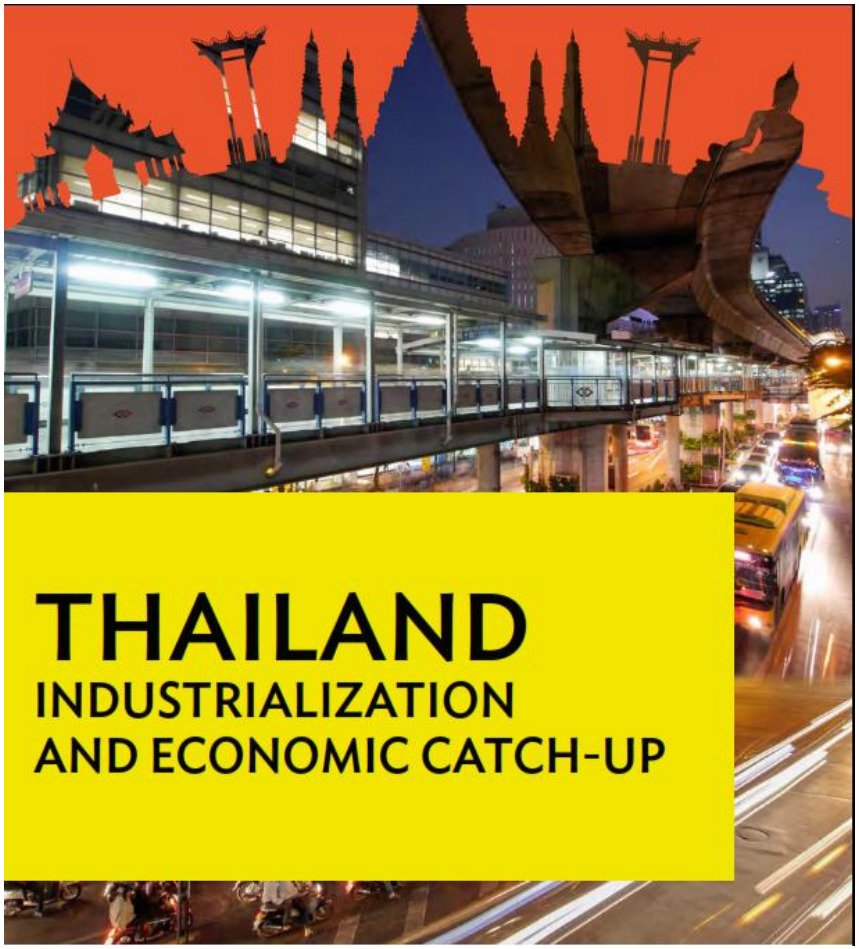
THAILAND: INDUSTRIALIZATION AND ECONOMIC CATCH-UP

ADB's Country Diagnostic Study

EE 460: Thai Economy
Semester 1 / 2019
Faculty of Economics, Thammasat University



THAILAND
INDUSTRIALIZATION AND ECONOMIC CATCH-UP

COUNTRY DIAGNOSTIC STUDY

ASIAN DEVELOPMENT BANK

ADB

1. Overview: Economic Transformation and Industrial upgrade

- Thailand has undergone major industrial and social transformation amid rapid economic growth and development for over half a century. It is now the second largest economy with the 4th highest income per capita in the Association of Southeast Asian Nations.

- It has successfully shifted its economy from agriculture to export-oriented manufacturing, while integrating key production, particularly automobiles and electronics, into regional value chains.

Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- Now, as an upper-middle-income country, however, it faces new challenges. Wages are rising rapidly and productivity growth needs to keep up. Overall labor productivity grew 1.9% between 2007 and 2012, but with marked differences across sectors: it increased 2.5% in manufacturing, 1.9% in services, and 0.9% in agriculture.

- The country is also losing competitiveness in low-wage, low-skilled goods to less-developed, labor-abundant countries. Exports of labor-intensive goods will soon fall below imports of those goods.

Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- As Thailand has transitioned from an agrarian to industrial economy, its manufacturing and service industries have also moved from the lower-end of the global value chain to the higher end.
- However, both horizontal and vertical transitions remain incomplete. The agriculture sector still employs almost 40% of the workforce.
- Employment in manufacturing has stagnated, while the bulk of the workforce remains engaged in low-productivity, small-scale activities in trading and services.

Source: ADB(2015)

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- Moving further up the global value chain and reaching high-income status requires upgrading industrial sophistication and increasing domestic value addition in exports.

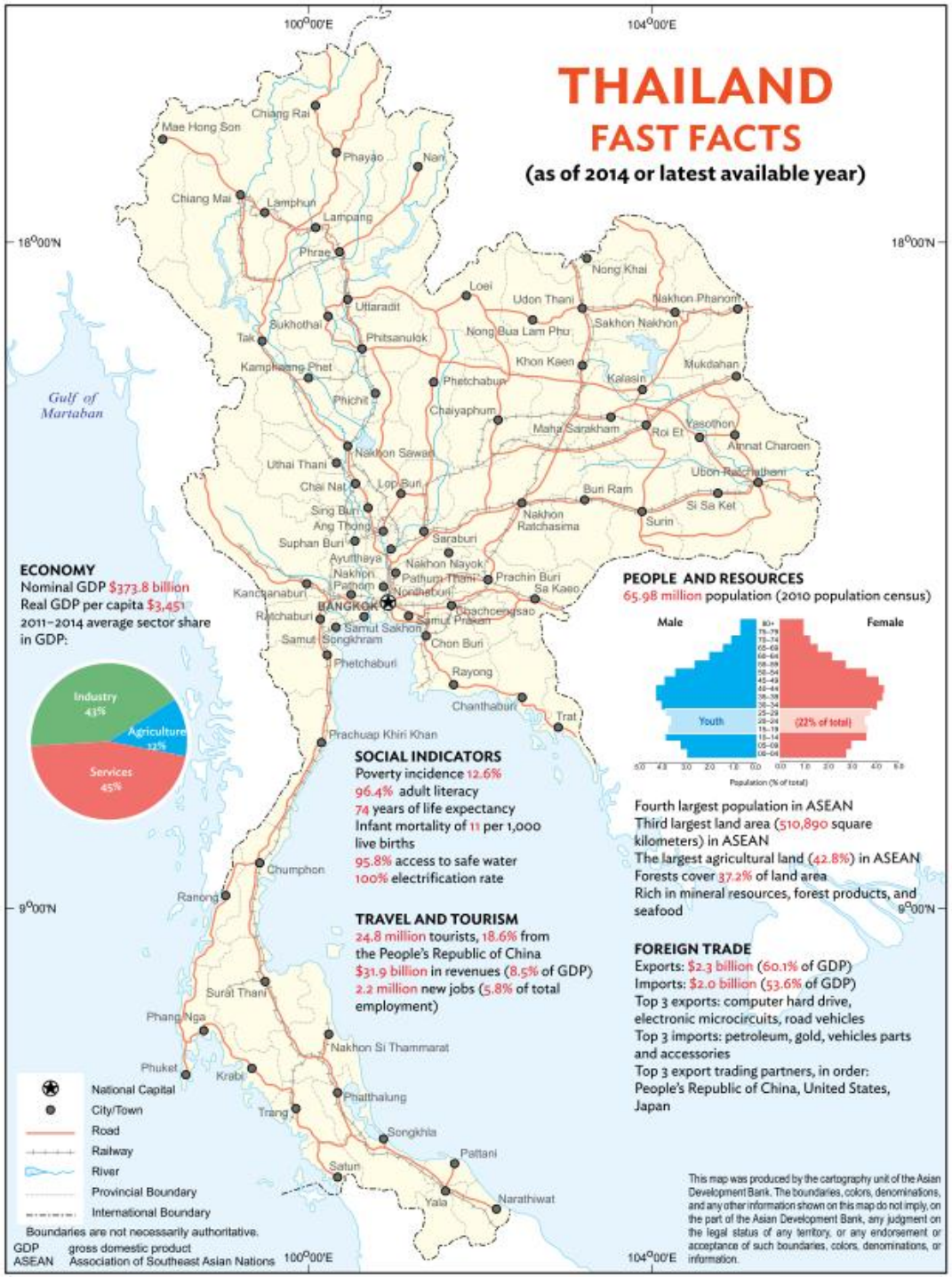
- Failure to do so, or to establish a broader base of innovative firms and improve competitiveness in the services sector, may constrain longer-term growth potential and, more importantly, the prospect of creating an adequate number of quality jobs for inclusive growth.

Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- This report identifies five major challenges in this transition:
  - (i) enhancing research and development and international technology transfers;
  - (ii) elevating workers' skills and their industrial relevance;
  - (iii) addressing structural impediments to competition, notably in services;
  - (iv) providing advanced transport and logistics infrastructure; (v) improving access to finance and technology for micro, small, and medium-sized enterprises.
- Thailand needs to enhance the domestic content of production capabilities for current technology and capital intensive export industries.

Source: ADB(2015)



SOCIAL INDICATORS

Poverty incidence 12.6%
96.4% adult literacy
74 years of life expectancy
Infant mortality of 11 per 1,000 live births
95.8% access to safe water
100% electrification rate

TRAVEL AND TOURISM

24.8 million tourists, 18.6% from the People's Republic of China
$31.9 billion in revenues (8.5% of GDP)
2.2 million new jobs (5.8% of total employment)

FOREIGN TRADE

Exports: $2.3 billion (60.1% of GDP)
Imports: $2.0 billion (53.6% of GDP)
Top 3 exports: computer hard drive, electronic microcircuits, road vehicles
Top 3 imports: petroleum, gold, vehicles parts and accessories
Top 3 export trading partners, in order: People's Republic of China, United States, Japan

Source: ADB(2015)

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- While the economy staged a notable comeback in 2010 and 2012 following the global financial crisis of 2008–2009, concerns remain about long-term growth potential.
- As an upper-middle-income country, Thailand faces new challenges. Wages are rising rapidly, which requires productivity to keep pace for industries to remain competitive. Despite the visible shift from an agrarian to an industrial economy, employment in manufacturing has stagnated.
- While parts of the economy are engaged in world-class export sectors, such as automobiles and electronics or in high-end hospitality and other services, the bulk of the workforce remains in low-productivity, small-scale activities in trading and services. The agriculture sector still employs almost 40% of the workforce.

Source: ADB(2015)

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- Regional imbalances are another challenge. Areas near and around Bangkok are highly developed, but a key challenge remains in spreading activity to the less developed North, Northeast, and far South regions.
- Failure to upgrade and move to higher-value segments of global production networks, establish a broader base of innovative firms, and improve competitiveness in services may constrain longer-term growth potential and, more importantly, the prospect of creating an adequate number of quality jobs that can make growth inclusive.

Source: ADB(2015)

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- Moving into the higher-value economic sectors requires not only innovation and advanced technologies in production and processing, but also an environment that is conducive to new businesses and investments. Major transformation is in order:
- this means accelerating market reform and enhancing competition, upgrading infrastructure for a modern industrial and service economy, improving access to finance and technology for micro, small, and medium sized enterprises, establishing effective social and educational policy, and promoting regionally balanced growth and development.

Source: ADB(2015)

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- Thailand has transitioned to an upper-middle income country, but recent economic growth has lagged behind low- and middle-income southeast Asian neighbors.
- Thailand has been a development success story, with sustained growth and impressive poverty reduction, particularly in the 1980s, when gross domestic product (GDP) grew 7.8% a year on average, which was the second highest among comparators after the Republic of Korea.
- However, this high growth momentum was interrupted by the Asian financial crisis of 1997–1998, followed by the fallout from the global financial crisis of 2008–2009 and the devastating flood in 2011. More recently, during 2011–2014, GDP growth has slowed to 2.5% (Table 1.1).

Source: ADB(2015)

Table 1.1: Real GDP Growth Rates, 1971–2014 (%)

Year	Indonesia	Republic of Korea	Malaysia	Philippines	Taipei,China	Thailand	Viet Nam
1971–1980	7.9	9.0	7.8	5.9	7.4	**6.9**	...
1981–1990	6.4	9.7	6.0	1.7	7.6	**7.8**	4.6
1991–2000	4.2	6.5	7.1	2.9	6.2	**4.5**	7.6
2001–2010	5.2	4.4	4.6	4.8	3.9	**4.3**	6.6
2011–2014	5.7	3.0	5.4	5.9	3.0	**2.5**	5.7

Table 1.2: Per Capita Real GDP, 1985–2014 (in 2005 $)

Country	1985	1990	1995	2000	2005	2010	2014
Cambodia	...	...	263	329	471	605	745
Lao PDR	245	262	308	375	472	629	794
Viet Nam	268	301	410	532	699	900	1,078
Indonesia	655	840	1,129	1,086	1,273	1,570	1,866
Philippines	907	1,002	993	1,061	1,201	1,403	1,649
Thailand	**1,047**	**1,572**	**2,280**	**2,206**	**2,690**	**3,164**	**3,451**
Malaysia	2,609	3,147	4,348	4,862	5,554	6,319	7,304
Brunei Darussalam	30,806	26,831	27,294	25,926	25,914	24,589	25,140
Singapore	12,193	16,554	21,651	24,921	29,870	34,758	38,088

Source: ADB(2015)

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- Income per capita has increased considerably after decades of steady economic growth, by 2014 reaching at least three times the 1985 level (Table 1.2), pushing poverty rates lower.
- The share of the population living below the national poverty line reached 12.6% in 2012, down from 65.3% in 1988 (World Bank, WDI).
- However, growth was the lowest in the ASEAN region during 2011–2014, at 2.5%. The economy contracted 2.3% in 2009, and, even though it rebounded in 2010 by 7.8%, devastating floods saw near-zero growth in 2011 (0.1%). Growth gained a second wind in 2012 (6.5%).

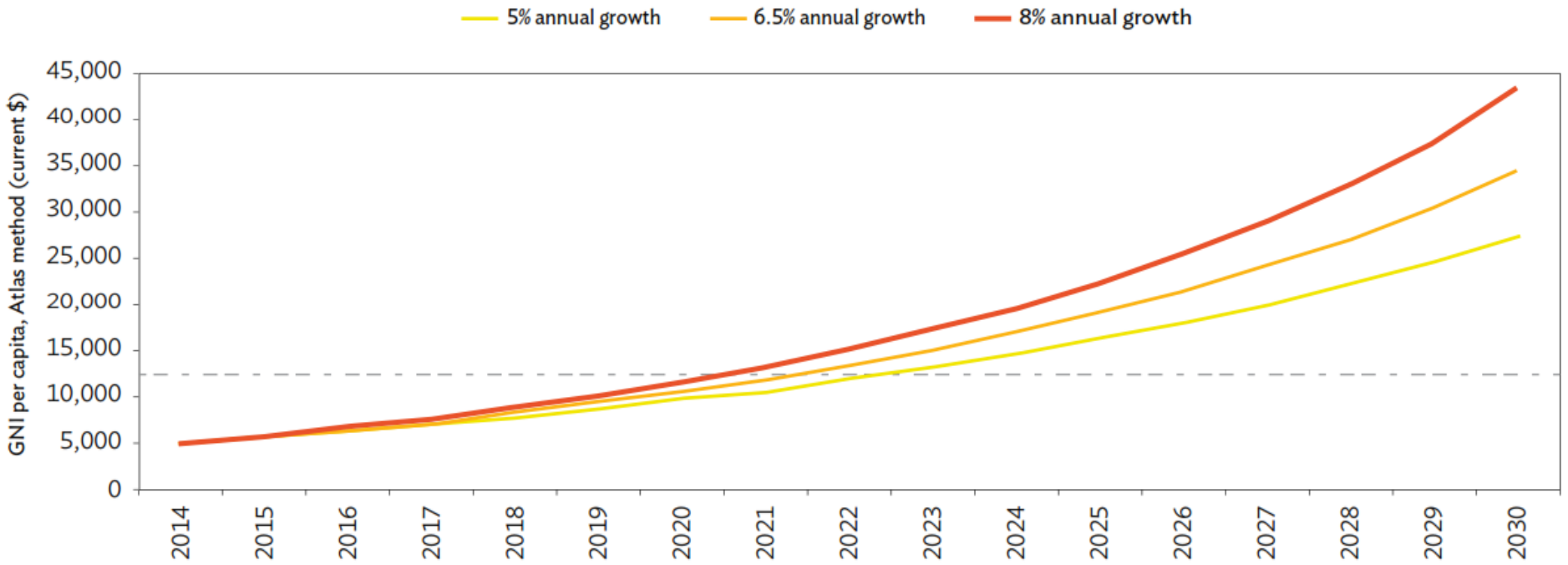
Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- Yet, simple projections based on possible growth rates suggest that Thailand has a lot of growing to do.
- Gross national income per capita grew an average of 2.9% during 2005–2014. Continuing at that pace, it would take 11 years, or until 2025, for Thailand to become a high-income country.
- But with fewer negative shocks, the country could grow faster, at 5% it would take 9 years (by 2023) to reach that income level; at 8%, it would take 7 years (by 2021) (Figure 1.1).

