve assets in Q3 2025, with smaller financial and capital outflows

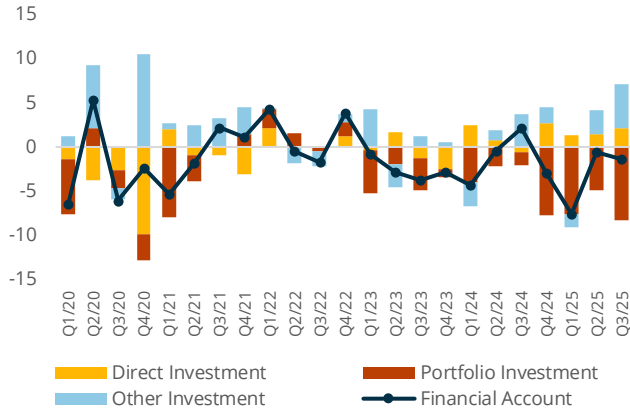


Source: Bank of Thailand; World Bank staff calculations.

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Figure 20: FDI and other financial inflows offset increased portfolio outflows

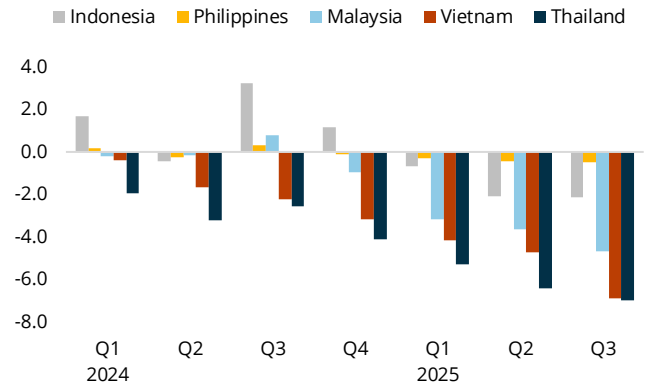
(Percent of GDP)



Source: Bank of Thailand; World Bank staff calculations.

Figure 21: Thailand's equity outflows exceeded regional peers

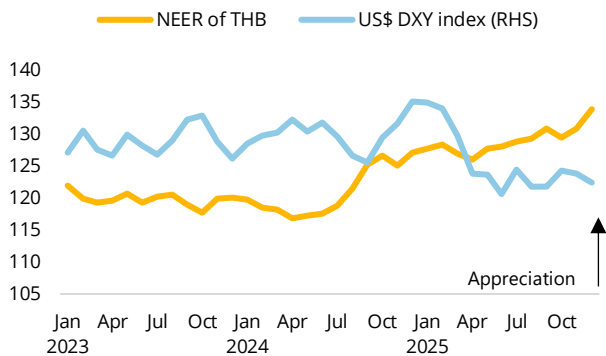
(Billion US\$, cumulative flow starting Q1 2024)



Source: International Institute of Finance (IIF), retrieved from Haver.; World Bank staff calculations.

Figure 22: The nominal exchange rate of the Thai baht continued to appreciate, partly reflecting a weak USD

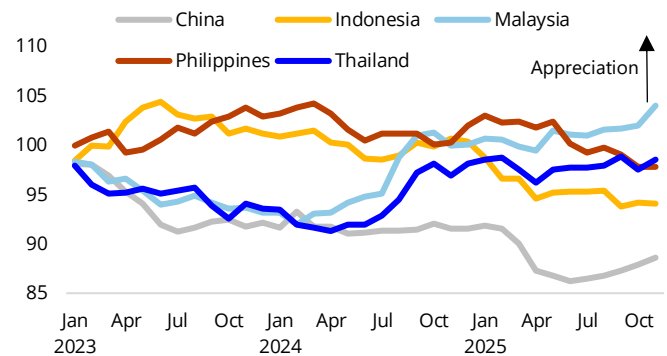
(Exchange rate of Thai Baht, 2012 = 100. 3-month moving average)



Source: Haver; World Bank staff calculations.

Figure 23: The Thai baht strengthened slightly in real effective terms in H2 2025, similar to the Malaysian ringgit

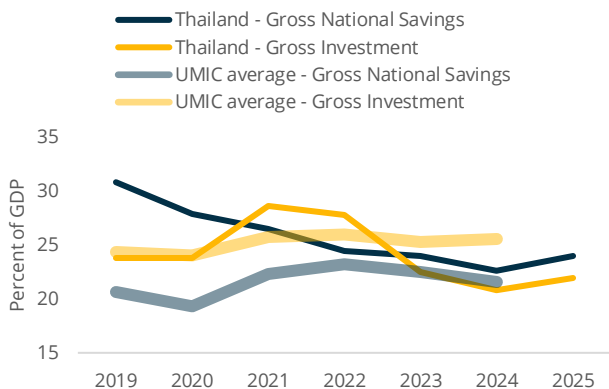
(January 2020 = 100)



Source: Bank for International Settlements (BIS); World Bank staff calculations.

Figure 24: Unlike peers, Thailand became a net lender to the world in the last three years

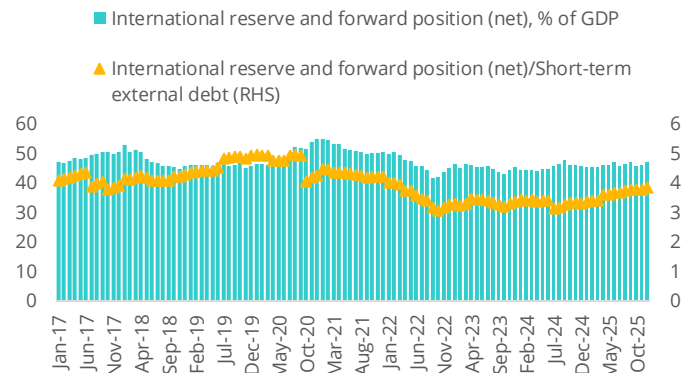
(percent of GDP)



Source: IMF WEO and World Bank staff calculations.

Figure 25: Net international reserves remain more than adequate

(LHS: percent of GDP, RHS: short-term debt)



Source: Bank of Thailand; World Bank staff calculations.

vi. The financial sector remains resilient but faces challenges

High household debt, tightened lending standards and weak demand resulted in a credit crunch. Credit to the private sector has been subdued since January 2025, expanding by only 0.4 percent in November 2025. Household debt continued to trend down due to policy measures and credit tightening but remained elevated at 87.8 percent of GDP in Q3 2025, well above the 55 percent average for ASEAN-5 and 60 percent for China.⁹ The total household debt burden may prove to be even higher due to informal debt.¹⁰ Unsecured loans, such as credit cards and personal loans, account for around 30 percent of household debt, and represent around two-thirds of current non-performing loans (NPLs).¹¹

The financial sector remained resilient with banks well-capitalized and liquid. Despite subdued profitability, weak private sector lending and elevated household debt, banks remained resilient. The system-wide NPL ratio remained low at 2.8 percent as of September 2025, while special mention loans, an early warning indicator, also remained stable. The capital adequacy ratio (CAR) stood at 21.2 percent in Q3 2025, double the regulatory minimum of 10.5 percent. Liquidity coverage is ample at 204 percent, well above the regulatory minimum of 100 percent. Banking sector profitability has been stable but weak, with Return on Assets (ROA) and Return on Equity (ROE) at 1.1 percent and 7.7 percent in September 2025, respectively.

A bank-level stress test confirms the banking sector's resilience. A reverse stress test conducted on a sample of 53 Thai banks using Fitch bank-level balance sheet data, suggests that the banking system is resilient to a significant credit shock: the NPL ratio would need to increase by 14.5 percent from its current level (i.e., the distance to distress) before the weakest 20 percent of the banking system would breach the minimum capital adequacy ratio due to depleted capital buffers. The distance to stress has been consistently high, throughout the pandemic and into the present, indicating that the likelihood of significant stress or a systemic banking crisis remains low based on available data.

⁹ Household debt above thresholds (60–80 percent of GDP) bring about negative effects on growth and consumption (Lombardi, Mohanty, and Shim, 2017). This is reflected in Thailand's subdued domestic demand and slowing GDP growth despite fiscal stimulus and monetary accommodation. Thailand's debt is about 8 percentage points above the threshold, implying a drag of approximately 0.8 percentage points on annual GDP growth compared to a scenario where debt is below the threshold. The ratio crossed 80 percent around late-2013 and stayed above 80 percent through 2014 and beyond; consumption growth cooled at roughly the same time.

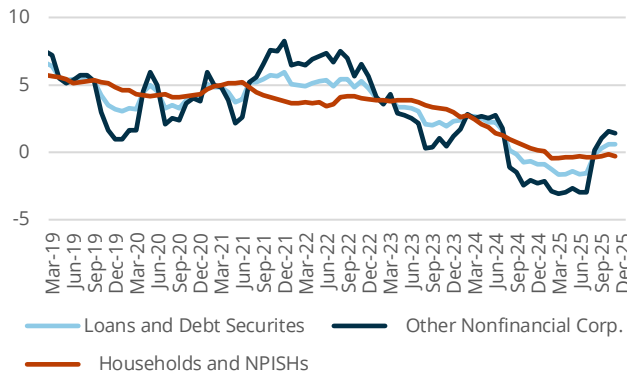
¹⁰ Krungthai Bank and Chulalongkorn University (Faculty of Economics) conducted a nationwide survey and analysis of informal debt. The study finds informal debt—loans from unregulated sources such as moneylenders, friends, and relatives—amounts to 13–14 percent of GDP. This informal debt is not included in official formal household debt statistics.

¹¹ Bank of Thailand, 2024 data.

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Figure 26: Private sector credit to households contracted

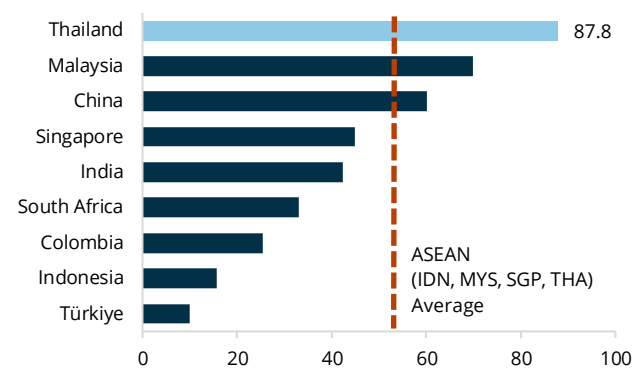
(Percent year-on-year)



Source: Bank of Thailand

Figure 27: Household debt remained the highest among peers

(Percent of GDP)



Source: Institute of International Finance

The government has adopted a more centralized approach towards tackling household debt, using a public asset management company (AMC) to manage bank NPLs.

The government's new public AMC initiative aims to leverage Sukhumvit Asset Management (SAM) which is funded by the state-owned Financial Institutions Development Fund (FIDF) rather than the state budget.¹² SAM is capitalized at THB 20 billion (0.1 percent of GDP) and aims to purchase and restructure small-scale household NPLs totaling up to THB 122 billion (0.6 percent of GDP), with the first phase covering THB 44 billion (0.2 percent of GDP). This quasi-fiscal program forms part of a broader policy package to tackle high household debt, including short-term relief for borrowers and medium-term measures to promote responsible lending, curb excessive pricing in informal lending, and strengthen macroprudential policies. International experience suggests that such programs could potentially help alleviate household debt if appropriate institutional and governance preconditions are met (See Box 2 below).

Box 2: International Experience on Public Asset Management Companies

Public and centralized asset management companies (AMCs) have proven effective worldwide in resolving non-performing loans (NPLs) and strengthening financial systems. Globally, public AMCs have been used to remove NPLs and maximize recovery of distressed assets, either by liquidating failed institutions or purchasing assets from open banks. After the Asian Financial Crisis, countries such as China, Indonesia, Japan, South Korea, Malaysia, and Thailand successfully used AMCs to clean bank balance sheets. In Europe, Ireland, Spain, and Slovenia adopted AMCs following the 2008 global financial crisis. More recently, countries like Thailand, Hungary, Italy, and South Korea have implemented AMCs outside crisis periods, though this remains less common.

Public AMCs play a pivotal role in strengthening financial sector stability by efficiently resolving NPLs. Public AMCs can enhance financial stability by compelling banks to recognize credit losses, which

¹² The primary source of FIDF funding is contributions from commercial banks. Commercial banks and other financial institutions are required by law to pay a fixed percentage of their deposit base (currently 0.23–0.46 percent) to the FIDF. This payment is mandatory, non-negotiable, and collected by the Bank of Thailand to fund financial sector stability, repay legacy bailout debts, and support quasi-fiscal initiatives such as asset management company (AMC) programs.

Box 2: International Experience on Public Asset Management Companies

increases transparency and restores confidence in the system. By purchasing NPLs, AMCs reduce uncertainty about impaired assets and help prevent negative market spirals. Centralized AMCs also achieve cost efficiencies and technical expertise by managing large volumes of distressed assets. This approach improves creditor coordination, strengthens bargaining power, and allows time for asset recovery, ultimately enabling banks to refocus on lending—especially important amid weak credit growth in Thailand.

However, careful design features and certain pre-conditions need to be in place to fully achieve these benefits.

- **Clear mandate and governance:** Without appropriate design and institutional independence, public AMCs may be vulnerable to external interference, providing support to certain borrowers or firms that are not driven by commercial considerations. There should be strong political will to commit to the recognition and fair allocation of losses, including through a fair transfer price of assets (Ireland, Korea).
- **Creditor rights and asset transfer:** A robust legal framework for bank resolution, insolvency and creditor right protection provides critical support to the functioning of AMCs. International experiences also do not recommend the transfer of unsecured retail loans to an AMC due to shorter time duration and higher complexity and costs (Malaysia, South Korea).
- **Exit strategy:** Distressed assets may not be disposed in a timely manner due to the lack of a timebound strategy and predefined timeframe for disposal, creating “warehousing” of problem assets (Hungary).
- **Integration with social and financial policy:** A centralized AMC should be viewed as part of a comprehensive strategy to tackle household debt and NPLs in the financial system (South Korea).
- **Critical mass:** Achieving sufficient scale is important for meaningful impact (South Korea).

vii. **The fiscal deficit increased while public debt remained sustainable**

The central government's fiscal deficit widened in FY2025.

Countercyclical government spending, such as the new stimulus and energy subsidies, have supported short-term growth.

In FY2025 (October 2024-September 2025), the central government's fiscal deficit (GFS basis) widened to 2.9 percent of GDP, up from 2.4 percent a year earlier and above pre-pandemic levels (Figure 28 and Figure 29). The increased deficit reflected higher capital expenditure, as spending normalized following last year's delay. On the revenue side, tax revenue remained stable as increases in the personal income tax, VAT, and fuel excise collections were offset by lower petroleum tax and vehicle excise revenues. Government spending has been countercyclical, increasing expenditure during downturns to support the economy, as output remained well below the long-term trend (Figure 30). The government recently announced a THB 66.8 billion (0.43 percent of GDP) stimulus aimed to deliver a short-term lift to growth. The package comprised top-ups for state welfare card holders and a co-payment program and was financed through the reallocation of unspent stimulus funds (THB 25 billion) and the central budget (THB 41.8 billion). By linking co-payment benefits to tax registration and digital skills, the scheme aims to support a stronger culture of tax responsibility while strengthening the digital capabilities of small vendors (Box 3). On the revenue side, a temporary personal income tax deduction for spending on hotels and

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restaurants of up to THB 20,000 per person for travel in major cities and THB 30,000 for travel in secondary cities (Oct 29–Dec 15) was introduced to stimulate tourism.

The government continued to use energy subsidies to mitigate living costs.

Additionally, retail diesel and gasoline prices were reduced by THB 0.50 and THB 0.30 per liter, respectively, through lower contributions to the State Oil Fund, while electricity tariffs were capped at THB 4.18 per unit. The Electricity Generating Authority of Thailand (EGAT) remains liable for THB 66 billion in outstanding debt from previous cost-of-living subsidy measures (as of April 2025). While these subsidies on diesel, gasoline, electricity, and cooking gas provide short-term relief, they are costly and relatively inefficient in reducing poverty and inequality, as a larger share of the benefits accrues to higher-income households while also reducing incentives to decarbonize ([PRSA 2023](#)).

Public investment rose in FY25, as spending was rebalanced towards capital expenditure to support long-term growth.

Central government public investment spending rose to 1.5 percent of GDP, up from 0.8 percent in the previous fiscal year and broadly in line with the FY14–FY24 long-term average. Accelerated public investment during the first three quarters of FY25 reflected a reallocation toward capital spending. Spending on productive public investment typically generates stronger multiplier effects and can help maintain the public debt trajectory below the ceiling over the long term (Thailand Economic Monitor [July 2025](#)). While public investment execution accelerated in the first three quarters of FY25, it slowed in the final quarter and fell below previous year’s level at 65 percent, due to execution delays associated with the government transition.

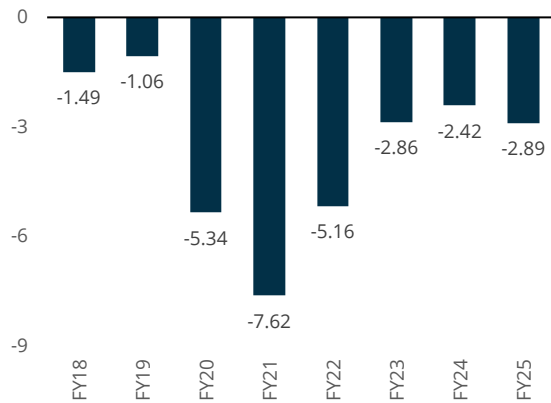
Fiscal revenues remained stable in FY25 but low by international standards, underscoring the need to strengthen tax mobilization.

In FY25, fiscal revenues remained stable at 15.8 percent of GDP as increases in the personal income tax, VAT, and fuel excise collections were offset by lower petroleum tax and vehicle excise revenues. The latter was the EV promotion policy with excise tax cut from 8 percent down to 2 percent to incentivize EV adoption. Over the past two decades, revenues averaged 16 percent of GDP, low relative to upper middle-income countries, as well as regional peers and OECD economies. The gap between revenue and expenditure also widened relative to the pre-pandemic period (Figure 33). Enhanced revenue mobilization efforts, especially in areas where collections remain well below potential (including VAT, personal income tax, tax on e-commerce, and wealth tax), could reduce overall spending constraints.

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Figure 28: The central government's fiscal deficit in FY25 widened...

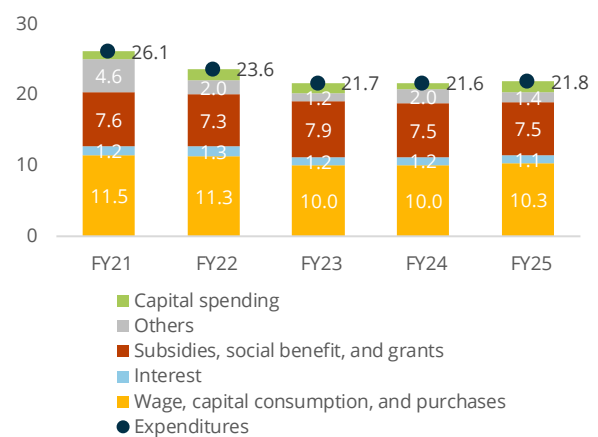
(Percent of fiscal year GDP, Central Government, GFS basis)



Source: Fiscal Policy Office, Ministry of Finance

Figure 29: ...due to both current and capital spending.

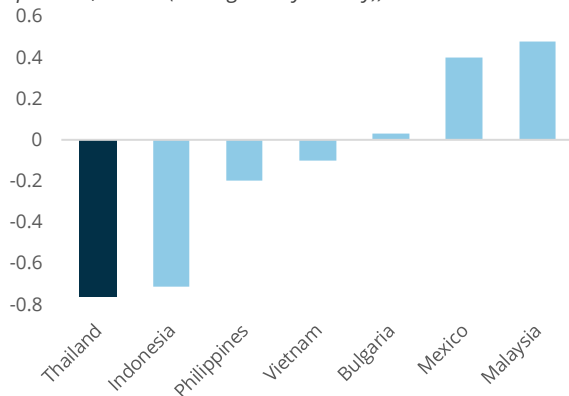
(Percent of fiscal year GDP, Central Government, GFS basis)



Source: Fiscal Policy Office, Ministry of Finance, NESDC.

Figure 30: Countercyclical government spending supported growth recovery

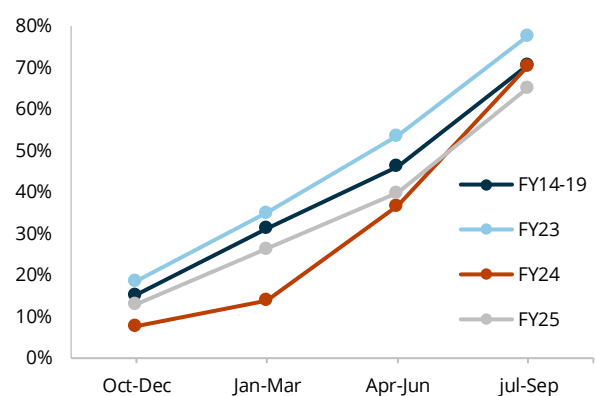
(Correlation between GDP and public spending cyclical components; -1 to 1 (the highest cyclicality))



Source: World Bank staff estimates.

Figure 31: Public investment budget execution slipped below levels seen in previous years

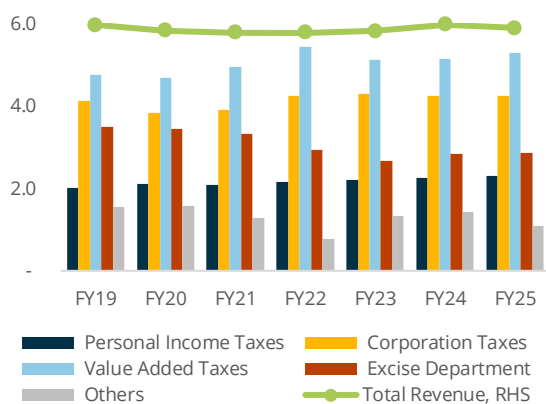
(Public investment budget execution rate, percent, cash basis)



Source: Fiscal Policy Office; World Bank staff calculations

Figure 32: Total revenues remained stable

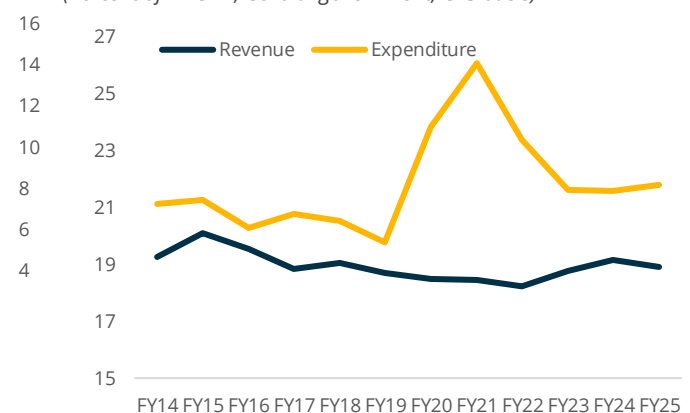
(Percent of FY GDP, cash basis)



Source: Fiscal Policy Office; World Bank staff calculations

Figure 33: Fiscal expenditure has remained above pre-pandemic levels, while revenue has declined

(Percent of FY GDP, Central government, GFS basis)



Source: Fiscal Policy Office; World Bank staff calculations.

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Public debt continued to rise in FY2025, amid persistent fiscal deficits and slow economic growth.