Source: ADB(2015)

Figure 1.1: Thailand's Growth Path at Different Growth Rates, 2014–2030



GNI = gross national income.
Note: Thailand is an upper-middle-income country, with a per capita GNI of $5,340 in 2013 (the threshold for upper middle income is $4,125). The dashed line indicates the threshold for high income (and the upper boundary for upper middle income) at $12,736 per capita GNI. Income thresholds are based on World Bank classifications.

Source: ADB(2015)

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- Thailand's economic restructuring has been significant in the past 3 decades.
- An inter-sectoral shift from agriculture to industry has occurred, with services retaining an important role.
- The economic shocks and consequently more moderate growth of the past 15 years have not impeded this long-term secular trend.
- But the transformation into a fully industrialized economy is far from complete, and a significant intra-sectoral transformation into higher value segments within the manufacturing and services sectors is at an early stage.

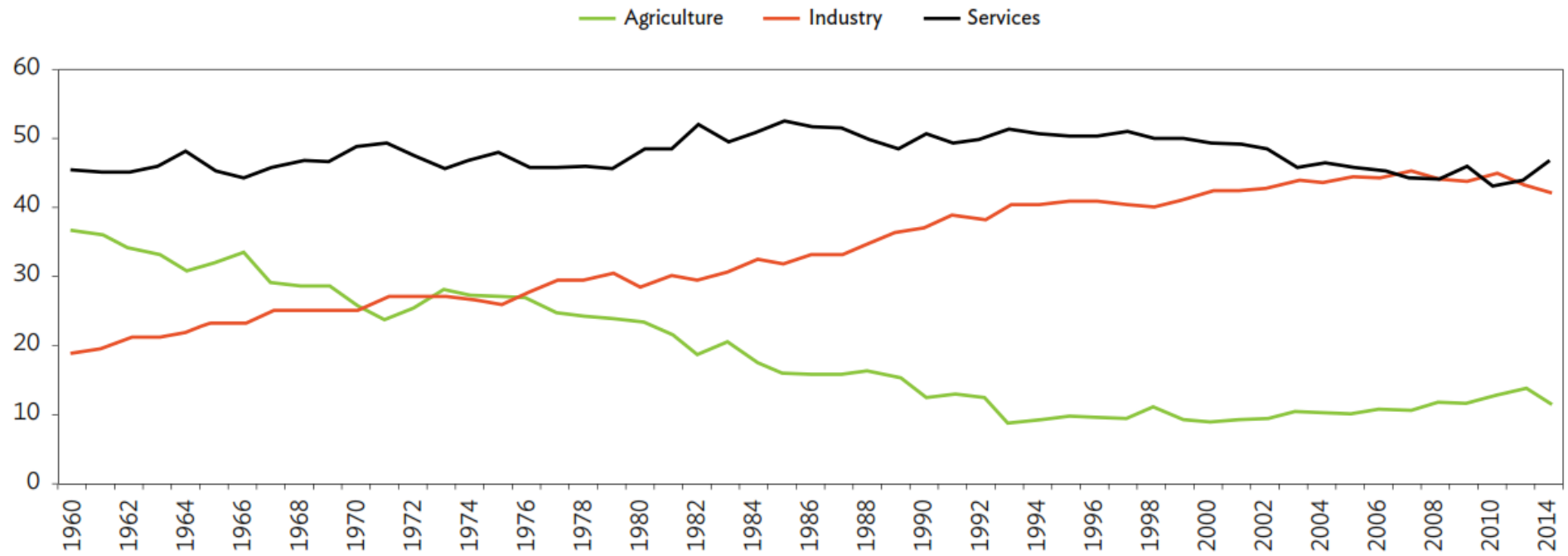
Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- The industry sector expanded rapidly in the past several decades, accounting for 42% of GDP in 2014, from 30% in the early 1980s (Figure 1.2).
- Over the same period, agriculture's share of output has fallen significantly, from about 25% to just over 12%.
- Thailand's sectoral shares are broadly similar to those of other large developing economies in Southeast Asia, notably Indonesia, Malaysia, the Philippines, and Viet Nam (Figure 1.3).

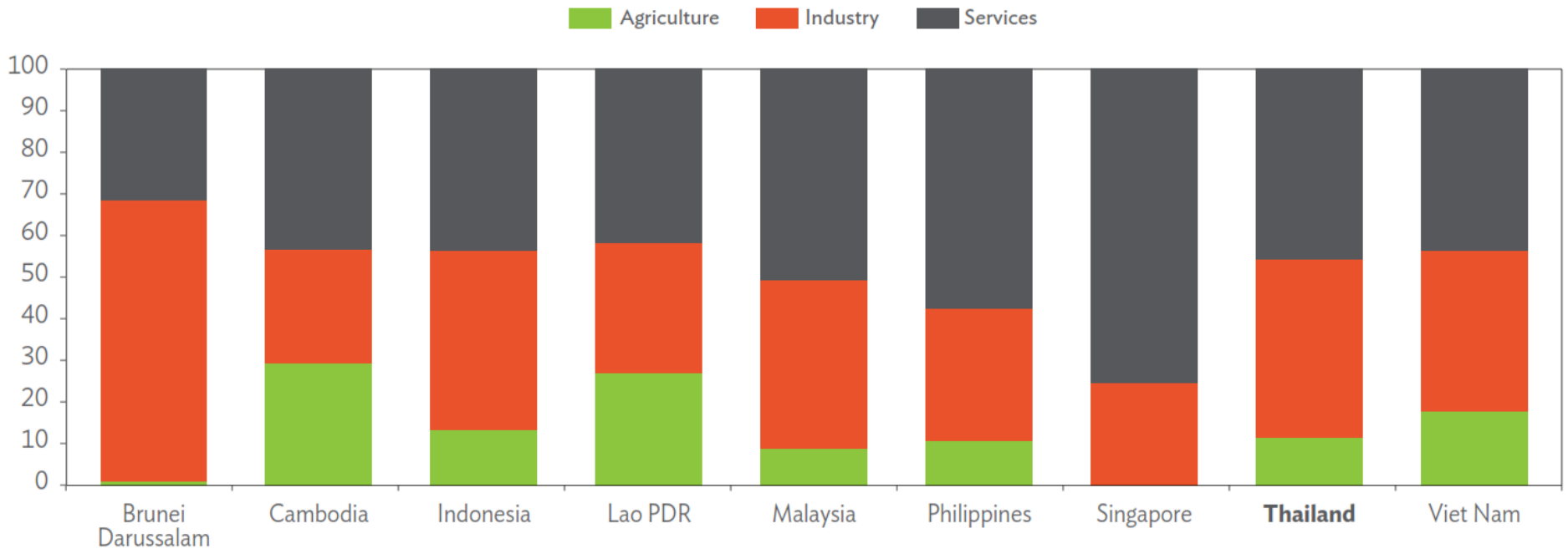
Source: ADB(2015)

Figure 1.2: Sector Shares in GDP, 1960–2014 (%)



Source: ADB(2015)

Figure 1.3: Shares of Major Production Sectors in GDP, 2014 (%)



Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- But structural transformation is far from complete.
- While agriculture's share of GDP has declined sharply, its share of the labor force has not.
- Agriculture accounts for 12% of output, but around 40% of employment. This suggests still significant room for rural labor shedding.
- The government has put a high priority on improving agricultural productivity in its 11th National Economic Social Development Plan, which targets increasing the proportion of agriculture and agro-industry sectors in GDP to at least 16%.
- Improving productivity in the agriculture sector will boost rural incomes and promote more regionally balanced growth while freeing up underemployed rural labor for potentially more productive industrial and service sectors.

Source: ADB(2015)

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- The share of labor in manufacturing has been relatively flat since the mid-1990s, peaking at 16% in 2005 with 5.6 million workers.
- It has fallen since then to below 14%. Increases in services have made up for the declines in agriculture and manufacturing employment—and the sector now accounts for 39% of the labor force.
- As part of this structural transformation, the contribution of the respective sectors to output growth has also evolved over time (Table 1.3).
- Agriculture's contribution declined considerably from about 22% in the 1960s to about 10% during 2011–2014. Growth in the sector fell to around 2% annually over the last 2 decades as increases in crop productivity waned.

Source: ADB(2015)

Table 1.3: GDP Average Annual Growth and Contribution of Major Production Sectors, 1961–2014 (%)

Period	GDP Growth Rate	Agriculture			Industry			Services		
		Growth Rate	Share to GDP	Contribution to GDP Growth	Growth Rate	Share to GDP	Contribution to GDP Growth	Growth Rate	Share to GDP	Contribution to GDP Growth
1961–1970	7.6	5.1	31.1	21.7	11.2	22.8	27.6	8.0	46.0	50.7
1971–1980	6.9	4.0	25.4	14.8	9.3	27.9	33.4	7.1	46.7	51.8
1981–1990	7.8	3.9	16.8	9.2	10.5	32.8	41.5	7.7	50.3	49.3
1991–2000	4.5	1.7	10.0	5.2	6.2	40.2	53.2	3.8	49.8	41.6
2001–2010	4.3	2.2	10.6	5.3	5.4	43.7	54.1	3.8	45.7	40.6
2011–2014	2.5	2.5	12.3	9.4	0.5	42.8	9.3	4.4	44.9	81.3

Source: ADB(2015)

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- The services sector contributed just over one-half of GDP growth from the 1960s to the 1980s and then yielded preeminence to industry in the 1990s. However, growth in both industry and services has slowed markedly in the past 15 years, lowering GDP growth overall.
- The manufacturing subsector, now accounting for about three-quarters of industrial output, posted strong growth of about 10% annually during the 1960–1980s.
- While its growth slowed to about 5%–7% during the 1990s and 2000s, its share in GDP and contribution to overall growth rose to the highest levels.
- During 2011–2014, however, manufacturing sector growth and its contribution to GDP growth declined substantially (Table 1.4).

Source: ADB(2015)

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- Wage rates in Thailand did increase in the early 1990s, with hardly any corresponding increases in labor productivity (Nipon and Somkiat 2001).
- The country faced increasing competition from low-wage countries such as the People's Republic of China (PRC), India, the Philippines, and Viet Nam.
- During 1996–2001, including the Asian financial crisis years, Fukao (2013) estimates that Thailand's annual growth rate of labor productivity was 7.83 percentage points lower than the level during the high-growth period of 1985–1996, before the crisis.
- Of this, about 2 percentage points decline in labor productivity following the crisis was due to the marked slowdown in the shift of labor from agriculture to high-productivity sectors; the remaining 5.83 percentage points has been attributed to a drop in total factor productivity, which led to a decline in capital accumulation within each sector

Source: ADB(2015)

Table 1.4: Contribution of Manufacturing Industry Subsector to GDP Growth, 1961–2014 (%)

Period	Manufacturing		
	Growth Rate	Share to GDP	Contribution to GDP Growth
1961–1970	11.6	14.2	19.6
1971–1980	10.1	19.0	26.2
1981–1990	9.9	23.3	28.5
1991–2000	7.3	29.5	46.6
2001–2010	5.5	34.4	43.7
2011–2014	0.3	34.1	4.7

Source: ADB(2015)

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- The manufacturing sector is becoming more capital intensive as Thailand loses the competitive advantage of abundant labor and low wages.
- The shares of labor-intensive sectors, such as food and textiles, have declined steadily, while shares rose in industries such as automobiles and electronics, which are relatively capital-intensive (Kim 2012), with possible implications for the ability of these industries in the manufacturing sector to generate employment.
- Growth and structural transformation have largely concentrated in and around Bangkok.

Source: ADB(2015)

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- Table 1.5 illustrates substantial differences in income, population, and the nature of economic activity across the seven geographic regions used in aggregating the gross provincial product of Thailand's 77 provinces.
- The three faster-growing, richest regions account for nearly 68% of national GDP, but just 36% of the population.
- That means that the four poorer regions are home to about 64% of the population, but produce only about one-third of national output.
- The Northeastern region is especially lagging, accounting for about 28% of the population, but only 11% of output.
- Moreover, the ratio of per capita GDP between the Eastern region (the richest) and Northeast (the poorest) was 6 in 2013, a large regional disparity by international standards, and one that has not improved over the past 3 decades.

Source: ADB(2015)

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- Over the last 30 years, the gap between the poorer and richer regions has widened, with per capita income expanding nearly three times faster in the richer.
- Per capita income in the richer group was 3.9 times that of the poorer group in 2013 (Table 1.6).
- Indeed, even within the richer region there has been very little income convergence, although the relatively small Eastern region, with development of its petrochemical activities and other capital-intensive industries, has recently overtaken Bangkok and vicinities for the top spot in regional per capita income.
- The Central region is making only modest progress in closing the gap.

Source: ADB(2015)

Table 1.5: Gross Regional Product, Population, and GRP per Capita

Region	GRP in 2013 (B million)	Population ('000 people)	GRP per Capita	GRP Growth 1981–2013
Bangkok and vicinity	5,723,246	15,203	376,463	5.5
Central	748,582	3,131	239,078	5.8
Eastern	2,327,906	5,406	430,584	7.6
Faster-growing regions	8,799,734	23,740	370,668	5.9
Northeastern	1,403,267	18,828	74,532	5.7
Northern	1,135,633	11,557	98,268	4.4
Southern	1,114,868	9,044	123,270	4.6
Western	456,530	3,586	127,294	4.3
Slower-growing regions	4,110,298	43,015	95,556	5.2
Thailand	**12,910,038**	**66,755**	**193,395**	**5.3**

B = Thai baht, GRP = gross regional product.
Sources: National Economic and Social Development Board Database. http://eng.nesdb.go.th/Default.aspx?tabid=96 (accessed October 2015), and ADB estimates.

Source: ADB(2015)

Table 1.6: Sector Shares in Regional GDP, 1981, 1983, 2013 (%)

	Poorer Regions		Richer Regions		Thailand	
	1981	2013	1983	2013	1983	2013
Agriculture	37.6	28.5	9.6	3.3	21.4	11.3
Industry	17.0	25.3	39.6	42.4	30.1	37.0
Manufacturing	8.4	15.6	32.9	33.4	22.6	27.7
Services	45.4	46.1	50.8	54.3	48.5	51.7
GDP	100.0	100.0	100.0	100.0	100.0	100.0
Ratios of per capita GDP						
Richer/poorer	3.9	3.9	...	...	...	...
Richer/Thailand	...	...	2.2	1.9	...	...
Share of population	73.9	64.4	26.1	35.6		

... = not applicable, GDP = gross domestic product.
Sources: National Economic and Social Development Board databases (accessed October 2015), and ADB estimates.