In FY25, public debt rose to 65.1 percent of GDP, more than 20 percentage above pre-pandemic levels, reflecting continued borrowing to finance the fiscal deficit (Figure 34). The public debt to GDP ratio has increased steadily since the pandemic, largely reflecting increased fiscal deficit financing. The contribution of interest costs to debt dynamics remained modest due to a relatively low-interest rate environment, while subdued economic growth contributed to the higher debt-to-GDP ratio compared to peers (Figure 35). Looking ahead, tax and spending policies that prioritize efficient use of fiscal space and support higher potential growth will be key to ensuring long-term debt sustainability.

Public debt remains sustainable, supported by low external debt and prudent fiscal management.

The 10-year government bond yield declined in 2025 and remained the lowest among ASEAN peers, reflecting policy rate cuts, low inflation and subdued growth. Public debt remained below the statutory ceiling of 70 percent while external debt accounted for less than 1 percent of total public debt (Table 1). Foreign ownership of local currency government debt also remained low relative to other countries in the region (Figure 37). However, rising public debt has pushed the debt service-to-revenue ratio to its highest level since 2006, driven by both principal and interest payments. Public debt dynamics will need to be closely monitored, given ongoing economic uncertainty and structural challenges that may increase spending pressures over time.

Table 1: Key fiscal-responsibility indicators remain within their established parameters

Key fiscal responsibility, percent or otherwise specified	Ceiling (percent)	FY21	FY22	FY23	FY24	FY25
Public Debt / GDP	70	58.4	60.5	62.3	63.2	65.1
Government Debt Service / Revenue	35	8.6	8.1	8.2	9.0	10.5
External Debt / Public Debt	10	1.8	1.7	1.4	1.0	0.8
External Debt Service / Exports	5	0.08	0.15	0.17	0.24	0.14
Principal repayment / Annual budget expenditure	2.5-4.0	2.1	2.1	2.2	2.8	3.6
Average Time to Maturity		9 years 1 month	8 years 9 months	8 years 9 months	9 years 2 months	9 years 2 months**
10-year government bond yields*		1.6	2.4	2.7	2.7	1.6

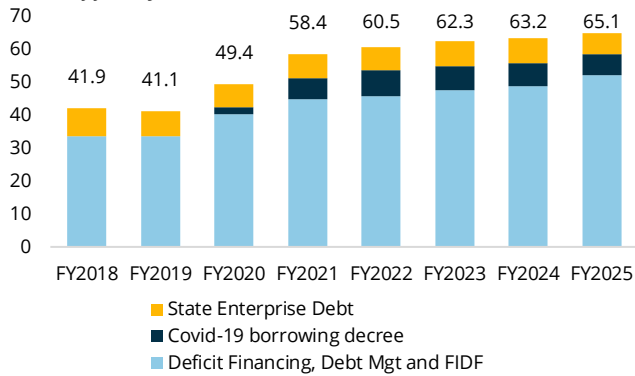
Note: *average of the period, **PDMO website, December 2025

Source: Public Debt Management Office, Ministry of Finance; World Bank staff calculations.

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Figure 34: Public debt increased but remained sustainable

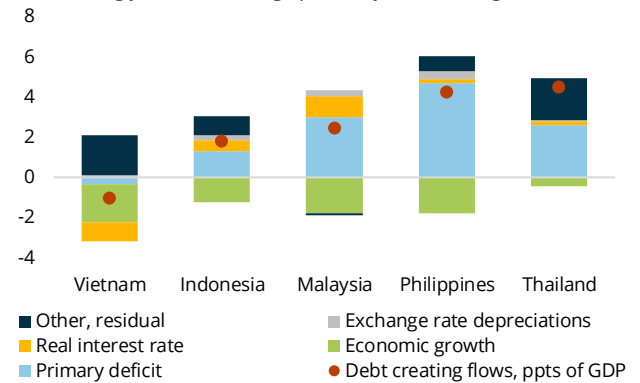
(Percent of fiscal year GDP)



Source: PDMO, World Bank staff calculation.

Figure 35: Increased public debt was driven by fiscal deficit financing and subdued growth

(Debt-creating flows, Percentage points of GDP, average 2020-24)

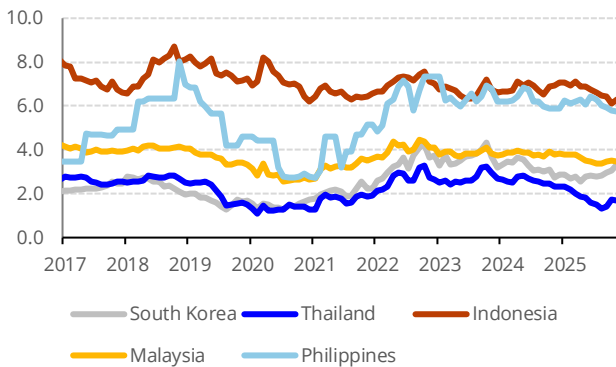


Note: The real interest rate effect includes the effect of changes in the nominal interest rate and inflation rate.

Source: World Bank staff calculation.

Figure 36: 10-year government bond yield was the lowest among ASEAN peers

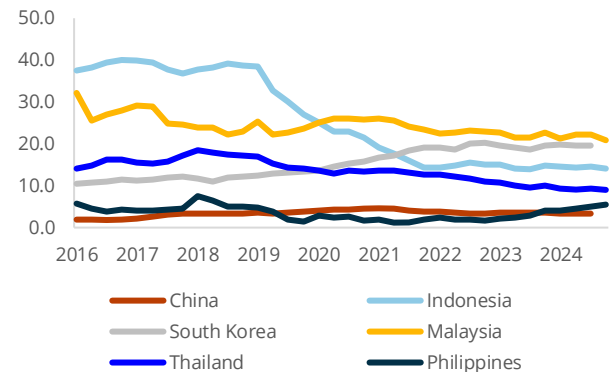
(Percent)



Source: CEIC, World Bank staff calculation.

Figure 37: Foreign holding of local currency government debt remained low relative to peers

(Percent of total LCY government debt)



Source: Haver analytics; IIF; Asianbonds online, World Bank staff calculation.

Box 3: Thailand's Co-payment Consumption Stimulus: Promoting Tax Registration and Digital Adoption for Micro-Retailers

The consumption stimulus program is expected to deliver a short-term boost, while also promoting tax registration and digital adoption. The stimulus program provides semi-targeted support to around 33 million Thais, including 13 million Social Welfare Card (SWC) holders who will receive a THB 1,700 transfer (on top of their existing THB 300), and about 20 million participants under the Khon La Krueng Plus (Co-payment Plus). The Khon La Krueng Plus (Co-payment Plus) scheme delivers consumption support on a broad, non-means-tested basis. Running from October to December 2025, the program provides a 50 percent subsidy for everyday spending at registered local micro-retailers through the government's digital wallet, with design features that steer spending toward small vendors rather than large stores. An accompanying Upskill/Reskill component further supports digital capability and productivity among micro-SMEs.

Earlier versions of the co-payment program were implemented during the COVID-19 pandemic in 2021–2022, where they were effective in expanding the use of digital payments through the “Pao

Box 3: Thailand's Co-payment Consumption Stimulus: Promoting Tax Registration and Digital Adoption for Micro-Retailers

Tang” application. Evidence in Muthitachoen (2023)¹³ suggests that these earlier versions supported the living cost of individuals, boosted sales of the participating vendors, and promoted the adoption of digital payments. The findings indicate that the program (1) expanded the customer base, (2) had a proportionally larger impact on smallest vendors, and (3) exhibited persistent positive effects beyond the program’s duration, as participating vendors continued to experience higher sales. The appeal of the co-payment scheme is associated with the provision of positive incentives to increase tax compliance through formalization. This reduces the reliance on the more traditional means, such as penalties and audits, which are often more costly and difficult to implement in an economy composed of many micro-retailers. Consumers are essentially becoming auditors who promote registration and formalization in the economy.

Experience in the use of electronic consumption programs in other countries indicates significant potential in the fight against informality, but effectiveness requires careful design and full utilization of the generated information.¹⁴ These programs have gained popularity globally in recent years because of the increasing use of electronic payments by consumers, which governments can utilize to increase participation and improve targeting. The data is generated in real-time, thus enabling automatic pre-filing of tax forms and cross-checking of incomes. In the Thai co-payment program, the tax authorities can have precise knowledge of the location, time and amounts of spending, which provides valuable information for checks as well as macroeconomic forecasting. Going forward, the proper and timely use of the data generated by the tax authority, as well as the administrative structure that will enable cross-checks and pre-filing of information, are crucial elements for the increase in tax revenue and for formalization improvements.

¹³ Muthitachoen, Athiphat (2023). Digital Fiscal Stimulus and SMEs: Insights from Thailand's Half and Half Program, CESifo Working Paper, No. 10711, Center for Economic Studies and ifo Institute (CESifo), Munich

¹⁴ Examples of such programs using electronic payments and electronic registration for tax rebates and tax lotteries can be found in Brazil (Naritomi, J., Consumers as Tax Auditors, American Economic Review, 2019), Mongolia (Nyamdavaa, T., Does consumer monitoring reduce corporate tax evasion along the supply chain? Evidence from Mongolia, 2022), Greece (Nicolaidis, P., Characteristics and responses of winners in the Greek tax lottery, International Tax and Public Finance, 2025), Uruguay (see Brockmeyer, A., and Somarriba, M., S., Electronic payment technology and tax compliance: Evidence from Uruguay’s financial inclusion reform, American Economic Journal: Economic Policy, 2025).

2. Outlook and Risks



i. The Thai economy is expected to decelerate further as domestic and global headwinds intensify

The global economy has shown considerable resilience to heightened trade tensions and policy uncertainty.

In 2025, the stockpiling of traded goods provided a boost to activity, helping mute the initial drag from increased trade barriers. Risk appetite in financial markets was robust, while a surge in spending on artificial intelligence (AI) lifted investment. In 2026, global trade growth is set to weaken markedly, as the front-loading that supported trade in 2025 fades (*World Bank Global Economic Prospects, January 2026*). The weakening of global trade and a slowdown in some major economies are also expected to weigh on demand for energy and industrial commodities. The price of Brent crude oil averaged \$68 per barrel in 2025 and is projected to fall to \$60 per barrel in 2026 (*World Bank [Commodity Markets Outlook, October 2025](#)*).

The growth of Thailand's major trading partners is projected to slow

In the United States, growth is projected to reach 2.2 percent in 2026, up from an estimated 2.1 percent in 2025. While elevated tariffs are expected to increasingly weigh on consumption and investment, their impact is likely to be partly offset by the extension of tax breaks and other measures in the U.S. budget adopted in mid-2025. In 2027, U.S. growth is expected to ease to 1.9 percent as the drag from tariffs and policy uncertainty persists, along with the waning boost from past monetary easing and budget measures. In China, growth is expected to slow to 4.4 percent in 2026, as subdued consumer confidence, the prolonged property sector downturn, and a softer labor market weigh on consumption and investment. In EAP excluding China,

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growth is projected to also moderate from 4.6 percent to 4.5 percent in 2026, to then strengthen to 4.7 percent in 2027, as policy support helps to offset the waning contribution of net exports.

Thailand's growth is projected to slow to 1.6 percent in 2026 amid weaker exports and soft domestic demand, before rebounding to 2.2 percent in 2027 as exports and investment recover.

Growth is projected to slow from an estimated 2.2 percent in 2025 to 1.6 percent in 2026 amid intensifying global and domestic headwinds. The deceleration reflects weaker export growth following the unwinding of front-loading in 2025, alongside slowing domestic demand and subdued tourism recovery. Private consumption is expected to moderate due to household deleveraging, though fiscal stimulus will provide some cushioning. Private investment is also projected to weaken in 2026, amid heightened global uncertainty and domestic political uncertainty in an election year. In 2027, growth is expected to rebound to 2.2 percent as goods exports normalize and private consumption and investment strengthen, supported by a more positive FDI outlook.

Table 2: Growth is projected to slow significantly in 2026 as goods exports slow

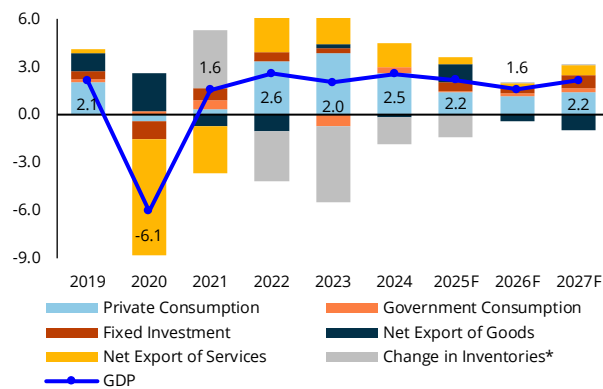
Percentage change	Share of GDP, percent 2024	Forecast				Contribution to GDP growth		
		2024	2025e	2026F	2027F	2025e	2026F	2027F
GDP	100	2.5	2.2	1.6	2.2	2.2	1.6	2.2
Private Consumption	60	4.4	2.4	1.9	2.3	1.4	1.2	1.4
Government Consumption	15	2.5	0.3	1.3	1.9	0.0	0.2	0.3
Fixed Investment	24	0.0	2.4	1.2	3.3	0.6	0.3	0.8
GFCF-Private	18	-1.6	1.6	0.9	3.7	0.3	0.2	0.6
GFCF-Public	6	4.8	4.7	2.0	2.4	0.3	0.1	0.2
Exports of Goods and Services	68	7.8	8.9	1.4	2.7	6.5	1.1	2.1
Exports of Goods	59	4.5	10.8	0.5	2.4	6.4	0.3	1.5
Exports of Services	14	25.7	1.0	5.2	4.0	0.1	0.7	0.6
Imports of Goods and Services	64	6.3	7.2	1.6	3.4	4.9	1.1	2.4
Import of Goods	54	5.3	9.7	1.2	4.3	5.3	0.7	2.5
Imports of Services	14	11.1	-2.3	3.0	-0.3	-0.3	0.4	0.0
Net Export of Goods and Services						1.6	-0.1	-0.4
Change in Inventories*						1.1	-0.4	-1.0
		2024	2025e	2026F	2027F			
Exports of Goods, USD term		5.8	11.4	0.8	2.7			
Imports of Goods, USD term		6.3	12.0	1.4	4.2			
Goods trade Balance, USD Billion		19.3	19.7	17.5	13.3			
Current Account Balance, USD Billion		11.1	12.2	11.8	11.0			
Current Account Balance (percent of GDP)		2.1	2.1	2.0	1.8			
Headline CPI		0.4	-0.1	0.7	1.7			

Note: *including statistical discrepancies.

Source: NESDC, Haver Analytics; World Bank staff calculations.

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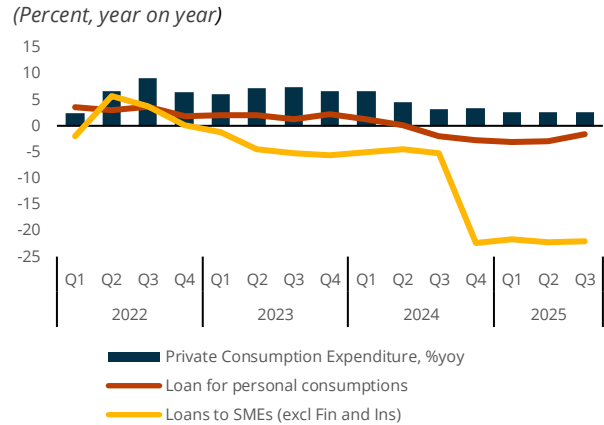
Figure 38: Growth in 2026 is estimated to reach 1.6 percent, before improving to 2.2 percent in 2027
(Percent)



Note: *including statistical discrepancy.

Source: World Bank staff projections.

Figure 39: Private consumption will continue to be limited by stringent loan approvals
(Percent, year on year)



Source: CEIC

Severe flooding across southern provinces has disrupted livelihoods and economic activity, causing significant asset losses and are expected to weigh on short-term consumption and regional GDP.

The floods in nine southern provinces, including Songkhla, Nakhon Si Thammarat, Phatthalung, Surat Thani, Narathiwat, Pattani, Trang, Satun, and Yala, triggered by a “one-in-200-years” event in November 2025, have severely disrupted livelihoods and local economic activity. Widespread flooding of homes, commercial buildings, retail shops, service establishments, hotels, and industrial facilities resulted in significant asset losses. The affected provinces together account for 5 percent of Thailand’s GDP, with Songkhla as the largest (1.4 percent). Disruptions to retail trade, tourism, logistics, and small businesses are expected to weigh on short-term consumption and regional GDP. The severity of physical and economic damage suggests a prolonged recovery, particularly for SMEs and liquidity-constrained households. Thai authorities estimate the economic cost of the floods at 0.1–0.2 percent of GDP.

In 2026, goods export growth is projected to slow significantly, due to shifts in global trade policy, although continued demand for electronics-related products will help cushion the impact.

In 2025, exports grew by 12.7 percent in US-dollar terms, driven by front-loaded shipments ahead of the entry into force of US reciprocal tariffs and strong global demand for high-technology products. As these one-off effects unwind, goods exports are projected to contract in 2026. Although Thailand’s average tariff exposure is lower than the headline 19 percent — reflecting its specialization in electronics and semiconductors, which are largely exempt—it remains vulnerable due to the country’s sizeable export base in automobiles and automotive components (Figure 40). Despite of the possible direct impact of the new US tariffs, given Thailand’s high degree of export reliance and its strong trade linkages with the US, exports to the US remained strong both for technology related and other goods (Figure 41 and Figure 42).

On the upside, continued growth in high-technology electronics exports, supported by rising global demand for artificial intelligence (AI), high-performance computing, and cloud-infrastructure hardware (Figure 43) are expected to support export growth. The global manufacturing cycle has also shown signs of stabilization, with the Global Manufacturing Purchasing

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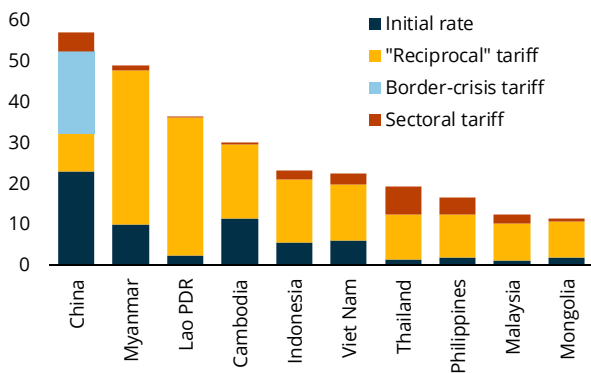
Managers' Index (PMI) remaining in expansionary territory in November 2025 (Figure 44).

Domestic manufacturing is likely to remain under pressure.

Manufacturing production is expected to continue contracting as weaker exports and softening confidence continue to weigh on private consumption and investment. Recent global trade policy changes also raise the risk of trade diversion, potentially increasing competition from lower-priced imports and transshipment. While consumers may benefit, domestic producers could face growing pressures to maintain competitiveness. This pattern has already emerged in recent years, with exports and consumption growing even as manufacturing output declined (Figure 45).

Figure 40: Initial tariff barriers applied by US and increments in 2025

(Percent in, 2025)

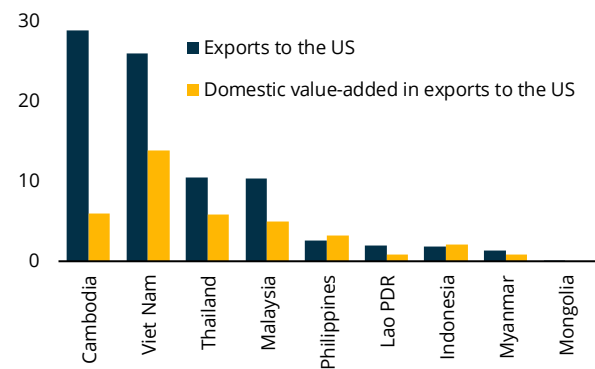


Note: the average tariff rates applied by the US, weighing by shares of each product in exports to the US in 2024.

Source: EAP update October 2025

Figure 41: The Thai economy is exposed to changes in US trade policy

Exports and value-added in exports to the US, Percent of GDP

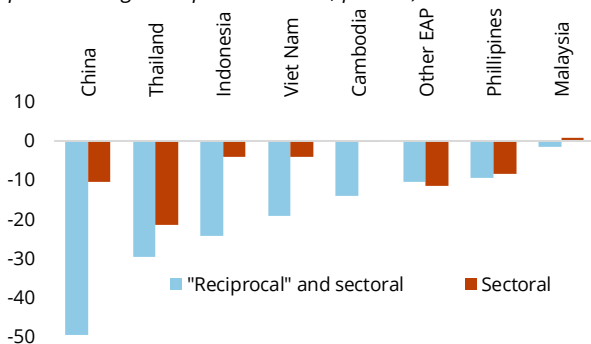


Note: Domestic value-added exports show 2022 data

Source: EAP update October 2025

Figure 42: Higher US tariffs are likely to hurt exports

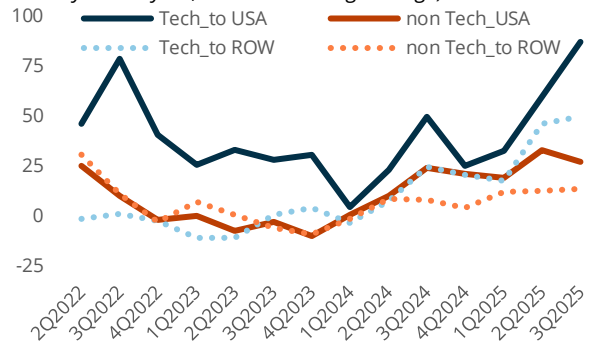
(Expected change in exports to the US, percent)



Source: EAP update October 2025

Figure 43: Hi-tech exports to the United States and other markets saw solid growth, driven by a global technology upcycle

(Percent year-on-year, 3-month moving average)



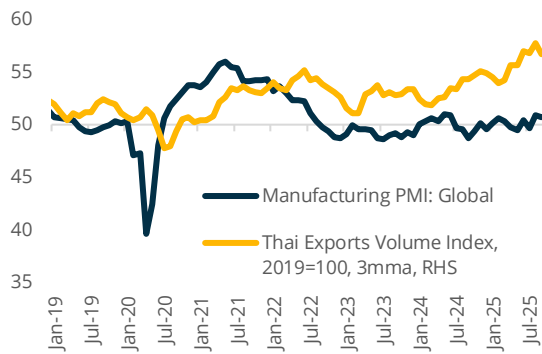
Note: Tech exports include Electronics & Semiconductors, Computers & Data Storage, Telecommunication Equipment, Electrical Machinery and appliances, EV-Related Electronics, Optical & Precision Instruments, and Industrial Automation

Source: Trademap; World Bank staff calculation.

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Figure 44: Global Purchasing Manager Index remained positive

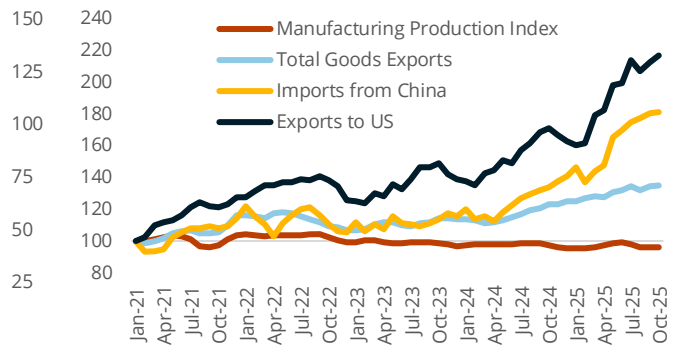
(LHS: Diffusion Index; RHS: Percent year-on-year)



Source: CEIC; S&P Global; World Bank staff calculation.

Figure 45: Increase in exports have been partly driven by imports from China

(2021=100, 3mma)



Source: CEIC; World Bank staff calculation.

Tourism recovery is expected to remain slow through 2026–27, with arrivals remaining below pre-pandemic levels over the forecast period.

Tourist arrivals are estimated to have contracted by 7.2 percent in 2025, reaching 33 million, largely due to a sharp fall in tourists from China. Chinese arrivals have fallen by 33.7 percent in 2025, reflecting safety concerns, economic factors, shifting travel preferences, the appreciation of the Thai baht, and growing competition from destinations like Japan, Viet Nam, and the Republic of Korea (Figure 47). In 2026, total arrivals are expected to reach 35.0 million, or about 88 percent of the pre-pandemic 2019 level (Figure 46). In 2027, total arrivals are expected to reach 36.6 million. A one-million increase in foreign tourist arrivals is estimated to contribute 0.2 percentage points to GDP growth—lower than pre-pandemic levels—due to declining spending per visitor, which fell to THB 44,091 in Q2 2025.

The government's efforts to restore traveler confidence in response to recent security concerns can support the tourism recovery.

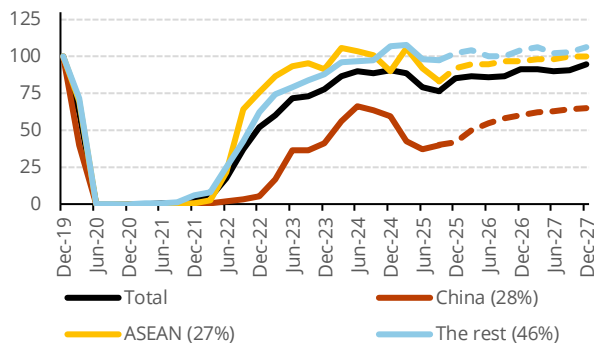
Stricter immigration measures included targeting the misuse of tourist visas potentially linked to cybercrime and money laundering. Thailand's Immigration Bureau (IMM) has introduced measures such as stricter screening of visa-exempt travelers with frequent entries and exits¹⁵, blocking re-entry of individuals on watchlists near areas known for scam operations, tightening approvals for temporary stay extensions, and conducting nationwide crackdowns on overstay cases.

¹⁵ Anyone using visa-free entry for more than twice without a valid explanation may be denied entry and required to apply for the correct visa type. Since early 2025, about 2,900 such individuals have already been refused entry at airports.

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Figure 46: Tourist arrivals are projected to reach pre-pandemic levels only by Q4 2027

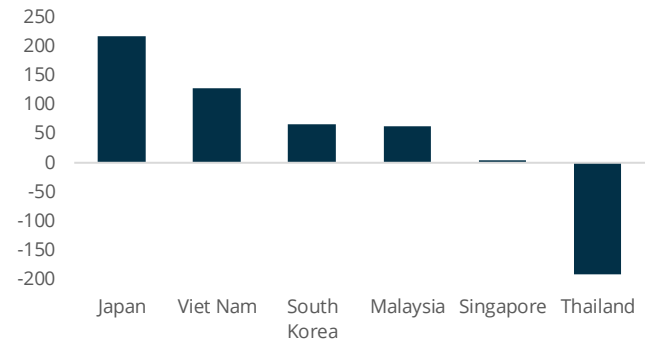
(Percent of pre-pandemic level in 2019)



Source: CEIC; World Bank staff projection.

Figure 47: Chinese tourists arrivals declined in the first ten months of 2025, reflecting a shift to other major Asian destinations

(Change in monthly Chinese tourists, Jan-Nov 2025 versus 2024)



Note: Changes in Malaysia as of August

Source: CEIC; World Bank staff calculation.

The current account surplus is projected to narrow slightly due to weakening global trade in goods.

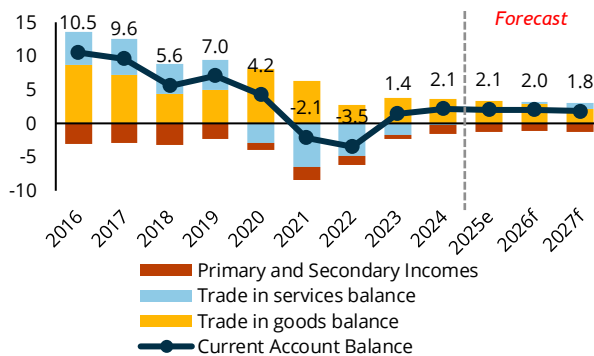
The current account balance is expected to decline slightly to 2.0 percent of GDP in 2026, down from 2.1 percent of GDP in 2025, reflecting a narrower goods trade surplus (Figure 48). Weakening goods exports due to elevated global trade policy uncertainty and slowing global trade will contribute to decline in goods trade balance surplus. However, falling oil import bills and improving services trade balance are projected to support the current account surplus.

Headline inflation is expected to rise as food and core prices recover, while energy prices decline and monetary policy remains accommodative.

Headline inflation is projected to increase from -0.1 percent last year to 0.7 percent in 2026 and return to the BOT's target range of 1-3 percent by Q3 2026 (Figure 49). The increase reflects the recovery of food and core prices from last year's contraction, supported by cost-of-living measures such as the co-payment program (Half-Half Plus). In contrast, energy prices are expected to decline further, with falling global oil prices and additional subsidies for electricity and transport fuels. Inflation is projected to further rise to 1.7 percent in 2027 as the domestic demand recovers. With elevated domestic and external uncertainty, as well as fading inflationary pressures, the monetary stance is projected to remain accommodative in 2026.

Figure 48: The current account surplus will remain well below pre-pandemic levels

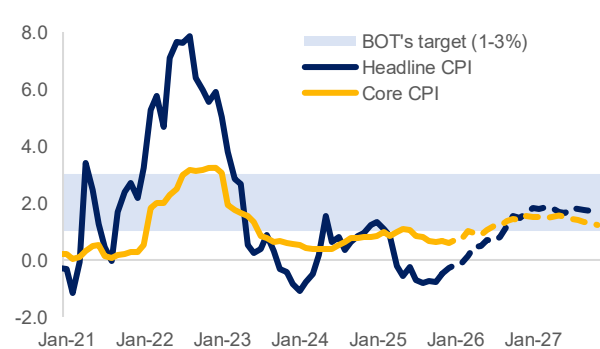
(Percent of GDP)



Source: CEIC; World Bank staff projection.

Figure 49: Headline inflation is projected to return to BOT's target range of 1-3 percent by Q2 2026

(Percent of GDP)



Source: CEIC; World Bank staff projection.

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Fiscal policy is expected to remain expansionary to support growth.

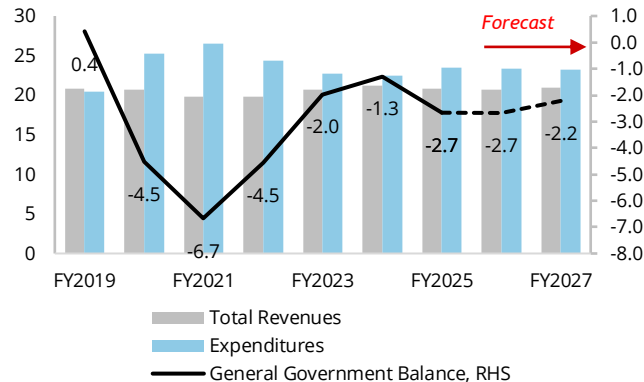
The general government deficit (GFS basis) is projected to remain broadly unchanged at 2.7 percent of GDP in FY 2026 (October 2024-September 2026). Revenue is expected to remain broadly stable as a share of GDP. Fiscal policy will remain expansionary as spending pressures persist, with the deficit significantly above pre-pandemic levels to support the economy's slow recovery.

Public debt will continue to rise but remain below the 70 percent debt ceiling over the medium term.

Amid a persistent fiscal deficit and slow post-pandemic output growth, public debt is projected to rise further, reaching 68.7 percent of GDP by 2027 (Figure 50). Over the medium term, without revenue mobilization reforms and improved spending efficiency, public debt levels could become more difficult to sustain. As recognized by the government's medium-term fiscal framework (FY 2026-2030), a gradual deficit reduction will be needed over the medium term to preserve fiscal sustainability (See Box 4). The fiscal costs and risks associated with public debt at above 60 percent of GDP are higher than what Thailand was exposed to before the pandemic. Key risks include: i) an increase in future interest costs on public debt (with the potential to crowd out other public spending); ii) higher rollover risks associated with a larger stock of maturing debt; iii) elevated risks of an adverse shift in interest rates (due to higher risk premia) and/or growth, which would make it more difficult to maintain debt sustainability; and iv) reduced fiscal space available to respond to future economic shocks (Thailand PRSA, 2023).

Figure 50: The general government deficit is projected to remain persistent in FY 2026 ...

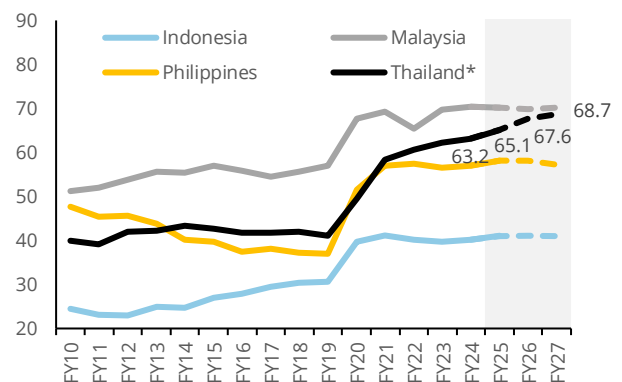
(Percent of GDP, GFS basis)



Source: FPO; World Bank staff projections.

Figure 51: ... and public debt is projected to increase

(Percent of GDP)



Source: IMF WEO; *World Bank staff projections.

Box 4: The 2026–2030 Medium-Term Fiscal Framework (MTFF): A Pathway for Fiscal Consolidation

The revised [2026–2030 Medium-Term Fiscal Framework \(MTFF¹⁶\)](#) from November 2025 brings forward the timeline for fiscal consolidation, targeting a fiscal deficit below 3 percent of GDP by 2029. The updated MTFF aims to align fiscal decisions with national development strategies while safeguarding macro-fiscal sustainability. It sets out needed reforms across revenue, expenditure, and fiscal discipline instruments, with a focus on improving allocative efficiency, strengthening long-term competitiveness, and supporting inclusive and climate-responsive growth.

This signals that the government is moving in the right direction, as the publication of the MTFF reflects a clear intention to preserve fiscal sustainability and enhance transparency. However, translating plans into concrete fiscal reforms will require careful design with support from strong institutions to limit adverse economic impacts, generate efficiency gains, and ensure fairness Thailand (see [PRSA 2023](#)). Key reforms from the 2026–2030 MTFF include:

- **Tax policy & administration reforms**
 - Gradually restore VAT to the statutory rate, raising to 8.5 percent in FY 2028 and returning to 10 percent in FY 2030, with targeted support for vulnerable households;
 - Rationalize inefficient tax incentives and expand carbon taxation as part of green fiscal reforms;
 - Broaden the tax base through digitalization, big-data-driven compliance, and stronger tax administration.
- **Expenditure & budget efficiency measures**
 - Pursuing a pro-growth budget aligned with the National Strategy, 13th National Economic and Social Development Plan (NESDP), Sustainable Development Goals (SDGs), climate goals, and Gender Responsive Budget (GRB);
 - Improve public-sector efficiency through project streamlining, digitalization, and performance-based budgeting;
 - Reduce operating costs (e.g., energy efficiency and ESCO models) and contain personnel, welfare, and health-care spending through cost control and prevention.
- **Fiscal rules & quasi-fiscal controls (Section 28 of the Fiscal Sustainability Act):** Strengthening discipline on quasi-fiscal operations by capping Section 28 commitments at 32 percent of the annual budget, restricting approval of non-productive grant-style subsidies, particularly those in agriculture that do not raise productivity, and reinforcing ex-ante approval and oversight.

Additionally, to improve fiscal transparency and monitoring of fiscal policy effectiveness, for the first time, the government published a report of tax expenditure for the major tax incentives, including BOI promotion policies and import tax incentives. In 2023, the total tax expenditure amounted to THB 269 billion (1.5 percent of GDP), 0.1 ppts higher than in the previous year.

¹⁶ Thailand MTFF serves as the master plan for fiscal and budget management, linking the 30-year National Strategy with fiscal planning, budget proceedings, and public debt administration. Thailand has elevated its Medium-Term Fiscal Framework (MTFF) to sit firmly within a legislative structure and strengthened its top-down budgeting approach by expanding the responsibilities of the Budget Bureau. Under the 2018 Fiscal Responsibility Act (FRA), Section 13 establishes the Fiscal Policy Committee, the Fiscal Policy Committee—chaired by the Prime Minister and comprising the Budget Bureau, Ministry of Finance (MoF), Bank of Thailand (BOT), and the National Economic and Social Development (NESDC) Council. The Committee is mandated to oversee fiscal policy management, including preparing and revising the MTFF and setting fiscal rules ([IMF 2024](#)).

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Box 4: The 2026–2030 Medium-Term Fiscal Framework (MTFF): A Pathway for Fiscal Consolidation

Budget Structure (THB million)	Actual	Medium Term Fiscal Projections (based on MTFF 2026-2030)				
	FY2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Total Revenues	2,821,730 [14.9]	2,920,600 [15]	3,000,000 [14.9]	3,145,000 [14.9]	3,274,000 [14.9]	3,422,000 [15.0]
Total Expenditures	3,723,068 [19.7]	3,780,600 [19.5]	3,788,000 [18.8]	3,826,000 [18.2]	3,864,000 [17.6]	3,903,000 [17.1]
Fiscal Surplus/Deficit	-901,338 [-4.8]	-860,000 [-4.4]	-788,000 [-3.9]	-681,000 [-3.2]	-590,000 [-2.7]	-481,000 [-2.1]
Public Debt** (PDMO projection)	65.1	68.2	69.4	69.8	69.5	68.2

Note: *share of GDP in parenthesis. GDP is based on World Bank projections, **PDMO projection

Source: FPO, World Bank staff calculation

ii. The Thai economy faces external and internal risks

Risks to the global outlook remain tilted to the downside.

Further escalation of trade tensions could weigh on Thailand's exports and business confidence, dampening private investment, domestic production, and employment. Weaker-than-expected growth in major economies, particularly the United States and China also pose additional risk to demand for Thai exports. In addition, geopolitical tensions can also exert pressure on prices of oil and other critical commodities due to supply disruptions. On the upside, easing trade tensions on the back of ongoing negotiations could help limit trade disruptions and strengthen business and consumer confidence.

Thailand's tourism recovery faces risks from persistent safety concerns and changing travel preferences.

Thailand's tourism recovery faces the risk of losing momentum due to a decline in Chinese and ASEAN tourist arrivals, driven partly by recent natural disasters such as the March 2025 earthquake and the November 2025 floods. More persistent concerns, including safety issues and shifting travel preferences, may have longer-lasting structural effects and will require targeted policy responses. Sustaining the recovery will depend on Thailand's ability to restore traveler confidence while promoting connectivity to secondary destinations and sustainable tourism development (Box 5).

Domestic political uncertainty remains a key downside risk, while stronger FDI inflows pose an upside risk.

Delays to form a new government after the February 2026 elections, could slow approval and execution of the FY2027 budget, especially for public investment¹⁷, creating execution bottlenecks for infrastructure projects and dampening private sector confidence. Conversely, the recent surge in approved FDI in strategic sectors, could support stronger-than-expected investment growth over the medium-term.

¹⁷ Thailand has experienced such situation before; for example, after the 2019 general election, the extended period required to form a coalition government delayed the FY2020 budget approval by five months.

iii. Policy can pivot towards targeted resilience and growth-enhancing investments

Recent sovereign outlook revisions underscore the urgency of credible fiscal consolidation and raising the growth.

While Thailand retains its investment-grade rating (BBB+/Baa1), the recent revision of the sovereign outlook to Negative by key rating agencies signals growing unease regarding Thailand's medium-term fiscal and growth trajectory. The divergence between Thailand's fiscal path and its pre-pandemic norms is becoming structurally entrenched. Despite the ongoing cyclical recovery, the fiscal deficit remains elevated at 4.5 percent of GDP (FY2025/26), driven largely by untargeted consumption stimulus measures that have yielded limited multipliers in a high-household-debt environment. Medium-term growth has fallen below 2.7 percent.

The narrowing fiscal space leaves the economy exposed to future shocks.

Public debt is projected to test the 70 percent of GDP ceiling absent significant policy reforms. This accumulation limits the government's capacity to respond to looming structural headwinds, particularly climate-related disasters and the fiscal costs of an aging society. Without a concrete roadmap to reduce the primary deficit, Thailand risks a higher risk premium on its sovereign bonds, which would crowd out public investment needed to upgrade digital and physical infrastructure.

Policy can pivot from broad stimulus to targeted resilience.

To revert the outlook to "Stable" and secure long-term growth, policymakers can consider a three-pronged consolidation strategy:

1. **Revenue Mobilization:** Transitioning away from one-off non-tax revenue measures toward permanent structural reforms, including a gradual, communicated increase in the VAT rate and a review of inefficient tax expenditures.
2. **Expenditure Efficiency:** Replacing universal cash transfers with **targeted social assistance** using the new social registry databases. This maximizes poverty alleviation and offsets the impact of VAT on households while reducing the overall fiscal burden.
3. **Growth-Enhancing Investment and Reforms:** Reallocating from consumption subsidies into high-multiplier public investments—specifically in human capital, transportation links to connect lagging regions, and secondary city infrastructure—to unlock a higher growth path. Reforms to strengthen competition policy and modernize the services sector can attract new private investment, technology and innovation into rising high-yield sectors such as green manufacturing and digital services (see Chapter 2 and *Thailand Economic Monitor* July 2025). In parallel, education and labor market reforms can create better jobs.

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Addressing Thailand's foundation for growth and jobs will require a coordinated reform package anchored on competition, skills, and fiscal rebalancing.

First, strengthening **competition**—particularly in services, digital infrastructure, logistics, and other backbone sectors—is essential to improve productivity, unlock domestic and foreign investment in high-return activities, and reduce regulatory barriers that currently hinder market entry, scaling, and innovation.

Second, upgrading **skills** must become a national priority, with a shift toward industry-aligned training, reskilling, and technical programs that equip workers for fast-growing sectors such as EVs, advanced electronics, digital services, and green manufacturing (see Chapter 2 and *Thailand Economic Monitor* July 2025). Education-spending reforms—highlighted in the World Bank's Thailand PRSA (2023)—are needed to improve efficiency and reallocate resources toward quality learning and stronger foundational skills, helping ensure workers can adapt to rapidly changing labor-market demands. This is especially critical given the widening mismatch reflected in rising “quasi-unemployment” in rural areas and vacancies in high-skill jobs.

Third, **fiscal rebalancing** is needed to rebuild space and revert the outlook to “Stable” while supporting growth: this includes gradually reducing the deficit in line with the Medium-Term Fiscal Framework, prioritizing efficient public investment and targeted social protection over broad subsidies and consumption transfers, and broadening the revenue base—including through improved tax administration and potential VAT normalization. Taken together, these reforms would help realign capital toward productive sectors, strengthen household and labor-market resilience, and position Thailand to capture emerging opportunities in green and technologically advanced industries.

Box 5: Beyond Arrivals—Decomposing the Structural Decline in Thailand's Tourism Revenue

Thailand's tourism recovery presents a paradox: crowds have returned but revenue has stagnated. International arrivals in 2024 rebounded to 89 percent of pre-pandemic levels, while real tourism receipts stagnated at only 75.5 percent, resulting in a 15.1 percent drop in revenue per visitor. A decomposition of this revenue shortfall points to weakening domestic competitiveness, offsetting the benefits of external economic tailwinds. Between 2019 and 2024, the decline in Thailand's infrastructure quality—especially ground and port connectivity—combined with weaknesses in the enabling environment each contributed about –22 percent to the revenue contraction. These domestic factors largely offset +15 percent competitive gain from a weaker currency. Critically, the analysis shows that without the boost from the global economic recovery—worth about +32 percent—Thailand's tourism revenue decline would have exceeded 50 percent, instead of the observed 24.5 percent.

The erosion of revenue quality reflects missed opportunities to diversify into higher-return segments of the tourism economy. Econometric estimates (Annex B) indicate that improvements in natural and cultural resources (including business travel facilities) generate a long-run revenue multiplier of 0.77—more than double the impact of infrastructure investments (0.37). Thailand's progress on cultural resource development has stagnated facing a critical gap in business travel infrastructure compared to regional peers such as Singapore and Japan. Furthermore, the enabling environment has weakened most notably through a decline in safety and security, where Thailand now ranks the lowest among key competitors. The structural shift toward lower-value segments

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Box 5: Beyond Arrivals—Decomposing the Structural Decline in Thailand’s Tourism Revenue

renders the sector increasingly vulnerable to external shocks, as the “volume-over-value” model lacks the pricing power to absorb economic volatility.

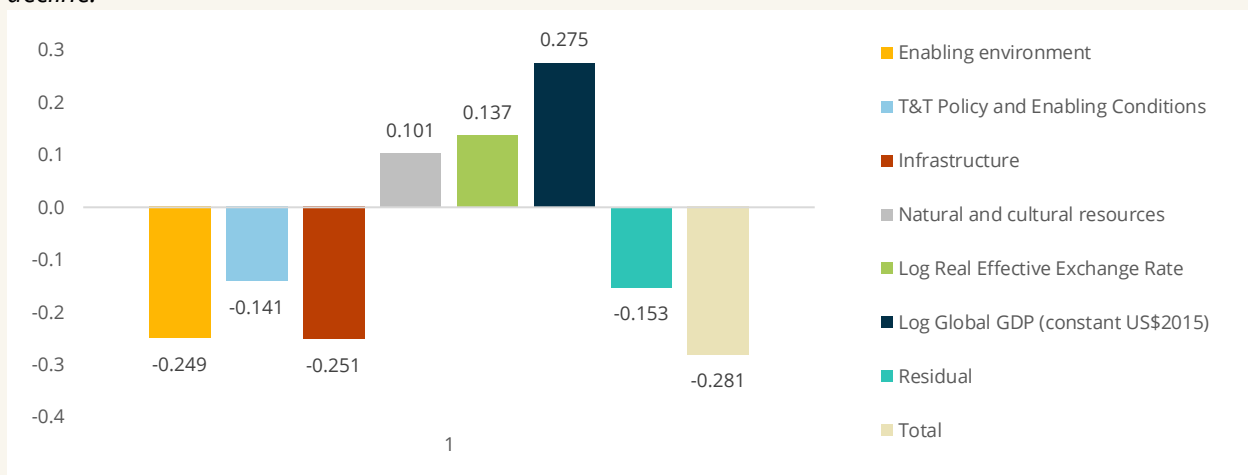
Looking forward, scenario simulations underscore the urgency of policy recalibration. While a baseline projection shows a 5.1 percent growth in 2025 tourism receipts driven by global momentum and return to pre-covid tourism arrivals in 2027, the sector remains highly sensitive to competitiveness and currency risks. A simulation combining a 7 percent real appreciation of the Baht with a moderate (0.5 standard deviation) further decline in safety standards results in a 3.5 percent revenue contraction—an 8.5 percentage point decline relative to the baseline. To secure sustainable growth, public investment must pivot away from generic infrastructure expansion toward high-multiplier interventions: upgrading safety protocols, professionalizing cultural heritage management, and developing world-class business travel facilities.