Source: ADB(2015)

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- The structure of regional production evolved only slightly between 1981 and 2013.
- The poorer regions continue to rely on agriculture, as agriculture accounts for nearly 30% of gross regional product (GRP), although that reliance has weakened by 9 percentage points of GRP, shifting resources largely to small scale manufacturing.
- Meanwhile, the richer regions expanded in manufacturing and services as agriculture dwindled to about 3% of GRP.
- Notably, the share of services in GRP in the richer regions increased only slightly over a long period of sustained increases in income, while it did not change in the poorer group.
- Despite marked differences in income between the two regional groups, population shifted only modestly to the richer region.
- Since labor participation rates are broadly uniform across the country, with essentially no unemployment, labor productivity in the various regions is broadly reflected in the disparity in per capita income levels.

Source: ADB(2015)

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- Lagging growth and growing income gaps in the poorer regions reflect low investment in physical and human capital and, consequently, low productivity in these regions.
- A study of recent budget expenditures (World Bank 2012a) indicated that the Bangkok area, with 17% of the population, received 72% of total budget expenditures; the Northeast, with 34% of the population, received only about 6%.
- This and similar small shares of budget resources for other lagging regions is a major factor behind disparities in the provision of infrastructure and the quality of educational and health services.
- While concentrating resources on developing Bangkok, with its port and the nearby provinces, likely offered the best opportunity for achieving rapid national growth, the challenge now is to broaden the scope of growth.
- It is also to reduce economic and structural imbalances across domestic regions by balancing the focus of public expenditure and inducing greater private investment to increase growth both in lagging regions and the whole country.

Source: ADB(2015)

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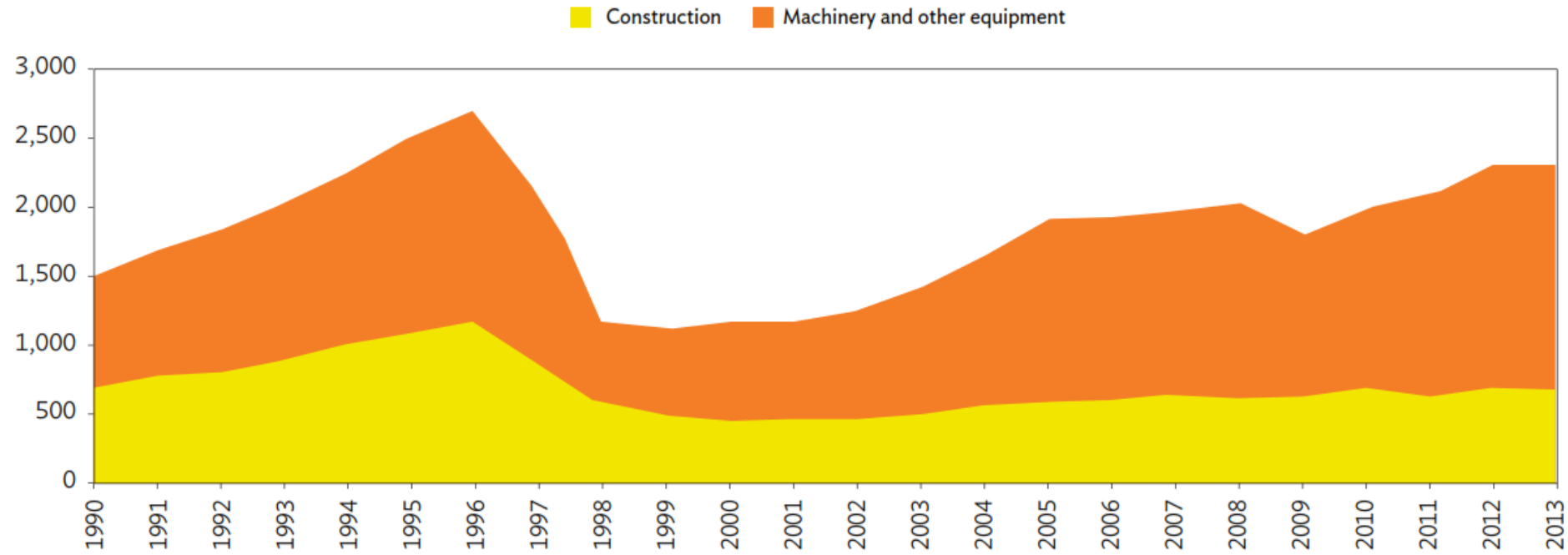
- Relatively low investment has been the key economic weakness over the past decade or longer.
- The investment rate has averaged more than 26% over the past decade, down sharply from 41% of GDP in the high-growth period in the 1990s prior to the Asian financial crisis.
- Total investment has not regained its pre-crisis level in absolute terms, although, admittedly, the pre-crisis level may have been largely exaggerated due to prevailing asset price booms.
- Nonetheless, investment in machinery and equipment, which also fell sharply during the Asian financial crisis, has regained its pre-crisis level in recent years (Figure 1.4).
- Construction investment has remained generally lower than levels of the early 1990s prior to the real estate boom years.

Source: ADB(2015)

Figure 1.4: Real Gross Capital Formation by Type, 1990–2013

(chain volume measures, reference year = 2002)



Source: National Economic and Social Development Board databases (accessed August 2015).

Source: ADB(2015)

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- The slowing of foreign direct investment and the fall in high-technology exports is a concern for the sustainability of growth.
- Where domestic investment fell, foreign investment picked up part of the slack.
- Foreign direct investment (FDI) became significantly more important in the years following the Asian financial crisis, accounting for between 10% and 30% of investment in most years (1999–2008) prior to the global financial crisis (Figure1.5).
- Its role is crucial, as the bulk of FDI is oriented toward higher-value-added manufacturing.

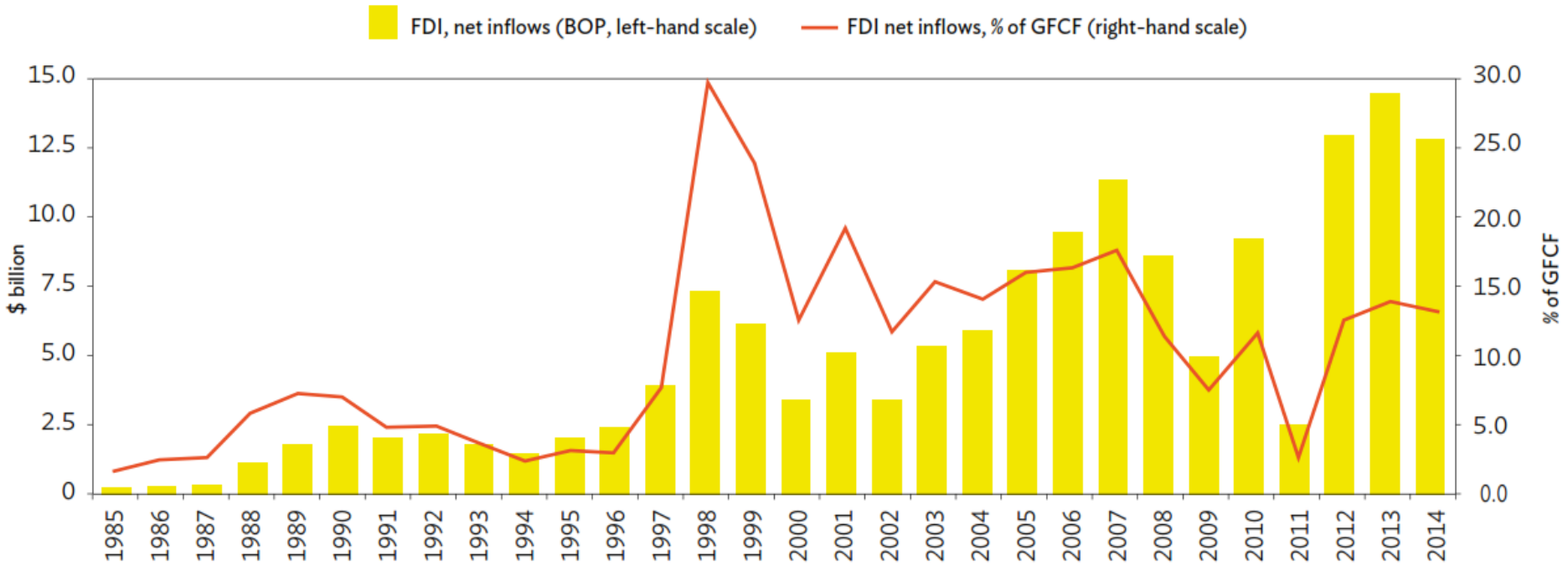
Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- However, FDI inflows slowed in the wake of the global financial crisis, and the share of FDI in total financial flows has been
- trending lower since peaking in 2007.
- It is now under 13%, although the dollar value of FDI recovered to a relatively high $12.7 billion in 2014.
- Taken together, the fall of FDI as a share in fixed investment in recent years—along with the fall to 25% from just over 30% in the early 2000s in the share of high-technology exports in total manufactured exports—is worrisome.
- On the other hand, outward FDI by Thai companies to neighboring ASEAN economies has increased sharply in recent years, reflecting the shortage of operational workers and relatively high wage rates in Thailand.

Source: ADB(2015)

Figure 1.5 Foreign Direct Investment, 1985–2014



BOP = balance of payments, FDI = foreign direct investment, GFCF = gross fixed capital formation.
Source: World Bank. World Development Indicators. http://data.worldbank.org/data-catalog/world-development-indicators (accessed August 2015).

Source: ADB(2015)

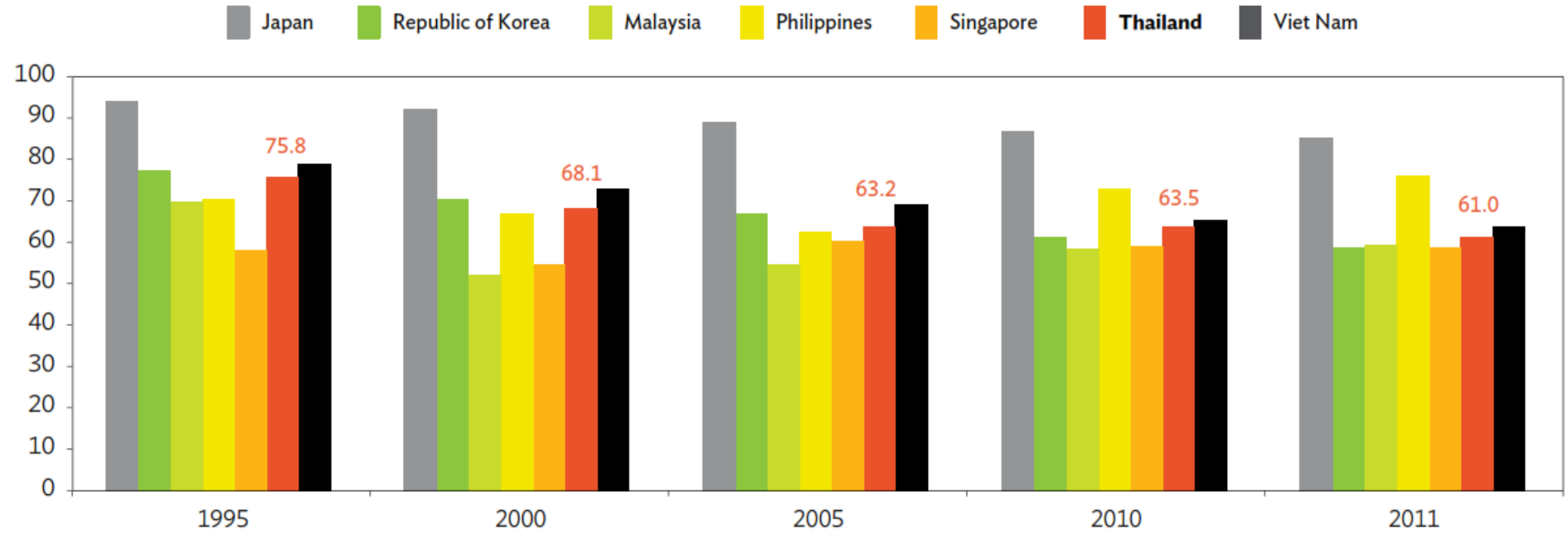
1. Overview: Economic Transformation and Industrial upgrade

- Enhancing domestic value addition will have important implications for the sustainability of economic growth and employment generation.
- Although until now Thailand has attracted FDI quite successfully to move up the global value chain and join the camp of high-income economies, particularly in export-oriented sectors, it needs to upgrade industrial sophistication and increase domestic value addition in its exports.
- The domestic-value-added content in total gross exports declined overall during 1995–2011, while the gross exports-to-GDP ratio increased from 33.0% in 1995 to 54.2% by 2011; domestic value added in gross exports during the same period declined from 75.7% to 61.0% (Figure 1.6).

Source: ADB(2015)

Figure 1.6: Domestic Value Added in Gross Exports, Selected Economies, 1995–2011

(% of total exports)



Source: OECD.iLibrary. OECD.Stat. http://www.oecd-ilibrary.org/economics/data/oecd-stat_data-00285-en (accessed August 2015).

Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- Analyzing the disaggregated data gains more insight into the domestic-value-added content in exports.
- Table 1.7 breaks down the different sectors by domestic value addition, showing that total manufacturing and transport equipment, along with basic metals and machinery equipment, are the major sectors responsible for this decline.
- This also reflects the declines in the country's comparative advantage and competitiveness in these sectors.
- Of particular concern associated with this is a fall in both FDI inflows and domestic value addition after the global financial crisis.

Source: ADB(2015)

Table 1.7: Thailand Domestic Value Added in Exports by Industry, 1995–2011 (%)

Industry	1995	2000	2005	2010	2011
Total	**75.71**	**68.08**	**63.16**	**63.43**	**61.01**
Agriculture, hunting, forestry, and fishing	**90.44**	**86.76**	**83.53**	**83.64**	**81.91**
Mining and quarrying	**89.92**	**89.12**	**84.15**	**84.78**	**82.48**
Total Manufactures	**68.23**	**60.35**	**55.52**	**55.16**	**51.66**
Wood, paper, paper products, printing, and publishing	75.52	75.90	70.28	66.49	61.40
Chemicals and non-metallic mineral products	71.24	64.14	59.32	60.05	55.41
Coke, refined petroleum products, and nuclear fuel	70.44	53.37	38.51	44.02	40.56
Rubber and plastics products	72.76	67.68	64.79	66.05	62.60
Other non-metallic mineral products	74.88	70.69	61.51	65.24	59.90
Basic metals and fabricated metal products	52.94	56.54	43.89	42.46	37.23
Machinery and equipment, nec	51.69	53.28	47.95	51.59	44.38
Electrical and optical equipment	51.40	40.66	39.88	41.68	37.51
Computer, electronic, and optical equipment	51.05	39.09	37.36	39.27	34.75
Electrical machinery and apparatus, nec	52.90	45.87	46.78	50.02	46.58
Transport equipment	51.81	48.75	49.44	50.58	45.12
Electricity, gas, and water supply	**82.54**	**77.39**	**63.23**	**67.21**	**62.49**
Construction	**71.80**	**64.17**	**54.27**	**58.04**	**52.67**
Total Business Sector Services	**88.53**	**84.25**	**80.72**	**82.12**	**80.44**
Transport and storage, post, and telecommunication	83.86	75.18	69.45	71.58	68.96
Community, social, and personal services	**80.15**	**75.72**	**74.74**	**75.00**	**71.30**

...nec = not elsewhere classified.
Source: OECD iLibrary. OECD.Stat. http://www.oecd-ilibrary.org/economics/data/oecd-stat_data-00285-en (accessed August 2015).