Factor	Impact on Revenue	Explanation
Global Economy	POSITIVE (+)	Global recovery acted as a life-raft, preventing a much deeper recession.
Exchange Rate	POSITIVE (+)	A weaker Baht made Thailand cheaper for tourists, boosting demand slightly.
Government Policy	NEGATIVE (-)	Declining prioritization of tourism and outdated policies hurt growth.
Safety & Environment	NEGATIVE (-)	Major Drag: Worsening safety rankings and health standards drove high-value tourists away.
Infrastructure	NEGATIVE (-)	Major Drag: Degradation in ground transport (roads/buses) and ports reduced accessibility.
Net Effect	DECLINE	Domestic failures overwhelmed global benefits, causing a ~25 percent total revenue drop.

Source: World Bank Staff estimates based on WEF and UNWTO data

Figure Box 5.1: What is Driving the Decline in Tourism Revenue? (2019–2024)

This chart breaks down the 24.5 percent drop in real revenue. It shows that strong global economic conditions supported growth, while domestic issues (Safety & Infrastructure) were the primary causes of decline.



Source: World Bank Staff simulations

Part 1. Recent Economic Developments and Outlook: Slower Growth, Rising Risks

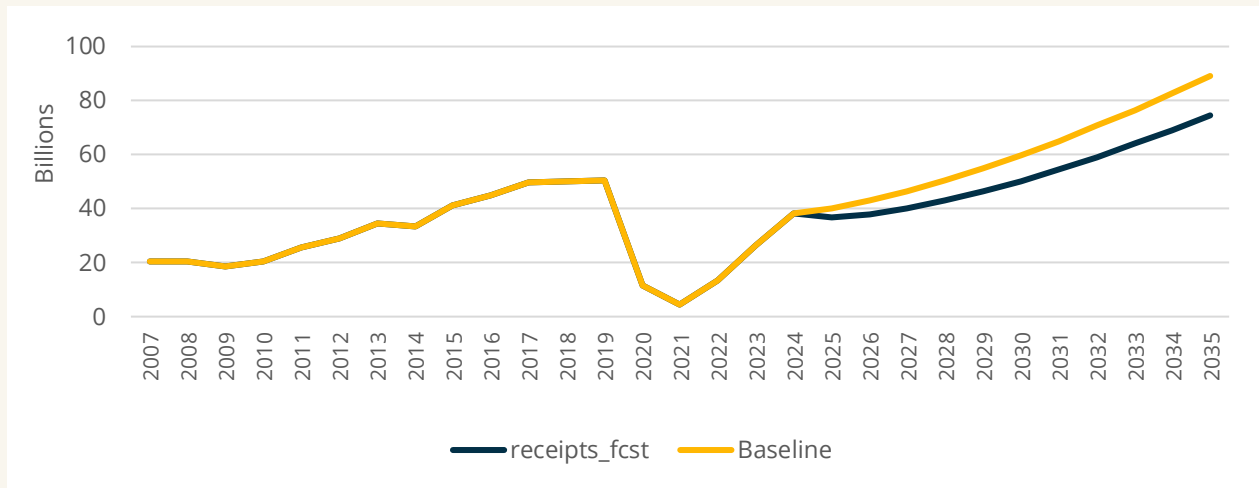
Box 5: Beyond Arrivals—Decomposing the Structural Decline in Thailand’s Tourism Revenue

Figure Box 5.2: Growth vs. Contraction Scenarios in Thailand’s International Tourism Receipts (constant 2015 USD)

The "Shock Scenario" simulates what would happen if the Baht appreciates (7 percent appreciation) and safety rankings drop slightly further.

Baseline Scenario: +5.1 percent Growth (If conditions remain stable)

Shock Scenario: -3.5 percent Contraction (If currency strengthens + safety worsens)



Source: World Bank Staff simulations

Part 2. Advanced Green Manufacturing for a Competitive Thailand



1. Introduction

Thailand's export-oriented industrialization growth model has delivered substantial gains but now needs new engines of growth.

Rapid growth during 1980–1996 was driven by structural transformation, as labor shifted from low-productivity agriculture into higher-productivity manufacturing and services. Thailand benefited strongly from globalization, with the trade-to-GDP ratio nearly tripling, from 54 percent in 1980 to 137 percent in 2024. Since the mid-2010s, however, external and domestic headwinds have increasingly constrained Thailand's growth model. Structural transformation¹⁸ has stalled. The creation of high-quality jobs in manufacturing and modern services has plateaued and further declined since 2021, while employment has increasingly expanded in lower-productivity traditional services.¹⁹ Around 30 percent of the labor force remains in agriculture, despite the sector accounting for only 8 percent of GDP. As a result, Thailand's GDP growth has slowed to a post-pandemic average of 2.1 percent, roughly half the East Asia and Pacific average. Looking ahead, sustaining convergence and achieving Thailand's high-income ambitions by

¹⁸ Structural transformation refers to the long-run reallocation of economic activity and factors of production from low-productivity toward higher-productivity sectors.

¹⁹ High-quality job is defined as wage and salaried workers; low productivity traditional services include traditional wholesale/retail trade, transport& storage, and accommodation & food services.

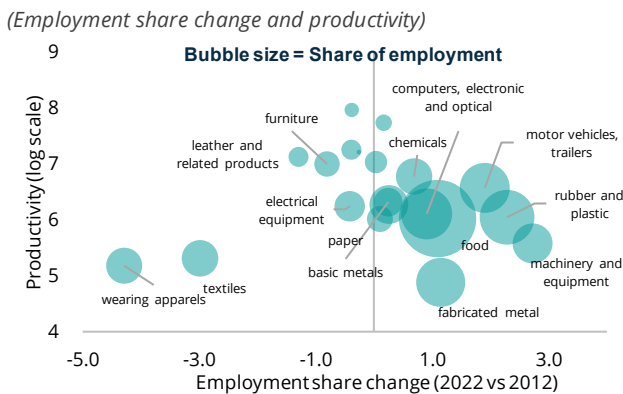
Part 2. Advanced Green Manufacturing for a Competitive Thailand

2037 would require growth of around 5 percent per year and new sources of growth.

Manufacturing has been critical, but its contribution to productivity and job creation is increasingly constrained by limited value added.

Over the past decade, employment has continued to shift toward higher-productivity manufacturing sectors such as automotive and electronics (Figure 52). However, aggregate productivity gains have stalled (Figure 53), indicating diminishing returns from current patterns of specialization. Thailand's export basket is relatively complex, dominated by automotive, electronics, and food products but participation in global value chains (GVCs) is concentrated in backward linkages, reflecting specialization in assembly and final-stage production (Figure 55). These factors all limit domestic value addition, technology diffusion, and high-quality job creation. Expanding forward participation in regional and global value chains would be key for boosting productivity growth, strengthening export revenues, and increasing international competitiveness (Figure 54).

Figure 52: Employment increased in most high-productivity and high-employment sectors



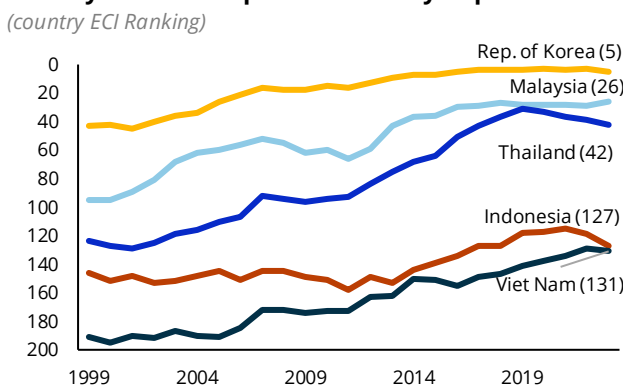
Source: NSO manufacturing firm census; Office of Industrial Economics; World Bank staff calculations

Figure 53: Thailand has achieved strong labor productivity growth in manufacturing, but is now seeing a reversal



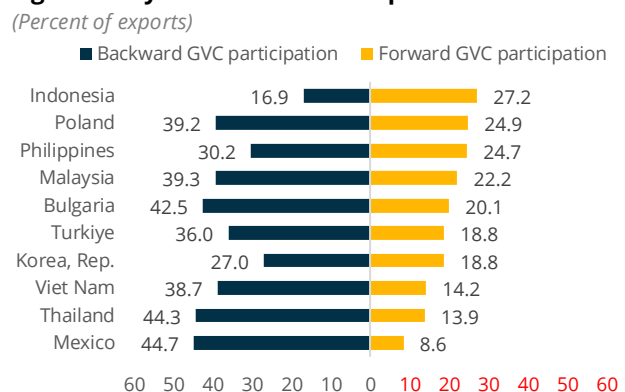
Source: World Bank WDI; World Bank staff calculations.

Figure 54: Gains in export complexity have slowed in recent years after a period of steady improvement



Source: Observatory of Economic Complexity (OEC)

Figure 55: Thailand's forward GVC participation is significantly lower than that of peers



Note: Backward participation refers to the extent to which a country's exports rely on foreign inputs (imported intermediate goods or services); Forward participation refers to the extent to which a country's domestic value added is used in other countries' exports.

Source: TIVA, WITS

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Global megatrends are reshaping comparative advantages, opening a window of opportunity for Thailand.

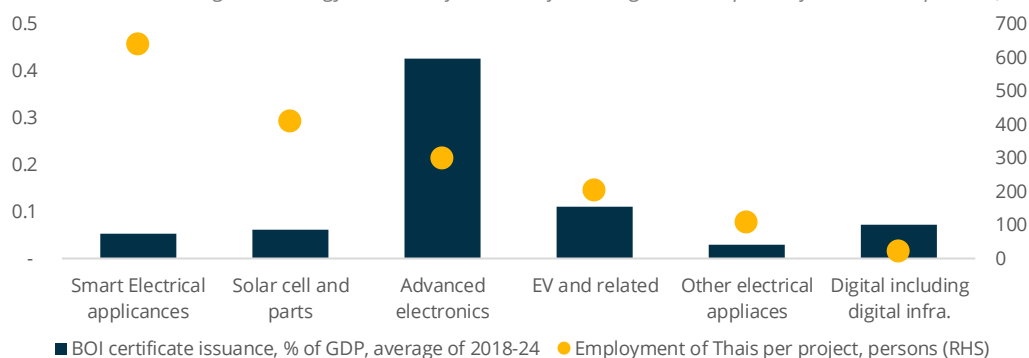
Climate change, fast-paced technological change, and trade fragmentation are reshaping the global economy and the international trading system, directly affecting Thailand's growth prospects. With a trade-to-GDP ratio close to 140 percent, Thailand is highly exposed, as well as to changes in trade policies, global demand, and value-chain dynamics. Global megatrends create opportunities and risks for Thailand. On the one hand, they weaken Thailand's traditional advantages based on assembly, scale and cost competitiveness, and against a backdrop of slowing productivity growth, intensifies pressure on its export-oriented growth model. On the other hand, they offer an opportunity for Thailand to strengthen existing industries, reposition toward higher value-added and greener activities, leveraging its strong manufacturing base.

Green manufacturing²⁰ could emerge as an industry of the future and a new engine of growth for Thailand.

As traditional growth engines weaken, green manufacturing combines rapidly expanding global demand, rising technological intensity, and economies of scale building on Thailand's established strengths in automotive, electronics, and electrical appliances. Rising Board of Investment approved investment applications point to growing investor interest in green manufacturing industries such as electric vehicles and solar panels (Figure 56). Strengthening green competitiveness is therefore a priority to strengthen export-led growth, advance environmental objectives, and support Thailand's ambitions to become a high-income country.

Figure 56: BOI certificate issuance for investment promotion in green industries has risen

(BOI certificate issuance in selected high-technology sectors, Left axis: % of GDP, Right axis: expected job creation, persons)



Note: Employment refers to the expected numbers of job creation indicated in the investment promotion applications

Source: Board of Investment; World Bank staff calculations.

Rising global demand for renewables and electric mobility is reinforcing opportunities in green manufacturing.

The pace of change has been the fastest in electricity generation. Renewables have expanded rapidly, accounting for 30 percent of global electricity generation in 2023, and are projected to reach 46 percent by 2030 (Figure 57).²¹ In 2024, over 90 percent of the sector's expansion came from renewables. Electrification of transport is also accelerating, led by early adopters such as China, Europe, and the United States. Electric vehicles accounted for about 18 percent of global passenger car sales in 2023 and are projected to reach 46 percent by 2030. In Thailand, mirroring trends observed

²⁰ Green products or technologies are ones that reduce environmental pressures, including climate change. Green manufacturing means doing two things. First, producing green technologies like solar panels and electric vehicles. Second, adapting other domestic production to use green technologies. Both will be important for Thailand.

²¹ Projection of renewables and EV adoption are according to the International Energy Agency.

Part 2. Advanced Green Manufacturing for a Competitive Thailand

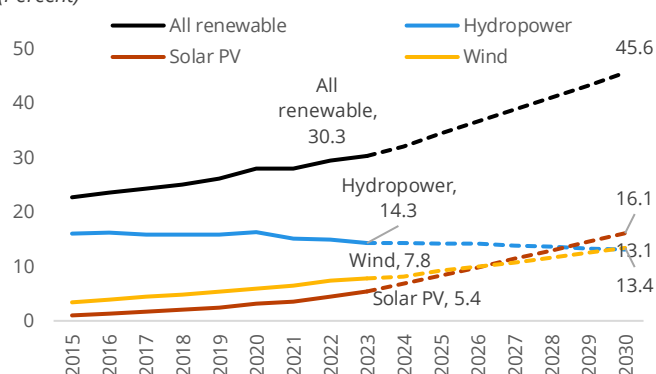
in Viet Nam and Turkey, EV adoption has increased sharply, reaching 12 percent of total passenger car sales in 2023 (Figure 58).

Green products offer strong growth opportunities, conditional on their commercial uptake.

Green technologies such as wind and solar, together with electric vehicles, are technologically sophisticated and exhibit increasing returns to scale in both production and deployment. Uptake depends on their relative price competitiveness and social acceptance, together with institutional factors such as the regulatory environment, infrastructure readiness, firm capabilities and the availability of skilled workforce for installation and operation (Thailand Economic Monitor, December 2023²²). Globally, these factors are increasingly aligned in favor of green products as the key technologies mature and deployment scales up. Several green technologies (solar, and wind energy power) are already price competitive, while others are expected to become viable in the near term (batteries), or more distant future (green hydrogen; Table 3).

Figure 57: The share of renewables in electricity generation is projected to significantly increase

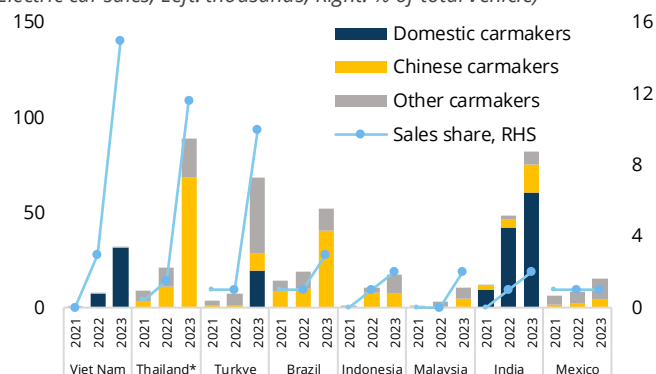
(Percent)



Source: IEA

Figure 58: EV adoption has surged in select emerging market peers

(Electric car sales, Left: thousands; Right: % of total vehicle)



Source: IEA; World Bank staff calculations.

²² World Bank Group. 2023. Thailand Economic Monitor: [Thailand's Pathway to Carbon Neutrality: The Role of Carbon Pricing](#)

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Table 3: Sectoral emissions and associated green technologies

Sector	Subsector	Total global emissions (%)	Examples of technology	Maturity level
Energy	Electricity / heat	32.0	Solar	Mass market
			Wind plus storage	Mass market for wind; early adoption for storage
	Transportation	15.3	Battery electric vehicles	Niche / mass market
			Battery electric trucks	Early adoption stage
	Industry	13.1	Green ammonia; power-to-liquid fuels	Concept / prototype / demonstration stage
			Green hydrogen-based direct reduction of iron; green ammonia	Concept / prototype / demonstration stage
Building	6.3	Heat pumps (residential retrofits)	Niche / mass market	
Other	8.0	Satellite monitoring for large-scale methane leak detection and repair	Demonstration or early adoption stage	
Industrial processes	Industrial processes	6.6	Carbon capture usage and storage; green cement from alternatives	Concept / prototype / demonstration stage
Agriculture, forestry, land use	Agriculture	12.3	Alternative protein	Early adoption stage
	Land-use change & forestry	2.9	precision farming	Niche / mass market
Waste	Waste	3.5	Nature-based solutions	Early adoption stage
			Pyrolysis treatment for chemically recycling plastics	Concept / prototype / demonstration stage

Sources: See de Nicola, Francesca, Aaditya Mattoo, and Trang Thu Tran. 2025. Emissions by sector data are from Climate Watch (<https://www.climatewatchdata.org/>). Examples of technology options are adapted from IEA (2023) and Systemiq (2023)

Building on existing strengths, specialization and greater participation in green regional and global value chains could enhance Thailand's growth opportunities.

Technologies that are already economically viable, including solar PV and wind power, have diffused rapidly across Asia, although at uneven speeds, with China leading adoption. China has been among global leaders in green innovation, accounting for a growing share of global research and development (R&D) and patents in renewable energy and electric vehicles. At the same time, regional specialization in green value chains has intensified. Viet Nam has strengthened its position in solar panels, while Thailand has maintained a strong role in automotive components. China and other East Asian economies occupy dominant positions in downstream segments of clean energy and high-efficiency manufacturing value chains.²³ Given these exporters' scale and cost leadership for manufacturing of several green products and technologies, Thailand can build on its existing strengths by focusing on selective upgrading in segments where it holds clear and defensible advantages, rather than competing primarily on volume.

²³ de Nicola, Francesca, Aaditya Mattoo, and Trang Thu Tran. 2025. "Green Technologies: Decarbonizing Development in East Asia and Pacific." Overview booklet. East Asia and Pacific Development Studies. World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO.

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Thailand is well placed to emerge as a supplier of low-carbon solutions, as the region becomes a driver of the green transition.

While declining demand for carbon-intensive exports poses adjustment risks, Thailand is well positioned to benefit from expanding international markets for green and climate-adaptive technologies. These include renewable energy technologies such as solar and wind, energy-efficient products such as electric vehicles, and adaptation technologies including advanced air conditioners and heat pumps. Many of these sectors are characterized by economies of scale, which can amplify economic gains once a competitive foothold is established, particularly as falling technology costs increase accessibility for middle- and low-income markets (WDR 2024).

Thailand's net-zero and high-income ambitions could help catalyze green manufacturing, if aligned with competitiveness, skill development, and strategic supply chain integration.

Thailand aspires to become a resilient, green, and high-income economy. The country has committed to achieving net-zero greenhouse gas emissions by 2050²⁴, while seeking to unlock new sources of sustainable growth. Thailand also aims to reach high-income status by 2037, guided by the principles of security, prosperity, and sustainability set out in the 20-Year National Strategy. These ambitions are reinforced by Thailand's 4.0 vision, which emphasizes innovation-led growth and a transition toward a Bio-Circular-Green (BCG) economic model focused on higher value-added production, lower resource intensity, and the protection of natural capital. Achieving these goals will require a structural shift toward greener industrial production and reduced reliance on fossil fuels. Renewable energy sources, including solar, wind, biomass, biogas, waste, and hydropower, are expected to play an increasingly important role in Thailand's energy transition, supported by rapid technological progress and declining costs.²⁵ Improvements in energy efficiency will be critical, particularly in transport, which is the second-largest source of greenhouse gas emissions after electricity generation. Accelerating electrification and improving vehicle efficiency will therefore be essential components of Thailand's decarbonization pathways.

Current ambitions thus provide businesses in Thailand with some confidence that there will be future demand for green products, which would be further enhanced by policy implementation. This allows businesses to focus on efficient production to compete with imported goods and solutions to environmental issues specific to Thailand's context. A central trade-off lies between minimizing near-term decarbonization costs through global sourcing and fostering domestic green manufacturing, which may raise short-term costs but can generate wider development gains such as employment, technology spillovers, and stronger supply-chain resilience over the longer term.

²⁴ On 29 September 2025, Thailand's government, led by Prime Minister Anutin, announced an ambitious policy to advance the country's Net Zero greenhouse gas emissions target by 15 years—from 2065 to 2050.

²⁵ Biomass is generally agricultural waste, biogas comes from sources including manure, wastewater comes from agro-processing industries, and energy crops, and waste comes from municipal solid waste and industrial sources (Krungsri Outlook: [Power Generation](#)).

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Export market access is increasingly conditional on low-emission production, raising the premium on green technologies.

Demand for cleaner production processes and energy-efficient technologies is expected to increase, driven by both international trade policies and domestic regulatory reforms. Measures such as the European Union's Carbon Border Adjustment Mechanism (CBAM)²⁶ will require exporters to reduce carbon intensity across production stages. In Thailand, the direct impacts of the current CBAM will be limited outside highly carbon-intensive sectors (e.g., plastics). However, adjustment risks could intensify if the scope of CBAM expands or if additional countries adopt comparable measures. Beyond formal trade policies, multinational corporations are increasingly incorporating carbon intensity considerations into supplier selection decisions. It was estimated that 78 percent of multinational firms planned to exclude high-carbon suppliers by 2025, creating additional incentives for Thai producers to invest in renewable energy, energy efficiency, and other carbon-saving technologies to maintain access to global markets.²⁷

2. Green manufacturing opportunities

Thailand's green competitiveness has been improving but lags structural and higher-income peers.

Thailand already exports green products. Since 2010, exports of green goods and technologies²⁸ have steadily increased, broadly tracking the regional average in East Asia and Pacific (Figure 59). In 2023, green products accounted for close to 10 percent of Thailand's total exports, a level comparable to regional peers and broadly in line with Malaysia, but still well below the performance of more advanced exporters (Figure 60). In contrast, exports of green products amounted to more than 12 and 14 percent of Singapore and China's total exports, respectively. This gap underscores Thailand's potential to strengthen green competitiveness and expand global market share, particularly in higher value-added green production, as global demand for green goods and technologies continues to increase.

²⁶ EU CBAM is a policy to prevent carbon leakage by charging imports for their embedded carbon emissions, aligning them with the EU's carbon price under the ETS, effective from January 2026, covering cement, iron and steel, aluminum, fertilizers, hydrogen, and electricity, with possible expansion to specific steel and aluminum-intensive downstream products in 2028 and broader sectors by 2030.

²⁷ Steenbergen, Saurav (2023).

²⁸ In the chart, green goods are defined in terms of the environmental benefits (including climate mitigation and adaptation) they provide. For example, climate change mitigation efforts are highly dependent on the improvement and deployment of renewable energy technologies; environmental monitoring devices are critical to the sustainable management of natural resources; and waste management products play a key role in curtailing the environmental impacts of production processes.

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Figure 59: Exports of green products have been steadily rising but stand below structural and high-income peers

(% of total exports; average of individual % of exports for country group)

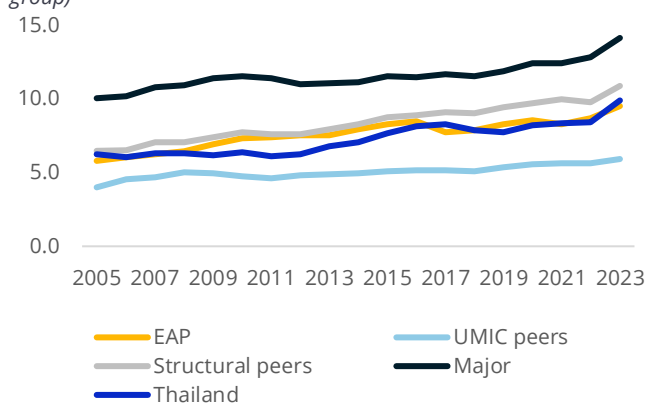
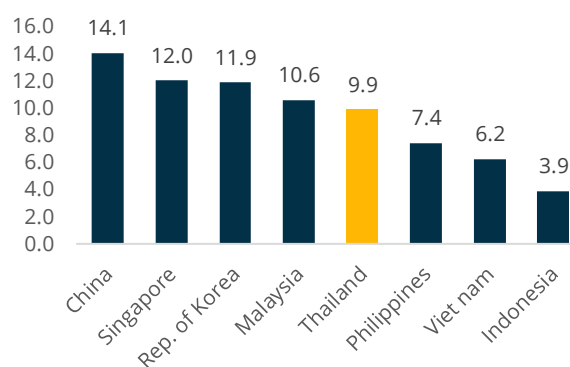


Figure 60: In 2023, green products accounted for 9.9 percent of Thailand's total exports

(% of total exports, 2023)



Note: Major includes China, Germany, USA, Japan, Italy, Rep. of Korea, France, Mexico, UK, and Netherlands; Structural peers include Malaysia, Mexico, Thailand, Bulgaria, and Turkey

Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Mealy and Teytelboym, 2022](#).

Thailand has considerable untapped green complexity potential.

Indicators of green export sophistication point to substantial headroom for upgrading. Based on the Green Complexity Index (GCI)²⁹, which measures a country's ability to export complex green products competitively, Thailand performs close to regional peers but remains well behind structural peers and major green exporters (Figure 61). At the same time, the Green Complexity Potential (GCP) Index, which captures the degree of relatedness between a country's existing capabilities and complex green products, places Thailand at the top among regional peers.³⁰ Mealy and Teytelboym (2022) show that increases in GCP are strong predictors of future gains in the Green Complexity Index (GCI). The difference between Thailand's GCI at 0.7 and GCP at 1.4 suggests strong latent capabilities in green value chains, particularly in complex, higher-value-added green products.

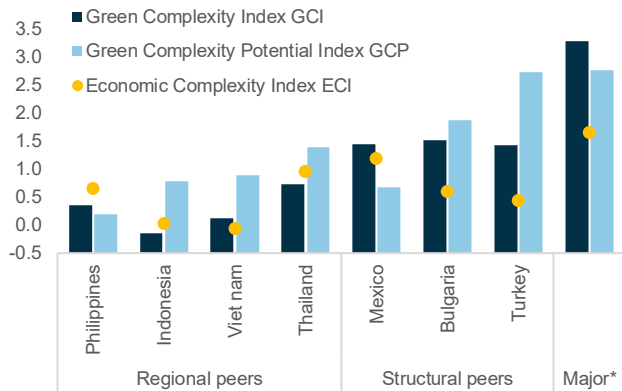
²⁹ The Green complexity Index (see [Mealy and Teytelboym, 2022](#)), based on 6-digit product classification of the Harmonized System, has it merit that allow comparison of trade data across countries. However, it is important to note that there remain some limitations since products may be used in more than one environmental category and many products are dual use, which means they can have both environmental and non-environmental purposes. As a result, these green products classifications tend to somewhat over-estimate environmental trade volumes and should be interpreted as maximum value. The green products draw on the OECD, WTO and APEC lists, totaling 293 products classified at the 6-digit level in HS1992.

³⁰ The Green Complexity Potential (GCP) Index evaluates a country's capacity to diversify into complex green products in the future. It is determined by analyzing the proximity and complexity of green products that the country is not yet competitive in. Proximity measures how closely related a new product is to the country's existing productive capabilities, while complexity reflects the technological sophistication of the product. A higher GCP suggests that a country is well-positioned to expand into advanced green sectors, leveraging its current strengths to develop competitiveness in new, complex green products.

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Figure 61: Thailand has considerable untapped green complexity potential

(Index)

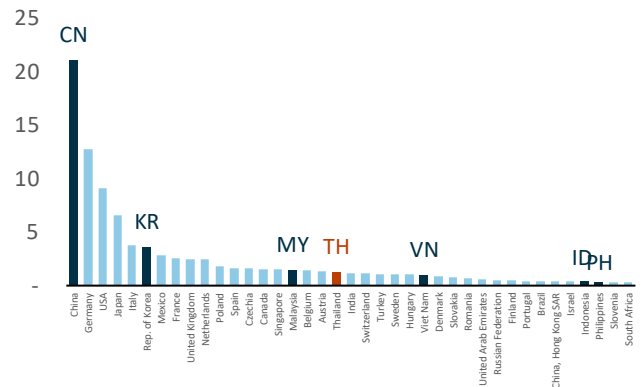


Source: UN Comtrade; CEPII's BACI database; World Bank; See [Mealy and Teytelboym, 2022](#)

Note: Green Complexity Potential measures how much potential a country has to diversify into green, complex products in the future based on its existing competitive strengths. *Major = Major green technology exporters, including Germany, Italy, China, USA, Japan, UK, and France

Figure 62: Scope to expand Thailand's global market share in green products

(share of global exports, %)



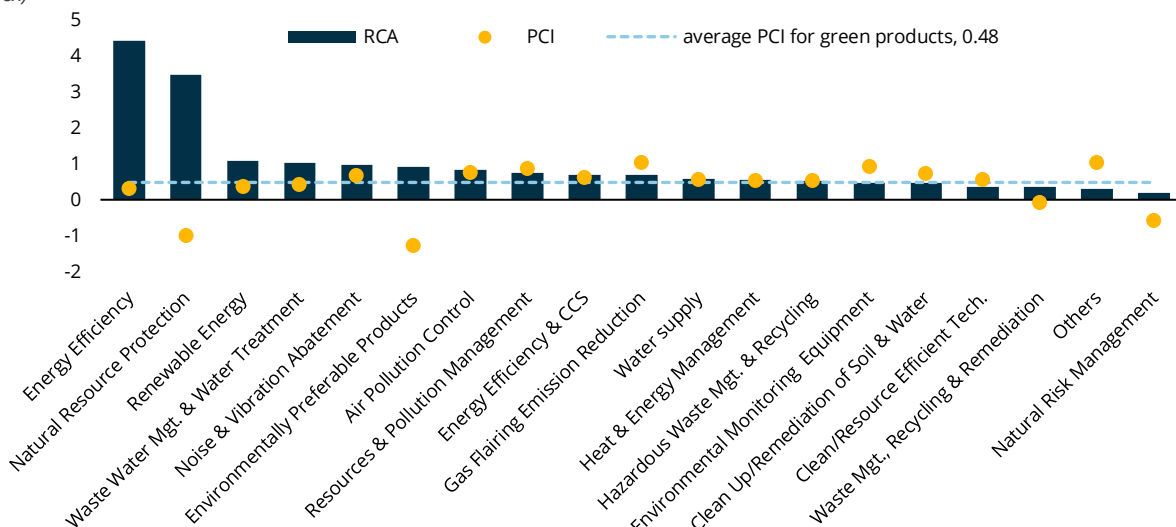
Source: Green transition navigator

Thailand's green exports vary in complexity and sophistication, with scope to shift toward higher-value-added segments.

Among 4,857 six-digit HS products, 293 green and renewable energy products, the finding showed above-average Product Complexity Index (PCI) values, with green products having an average PCI of 0.48, compared with a mean of zero across all products (Mealy and Teytelboym, 2022). Thailand's most sophisticated green exports are concentrated in technologies related to carbon capture and storage technologies, wastewater management, air pollution control, cleaner energy, as well as renewable energy products including solar photovoltaic panels (Figure 63 and Figure 64). In contrast, lower-complexity green exports, often based on vegetable materials, include fishing nets, twine, rope, and cable, and generate limited value added and offer fewer opportunities for productivity growth.

Figure 63: Thailand's exports of energy efficiency and natural resource protection technologies are substantial, but value added remains constrained by low product complexity

(Index)



Note: Others include Distilling or rectifying plant; Machinery for treatment by temperature change nes

Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Mealy and Teytelboym, 2022](#)

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Thailand's key exports remain tied to carbon-intensive industries, underscoring the importance of low-carbon diversification.

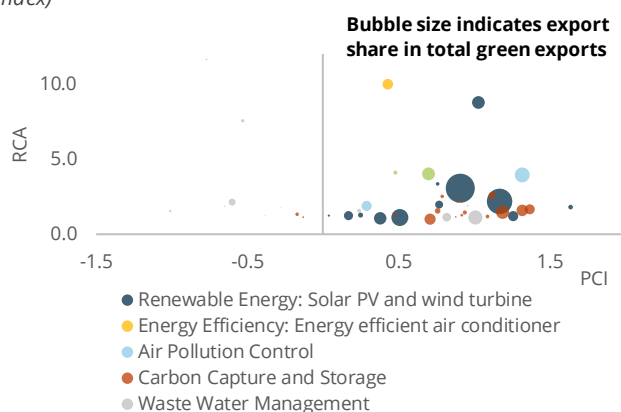
Despite improving green competitiveness, Thailand's export basket remains dominated by carbon-intensive products. The products identified relate specifically to internal combustion engine (ICE) vehicles, engines, and electronic machinery where the country has high revealed comparative advantage (RCA; Figure 65).³¹ This concentration exposes Thailand to rising transition risks. At the same time, Thailand's existing strengths in these sectors provide a strong foundation for upgrading toward greener production processes. In the automotive sector, for example, manufacturers and parts suppliers are well positioned to adapt technologies and production methods to serve the expanding electric vehicle market (see section on electric vehicles).

Policy support for the green transition is expanding but must be coupled with supply-side reforms and skill building.

Thailand has already introduced a range of demand- and supply-side measures to support the green transition, including purchase subsidies and tax incentives for domestic EV production. While these measures have helped accelerate early adoption, they will need to be complemented by stronger support for reskilling, technology transfers, and the development of domestic supply chains. This is particularly important given Thailand's high concentration in automotive manufacturing and the potential adjustment costs faced by ICE vehicle producers.

Figure 64: Thailand's Green Complexity Index and revealed comparative advantage

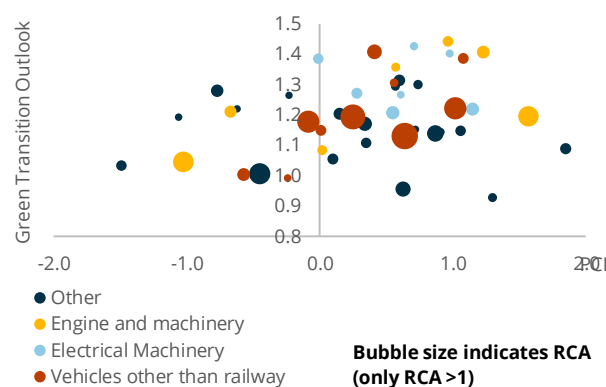
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Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Mealy and Teytelboym, 2022](#)

Figure 65: Thailand's brown lock-in products (with RCA > 1) and their green transition outlook index

(Index)



Note: Transition Outlook captures the relative ease of transitioning from brown exports to climate-compatible exports **Source:** UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Andres, Mealy, Handler, Fankhauser \(2023\)](#)

³¹ Revealed comparative advantage (RCA) is an index that measures whether a country is relatively more specialized in exporting a given product than the world average. It is calculated as the ratio of a product's share in a country's total exports to the same product's share in global exports. An RCA above 1 indicates that the country has a comparative advantage in that product, while an RCA below 1 indicates the opposite.

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Table 4: Thailand's major green export products, ranked by revealed comparative advantage

Products	PCI	RCA	Export,	HS	Description
Air conditioners with reverse cycle refrigeration	0.29	17.1	719,456	841581	Energy efficient air condition uses less electricity and emission
Lead monoxide (litharge, massicot)	-0.56	11.8	12,731	282410	Chemicals used in chemical recovery system
Parts and accessories of optical appliances	0.81	9.9	752,220	901390	Solar PV
Sodium sulphites	-0.94	8.6	46,211	283210	Chemicals used in chemical recovery system
Made up fishing nets, of manmade textile materials	-0.88	7.5	98,412	560811	Common uses of made-up fishing nets are for catching fish
Compressors for refrigerating equipment	1.31	4.2	857,010	841430	Compressors are used in refrigerating equipment to provide the cooling effect in a refrigerator.
Engines and motors nes	-0.28	4.2	59,515	841280	Carbon capture storage technology
Mounted lenses, prisms, mirrors, optical elements	1.03	3.7	146,676	900290	Solar PV
Knotted netting, nets, of natural materials	-0.79	3.3	8,093	560890	A common use of knotted netting is to create fishing nets from natural and biodegradable
Surveying levels	1.33	2.8	26,581	901530	Carbon capture storage technology, used for environmental purposes such as measuring ozone layer

Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Mealy and Teytelboym, 2022](#)

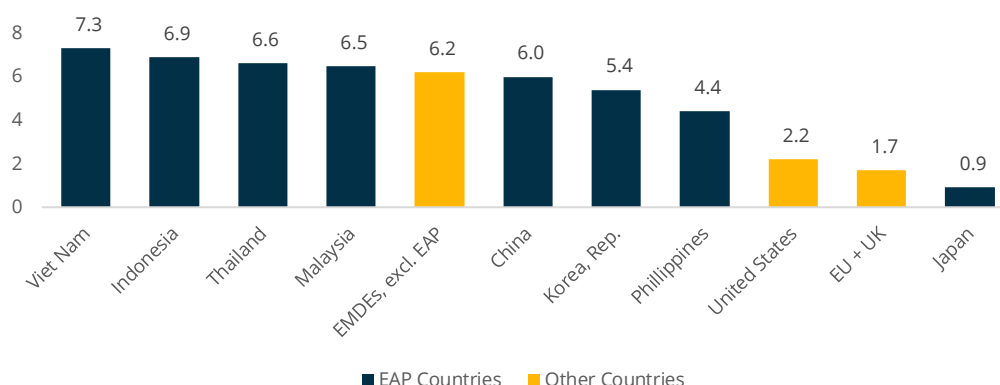
Removing domestic price distortions and trade barriers will be critical to unlock green manufacturing opportunities.

Unlocking green competitiveness will require addressing policy distortions that currently weaken incentives for green technologies. Thailand implemented extensive energy support measures during the global oil price spike in 2022, including caps on diesel, gasohol, cooking gas, and electricity tariffs. These measures, financed through excise tax cuts and transfers from the State Oil Fund, incurred a fiscal cost of approximately 1.1 percent of GDP. In addition, import tariffs on green technologies remain high in (Figure 66), dampening firm entry into green value chains. Firm-level evidence indicates that imports of green value-chain products are highly sensitive to tariffs, with a one-standard-deviation tariff reduction associated with a 2.8 percent increase in imports,³² and particularly strong effects in solar value-chain segments. SMEs are disproportionately affected, reinforcing the case for tariff reform as part of a broader green industrial strategy.

³² Reference to "High Tariffs, High Stakes: The Policy Drivers Behind Firm-Level Adoption of Green Technologies", [Rosenow, Espitia, and Fernandes \(2024\)](#). The estimation is based on import data from 35 emerging markets in a firm-level structural gravity mode to examines the policy determinants of firms' imports of products in green value chains, focusing on the dominant instruments of today's trade policy: tariffs and nontariff measures (NTMs).

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Figure 66: Average applied tariffs on green goods, 2021
(Percentage)



Note: The average tariffs applied on green goods are estimated based on data from Comtrade, where green goods are defined as low carbon technology goods based on Pigato et al. (2020). EAP = East Asia Pacific; EMDEs = emerging market and developing economies; EU = European Union; excl. = excluding; UK = United Kingdom

Source: Data from UN Comtrade Database. See de Nicola, Francesca, Aaditya Mattoo, and Trang Thu Tran. 2025

3. Deep dive on key green industries

To identify which sectors offer potential to drive future growth, analyzing global market dynamics and comparative advantage is essential.

The analysis combines indicators of global market growth, revealed comparative advantage, and product complexity to identify market segments where Thailand has potential to scale up and upgrade. Products that combine fast-growing global demand with above-average technological complexity and built on existing capabilities offer a great starting point for expanding value-added, exports, and productivity gains in Thailand.

Six manufacturing product groups with strong potential emerge: electric vehicles, solar photovoltaic modules, energy-efficient cooling technologies, wastewater management, air pollution control, and carbon capture and storage. These sectors stand out because they combine growing global demand and product sophistication, with production capabilities that Thailand already has competitive capabilities. PCI indicates product sophistication, whereas the RCA shows Thailand's existing competitive strength. For example, Thailand has strong comparative advantage in energy-efficient technologies, with an RCA of 4.4, and a global market share of 1.7 percent, reflecting its global position in products such as energy-efficient air conditioners (Table 5). In renewable energy technologies, including solar PV, Thailand's RCA is lower at around 1.1, but its global market share is rising at 1.35 percent, alongside global import growth of 3.4 percent, indicating an industry that could expand rapidly.

Part 2. Advanced Green Manufacturing for a Competitive Thailand

Table 5: Green export opportunities outcomes

Indicators:	Energy efficiency	Renewable energy	Waste water management	Air pollution control	Carbon capture and storage	Cleaner technologies
RCA	4.40	1.09	1.02	0.82	0.70	0.37
Global market share, %	1.71	1.35	1.51	1.00	1.25	0.68
Global import growth, %	2.09	3.37	2.03	6.47	1.05	9.19
Product complexity index	0.31	0.37	0.41	0.76	0.60	0.55
Product potential						
	High RCA in energy efficient air conditioners	Emerging Solar PV industry with rising global market share	High RCA	High product complexity; Rising global demand	Infrastructure, investment, and regulatory frameworks are insufficient to scale up CCUS	Rising global demand for EV

EVs, solar PV and energy efficient cooling technologies offer great potential to move beyond assembly participation toward higher-value-added, innovation- and skill-intensive segments.

Energy-efficient cooling combines relatively high RCA with moderate product complexity, suggesting near-term export potential based on existing capabilities. Solar PV shows moderate complexity and fast-growing global demand, pointing to opportunities to move beyond final assembly. Electric vehicles and related cleaner technologies are among the fastest growing segments globally and offer opportunities to boost domestic value added, skill intensity, and participation in more advanced segments of global value chains. Other environmental technologies—such as wastewater management, air-pollution control, and carbon capture and storage—also show relatively high RCA with moderate-to-high technological complexity, indicating scope for export expansion.

i. Electric vehicles

The automotive industry is an important sector for Thailand's economy and represents a natural entry point for building green competitiveness.

The automotive industry accounts for 3.1 percent of Thailand's GDP, making it the second-largest manufacturing industry after food processing. It employs more than 570 thousand workers, equivalent to 9.1 percent of total manufacturing employment.³³ In 2019, the industry generated THB 2.6 trillion in sales, equivalent to roughly 15 percent of GDP, reflecting its strong backward linkages to domestic suppliers and services sectors. Sales were dominated by powertrain components (34 percent of the total), followed by electrical and electronics (21 percent), chassis (19 percent), process-related parts (15 percent), and body components (11 percent; Figure 68 and Figure 69). Electrical and electronics parts generate the highest sales per company, reflecting higher value addition, while process-related components generate the lowest.

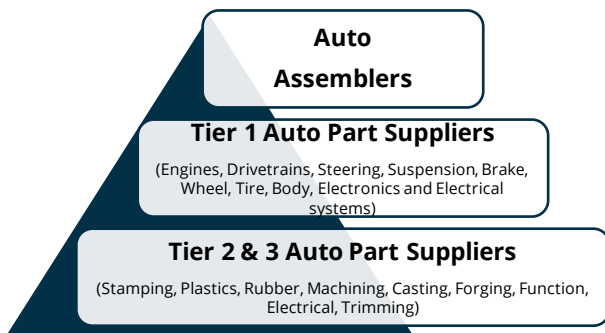
³³ Based on the 2022 NSO Firm Census and Labor Force Survey for auto and auto parts manufacturing industries including TSIC rev4 code: 28140, 2910, 29309, 29201, 29203, and 29301- 29302.

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Thailand's automotive ecosystem is organized around a three-tier supplier structure that has supported economies of scale, specialization, and integration in value chains.

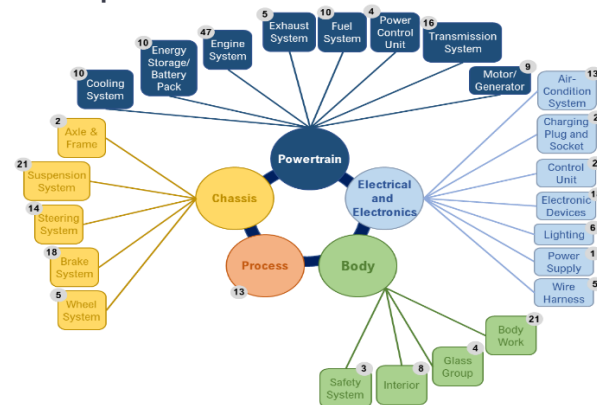
The industry is organized into three tiers: assemblers, Tier 1 suppliers, and Tier 2 and 3 suppliers (Figure 67). Assemblers focus on vehicle assembly using pre-made components and are foreign joint ventures. Tier 1 suppliers comprise around 720 firms with foreign, joint-venture, and Thai ownership and produce high-quality parts for original equipment manufacturers (OEMs) and replacement equipment markets. Tier 2 and 3 suppliers consist primarily of Thai-owned SMEs, totaling about 1,500 firms, that supply raw materials and basic parts.

Figure 67: Structure of the automotive industry



Source: Thailand Automotive Institute.

Figure 68: Schematic breakdown of automotive parts and components

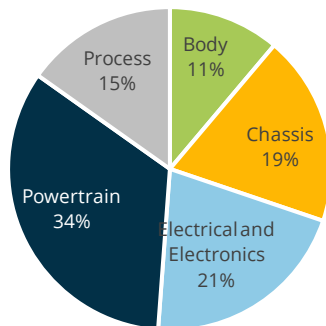


Source: Thailand Automotive Institute, Compiled by World Bank Team, Data as of August 2021

Note: Number in the grey circle indicates number of parts for each component.

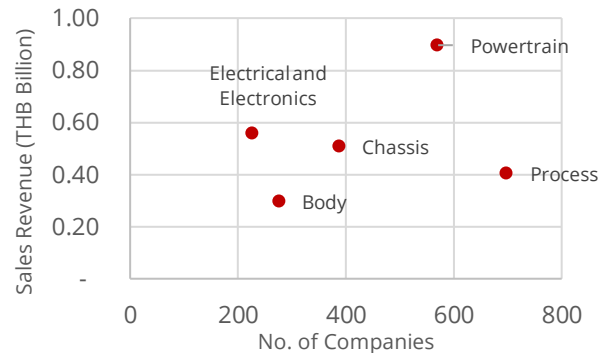
Figure 69: Number of firms and sales by automotive parts and components

(a) Share of sales by component group



Source: World Bank staff calculations.