Source: ADB(2015)

1. Overview: Economic Transformation and Industrial upgrade

- To strengthen competitiveness, and sustain high and inclusive growth, Thailand needs to develop sectors with high value-adding activities and employment generation potential.
- Growth and employment potential therefore depend on how well the country can diversify into new sectors and activities and move up the global value chain into high-value added manufacturing and, eventually, high-skill services sectors.

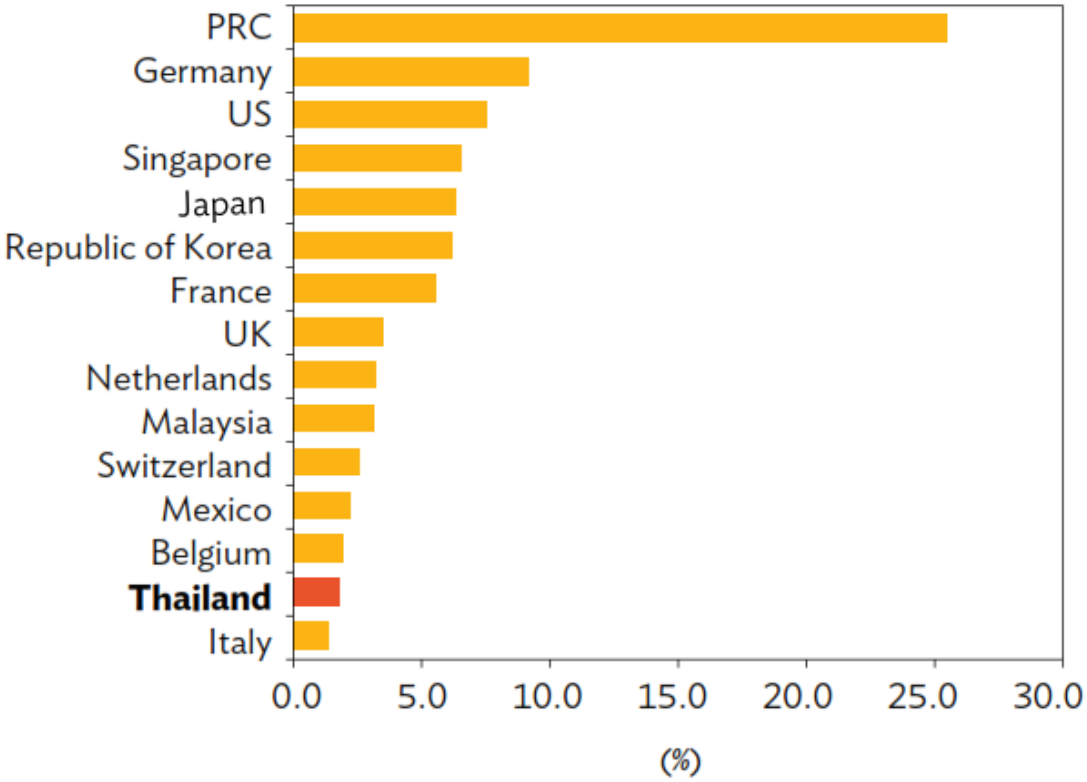
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- **Thailand's reliance on technology lending versus technology transfer**
- Multinational companies, both assemblers and component producers, have brought leading technologies into Thailand in the key areas of electronics and automobiles (see next section).
- But because it is acquired through FDI without substantial backward linkages, this technology does not constitute technology transfer—which in the traditional sense means the acquisition of technology by domestic firms.
- Instead it is "technological lending" between the parent company's headquarters and its Thai affiliate.
- Thailand's technological sophistication is thus related to the extent of technological lending determined by those links of the production network conducted there. In the early years of the auto industry, not only was there no technology transfer, but technological lending was also very weak, as the import of complete knock-down kits required only simple assembly activities with low technological requirements.

Source: ADB(2015)

Figure 2.1: Share of Global High-Tech Exports, Top 15 Economies, 2012



PRC = People's Republic of China, UK = United Kingdom, US = United States.
Note: The data indicate a country's total share of world exports in high-tech goods.
Source: World Bank. World Development Indicators. http://data.worldbank.org/data-catalog/world-development-indicators (accessed on September 2015).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- **Thailand's record in technology acquisition and innovation is complex and uneven.**
- On the one hand, it is a leading producer of high-tech products, notably in automobiles and electronics. It is the 12th largest automobile producer in the world, specializing in light trucks, and is a leading production site for hard disk drives. The country is thus a major exporter of high-value goods, ranking 14th in the world (Figure 2.1).
- Multinational firms provide much of the technology for this production, which from the 1980s onward capitalized on Thailand's stable economy, low cost workforce, and Large domestic market to develop production clusters.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Yet, innovation is an area for further improvement; the technology foreign companies provided has not spilled over to domestic firms, while the domestic business community has invested relatively less in innovation.
- Research and development (R&D) is weak, with limited patenting activity.
- The government has established a system of innovation through science parks, research grants, and public research institutions covering areas ranging from metallurgy and food processing to nanotechnology and biotechnology, but the impact of these efforts is yet to be seen.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Gauging the technological level of a country is not easy and is normally done by proxy—by charting the sophistication of goods produced. More advanced technology is needed to make more complex goods.
- While analyzing domestic production is useful, more standardized and detailed production data are provided by exports. Exports data can also provide a measure of competitiveness because goods are competing with those produced by other countries.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

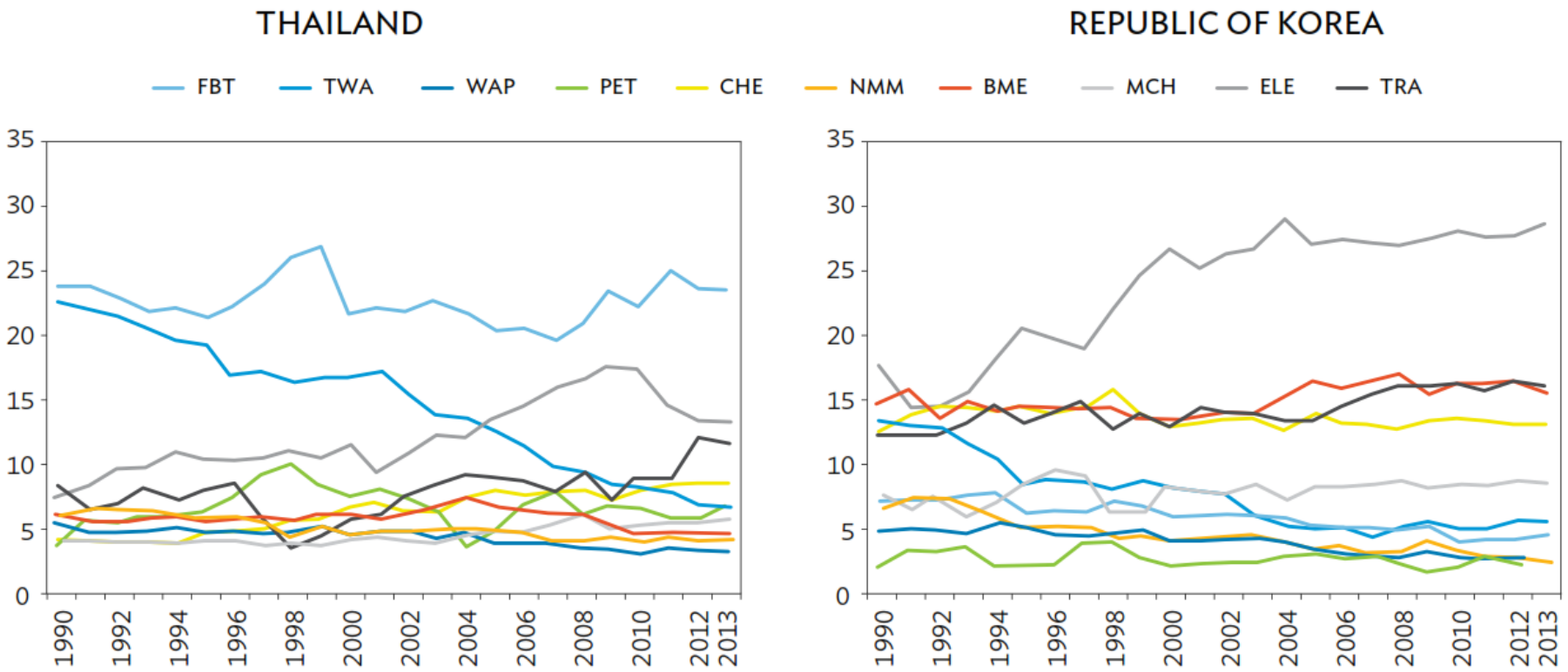
- Export data, however, may not clearly represent the domestic embeddedness of technology because
  - (i) technology to produce exported goods may be provided by and contained within foreign-owned firms; and
  - (ii) sophisticated inputs, which contribute to export value, may be imported. Despite these limitations, we first look briefly at changes in the domestic composition of production followed by a more detailed analysis of export data.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- **Industrial structure shows a significant shift to more high-value manufactured goods and away from agriculture.**
- The increased sophistication of production in Thailand is confirmed in the trend of value-added composition among manufacturing sectors (Figure 2.2).
- The shares of labor-intensive sectors such as food and textiles have declined steadily, while those of more technologically intensive sectors such as electronics and automobiles rose. In 2013, food processing accounted for the largest proportion of value added, at about 24% of total manufacturing, followed by electronics (13%), transport (12%), chemical products (9%), and petroleum products (around 7%).

Figure 2.2: Value-Added Composition of Manufacturing, Thailand and the Republic of Korea, 1990–2013 (%)



BME = basic metal and metal fabrication; CHE = chemical products; ELE = electrical and electronic products; FBT = food, beverage, and tobacco; MCH = machinery; NMM = non-metallic materials; PET = petroleum and coal products; TRA = transport equipment; TWA = textile and wearing apparel; WAP = wood and paper products.

Sources: For Thailand: National Economic and Social Development Board. Gross Regional and Provincial Product Database. http://eng.nesdb.go.th/Default.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The share of labor-intensive textile and food industries peaked in the mid-1970s and continued to decline, with less than 5% currently.
- Although this pattern of structural change in manufacturing is not so different from those of other countries, it is worth remarking that the Republic of Korea maintained a high share of textiles until the mid-1980s.
- The share of labor-intensive sectors in the Republic of Korea declined sharply afterward and was replaced by the rising share of electronics, chemical products, and transport equipment.
- Concurrently, Republic of Korea manufacturing in total turned from a labor-absorbing to a releasing industry.
- Thus, considering the high share of agricultural labor in Thailand, it may be premature for the country to shed labor-intensive manufacturing.
- It does appear, however, that the rise of labor-abundant countries, such as the PRC and Viet Nam, has squeezed Thailand's manufacturing into more capital-intensive production.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The significant shift to more high-value manufactured goods and away from agriculture and resource based.
- Products is also seen in basic export data, using the Standard International Trade Classification (SITC). The share of agricultural products and raw materials (SITC 1 to 4) declined from 61.4% in 1980 to 18.2% in 2013 (Table 2.1).
- Compared with the Republic of Korea and Taipei,China, whose exports are already more specialized in manufactured goods and machinery, Thailand is still active in exporting agricultural products. It is noticeable, however, that the SITC 7 items (relatively more sophisticated industrial products) account for 46.8% in Thailand.
- As the structural change in exports of the Republic of Korea and Taipei,China shows, export development occurs through shifting major export items from light industries (SITC 6 and 8) to heavy and more sophisticated ones (SITC 7).
- In this respect, the current export structure of manufactured products in Thailand appears highly developed considering its income level, which corresponds to the Republic of Korea's and Taipei,China's in the early 1980s.
- This could be due to the growth of Thailand's export industries through the expansion of the global production network on one hand and the decline of textiles and consumer nondurables through competitive pressure from low wage economies on the other.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- This conjecture is confirmed if we trace the share of the garments, a representative labor-intensive product that usually accounts for the largest share in manufactured items at the initial stage of export development.
- Garments accounted for about 9.2% and was a top export category in total exports of Thailand in 1990, but its share decreased to 5.9% by 2000 (Table 2.2).
- However, in 10 years it lost its top place to road vehicles, office machines, and electronic products and disappeared from the list of the top 10 exports in 2013.
- In comparison, apparel remained the number one export item in 1970–1990 in the Republic of Korea, where labor-intensive light industries accounted formore than 50% of total exports until the mid-1980s.

Source: ADB(2015)

Table 2.1: Export Shares, 1980 and 2013 (%)

SITC Description	Thailand		Republic of Korea		Taipei,China	
	1980	2013	1980	2013	1980	2013
Food, beverages, and tobacco (0,1)	44.0	11.9	7.1	1.0	9.7	0.8
Crude materials and animal oils (2,4)	17.4	6.3	2.1	1.3	2.0	1.1
Mineral fuels (3)	0.1	1.2	0.5	0.9	0.6	0.2
Chemicals (5)	1.2	10.6	3.4	12.2	3.0	10.6
Manufactured goods and miscellaneous articles (6,8)	31.4	21.3	70.3	22.5	60.4	29.4
Machinery and transport equipment (7)	5.6	46.8	15.8	60.9	23.8	63.6
Unclassified (9)	0.3	1.9	0.7	1.1	0.5	1.2

SITC = Standard International Trade Classification.
Note: The items are aggregated into 1-digit level based from the 4-digit levels of the SITC revision 2.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Table 2.2: Share of the Top 10 Export Items in Total Exports in Thailand, 1990, 2000, and 2013 (%)

1990		2000		2013	
Seafood	10.4	Office machines	15.1	Road vehicles	11.5
Garments	9.2	Electrical machinery	13.8	Office machines	11.4
Other manufactures	7.7	Telecommunications, etc.	6.8	Electrical machinery	10.9
Electrical machinery	7.0	Seafood	6.1	Telecommunications, etc.	5.0
Office machines	6.8	Garments	5.9	General machinery	4.9
Vegetables and fruit	6.7	Other manufactures	4.4	Artificial resins and plastic	4.7
Non-metallic minerals	5.1	Road vehicles	3.3	Crude rubber	4.0
Cereals	4.7	Non-metallic minerals	3.2	Other manufactures	3.9
Telecommunications, etc.	4.4	General machinery	3.2	Rubber products	3.3
Crude rubber	4.3	Artificial resins and plastic	3.1	Seafood	3.0

Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

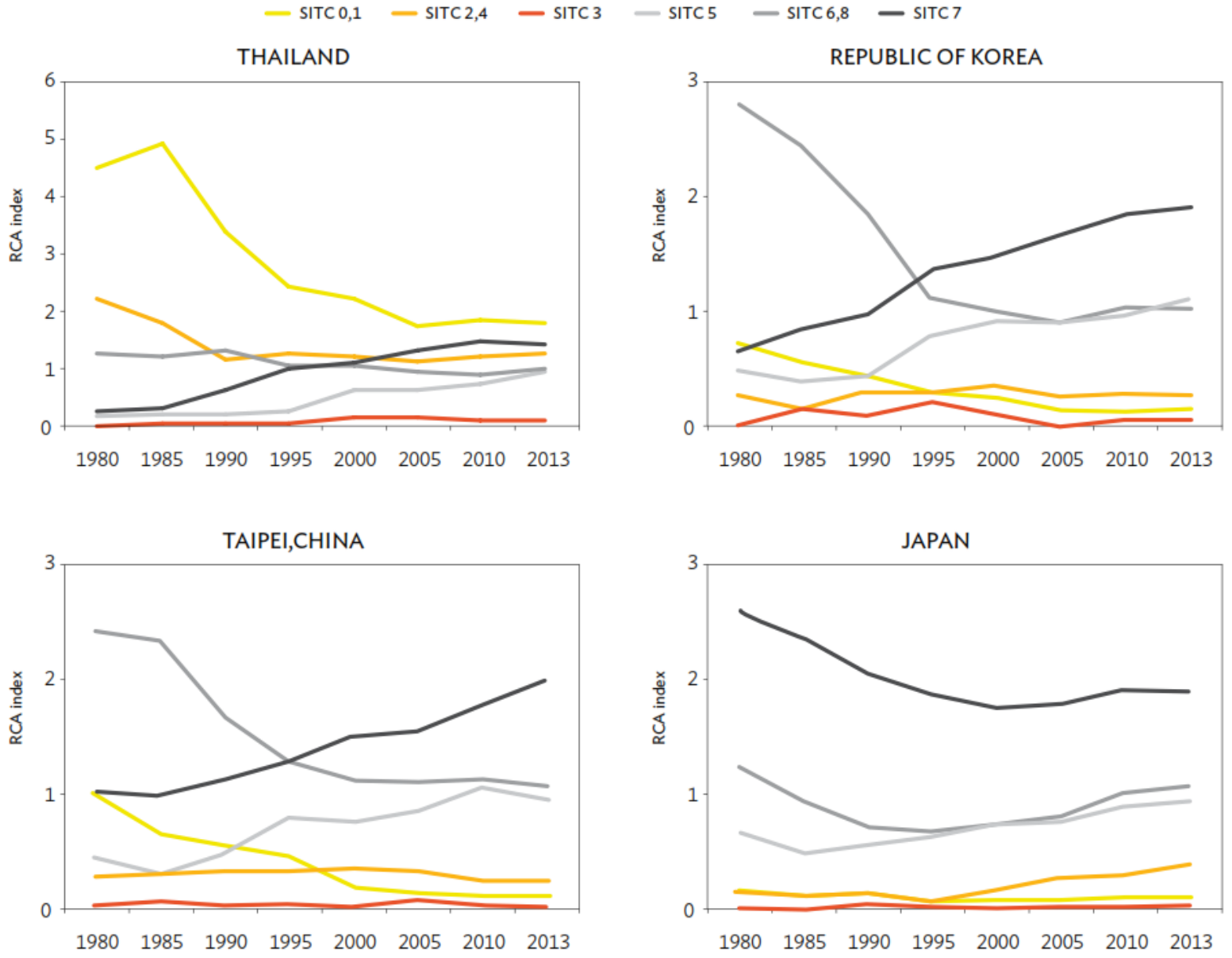
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The trend of revealed comparative advantage (RCA) tells the same story about Thailand's export structure (Figure 2.3).
- The experience in East Asia shows that the typical pattern of export development from labor-intensive light industries comes with a sharp decline of agricultural products or crude materials, and then moves to more sophisticated goods.
- It might be noted, however, that even Japan maintained the comparative advantage in the SITC 6 and 8 items until the mid1980s.
- The Republic of Korea and Taipei,China had maintained the comparative advantage of these items until the mid-1990s.
- Compared with these three countries, Thailand's export development in terms of RCA started in the 1980s, but skipped the period of rapid expansion of exports in SITC 6 and 8 items that these other countries went through.

Source: ADB(2015)

Figure 2.3: The Trend of Revealed Comparative Advantage, Selected Economies, 1980–2013



Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Another characteristic of Thailand is the rise of SITC 7 items triggered by foreign-invested enterprises.
- The RCA of the 2-digit-level items in SITC 7 shows that Thailand has strong comparative advantage in office machines and road vehicles.
- Japan has comparative advantage in most of the items in SITC 7, except for office machines and other transport equipment.
- The Republic of Korea has strong comparative advantage in SITC 76 and 77 items due to its competitive mobile phone and household appliances industries (Table 2.3).

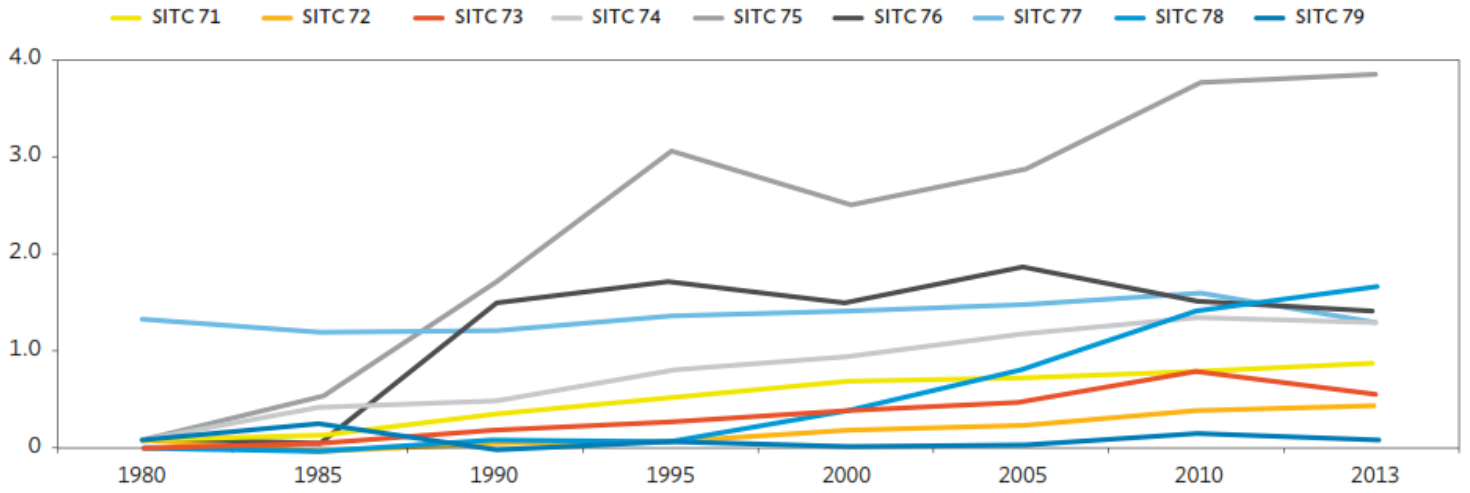
Source: ADB(2015)

Table 2.3: Revealed Comparative Advantage of SITC 7 Exports in 2013

SITC Code	Commodity Classification	Thailand	Republic of Korea	Japan
71	Power-generating machinery and equipment	0.86	0.79	1.97
72	Machinery specialized for particular industries	0.39	1.38	2.85
73	Metalworking machinery	0.58	1.58	4.68
74	General industrial machinery and equipment	1.35	1.14	1.74
75	Office machines and automatic data processing equipment	3.84	0.92	0.54
76	Telecommunications, sound recording, and reproducing equipment	1.35	2.80	0.89
77	Electric machinery, apparatus, and appliances	1.29	2.88	1.74
78	Road vehicles	1.62	1.67	2.99
79	Other transport equipment	0.06	1.15	0.70

SITC = Standard International Trade Classification.
Note: The items are aggregated into 2-digit levels based from 4-digit levels in SITC revision 2.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Figure 2.4: Trend of Thailand's Revealed Comparative Advantage of SITC 7 Exports, 1980–2013



SITC = Standard International Trade Classification.
Note: Commodity classification of SITC 71–79 provided in Table 2.3.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Among items in SITC 7 of Thailand, office machines including hard disks (SITC 75) and road vehicles including pickup trucks (SITC 78) rose rapidly in terms of RCA (Figure 2.4).
- It is noticeable that the RCA of general industrial machinery and equipment exports is steadily rising.
- The trend of export development, along with the rising income level of countries, indicates that the expansion of export volume and the diversification into new items in SITC 7 items are a natural way for Thailand to increase the role of manufacturing in production and employment.
- The question is where the potential is and how to realize it.

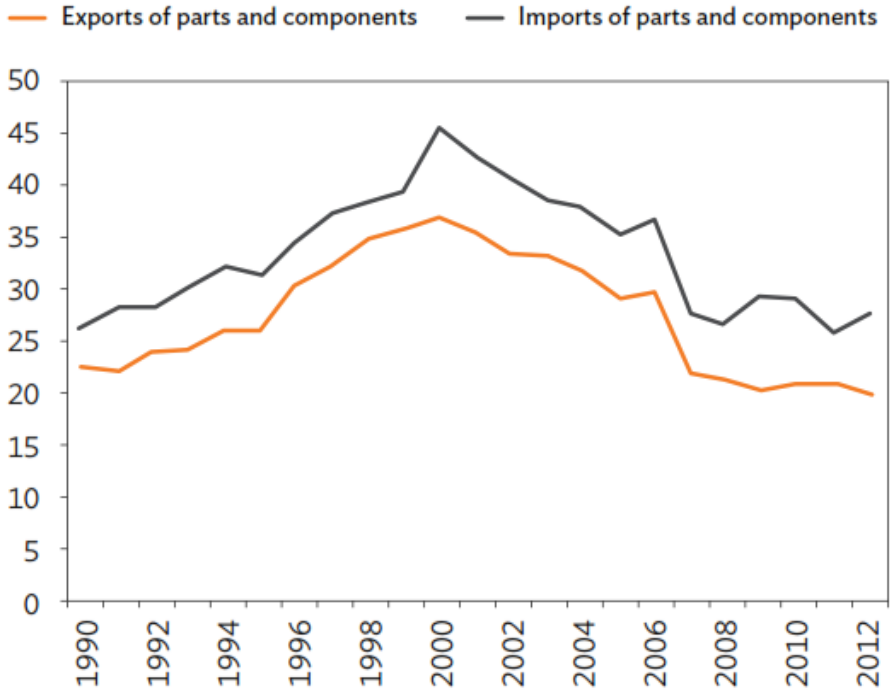
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Within the manufacturing sector, evidence shows that Thailand has upgraded from exporting parts and components to higher-value final products.
- Figures 2.5 and 2.6 show the evolution of parts and components vis-à-vis final goods as a share of trade in manufactured goods.
- In the 1990s, as Thailand was setting up its automotive and electronics assembly industries, parts and components increased as a share of exports, peaking in the early 2000s.
- However, the share of parts and components started to fall again in the late 2000s as the country's manufacturing industry upgraded to higher-value final products.

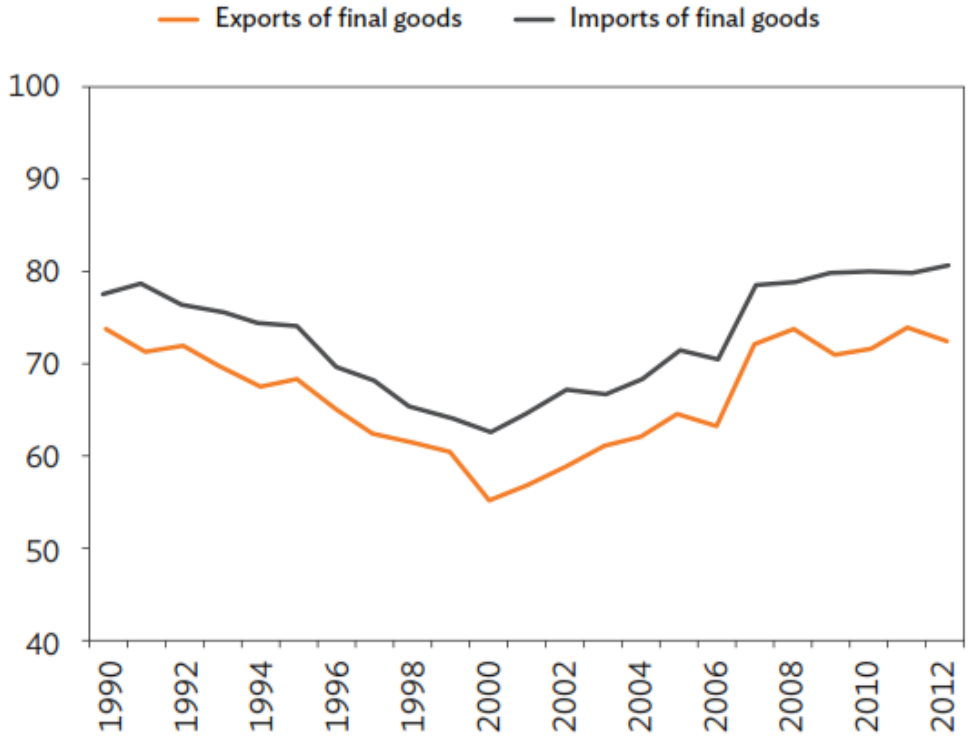
Source: ADB(2015)

Figure 2.5: Share of Parts and Components in Total Manufactured Exports and Imports in Thailand, 1990-2012 (%)



Note: Parts and components using SITC Revision 3 are defined by P. Athukorala and A. Kohpaiboon. 2009. Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. *ADBI Working Paper Series No. 177.* Tokyo: Asian Development Bank Institute.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Figure 2.6: Share of Final Manufactured in Total Manufactured Exports and Imports in Thailand, 1990-2012 (%)



Note: Final manufactured goods are computed as total manufactured goods less parts and components.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The overall sophistication of an economy is not easy to measure. But recently some researchers developed techniques based on detailed export data to create aggregate indicators that proxy for a particular country's productive capabilities.
- Briefly speaking, these indicators measure the sophistication of individual products based on the income level of countries that are successful in exporting them. The underlying assumption is that higher-income countries export more technically advanced and sophisticated goods.
- First, one can estimate a product's sophistication. The sophistication level of products (PRODY) index is the average exporting countries' gross domestic product per capita weighted by each country's revealed comparative advantage for the exported commodity.
- Second, one can estimate an aggregate PRODY index for the export basket of a particular country. This is the weighted sum of the PRODY values of all the products that a country exports, with the weights being the share of each commodity in the country's total exports.
- This aggregate sophistication score can offer insights into the country's productive capabilities. A higher score indicates that the country has acquired complex capabilities that make it easier to export sophisticated products.