(b) Number of companies and total sales by component group



A historically successful FDI-driven automotive sector now faces cyclical and

Thailand's automotive industry has long been a pillar of manufacturing and exports, supported by sustained FDI from Japan, the United States, and Sweden. As of 2024, FDI stocks in the motor vehicle sector remained substantial, estimated at 4.8 percent of GDP. The industry is also one of the few in which the government has consistently supported to promote backward linkages and strengthen domestic supplier capabilities.³⁴ In recent years,

³⁴ Government intervention focused on attracting inward FDI and initially relied on high tariffs, later combined with local content requirements (LCRs). In 1971, the government announced LCR measures to take effect in 1974,

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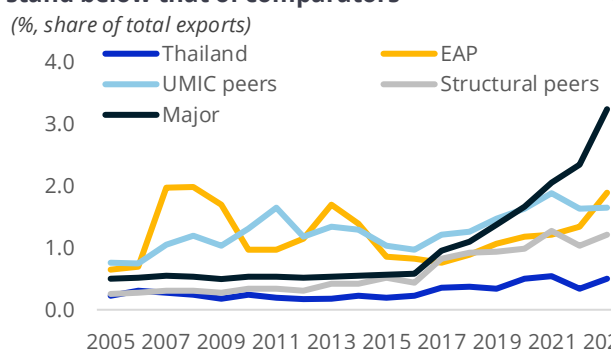
structural headwinds.

however, the automotive industry has faced mounting challenges. Thailand's vehicle production has declined to around 12 percent below its pre-pandemic average and continues to trend downward. Factors that have contributed to the decline include prolonged economic recovery, high household debt that constrains domestic demand, and the structural transition from internal combustion engines (ICE) to electric vehicles.

Thailand has potential to expand EV production and increase exports, leveraging its well-established base in electrical and electronics, body, and chassis manufacturing.

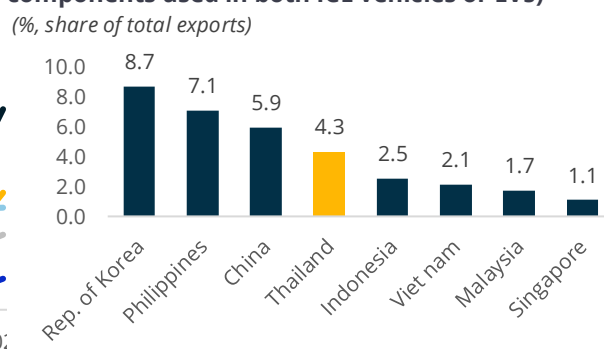
When considering the narrow EV value chain (batteries, EV components, and fully assembled EVs), Thailand's exports remain incipient at 0.5 percent of the total, lagging behind both EAP and structural peers (Figure 70). However, Thailand's competitiveness in traditional auto parts production provides a strong base for transitioning from ICE vehicles to EVs. Under a broader definition of the EV value chain that includes vehicle parts, Thailand's export share rises to 4.3 percent of total exports, exceeding most ASEAN peers (Figure 71). This strength is particularly evident in subcomponents such as interior parts, vehicle bodies, and brake systems, where Thailand maintains a strong global presence and high revealed comparative advantage (Figure 72). As global demand for EVs accelerates, building on this base could position Thailand as a competitive EV manufacturing hub.

Figure 70: Narrow EV value chain exports (batteries, EV components, and assembled EVs) stand below that of comparators



Source: World Bank staff calculations.

Figure 71: Thailand outperforms comparators on broader EV value chain exports (including components used in both ICE vehicles or EVs)



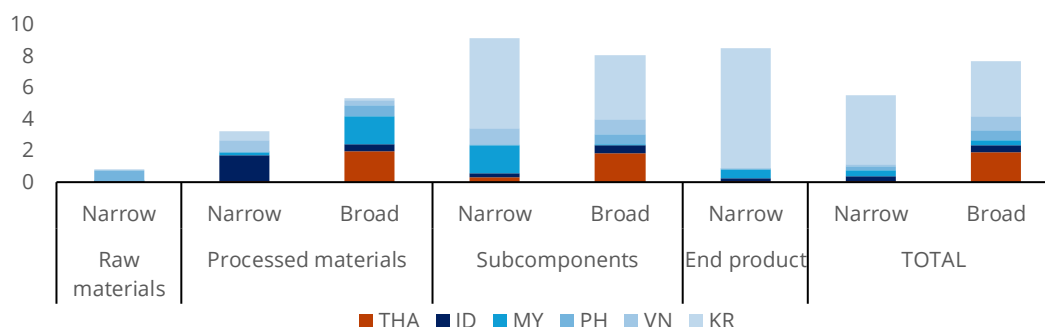
Source: World Bank staff calculations.

requiring domestically assembled vehicles to use locally produced parts for at least 25 percent of the vehicle's value; this threshold rose to 45 percent for all vehicles in 1986 and 54 percent for passenger cars. All LCRs were eventually abolished in 1997 (see [Peter Warr and Archanun Kohpaiboon, 2017](#)).

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Figure 72: Thailand's comparative strength is reflected in global market shares in processed materials and intermediate components

(% of world exports, only product with Exports>Imports)



Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Rosenow and Mealy, 2024](#)

Thailand's recent entry into EV markets marks an important milestone, but current scale remains limited relative to domestic and global demand.

Local EV production began in 202, and exports started in 2025, supported by supply- and demand-side incentives under the EV 3.5 package of subsidies and tax reductions (Box 6). While these measures have helped accelerate market uptake and signal policy commitment to investors, production and export volumes remain at an early stage. On the one hand, EVs accounted for 21 percent of total passenger car sales in 2025, dominated by imported completely built-up (CBU) vehicles. On the other hand, locally produced EVs represent only 11 percent of total vehicle production. EV exports totaled 3,500 units between January and October 2025, accounting for just 0.5 percent of passenger car exports. Strengthening the domestic EV supply chain will therefore be essential to translate demand growth into export expansion and job creation.

Box 6: Thailand's EV 30@30 policy and investment needs toward full electric mobility

Thailand's National Electric Vehicle Policy Committee (EV Board) has outlined a comprehensive policy framework to promote investment in zero-emission vehicle (ZEV) production and adoption. Adopted in 2021, the 30@30 policy targets ZEVs to represent at least 30 percent of passenger vehicles produced domestically and 50 percent of all new vehicle registrations by 2030. Thailand has also announced plans to phase out the sale of new internal combustion engine vehicles by 2035, with the objective of achieving 100 percent ZEV sales by then.

ZEV Production & Use	Vehicle Types	Goal (units per year)		
		2025	2030	2035
Production (% of total automobile production)	Passenger car/ Pickup	225,000 (10%)	725,000 (30%)	1,350,000 (50%)
	Motorcycle	360,000 (20%)	675,000 (30%)	1,850,000 (50%)
	Bus/Truck	18,000 (33%)	34,000 (47%)	84,000 (87%)
Use (% of total domestic sales)	Passenger car/ Pickup	225,000 (30%)	440,000 (50%)	1,154,000 (100%)
	Motorcycle	360,000 (20%)	650,000(40%)	1,800,000 (100%)
	Bus/Truck	18,000(23%)	33,000(40%)	83,000 (100%)

Box 6: Thailand's EV 30@30 policy and investment needs toward full electric mobility

Although EV sales have increased recently, complementary investments remain necessary to accelerate adoption and reduce emissions. In 2023, EVs accounted for 12 percent of total passenger car sales in Thailand, exceeding levels in Indonesia and Malaysia but remaining below Viet Nam. Growth in EV adoption has been supported by advances in battery technology, shifting consumer preferences, and declining total costs of ownership, reinforced by government subsidies. The EV3.0 (2022–2024) and EV3.5 (2024–2027) packages of subsidies and tax reductions will continue to support the market in the near term.³⁵ Between 2023 and 2025, government spending on incentives for electric passenger cars was estimated at THB 43 billion per year, equivalent to 0.23 percent of GDP. These incentives include direct purchase subsidies of THB 100,000–150,000 per vehicle, excise tax reductions from 8 percent to 2 percent, and import tariff cuts from 40 percent to zero. Carbon pricing could play a supporting role, but its impact on EV uptake is likely to be limited, especially given the low level of the carbon tax introduced in 2025 and its limited influence on retail fuel prices.

A critical factor for advancing low-emission passenger transport will be investment in charging infrastructure and the decarbonization of electricity generation.³⁶ Public charging infrastructure will be essential to accelerate EV adoption, particularly for households without access to home charging, for users concerned about driving range, and for operators of heavier vehicles. Public investment can help break the vicious cycle between the lack of charger availability and EV demand. To meet projected demand and catalyze private sector participation, Thailand would need to invest an average of USD 2.2 billion per year in public EV charging infrastructure over the next 25 years, with the bulk of investment required in the coming decade ([Thailand CCDR 2025](#)).

The shift toward EVs is expected to affect Thailand's well-established auto parts industry unevenly, with the largest impacts on suppliers specialized in ICE components.

To assess the impact of this transition, the analysis maps automotive parts to their associated manufacturing processes. It then classifies 266 components based on how EV adoption alters production needs, distinguishing between obsolete, modified, unchanged, and enhanced manufacturing activities. Some components will require adaptation for EV use, including parts related to transmission systems, power control units, and certain motors or generators. Other components, such as tires and suspension systems, remain largely unchanged. A smaller subset of parts will require enhancement, most notably battery systems.

Thailand's auto parts firms are mostly well

While some ICE vehicle parts and components will need to be adapted, more than 80 percent of auto parts currently sold in Thailand can potentially be used in EVs. World Bank analysis³⁷ also finds that around 58 percent of sales

³⁵ To stimulate EV adoption, the Thai government has rolled out a package of EV 3.5 Measures, the second phase of the EV Package, starting in 2024 and running until 2027. EV 3.5 measures include purchase subsidies from THB 50,000 to 100,000 per vehicle (\$1,515 to \$3,030), based on vehicle types and battery capacities. Additionally, excise tax reductions have been implemented, lowering rates from 8 percent to 2 percent for electric passenger cars. Conditions for these measures include domestic EV production offsets for CBUs imported at a 1:2 ratio by 2026 or a 1:3 ratio by 2027.

³⁶ Thailand's planned carbon tax on fuel, starting in 2025, is set at THB200/tCO₂e (approximately \$6) and is integrated into the existing excise tax structure for petroleum products, including gasoline, gasohol, kerosene, jet fuel, diesel, biodiesel, liquefied petroleum gas, and fuel oil. This means that the retail prices of these fuels remain unaffected.

³⁷ In this study, 266 automotive parts were classified into four categories based on potential use in EVs:

- i) obsolete (phased out in EVs);
- ii) modified (requiring adaptation);
- iii) unchanged (remains relevant); and

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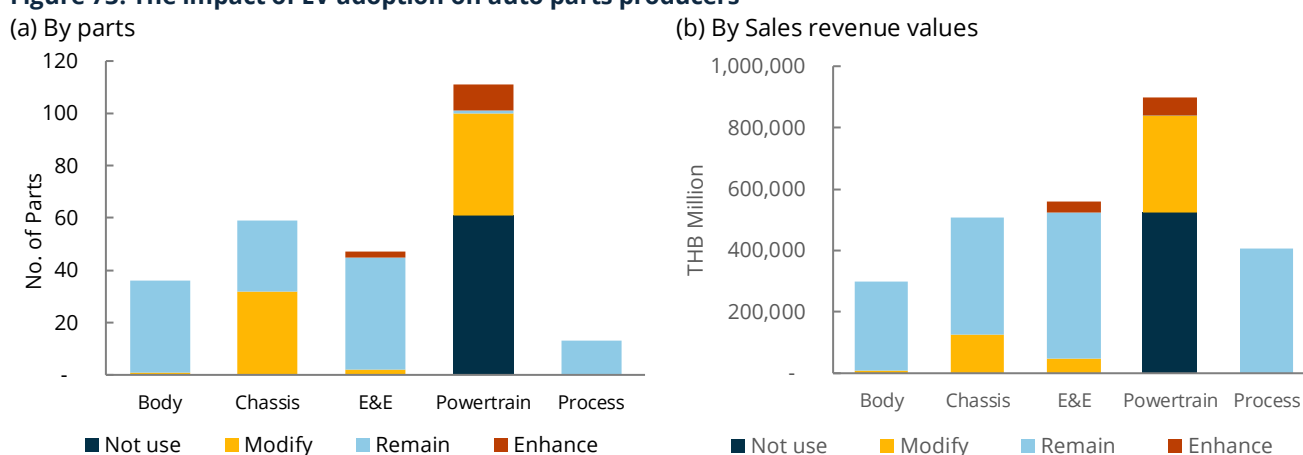
placed for a shift to EVs.

are expected to remain largely unaffected by the transition, while 22 percent of sales will require products to be modified or production processes to be enhanced, covering 318 companies out of a total of 1,425 (Figure 73).

Unaffected components (58 percent of sales) include body, chassis, and electrical and electronic parts.

Approximately 1,166 companies are expected to remain relevant for EVs, including producers of seats and body panels. Within the powertrain group, a small number of firms producing gearboxes, halfshafts, and accelerator pedals may continue operating with limited changes. This is consistent with comparisons between the components used in Tesla's Model 3 and parts already produced in Thailand, particularly brakes, suspension, interior fittings, and safety systems. In addition, 116 out of 309 electrical and electronics suppliers producing items such as wire harnesses, exterior lights, and infotainment systems are expected to continue operations without significant modifications.

Figure 73: The impact of EV adoption on auto parts producers



Source: Thai auto parts manufacturer database from the Thailand Automotive Institute; World Bank staff calculation

A smaller but important share of suppliers (23 percent of sales) will require upgrading or process modifications.

Around 19 percent of auto parts sales could be adapted with relatively minor adjustments, including interior, brake, steering, and electronic components. For example, Thai producers of brake discs and calipers could readily adapt. An additional 4 percent of 2019 auto parts sales are linked to components that require substantial enhancement, including power control units, cooling systems, transmission components, and electrical systems. Approximately 67 suppliers could pivot toward EV-related production, particularly in batteries and energy storage, electric motors, and power electronics. This transition will require new capabilities in handling materials such as lithium and cobalt, as well as upgrades to meet evolving OEM standards.

iv) enhanced (requiring new production processes to replace ICE components in EVs).

This study adopts a similar approach to that taken by several Thai financial institutions, including KTB Research (2021) in their report "Toward Production Base of EV for the Region" (in Thai), and the Kasikorn Bank Research Center (2021) in their analysis "Econ Analysis: EV Production Business," dated 5 July 2564 (in Thai).

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The remaining parts (20 percent of sales) face heightened exposure to the EV transition, but their role in cleaner, high-efficiency ICE engines should support market relevance.

The auto parts manufacturers primarily within the powertrain group covering engines, exhaust systems, and fuel systems will be impacted. However, these suppliers could remain relevant for the production of cleaner and more energy-efficient ICE vehicles (especially heavy-duty vehicles). Additionally, the transition to e-mobility will take time despite the 2030 target and incentives. Widespread investment in charging infrastructure is still needed to ensure convenience, reliability, and coverage of EVs across regions (see Box 6).

Table 6: Impact of EV Adoption on Thailand's Auto Part Makers

Impact on auto part makers	Definition	Sale value in 2019, THB	Share of sales value	Number of auto part makers*	Major products
Remain	Components that would remain in EV: Some auto part components may continue to be used when electric vehicles are adopted.	1,550,113 million	58%	1,166	Tire, Wiring, Harness, Seat, Printed Circuit Board, Stamping, Frame, Door, Alloy Wheel
Modify	Modification of auto part components to fit into EV design or technology, including the interior (body), brake system and steering system (chassis), electronic devices and power supply (electrical and electronics), and the cooling system, motor/generator, power control unit, and transmission system (powertrain).	497,968 million	19%	250	Inverter, Gear Drive shaft, Radiator, Low voltage motor, Rotor, Stator, Steering column
Enhance	Some auto parts can be adapted for EV technology, including the control unit (electrical and electronics) and the energy storage/battery pack (powertrain). Additionally, there is potential for new entrants in the market. For example, companies like Energy Absolute PCL and Global Power Synergy PCL are actively developing energy storage solutions for EVs.	93,928 million	4%	67	ECU, Li-ion battery, Lead acid battery, Seal or Gasket, Module monitoring unit, Junction, Box, VCU, DCU
Not used (Ceasing production)	Auto part components that are likely to be replaced in EV include those from the engine system, exhaust system, and fuel system, as these internal combustion engine auto parts will no longer be used in EV.	524,165 million	20%	318	Starter motor, Belt Turbocharger & Supercharger, Exhaust pipe & Muffler, Fuel pump, Fuel tank

*Note: Some companies produce more than one component and across groups

The transition toward EVs is unlikely to be highly disruptive if coupled with adequate investment and policy support.

The industry's high degree of specialization, with 70 percent of firms producing only one or two parts, and 85 percent producing no more than three, suggests that reconfiguration toward EV supply chains is feasible. However, Tier 2 and 3 suppliers will require targeted support to upgrade capabilities. At present, high-voltage batteries, high-voltage systems, and external charging connectors are not widely produced domestically, indicating gaps in local EV component manufacturing. Strategic support could enable Thailand to minimize the impact of the transition on domestic companies and deepen its role in EV supply chains.

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Complementary policies will be needed as the transition to electric vehicles will shape the demand for worker skills.

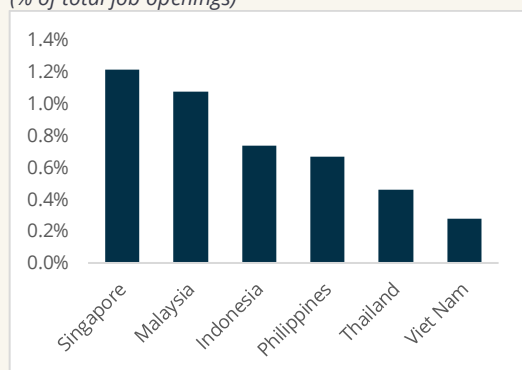
The EV transition will increase the need for skilled workers, including those pertaining to battery technology, electric drivetrains, and software integration. Process-level evidence from Cotterman et al. (2024) shows that BEV manufacturing involves a greater number of production steps and higher labor intensity than internal combustion engine vehicles, particularly due to battery and power-electronics manufacturing. Job postings data indicate that more than 90 percent of low-carbon technology roles require high-level skills (Box 7). Meeting these needs will require firms to upskill existing workers and, in some cases, attract international expertise.

Box 7: Using online job postings to assess labor demand for clean technologies

Online job postings data indicate substantial variation in labor demand for low-carbon technologies across ASEAN countries. In 2022, Singapore and Malaysia recorded the highest rates of job postings related to low-carbon technologies (LCTs), followed by Indonesia, the Philippines, Thailand, and Viet Nam, with lower but rising levels. For Indonesia, Malaysia, and Thailand, approximately half of all low-carbon technology job openings between 2019 and 2022 were concentrated in the renewable energy sector. Thailand and Viet Nam also recorded relatively high shares of job postings in the electric vehicles sector, with EV-related positions accounting for 21 percent of all low-carbon technology job openings, the highest share among ASEAN economies. While so far demand for low-carbon skills in Thailand remains below regional peers, the structure of new labor demand is already tilted toward electrification, reflecting the country's automotive base and early integration into EV value chains.

Figure Box 7.1: Online job postings in LCTs sector, 2019-2020

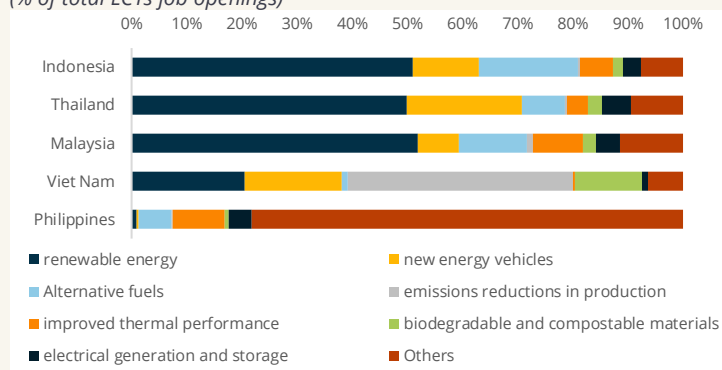
(% of total job openings)



Source: Mealy and Stapleton (2025)

Figure Box 7.2: Online job postings in LCTs by technology, 2019-2020

(% of total LCTs job openings)



Source: Mealy and Stapleton (2025)

ii. Solar PV

Rising global demand for solar PV presents an important opportunity for Thailand to expand its role in clean energy supply chains.

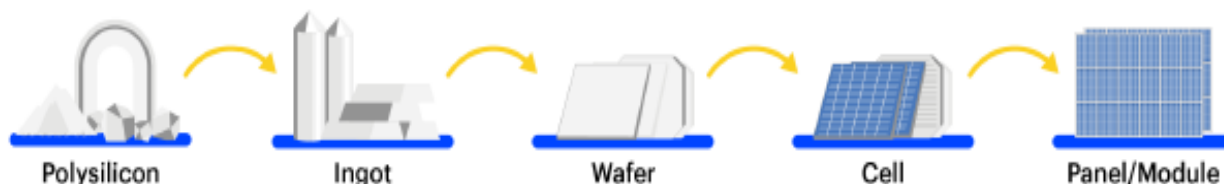
According to the IEA's Roadmap to Net Zero Emissions by 2050, global solar PV capacity is estimated to quadruple to reach 630 GW by 2030, up from 134 GW in 2020. By 2050, nearly 90 percent of global electricity generation is projected to come from renewable sources, with solar PV and wind together accounting for almost 70 percent (IEA 2022³⁸). Meeting this demand will require a more than twofold expansion in global production capacity across the entire solar PV chain, including for polysilicon, ingots, wafers, solar cells, and modules by 2030 (Figure 74).

³⁸IEA Special Report on Solar PV Global Supply Chains, 2022

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Although solar currently accounts for a relatively small share of Thailand's domestic electricity generation, the country's high solar irradiation, established manufacturing capabilities, and position in regional trade networks provide a great foundation to scale production and integrate more deeply into global solar PV markets.

Figure 74: Key stages in the main manufacturing process for solar PV



Source: IEA 2022, ADB

Thailand's solar PV exports have grown over the past decade but remain focused on final assembly, limiting domestic value addition.

As of 2023, Thailand had 36 solar PV cell and module manufacturers with a combined capacity of 3,294 MW.³⁹ At the same time, Thailand's exports of solar PV have gained significance, rising from 0.5 percent of total exports in 2018 to 1.9 percent in 2023 (Figure 75). This pace of growth exceeds the average of regional peers and closely mirrors recent trends observed in Viet Nam.⁴⁰ Investment prospects remain positive, reflected in a growing pipeline of announced projects.

However, Thailand's production structure remains heavily skewed toward module assembly, with limited participation in higher value-added segments such as solar cells, inverters, and semiconductor-grade silicon wafers (Figure 76 and Figure 77). Thailand's global market share in processed materials and subcomponents remains modest at 1.3 percent and 0.7 percent, respectively.⁴¹ In contrast, regional peers such as Malaysia have built a more balanced presence across upstream and midstream segments, including polysilicon and wafer manufacturing, underscoring Thailand's unrealized potential to expand intermediate exports and capture a larger share of value added within regional and global value chains.

³⁹ <https://www.mreport.co.th/experts/business-and-management/347-Solar-cell-Thailand-Overview>; https://pvgis.kmutt.ac.th/pvstatus2020/cell_and_module_production.html

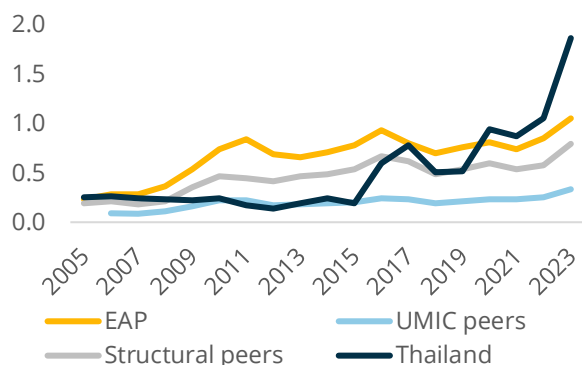
⁴⁰ 38 countries have module assembly facilities, with China taking the largest share 70 percent of production in 2021, up from 50 percent in 2010. Other important manufacturers include Viet Nam (5 percent), Malaysia (4 percent), Korea (4 percent) and Thailand (2 percent) (IEA 2022).

⁴¹ Processed materials include steel, glass and cement transformed or refined from basic raw materials. Subcomponents are unique constituent parts or elements that contribute to a finished product such as crystalline wafers for crystalline silicon PV modules.

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Figure 75: Thailand's exports of solar PV have recently accelerated

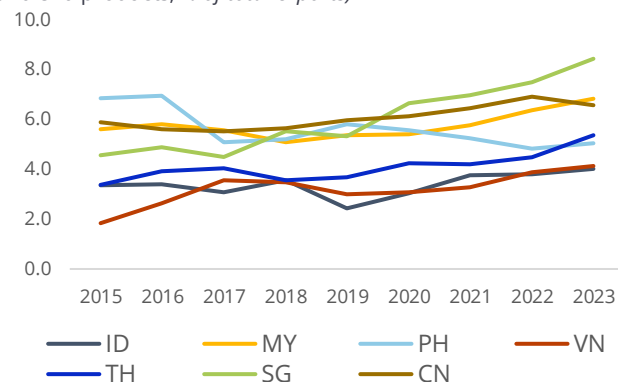
(End product only, % of total exports)



Source: World Bank staff calculations.

Figure 76: Total value chain solar PV exports remain below many regional comparators

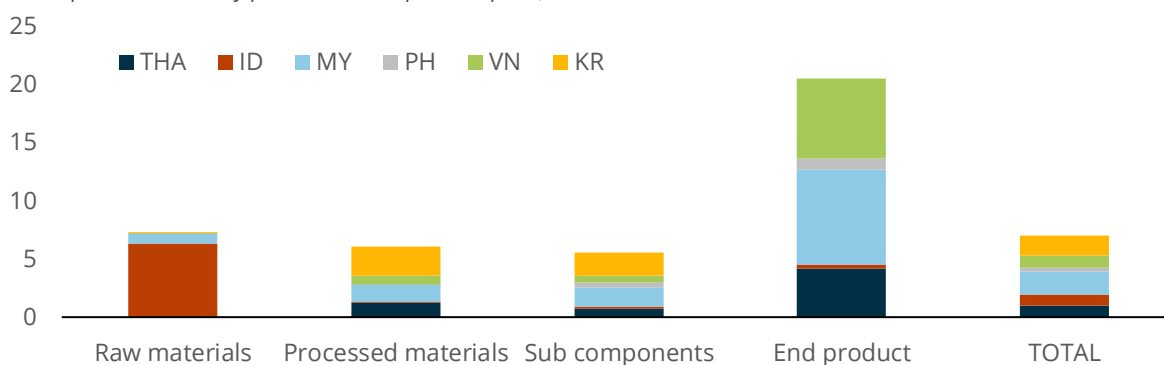
(Covering raw materials, processed materials, subcomponents, and end products, % of total exports)



Source: World Bank staff calculations.

Figure 77: Thailand plays a relatively larger role in global markets for end-product solar PV

(% of world exports in 2022, only products with Exports>Imports)



Source: UN Comtrade; CEPII's BACI database; World Bank staff calculations. See [Rosenow and Mealy, 2024](#)

Thailand's ability to generate higher domestic value added from the solar PV sector hinges on advancing innovation and capabilities across all segments of the supply chain.

Upstream, targeted support for R&D and localized manufacturing of advanced components (high-efficiency solar cells, modules, and inverters) would strengthen technological depth and improve export competitiveness. Midstream, expanding system integration capabilities, engineering services, and digital monitoring solutions can deepen domestic know-how and open new service-based revenue streams. Downstream, accelerating solar deployment through grid modernization, smart energy systems, and building integrated PV would raise domestic demand for locally produced components and services (Figure 78).

Workforce development is a binding constraint across all segments, particularly the availability of solar engineers, technicians, and R&D specialists supporting more sophisticated production. Thailand already holds a global lead in floating solar projects, hosting the world's largest floating solar installation at 45 MW at Sirindhorn Dam in Ubon Ratchathani.⁴² By contrast, rooftop solar deployment remains at an early stage, despite strong potential to support decentralized generation, stimulate SME participation, and anchor local value development (Figure 79).

⁴² https://www.bloomberg.com/news/articles/2021-11-09/world-s-largest-hydro-floating-solar-farm-goes-live-in-thailand?utm_source=chatgpt.com&embedded-checkout=true

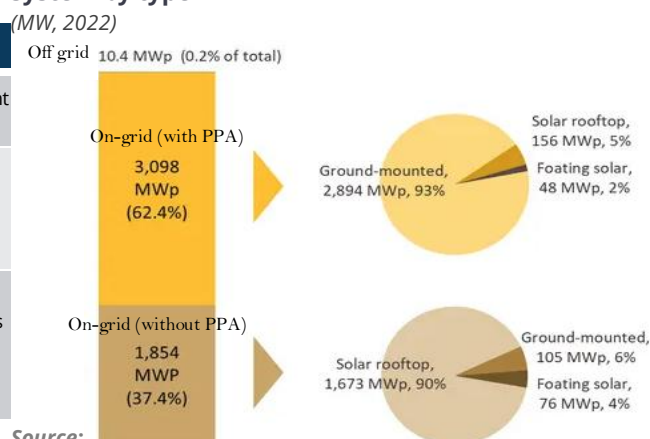
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Figure 78: Innovation potential solar energy value chains

Stage	R&D activities
Upstream	Module architecture: Higher energy efficient solar panel, Flexible, thin panel
Horizontal	Mounting systems: lightweight rooftop racking, floating solar platforms, Grid integration: smart grid interfaces, demand response, digital monitoring
Downstream	Digital innovation: AI for predictive maintenance, drone inspections, digital twins for solar farms, solar panel recycling Urban design: building-integrated PV (BIPV), agrivoltaics, EV charging integration

Source: World Bank

Figure 79: Cumulative installed capacity solar PV system by type



Source:

iii. Low emission air conditioners

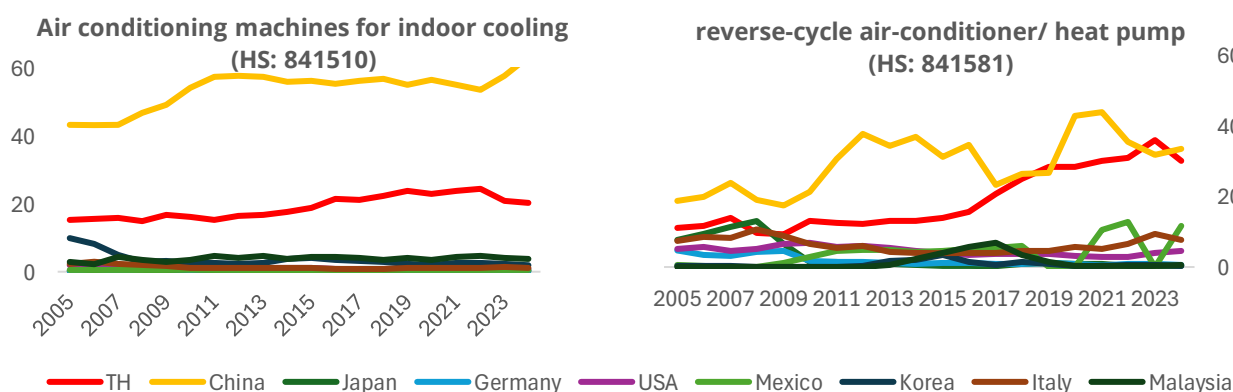
Thailand has become a key production hub for air conditioners with R-32 refrigerant manufacturing and heat pumps.

There are two types of air-conditioning technologies that significantly improve energy efficiency and reduce emissions. The first is R-32 air-conditioning technology⁴³ for residential and indoor cooling, which replaces conventional refrigerants with much higher global warming potential (GWP) and ozone-depleting properties with a cleaner alternative that enhances energy performance. The second is the reverse-cycle air-conditioning technology, or heat pump, which provides both heating and cooling (modern heat pumps are three to five times more energy-efficient than gas boilers).⁴⁴

Thailand is the world's 3rd largest exporter of air conditioners, accounting for around 10 percent of global exports and a leading production hub for R-32 inverter models, manufactured by firms such as Daikin, Mitsubishi, and Toshiba (Figure 80). Major export markets include Asia, Europe, United States and Australia.

Figure 80: Major exporters of energy efficient and green air conditioners

(% of world exports)



Source: Trademap; World Bank staff calculations.

⁴³ R32 refers to difluoromethane (CH₂F₂), a low-global-warming-potential refrigerant, that replaced older refrigerants such as R22, representing a 68 percent reduction in global warming potential.

⁴⁴ IEA "The Future of Heat Pumps", 2022

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Thailand's transition to R-32 refrigerants was enabled by global regulatory changes coupled with coordinated public-private action.

Thailand's emergence as a hub for R-32 refrigerant manufacturing reflects the global phase-out of high-GWP refrigerants under the Montreal Protocol (Box 8). All 12 Thai-owned air-conditioner manufacturers have now converted or phased out production from R-22 to R-32. This transition was supported by coordinated partnerships involving the Department of Industrial Works, the National Ozone Unit, Daikin Industries (Japan), and local compressor producers. The alignment of regulatory commitments with firm-level incentives enabled a rapid and industry-wide technology shift, minimizing disruption while upgrading production standards.

Technology transfers and open-patent strategies played a central role in accelerating firm-level upgrading.

Thailand's transition to R-32 production was accelerated through public and private sector collaboration on know-how, innovation sharing, and technology transfers. The process began in 2014, when Daikin Industries introduced the R-32 technology in Thailand and subsequently worked with local manufacturers to scale production. With support from Japan's Ministry of Economy, Trade, and Industry and Daikin's technology-sharing initiatives, Thai manufacturers, such as Saijo Denki received both funding and technical guidance to shift from R-22 to R-32 refrigerants, which offer higher energy efficiency and lower environmental impact. A critical enabler was Daikin's decision to allow participating Thai enterprises to use its HFC-32 air-conditioning patents. Later, the global release of these patents also benefited multinational manufacturers including Fujitsu, LG, and Panasonic.

World Bank support helped translate regulatory commitments into production and skills upgrading.

Since 2016, the World Bank has supported Thailand's transition through initiatives such as the HCFC⁴⁵ Phase-Out Management Plan, providing technical assistance and financial support to help firms upgrade production lines and comply with international environmental standards.⁴⁶ Following World Bank recommendations, Daikin formed a business alliance with the Federation of Thai Industries (FTI) to promote R-32 technology and delivered technical assistance to enterprises to improve production quality and strengthen technical capacity for installation and maintenance of R-32 systems. These efforts were reinforced by the introduction of new energy-efficiency standards by the Electricity Generating Authority of Thailand (EGAT) and the Thai Industrial Standards Institute (TISI). Together, these measures have helped position Thailand as a regional leader in green and energy-efficient cooling technologies.

Box 8: Global shift toward energy-efficient air conditioners under the Montreal Protocol

Global climate commitments under the Montreal Protocol have accelerated the shift toward energy-efficient air conditioners using R-32 refrigerants, as countries phase out ozone-depleting and high global-warming-potential substances, particularly hydrochlorofluorocarbons (HCFCs). Rising global temperatures and increasing cooling demand in buildings are reinforcing international demand for more efficient air-conditioning and refrigeration technologies. The transition to R-32 (HFC-32) refrigerant has become central to this effort, as it has zero ozone-depleting potential, a 65 percent lower global warming potential, and 5–15 percent higher energy efficiency than R-22. As a result, R-32 systems

⁴⁵ HCFC stands for hydrochlorofluorocarbon, a class of R-22 refrigerants.

⁴⁶ <https://www.worldbank.org/en/news/press-release/2016/04/20/new-air-conditioner-technology-adopted-in-thailand>

Box 8: Global shift toward energy-efficient air conditioners under the Montreal Protocol

reduce electricity consumption while supporting ozone layer recovery. In October 2016, 197 parties to the Montreal Protocol adopted the Kigali Amendment, committing to a progressive phase-down in the production and use of HCFCs worldwide. Implementation timelines vary by country, with start dates ranging from 2019 to 2028 depending on levels of development. The European Union and the United States began implementation on January 1, 2019, while China committed to start capping HCFC use by 2024. Under its Montreal Protocol commitments, Thailand has committed to a complete HCFC phase-out by 2040, which is expected to reduce more than 900 ozone-depleting-potential tons of harmful emissions.

Sustaining competitiveness will require continued skills, components, and innovation upgrading as global competition in air conditioners intensifies.

Sustaining Thailand's competitiveness in the global R-32 air-conditioner and heat-pump market will require deeper investment in institutional capacity, technical skills, and industry partnerships. To remain competitive, Thailand will need to strengthen production efficiency, improve supply-chain resilience, and expand vocational and certification programs for technicians, particularly in the safe handling, installation, and servicing of R-32 systems. Stronger university-industry research collaboration and increased local production of key components, including compressors and electronic controls, would further reinforce technological depth. Building on existing partnership models between government agencies, business associations, and international firms such as Daikin remains critical for sustained knowledge and technology transfers. At the same time, scaling up funding for cooling-technology research, particularly for next-generation technologies with the potential to reduce emissions, will be essential to preserve Thailand's position in an increasingly competitive global market.

4. Estimating green growth and export potential

Thailand could capture sizable gains from green exports under alternative future global demand and domestic supply scenarios.

Building on the analysis in the previous section, Thailand is well placed to benefit from the expansion of global demand for green goods and technologies. This section quantitatively assesses high-potential export opportunities and their implications for GDP growth and employment under two scenarios: (1) a baseline scenario, in which production expansion and market penetration are only partially realized, and (2) an ambitious scenario, in which Thailand fully leverages global market opportunities and domestic production capacity, supported by the policy reforms outlined above (See Table 7 for detailed assumptions).

The analysis is based on the E3-Thailand model⁴⁷, in which we simulate the economic impacts of the transition toward green and advanced manufacturing

⁴⁷ E3-Thailand is a macro-econometric model that provides an empirically grounded representation of Thailand's national accounting system, explicitly linked to energy consumption and greenhouse gas emissions. The model is estimated using econometric equations covering 43 economic sectors and does not impose equilibrium outcomes in either the short or long run. It relaxes standard modelling assumptions of perfect foresight, fully rational optimizing behavior, fully flexible markets, and a fixed money supply. Prices do not necessarily adjust to market-clearing levels, and factors of production, particularly labor, can remain underutilized. Economic activity in E3-Thailand is driven primarily by aggregate demand, unless binding supply constraints such as full employment are reached. As a result, the model allows for an output gap between potential output and actual output. These structural features imply that policy impacts depend

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in the three industries identified above: electric vehicles, solar photovoltaic products, and energy-efficient air conditioners. The results indicate that combined exports of EVs and parts, solar PV components and modules, and energy-efficient air conditioners could rise by an additional 2.9 percent of GDP by 2035, with scope for further expansion in subsequent decades.

Electric vehicles offer an important diversification opportunity, but export gains depend on the speed of domestic scale-up.

Thailand has strong potential to diversify into EVs, as global demand is expected to accelerate over the next decade. On the supply side, government policies promoting EV manufacturing are enabling capacity expansion, with domestic production projected to reach 411,550 private EVs by 2027 and a target of 725,000 by 2030 (Figure 81).⁴⁸ On the demand side, IEA projections suggest that global EV adoption will increase more than five-fold, from 13 percent of private vehicle sales in 2023 to 67 percent by 2035. Thailand's well-established auto parts supply chains provide a solid foundation to expand EV exports.

Under the baseline scenario, EV adoption and domestic production reach only half of government targets and continue to expand in line with global demand, resulting in EV exports that only partially offset the structural decline in internal combustion engine vehicle exports (Figure 82). Under the ambitious scenario, where Thailand fully capitalizes on both global market opportunities and domestic production capacity, EV exports could reach USD 14.9 billion by 2035 (2024 prices), equivalent to 678,116 EVs, compared to negligible export volumes today.

Despite strong export potential, the domestic value added embodied in EV exports may be lower than that of internal combustion engine vehicles, as EVs rely on fewer mechanical components (Figure 85). As shown in the previous section, World Bank analysis indicates that up to 80 percent of existing auto parts can be adapted for the EV supply chain. However, batteries, which are largely imported, account for 40–50 percent of the value of an EV, limiting local content and dampening domestic economic gains. Addressing this constraint will be critical for maximizing the growth and employment impact of EV export expansion.⁴⁹

Existing capabilities in solar PV and energy-efficient appliances provide a foundation for rapid export scaling under an ambitious scenario.

With global clean energy demand expected to surge, enhanced competitiveness could raise Thailand's solar PV export share to 7.5 percent by 2030, broadly in line with regional peers, with exports reaching USD 45.3 billion by 2035 (2024 prices).

Thailand could also build on its strong revealed comparative advantage in environmentally friendly appliances, including heat pumps and R-32 air conditioners. Under the ambitious scenario, Thailand is assumed to maintain this comparative advantage, preserving global market shares of around 35 percent for heat pumps and 20 percent for R-32 air conditioners by upgrading toward smart, energy-efficient, and low-emission technologies. These products

not only on improvements in the efficiency of resource allocation, but also on how policies affect aggregate demand through stimulus or contractionary channels.

⁴⁸ <https://www.thansettakij.com/climatecenter/net-zero/616041>

⁴⁹ https://www.deloitte.com/de/de/Industries/automotive/research/study-key-role-of-battery-costs-in-automotive.html?utm_source=chatgpt.com; <https://www.pwc.com/us/en/industrial-products/publications/assets/pwc-merge-ahead-electric-vehicles-supply-chain.pdf>

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are embedded in complex value chains with a high reliance on imported inputs, underscoring the importance of deeper participation in innovation-intensive segments and greater localization of supply chains to secure higher and more sustainable value added (Table 7).

The expansion of green manufacturing could deliver important GDP and employment gains.

Simulation results from the E3-Thailand model indicate that expansion in green manufacturing could boost real GDP growth by an average of 0.3 percentage points above the baseline during 2026–2035 (Figure 84). Sectoral output gains are strongest in electrical and electronic engineering and motor vehicles, both of which grow faster as export demand strengthens.

Employment is estimated to be around 0.6 percent higher (+203,000) than in the baseline by 2035. The largest job gains are projected in electrical appliances, with employment about 5.3 percent higher (+24,000), followed by the automotive sector at around 2 percent above baseline (+16,000). Employment responses are found to lag output gains, reflecting adjustment frictions and the capital-intensive nature of production in these sectors.

Overall employment gains are estimated to be smaller than output gains reflecting relatively lower output-employment elasticities of around 0.3–0.4 in green manufacturing, compared with an economy-wide average of about 0.5. The model also points to a shift in labor demand toward higher-skilled occupations and complementary services such as retail, logistics, and distribution, which typically offer higher wages.

These results underscore that achieving the full employment benefits of green and advanced manufacturing will depend on sustained investments in reskilling and upskilling, enabling workers to transition into emerging, higher-productivity jobs.

Figure 81: Estimated EV production capacities, based on current EV policy and targets

(EV production versus sales, units)

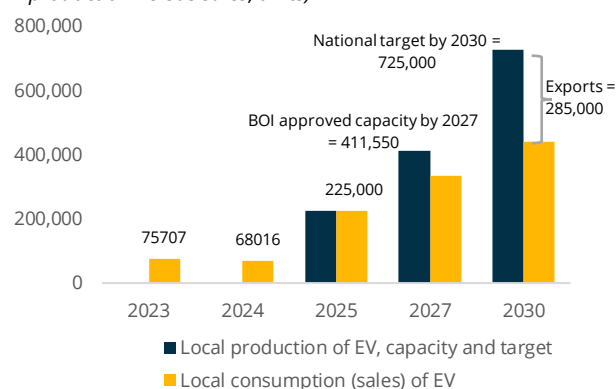
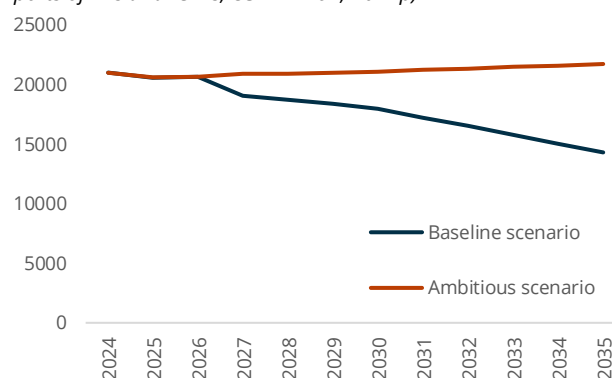


Figure 82: Automotives exports in baseline versus ambitious scenario

(Exports of EVs and ICEVs, USD million, 2024p)

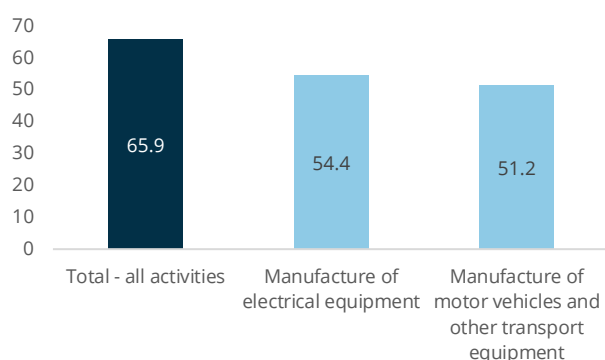


Source: National Electric Vehicle Policy Committee (EV Board), DLT, World Bank staff calculation. **Source:** World Bank staff calculations.

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Figure 83: Domestic value added in gross exports in sectors related to EV, solar PV, and A/C is lower than average

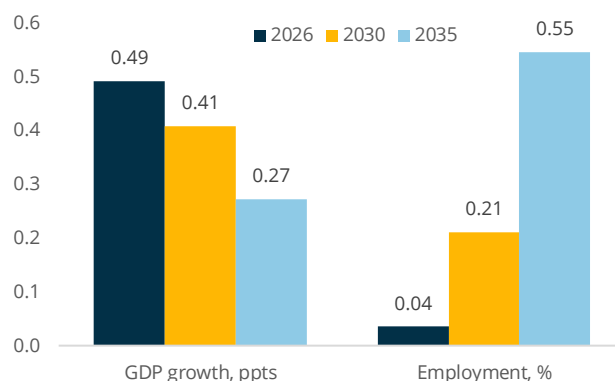
(Domestic value added, % of gross exports, 2018-22 average)



Source: OECD TiVA, World Bank staff calculations.

Figure 84: The ambitious scenario could unlock important GDP growth and employment gains relative to the baseline scenario

(GDP growth, ppts; employment, % difference from baseline)



Source: World Bank staff calculations.

Table 7: Assumptions for green product exports opportunities scenarios

Products	Scenarios	Global market share, %		Exports value, USD million 2024p		Domestic value added in exports, % of GDP	
		2023	2035	2023	2035	2023	2035
EV	Moderate: only half of the EV policy effort can be achieved	0	0.6	-	7,426	-	0.6
	Ambitious: EV policy target can be achieved by 2030	0	1.2	-	14,853	-	1.2
Solar PV	Moderate: constant market share at 4.2%	4.2	4.2	4,245	24,930	0.4	2.5
	Ambitious: market share reaches 7.5% by 2030	4.6	7.5	4,677	45,256	0.5	4.6
Air conditioners (R32) and heat pumps	Moderate: Constant market share at 20% from 2030	22.8	20	5,320	7,952	0.6	0.8
	Ambitious: Higher	22.8	25.6	5,320	10,202	0.6	1.0
Total	Baseline			9,564	40,309	1.0	4.0
	Ambitious			9,997	70,311	1.0	6.9
	<i>Different from baseline</i>			[+433]	[+30,003]	[+0.0]	[+2.9]

5. Policy recommendations

Thailand could develop a strategy to enhance green manufacturing and innovation, focusing on products where it has a comparative advantage, such as solar PV components, energy-efficient appliances, and EV parts. Strengthening participation in green GVCs will require capacity-building initiatives for SMEs, fostering public-private collaboration, and ensuring research and innovation efforts align with industry needs. A well-coordinated approach can help drive technological adoption and competitiveness in the global green economy.