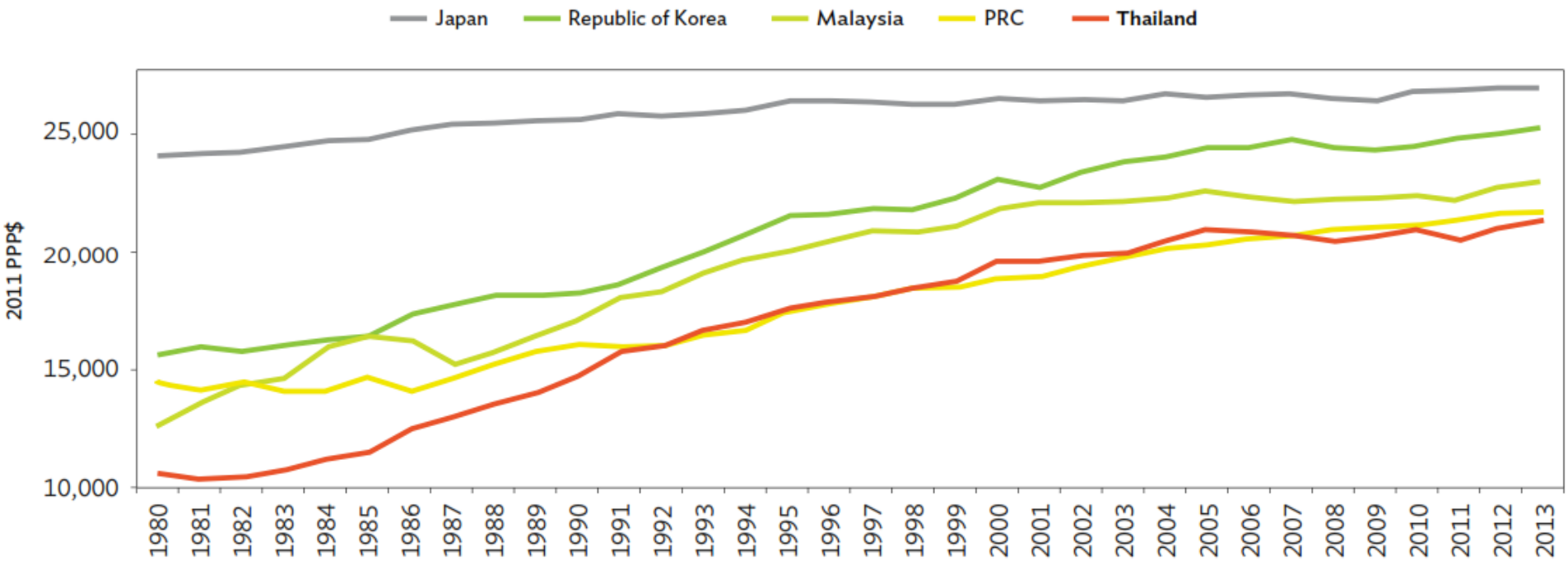
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Thailand's export sophistication has been steadily increasing since the 1980s; however, in the mid-2000s, this increase started to taper off, likely due to stiffer competition from the PRC combined with a glut in demand from advanced economies due to the global financial crisis (Figure 2.7).
- In fact, Thailand's export sophistication started declining from 2008 onward, though from 2013 it has been very slowly catching up with the PRC's again.
- The PRC's sophistication nonetheless also continued to increase in the same period, indicating that Thailand may have lost some ground to that country's lower costs of production and scale economies during this period.
- **The majority of Thailand's exports remain technically less sophisticated than other middle-and high-income Asian economies.**

Source: ADB(2015)

Figure 2.7: Sophistication of Export Baskets in Selected Countries, 1980–2013



PPP = purchasing power parity, PRC = People's Republic of China.
Note: Figures represent trends in the (PRODY) index.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Despite an increase in overall export sophistication, its exports are still focused on relatively less sophisticated manufactured goods.
- More than 60% of Thailand's exports are in groups 3, 4, and 5 of the PRODY index, similar to the PRC, but less sophisticated than Malaysia (Figure 2.8).
- In the case of Malaysia, 57% of its exports belong to highly sophisticated categories and fall under groups 1 and 2. Since 1980, however, Thailand's share of exports of more sophisticated goods (groups 1 and 2) has more than quadrupled (Figure 2.9).
- Likewise, the trade deficit in sophisticated goods has narrowed significantly (Figure 2.10).
- Overall, these findings suggest Thailand has gone a long way in increasing its technological sophistication, as indicated by its exports.
- In fact, its pace of structural transformation in technological sophistication seems even faster than that of the Republic of Korea.

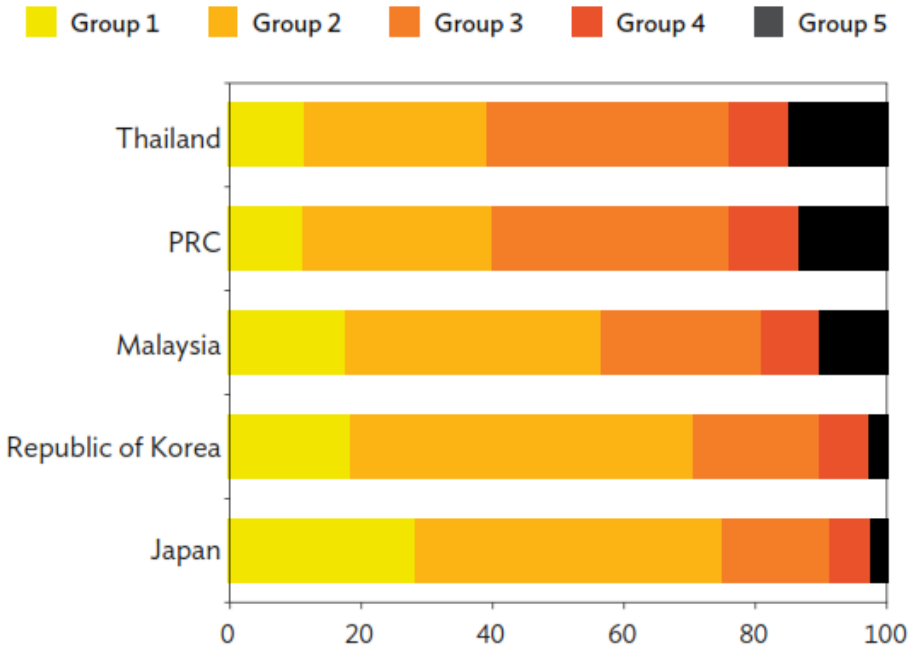
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- However, the data also indicate that Thailand is struggling to compete with its large northern neighbor, the PRC, which still has the advantage of scale.
- Thailand has been diversifying exports since 1980, but plenty more opportunities to do so exist when compared with other East Asian countries, especially Japan and the Republic of Korea. Japan is the most diversified among five countries in Figure 2.11.
- Export diversification is an indicator of technological competitiveness—a country that utilizes technology efficiently will be able to maintain its competitiveness in international trade.
- One measure of export diversification and competitiveness is the number of commodities with 1% of world market share, which has about tripled for Thailand since 1980, particularly rapidly between 1985 and 1995.

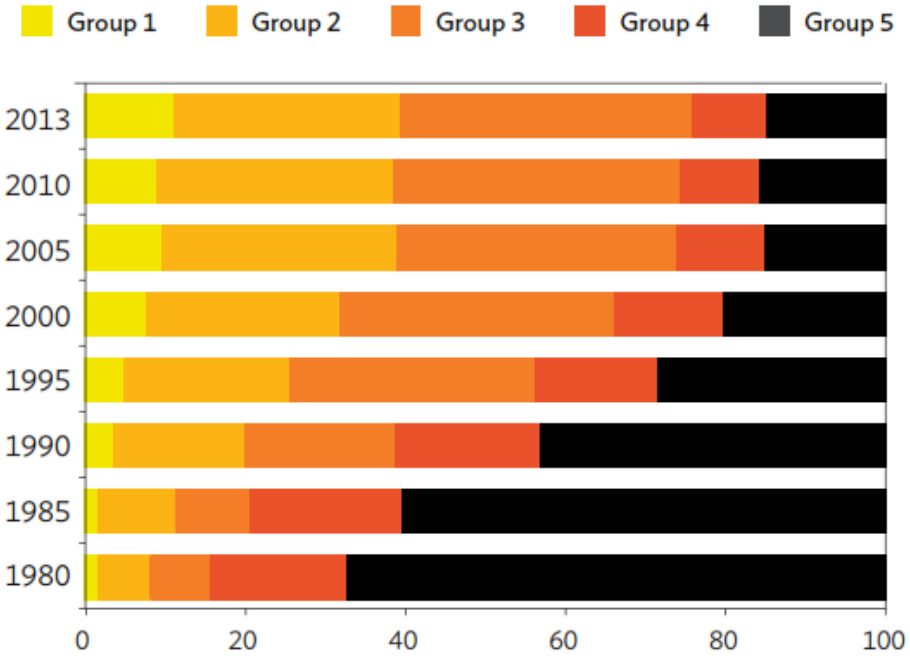
Source: ADB(2015)

Figure 2.8: Disaggregation of Exports by Technological Sophistication Group, Selected Economies, 2013 (% of total)



PRC = People's Republic of China.
Note: Groups are based on quintiles of sophistication level of products (PRODY). Group 1 = PRODY ≥ 28,900; Group 2 = 28,900 > PRODY ≥ 23,100; Group 3 = 23,100 > PRODY ≥ 17,600; Group 4 = 17,600 > PRODY ≥ 10,730; and Group 5 = PRODY < 10,730.
Source: Calculations using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

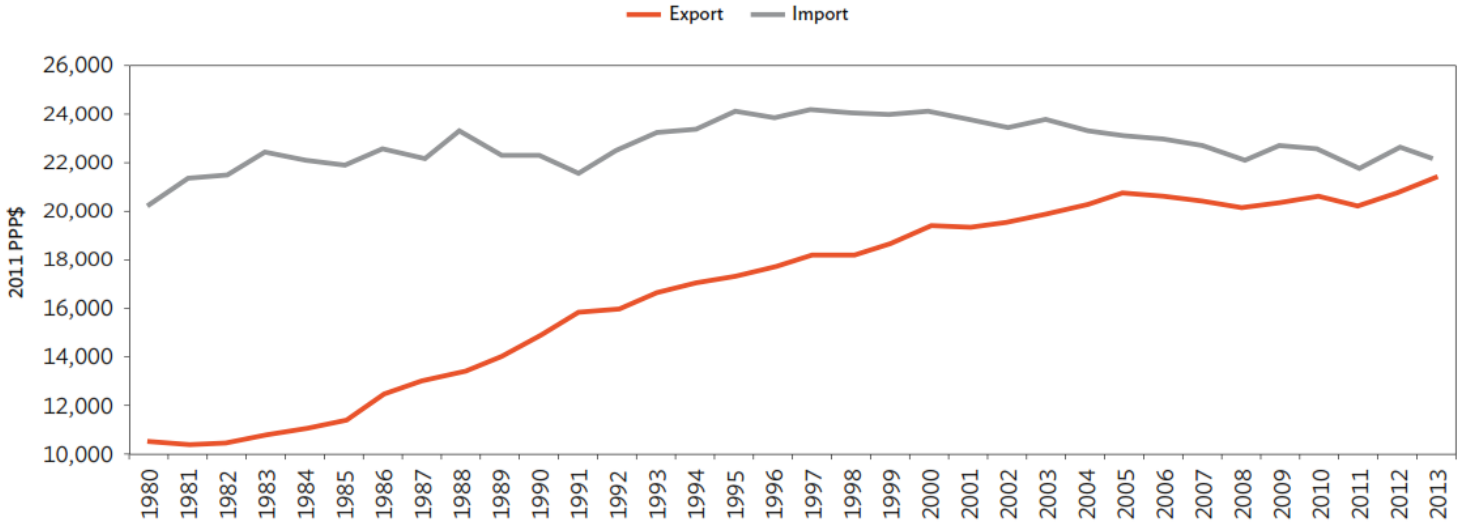
Figure 2.9: Disaggregation of Exports by Technological Sophistication Group, Thailand, 1980–2013 (% of total)



Note: Groups are based on quintiles of sophistication level of products (PRODY). Group 1 = PRODY ≥ 28,900; Group 2 = 28,900 > PRODY ≥ 23,100; Group 3 = 23,100 > PRODY ≥ 17,600; Group 4 = 17,600 > PRODY ≥ 10,730; and Group 5 = PRODY < 10,730.
Source: Calculations using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

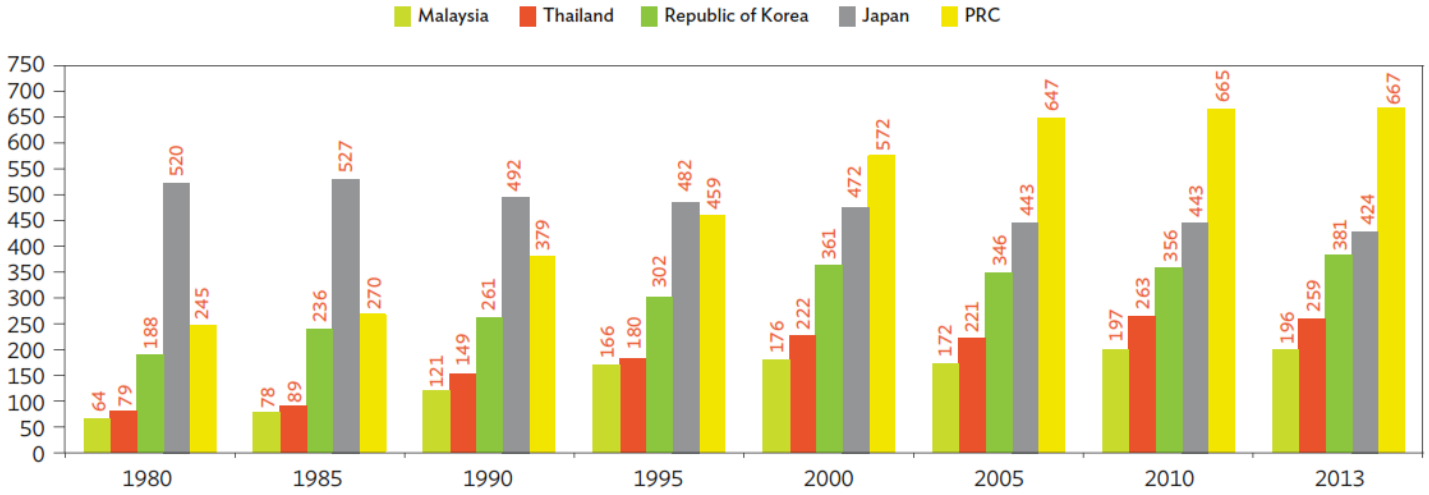
Source: ADB(2015)

Figure 2.10: Technical Sophistication of Export and Import Baskets in Thailand, 1980–2013



PPP = purchasing power parity.
Source: Calculations using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Figure 2.11: Number of Commodities with More Than 1% World Market Share, Selected Economies , 1980-2013



PRC = People's Republic of China.
Source: Calculations using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- In the degree of export diversification by commodity group (Table 2.4), Thailand is most diversified in food and animals (SITC 0).
- But there are significant gaps between Thailand and the other two countries in the levels of diversification for manufactured materials (SITC 6) and machinery and transport equipment (SITC 7), which suggest room for Thailand to expand into newer export areas.
- In SITC 5 and 8 (which include commodities such as consumer goods of light industries) the country is relatively diversified, although the number of commodities in this area is still significantly smaller than for Japan and the Republic of Korea. Japan holds many export products in SITC 8 that maintain a competitive edge in the world market.
- In this respect, finding niches in traditional industries, such as chemicals (SITC 5) and the light industries (SITC 6 and 8), is another important part of export diversification, in addition to entering the capital intensive and high-technology industries in SITC.