Incentivizing demand for decarbonization to unlock Thailand's high technology and green manufacturing export potential and mitigate rising risks from global trade policies such as the EU's CBAM

- **Create market incentives for low-carbon investment:** introducing an effective carbon pricing mechanism and reforming fossil fuel and electricity subsidies can generate strong price signals that encourage industries to reduce emissions and improve energy efficiency. Fiscal incentives and regulatory measures can further promote investment in cleaner production and resource-efficient technologies (Box 10).
- **Investment in renewable infrastructure, grid modernization, and energy efficiency.** Apart from carbon pricing, power market and grid reforms will be needed to drive the clean-energy transition. The current Enhanced Single Buyer (ESB) model, which historically supported rapid growth, limits competition and discourages innovation, as third-party access rules heavily favor incumbent utilities (Petroleum Authority and Electricity Generating Authority of Thailand). Thailand could (1) reform its power market structure to promote competition and accelerate renewable energy adoption by revising the ESB model, expanding grid access for decentralized renewables, and aligning regulations with decarbonization objectives. This would include enabling direct renewable Power Purchase Agreements (PPAs) to give firms predictable access to clean electricity. In parallel, Thailand could (2) invest in grid modernization and regional integration, deploying advanced grid management, demand-response systems, and storage solutions.
- **Accelerate green technology adoption and low-carbon innovation:** Expanding access to green finance and technology transfers could support firms in adopting carbon-saving innovations such as carbon capture, utilization and storage (CCUS), solar farms, and advanced cooling and building technologies. These measures foster productivity growth, strengthen industrial competitiveness, and help transition Thailand's manufacturing sector toward low-emission production.
- **Promote sustainable ecosystems and sectoral transformation:** Scaling up EV adoption and charging infrastructure, advancing smart agriculture and modern water management, and integrating the Bio-Circular-Green (BCG) model, particularly in the Eastern Economic Corridor (EEC), create synergies between sectors, attract sustainable investment, and position Thailand as a regional hub for green manufacturing and climate-resilient growth.

Building innovative GVC participation and skills to unlock green competitiveness

- **Improving Thailand's investment climate is essential to attract FDI and facilitate technology diffusion.** By removing market-entry barriers, ensuring fair competition, simplifying business permits and licensing procedures, and fostering a business-friendly regulatory environment, Thailand can encourage firms to upgrade their production processes and adopt new green technologies. A key enabler will be establishing a network of private service providers

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and promoting innovative business models like Energy Service Companies (ESCOs)⁵⁰ to facilitate the widespread adoption of energy-efficient and green technologies across industries.

- **Policy incentives and targets have supported EV manufacturing in Thailand, but there is a need to ensure that foreign investment in the sector builds local capacity.** The EV industry has benefited from various incentives, including most recently (as part of the EV 3.5 package) import duty and tax cuts, subsidies, and non-tax benefits related to visas, work permits, and land ownership. While these incentives have helped to attract foreign investment, the authorities could ensure that such investments also facilitate an infusion of international expertise into Thailand through technology and knowledge transfer, skills development, and the employment of local workers. One approach is to require FDI firms to integrate local SMEs into their supply chains and meet domestic sourcing and skills development requirements, with regular monitoring to ensure these conditions are effectively implemented and strengthen domestic supplier capacity. Additionally, the government could also provide matching grants to companies that meet technology transfer and local workforce training criteria, leveraging the existing Competitiveness Enhancement Fund.
- **Similar to other EAP countries, Thailand can also boost domestic demand for cleaner technologies by eliminating distortionary policies.**⁵¹ These include fossil fuel subsidies and barriers to trade and investment in green technologies. Complementary and more targeted measures could also be considered to support low-income beneficiaries of fuel subsidies and retraining for workers in fossil fuel industries. This can enhance the economic benefits and reduce the political difficulty of reforms.
- **Developing a skilled workforce will be crucial to sustaining Thailand's green industrial transition.** An analysis based on online job posting found that over 85 percent of low-carbon technology (LCT)-related job openings in Southeast Asian countries studied were classified as high-skilled jobs. The most common occupations were Science and Engineering Professionals, followed by Business and Administration Associate Professionals and Business and Administration Professionals. Firms report facing significant difficulties finding workers with the required skills, while certain measures of cognitive (problem solving) and non-cognitive (social and leadership) skills have declined over time among new graduates.
 - The government could prioritize high-tech skill development in digital, engineering, and sustainable manufacturing while implementing targeted talent attraction policies to bridge immediate skill gaps. This could be done in close collaboration with the private sector to ensure curricula evolve alongside technological advancements.
 - Government-supported training and certification programs, particularly for technicians such as EV mechanics and solar panel installers, will be essential to building a skilled workforce and mitigating job displacement from the legacy auto sector. Additionally, funding for scholarships, training centers, and incubation hubs will play a key role in fostering talent development and innovation (Box 9).
 - **Government support for green innovation in Thailand needs refinement.** Most of the budget for green innovation and climate technology initiatives is still allocated to research institutes, government agencies, higher education institutions, and researchers, with limited involvement from the private sector as beneficiaries of green initiatives (Figure 85). Further use could be made of policy instruments that promote non-R&D-based innovation, such as vouchers for innovation, innovation finance de-

⁵⁰ Energy Service Companies (ESCOs) offers services to help scale up energy efficiency by offering specialized technical and financial services for project design and implementation.

⁵¹ Green Technologies: Decarbonizing Development in East Asia and Pacific, 2025

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risking facilities, including partial credit guarantees, and early-stage support programs for startups with new green technologies. To foster innovative activity, it is essential to keep attracting and supporting a supply of highly skilled labor, with science, technology, engineering and mathematics (STEM) skills in particular. The number of STEM graduates in Thailand has been declining in recent years, while expected to rise over the next 5 years (Figure 86).

Box 9: Fostering skills for the EV industry in China

The skilled workforce underpinning the rapid expansion of China’s EV sector was developed through systemic reforms that established an industry-driven Technical and Vocational Education and Training (TVET). This transformation was catalyzed by the establishment of the Vocational Education Law of 2022, which formally designated TVET as a pillar of industrial development and granted it equal status to general education. The law also promoted shared responsibilities among ministries, industries, schools, and local governments, in achieving national economic priorities. Following its adoption, a range of new policies and programs were introduced to promote industry-integration into TVET.

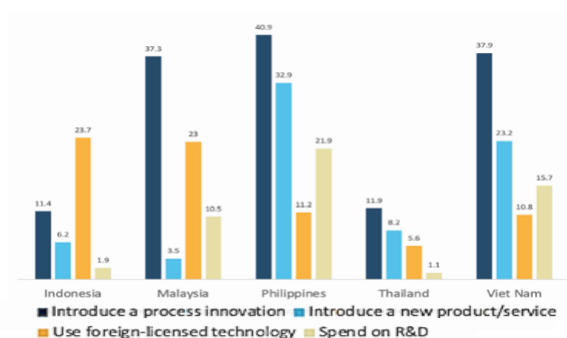
At the firm level, leading EV manufacturers have embedded training directly within the vocational education system. BYD, the leading EV and battery manufacturer, has recently established a vehicle maintenance service and training center within Changping Technical College in Beijing. To ensure the quality of vocational training, TVET instructors are required to maintain both academic and practical skills through the “dual teacher” program. The program mandates instructors to participate in placements in partner enterprises, while industry experts are recruited as part-time instructors in TVET institutions. This program helps to ensure that teaching remains aligned with rapidly evolving technologies and workplace practices.

Another example of industry-integration into TVET comes from the industrial park in Gansu Province, which puts TVET at the center of the provincial industrial development strategy. The industrial park provides incentives for leading enterprises such as Siemens to establish advanced training centers within the Park’s common facility, which is accessible across TVET institutions within the province. This approach helps to provide the most relevant training programs across the province which includes both advanced and lagging areas. Together, these efforts have helped establish a market responsive talent pipeline that supplies China’s EV sector with job-ready technicians and engineers.

Source: Based on field observations conducted during the World Bank Education Team’s China TVET Study Visit (October–November 2025)

Figure 85: There is large scope for supporting innovation and investing in R&D

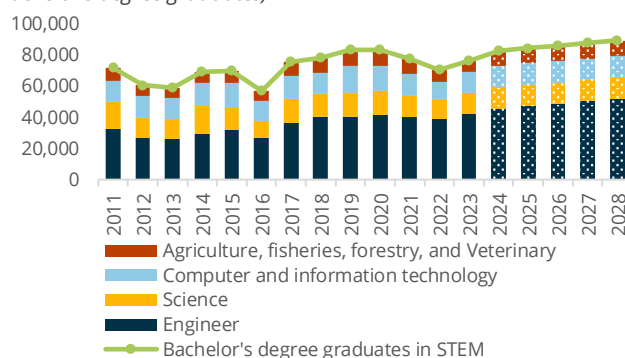
(%, share of firms)



Source: World Bank Enterprise Survey.

Figure 86: Bachelor's degree graduates in STEM

(Bachelor's degree graduates)



Source: Ministry of Higher Education, Science, Research and Innovation; World Bank staff calculations.

Box 10: Thailand's green manufacturing to attract FDI – and the role of Low Carbon Cities (LCC) project

Thailand's ambition to position itself as a regional hub for high-tech, low-carbon manufacturing increasingly hinges on access to reliable, competitively priced clean electricity. Investors in EVs, solar PV, semiconductors, and data centers are tightening low-emission production requirements. Regional competitors including Viet Nam, Malaysia, and Indonesia have all announced renewable energy commitments specifically targeting industrial users, intensifying competition for green manufacturing FDI. They now compare locations not only on labor and logistics costs, but also on access to renewables, long-term power price certainty, and credible decarbonization pathways, including the ability to use direct power purchase agreements (PPAs).

Without coordinated supply-side reforms, demand aggregation, and risk-sharing mechanisms, Thailand may face increasing difficulty to convince investors that its power system can grow fast enough, and clean enough, to support future industrial loads from EV supply chains and hyperscale data centers. Structural barriers include a constrained pipeline of utility-scale renewable energy projects; slow permitting and interconnection for new capacity; and limited grid flexibility to integrate variable renewables. Demand-side resources such as efficiency, storage, and flexible load management remain underutilized. Policy signals around direct and virtual PPAs are still fragmented, and there is not yet a carbon-pricing or trading instrument to channel private capital into mitigation at scale. SMEs and service providers in industrial estates, often key suppliers in global value chains, face additional hurdles such as higher cost of capital, limited access to tailored clean-energy products, and difficulty aggregating small projects to a bankable size.

The World Bank's Low-Carbon Cities (LCC) program helps close part of this gap by turning cities and industrial estates into demand anchors for clean energy and efficiency, while building the institutional infrastructure for a national carbon market:

- **For the public-sector, the LCC project bundles energy efficiency projects to cut costs and scale low-carbon public procurement.** The project aggregates standardized rooftop and ground-mounted solar, battery storage, and energy-efficiency investments across Bangkok and key industrial zones. Bundling projects and applying common technical standards lowers transaction costs and demonstrates how public entities can reliably procure low-carbon power and services at scale.
- **For the private sector, the LCC project provides assistance for a new national carbon credit platform.** The new national carbon crediting platform, implemented through Krung Thai Bank, uses a digital monitoring, reporting, and verification system together with a Verified Emission Reduction (VER) Payment Facility to provide results-based incentives. These payments reward factories, commercial buildings, and service providers that invest in renewable energy, storage, and efficiency using their own or commercial finance. Once emission reductions are independently verified, participants receive VER credits that can be monetized through the platform, improving project economics and accelerating payback periods.

Over time, this architecture will expand to other banks and economic sectors, creating channels to direct public and private resources into verifiable mitigation activities, including among SMEs in industrial estates. By creating a scalable pipeline of bankable low-carbon projects and a clear framework for measuring and rewarding emission reductions, the LCC project can help Thailand demonstrate to global investors that it possesses both the clean-energy infrastructure and the institutional frameworks needed to attract the next generation of green manufacturing and data center FDI.

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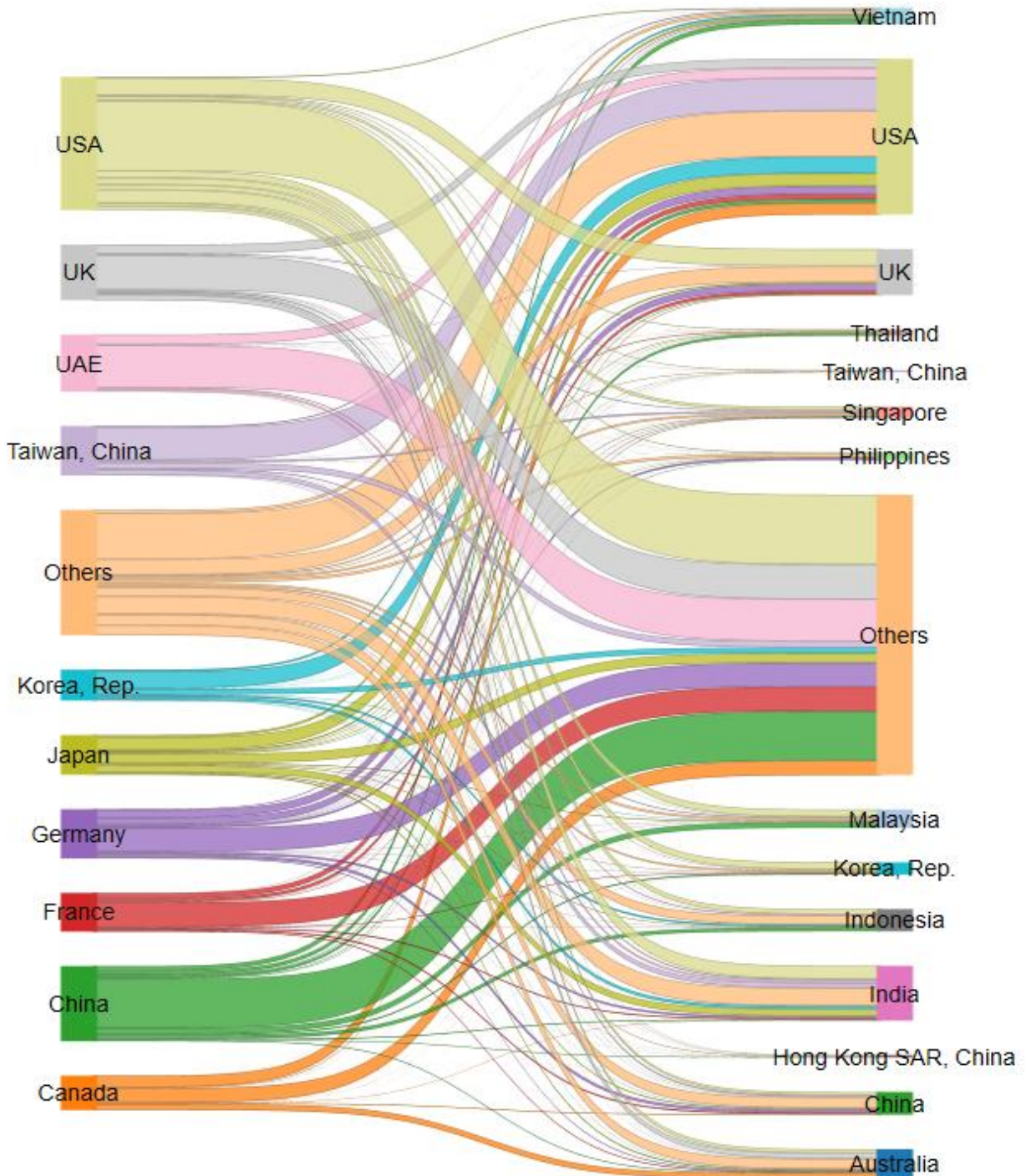
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Annex A: FDI trends

Figure Annex 1: While the United States is one of the top investors in greenfield FDI, it is also among the top recipients
(Flow of greenfield investments between top investors (on the left) and key destinations (right))



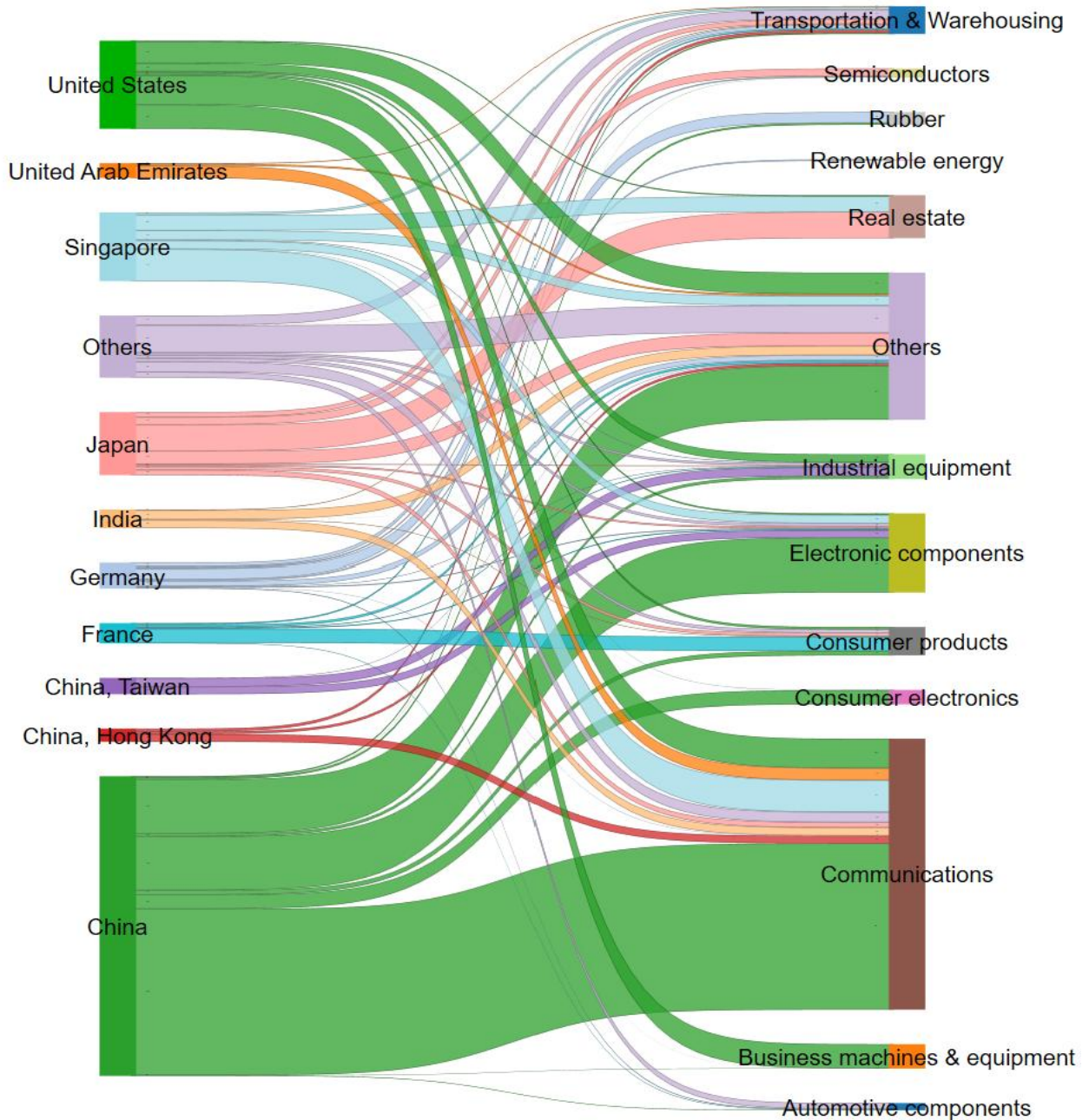
Source: fDi Markets database, Author's estimation.

Note: For simplicity, investment flows among countries not specifically depicted in the graph (i.e., those between Others and Others) are not shown.

Annex A: FDI trends

Figure Annex 2: Large investors, including those from China and the US, targeted greenfield projects in communications and electronic components in Thailand

(Top investors of greenfield FDI to Thailand (left) and sectors of Thailand that were targeted (right), average of the flows in 2023-2025)



Source: fDi Markets database, World Bank staff calculation.

Annex B: Tourism data and methodology

1. Data Sources and Coverage The analysis employs a panel dataset covering 90 economies over the period 2009–2024. The primary dependent variable is international tourism receipts (in constant 2015 US\$), derived from United Nations World Tourism Organization (UNWTO) data and deflated using World Bank GDP deflators. Tourism competitiveness data is drawn from the World Economic Forum’s (WEF) *Travel & Tourism Competitiveness Index* (2009–2019) and *Travel & Tourism Development Index* (2021–2024). Macroeconomic control variables include real effective exchange rates (REER) from the Bank for International Settlements and real global GDP from the World Bank’s World Development Indicators.

2. Construction of Competitiveness Indices (Principal Component Analysis) To address the arbitrary nature of the equal-weighting methodology used in standard WEF rankings, this analysis constructs four competitiveness sub-indices using Principal Component Analysis (PCA). PCA allows for data-driven weighting based on the correlation structure among the WEF’s 14 core pillars. The first principal component is extracted for each of the following dimensions:

- **Enabling Environment:** Aggregates business environment, safety, health, human resources, and ICT readiness (explaining ~64 percent of variance).
- **T&T Policy:** Captures government prioritization, openness, price competitiveness, and sustainability (explaining ~61 percent of variance).
- **Infrastructure:** Combines air, ground, port, and tourist service infrastructure (explaining ~76 percent of variance).
- **Natural & Cultural Resources:** Aggregates natural assets, cultural resources, and business travel facilities (explaining ~81 percent of variance).

3. Econometric Strategy (System GMM) The impact of competitiveness on tourism revenue is estimated using dynamic panel data specification to account for the persistence of tourism flows (where past performance influences current demand). The baseline model is estimated using the two-step System Generalized Method of Moments (System GMM) estimator (Arellano & Bond, 1991; Blundell & Bond, 1998) to address endogeneity concerns and potential reverse causality between tourism revenues and policy variables.

The preferred specification (Model 1) takes the form:

Where Y_{it} represents real tourism receipts, X_{it} represents the vector of four competitiveness indices, and D_{it} includes dummy variables controlling for the COVID-19 pandemic (2020–2021) and the WEF methodology change (Pre-Survey Change). Global GDP is included to capture external demand shocks, replacing mechanical time dummies to enable forecasting. Long-run multipliers, which account for dynamic adjustments over time, are calculated as

4. Decomposition and Scenario Simulation The decomposition of Thailand’s revenue decline (2019–2024) applies the estimated coefficients from the preferred model to the observed changes in Thailand’s competitiveness scores, exchange rates, and global economic conditions. The contribution of each factor is calculated as the product of its coefficient and its change over the period, expressed in log points.

Scenario simulations for 2025 forecast revenue growth by projecting the fitted model forward. The “Shock Scenario” incorporates a 7 percent real appreciation of the Thai Baht and a 0.5 standard

Annex B: Tourism data and methodology

deviation deterioration in the Enabling Environment index (specifically the safety component), while holding other factors constant at baseline projections.



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