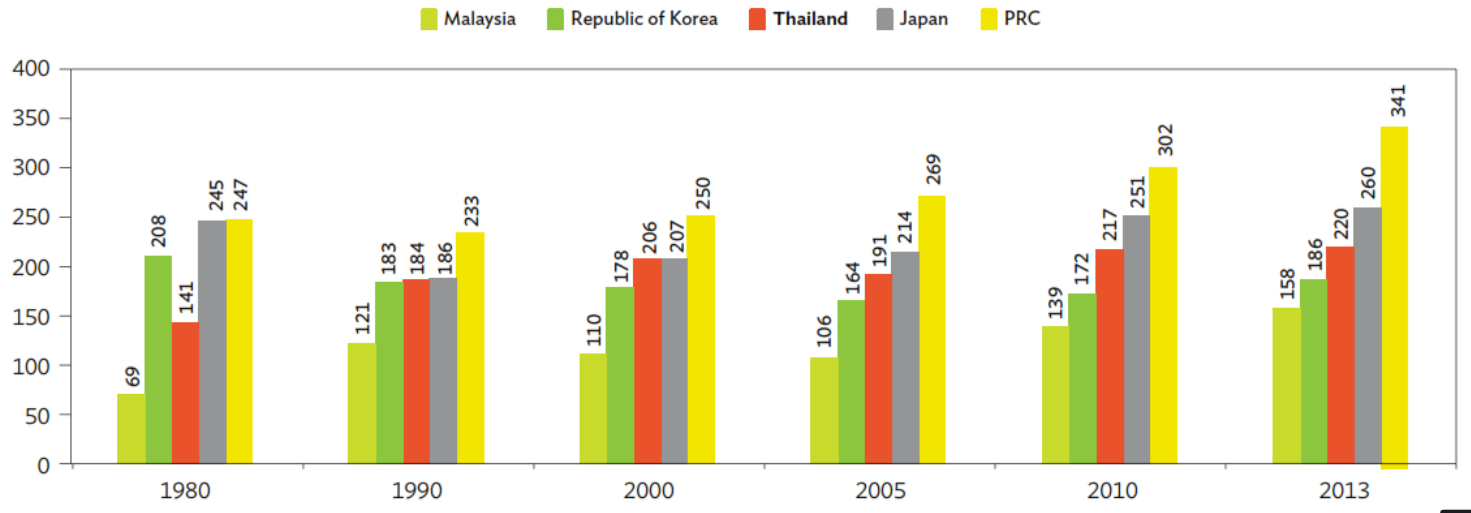
Source: ADB(2015)

Table 2.4: Diversification of Exports by Commodity Group, Selected Economies, 2013

SITC Code	SITC Description	Number of Goods with 1% Global Market Share		
		Japan	Republic of Korea	Thailand
0	Food and animals	8	12	31
1	Beverage and tobacco	1	3	2
2	Crude materials	22	20	23
3	Mineral fuels	9	7	7
4	Animal oils and fats	3	0	5
5	Chemicals	80	63	31
6	Manufactured materials	128	126	78
7	Machinery and transport equipment	126	112	55
8	Miscellaneous manufactured articles	45	36	26
9	Unclassified	2	2	1
	Total	424	381	259

SITC = Standard International Trade Classification.
Note: Commodities are classified at the 4-digit SITC.
Source: Calculations using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Figure 2.12: Product Diversification: Number of Commodities with Comparative Advantage (RCA ≥ 1), Selected Economies, 1980-2013



PRC = People's Republic of China, RCA = revealed comparative advantage.

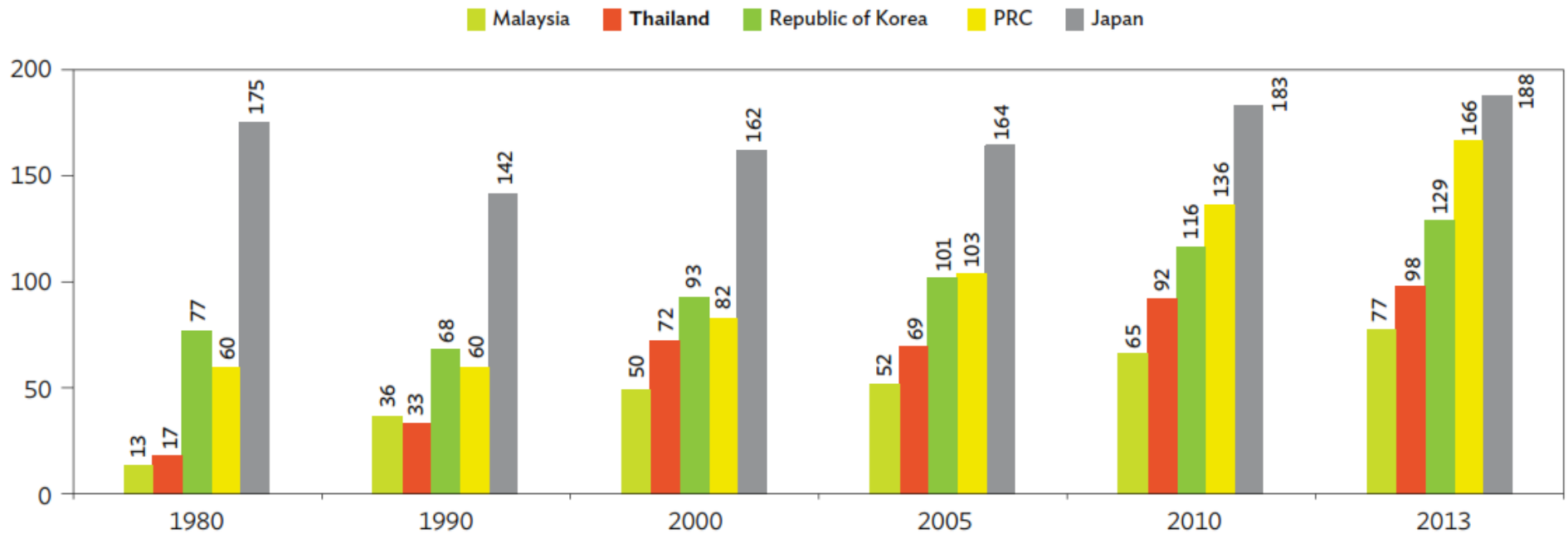
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- A more precise measure of diversification and competitiveness is the number of commodities with RCA; between 1980 and 2013, Thailand was able to increase the number of these commodities from 141 to 220 (Figure 2.12).
- This lags considerably behind the PRC and Japan, but is ahead of Malaysia and the Republic of Korea. Thailand's RCA in core products (machinery, chemical and metallurgy) increased almost sixfold between 1980 and 2013, but remains below the PRC, Japan, and the Republic of Korea (Figure 2.13).

Source: ADB(2015)

Figure 2.13: Number of Core Products with Comparative Advantage (RCA ≥ 1), Selected Economies, 1980-2013



PRC = People's Republic of China, RCA = revealed comparative advantage.
Notes: Core products include machinery, chemicals, and metallurgy. Most of these products have high technological sophistication.
Source: Calculations using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2015).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Since that early assembly stage, nonetheless, the country has made considerable progress.
- There is little doubt that such technological lending has helped Thailand to industrialize and become a leading exporter of high-tech goods.
- But technological lending has its limitations.
  - First is whether it creates a type of enclave industrialization in which the country possesses a few high-tech sectors, but not a high-tech economy.
  - The second is whether the technology will be “un-lent” or “retracted” if firms decide to move to lower-cost destinations.
  - Finally, Thailand may fail to engage in many of the higher-value research and design stages of product development.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The first and third concerns are very real now.
- The second is starting to be realized, but probably only for the lower-value segments for the time being, as the Greater Mekong Subregion and ASEAN liberalization and integration processes have gathered pace recently.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- **The automobile sector in Thailand has several characteristics.**
- Thailand has 18 automobile assemblers, all foreign owned, and no national car company (Thailand Board of Investment 2015).
- The Japanese automobile manufacturers account for about half of the approximately 1.5 million vehicles produced annually, and about half of production is exported, with the rest serving the large domestic market (Thailand Automotive Institute and Ministry of Industry 2012).
- The main niche (about 54% of units produced) is in pickup trucks (Tractus Thailand 2014).

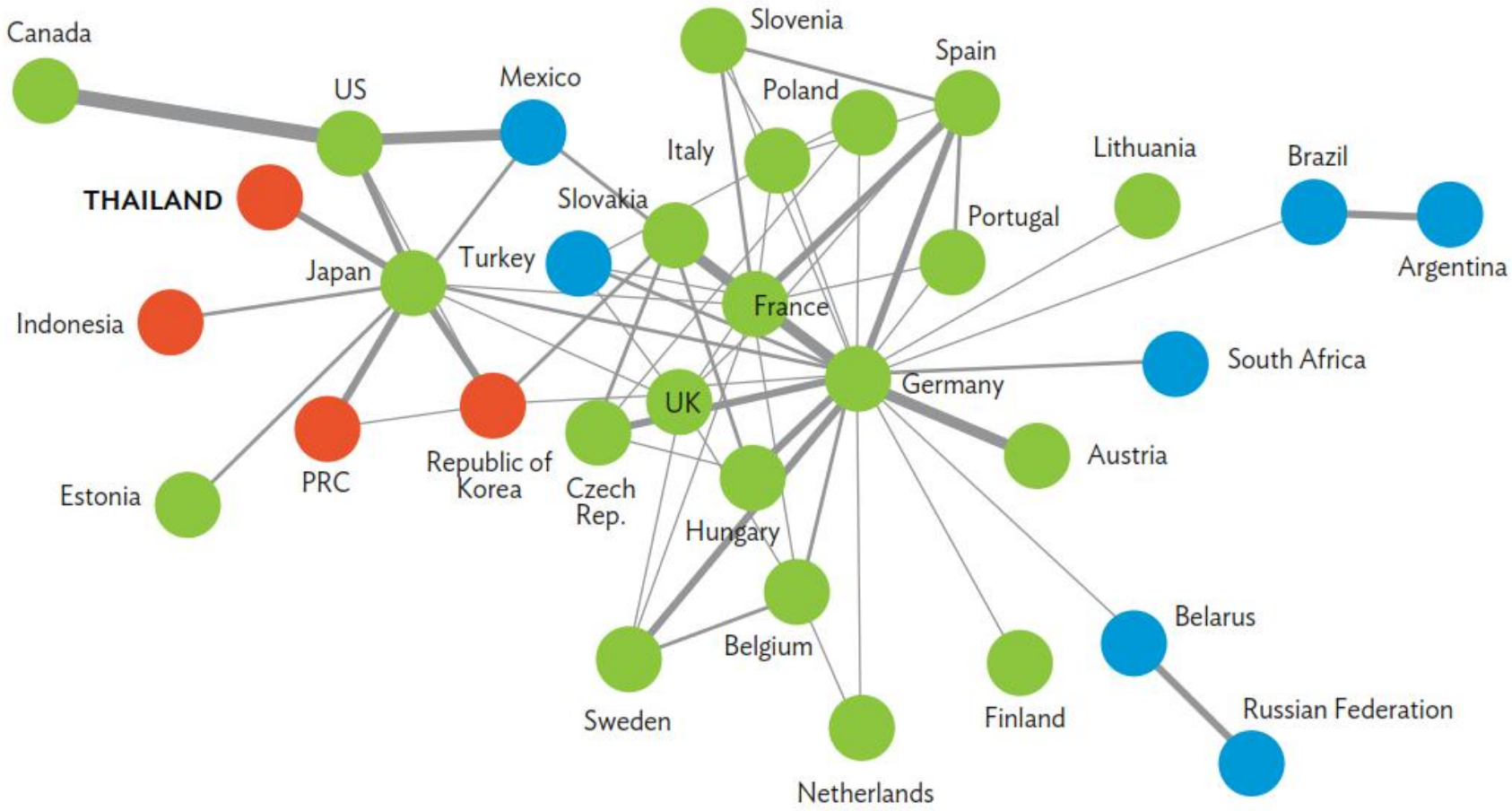
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The country has also emerged as an assembling hub for the multinational global automobile companies, supported by government efforts to promote export industries and FDI.
- The automobile industry uses parts procured outside as well as manufactured within the country.
- This differs from the electrical/electronics industry, in which Thailand is both a supplier and producer of parts and components and less of an assembler of final goods.
- Figure 2.14, based on Ferrarini (2011), shows the country's place in global and regional production networks for the automotive industries. The thickness of the lines represents the strength and extent of the relationships, with the connection to Japan clear.

Source: ADB(2015)

Figure 2.14: Global Network Trade Index—Automotive Industries



PRC = People's Republic of China, UK = United Kingdom, US = United States.
Source: B. Ferrarini. 2011. Mapping Vertical Trade. *ADB Economics Working Paper Series* No. 263. Manila: Asian Development Bank.

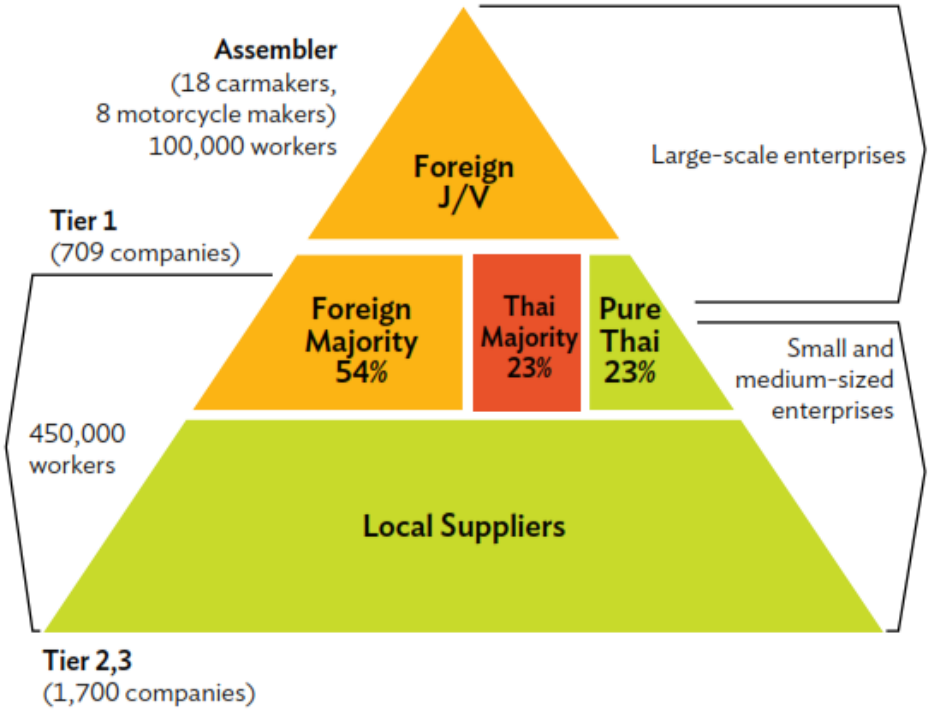
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- As vehicles are complex, multicomponent goods, the quality and reliability of suppliers are critical for the complete product. In Thailand, the Tier 1 auto parts suppliers are predominantly foreign controlled or foreign directed (Figure 2.15).
- About 54% of the almost 709 suppliers are foreign-majority joint ventures, while another 23% are Thai-majority joint ventures, although in these companies the foreign partners still tend to be the source of technology, which is channeled from the parent company.

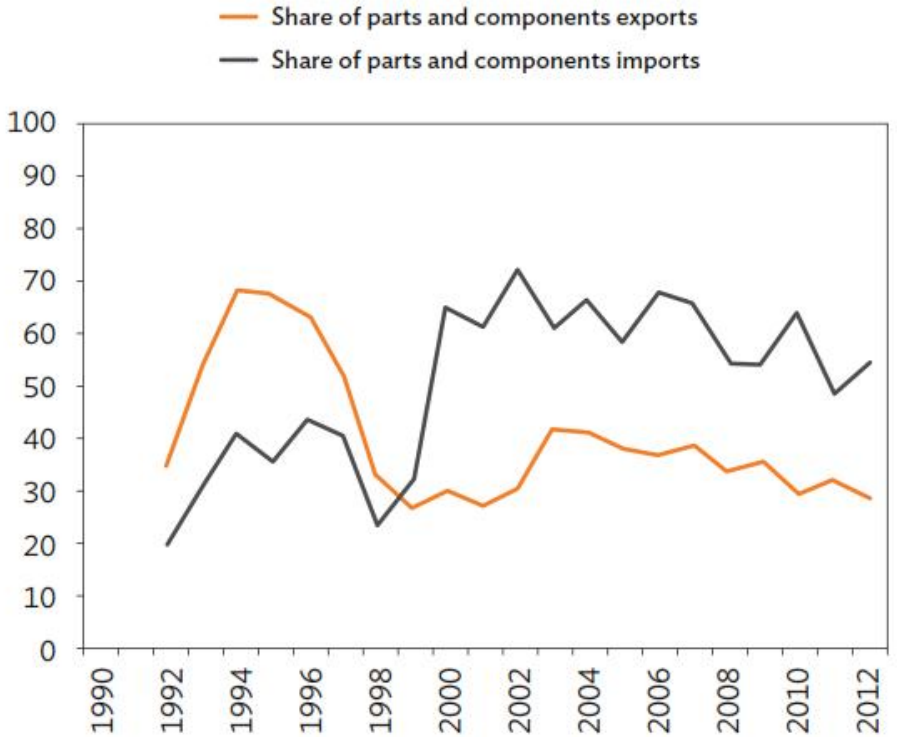
Source: ADB(2015)

Figure 2.15: Structure of Thailand's Automobile Industry in 2014



J/V = joint venture.
Source: Thailand Board of Investment. 2015. Thailand: Global Green Automotive Production Base. http://www.boi.go.th/upload/content/BOI-brochure%202015-automotive-20150325_70298.pdf

Figure 2.16: Share of Parts and Components in Motor Vehicle Exports and Imports



Note: Parts and components for each manufactured product type follow P. Athukorala and A. Kohpaiboon. 2009. Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. *ADBI Working Paper Series* No. 177. Tokyo: ADB Institute.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2013).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The remaining 23% are fully owned Thai firms, some of which have been able to break through and become respected Tier-1 suppliers, such as AAPICO Hitech and the Summit Group, and have exported to other countries.
- The technologically less sophisticated Tier-2 companies that supply basic rough components to Tier-1 firms for further processing are all Thai-owned.
- The nature of Thailand's auto industry is that assemblers prefer to link with a limited number of high-quality suppliers located in the same or near their industrial parks.
- Product development tends to be a top-down system in which suppliers seek to satisfy the requests for the assembler or a higher-tier supplier, resulting in relatively little joint development or within-firm innovation.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The development that does take place tends to be based on parent-country designs with modification to suit the local or regional market.
- As a result, research and development in the sector is very limited and assemblers or higher-tier foreign firms make little attempt to share or develop the technological capacity of local firms. There is technological lending, but little technological transfer.
- This lack of indigenous technological capacity is well recognized and various supplier-linkage programs have been promoted to integrate domestic firms with foreign-controlled producers.
- These programs were begun in the early 1990s and applied to the automobile sector, but they have generally been unsuccessful.
- They include the Industrial Linkages Development Program (1991), National Suppliers Development Program (1994), and 1995 Master Plan for the Development of Supporting Industries (with the Japan International Cooperation Agency).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- More recently, partnerships between the sector and the Ministry of Industry established the Thailand Automotive Institute supporting human resources development and the transfer of technology to develop Thai-owned suppliers.
- The institute had a major role in formulating the Thailand Automotive Sector Master Plan (2007–2011), which also focused on human resources and technology transfer to domestic firms.
- Under its framework, the Thailand Automotive Human Resources Development Program (2006–2010) was initiated with a lead role by Japanese producers Denso, Honda, Nissan, and Toyota.
- It aimed to improve the quality, cost, and delivery performance of Thai-owned component suppliers through human resources development, although the impacts of this program are not yet clear.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Over time, the Thai automotive industry seems to have upgraded from exporting parts and components to exporting finished goods.
- In the 1990s, the country was mainly exporting parts and components, suggesting a place on the relatively lower rungs of the automotive industry value chain (Figure 2.16).
- But in the 2000s, the share of parts and components in motor vehicle exports decreased and the share of completely built- up auto mobile exports increased.
- Likewise, the share of imports of motor vehicle parts and components increased during this period.
- These findings indicate that, since starting in the 2000s, Thailand has been importing motor vehicle parts and assembling them into built-up automobiles for export.

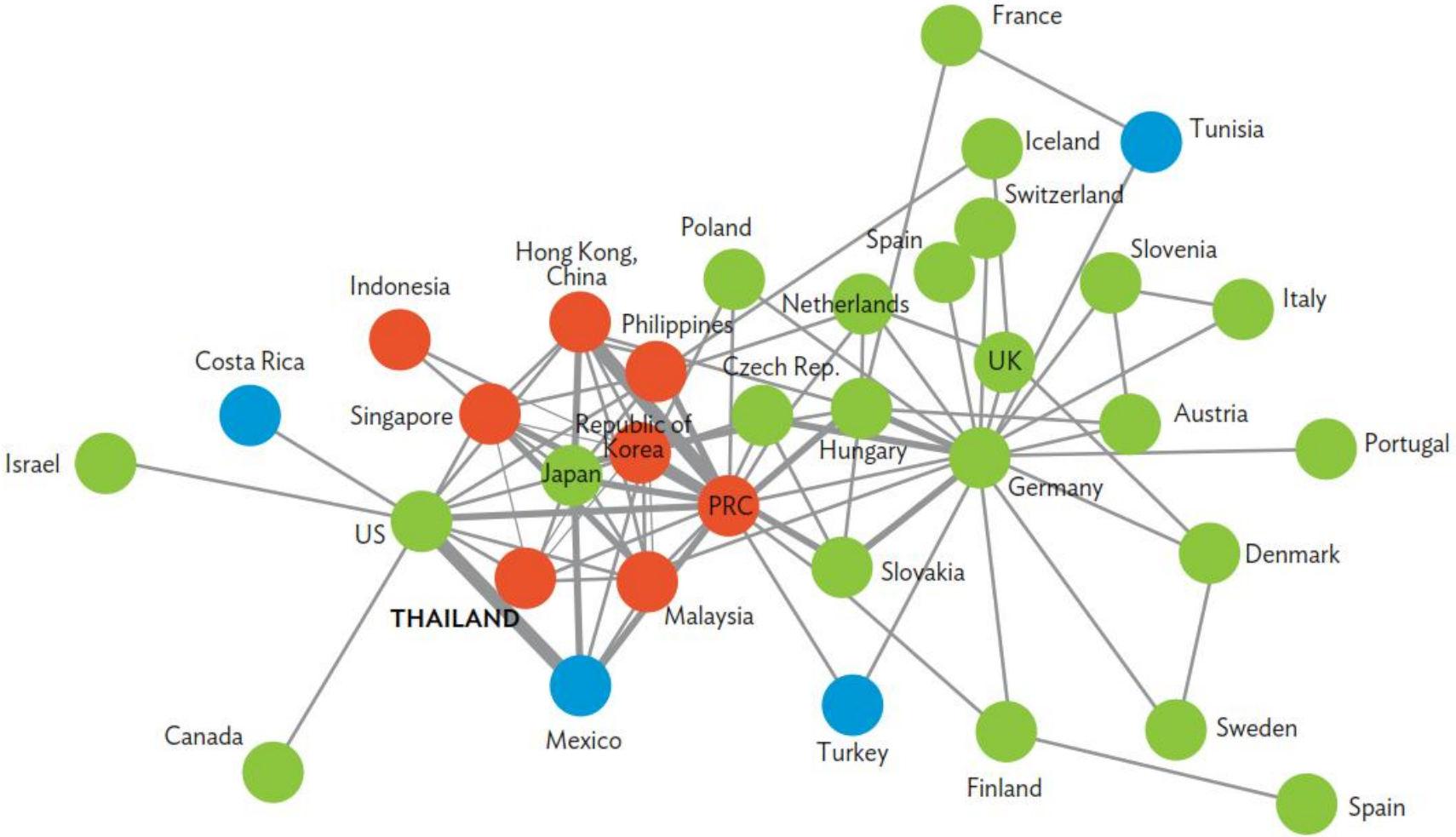
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- **Thailand's electronics sector has similarities to the automobile sector**
- Foreign dominance in the development of the electronics industry is similar to the auto industry, in that they have provided the technology for advanced production in Thailand.
- Electronic products are also complex, multicomponent goods that provide considerable opportunity for structuring along regional and global production networks (Figure 2.17), as well as the inclusion of domestic component suppliers.
- In electronics, similar to the automotive industries, Thailand is integrated with regional production processes. This time, the linkages are clear, with the PRC and Japan, and to a lesser extent with the Republic of Korea, Malaysia, Singapore, and the United States.
- Thailand has been able to increase the complexity of the tasks for electronics over the past 3 decades as more technology has been "lent" through intra-firm channels.

Source: ADB(2015)

Figure 2.17: Global Network Trade Index—Electric/Electronics Industries



PRC = People's Republic of China, UK = United Kingdom, US = United States.
Source: B. Ferrarini 2011. Mapping Vertical Trade. *ADB Economics Working Paper Series*. No. 263. Manila: Asian Development Bank.

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- The higher-value components of the chain are produced elsewhere and imported, however.
- Furthermore, like the auto sector, domestic firms are located in the low-tech tiers. The main electronics subsector is the manufacture of hard disk drives, for which Thailand is known as a leading global production site, hosting the world's major players.
- The hard disk drive industry in Thailand was effectively founded when Seagate Technologies moved its labor-intensive head stack assembly operations from Singapore to Thailand in 1983 to take advantage of lower wages.
- With other multinational companies following suit, the number of operations grew from 5 in the mid-1980s to 74 by the mid-2000s (Kohpaiboon and Poapongsakorn 2011).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Unlike the automobile sector, the government did not attempt to apply local content requirements to the electronics sector, and gradual tariff reductions have allowed for a relatively free flow of parts and components into and out of the country.
- High-value components are produced elsewhere, notably in areas near Singapore (such as Johor, Malaysia), and then imported to create the completed drives, which are then exported for placement in computers and other finished products.
- While accurate figures are hard to come by, the value of local content is about 30%–40%.
- Thai producers inhabit the lower technological levels of the value chain and contribute little to innovation and design (ADB 2013).

Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Concern is emerging about the minor role of Thai owned firms, and that increased participation would be beneficial, with efforts made in this regard through private sector collaboration.
- The Hard Disk Drive Institute was established in 2005 and counts among its members the leading industry players.
- The institute works to support skill development among small- and medium-sized Thai enterprises to reach the quality standards needed for supplying large foreign firms.
- Yet, while there is recognized interest in fostering innovation so that Thai firms can participate fully in the hard disk drive value chain, little evidence yet shows that it is bearing fruit.

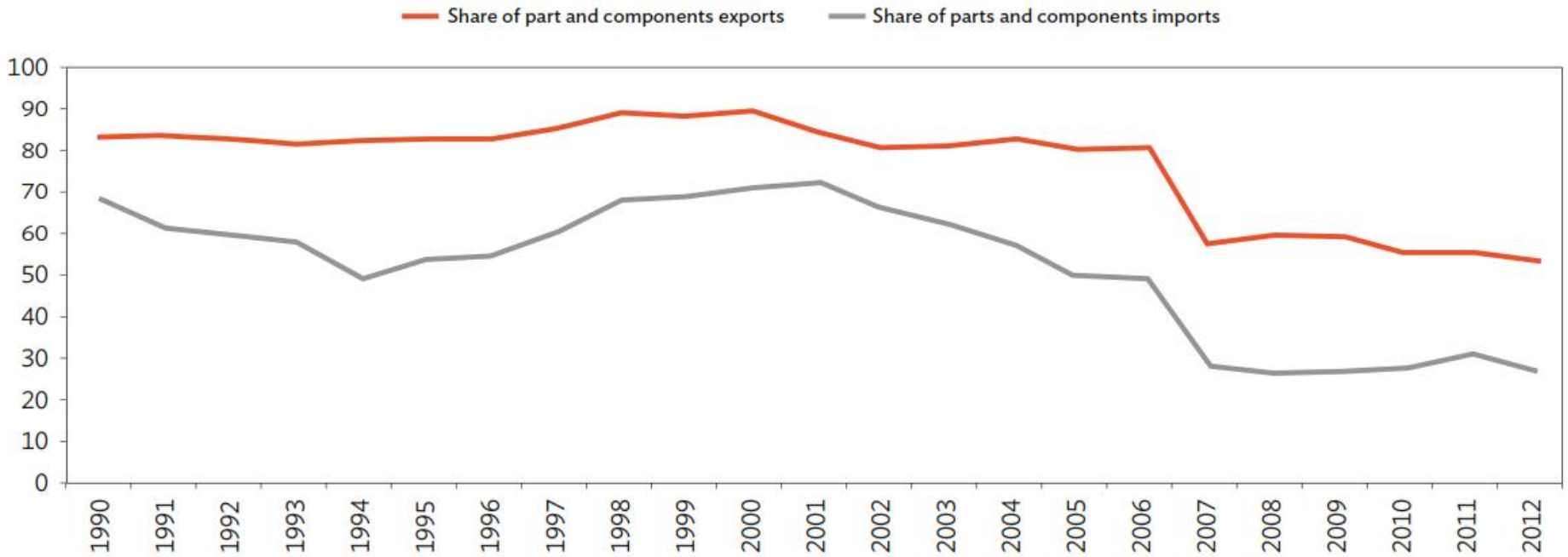
Source: ADB(2015)

2. Technological Progress: Limited International Technology Transfer

- Also similar to the auto industry, the share of parts and components in information and communication technology exports has been going down since the 1990s, indicating a higher concentration on exporting finished information and technology products.
- Imports of related parts and components have also been declining (Figure 2.18).

Source: ADB(2015)

Figure 2.18: Share of Parts and Components in Information and Communication Technology Exports and Imports (%)



Note: Parts and components for each manufactured product type follow P. Athukorala and A. Kohpaiboon. 2009. Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. *ADBI Working Paper Series* No. 177. Tokyo: ADB Institute.
Source: Estimates using data from UN Comtrade Database. http://comtrade.un.org/ (accessed June 2013).

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Thailand's progression into high-income status will depend on two key factors:
- (i) the ability to move up the global value chain and support investment in the innovation, design, and production of more sophisticated goods and services
- (ii) the ability to expand investment and development more broadly throughout the country. As it stands, large areas, notably the North and Northeast, and to a lesser extent the South, have not gained the full benefits of Thailand's development.

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- The ability to innovate, adopt, and use technology is a critical aspect of growth, driving improvements in productivity and enabling the production of more sophisticated and higher-value goods and services.
- Technologies are embedded in and utilized by firms and the ability to develop technologically advanced and innovative firms is a central aspect of the development process for middle-income countries.

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- The high-income East Asian economies of Hong Kong, China; Japan; Republic of Korea; Singapore; and Taipei,China successfully adopted increasingly complex technology through imports, adaptation, and subsequent innovation.
- Governments recognized the importance of technology and utilized whatever means possible to entice firms to improve their capabilities.
- The PRC, now in the process of its own “East Asian miracle,” is also working hard not only to attract advanced technologies brought by foreign firms, but also to leverage strategic partnerships with these firms and to develop technology and innovation by domestic firms, in collaboration with research institutes and other public bodies.

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Thailand is growing in a different environment from the earlier crop of high-growth economies.
- Asia is a more integrated economy with production chains on a regional scale driven by large multinational firms from within and outside of the region.
- These firms have moved production—and with it technology—to countries in Southeast Asia to take advantage of low wages and other production cost advantages, as well as to be closer to growing consumer markets.
- From the late 1980s, parts of Thailand's economy have become firmly embedded in and benefited from the rise of "Factory Asia."
- To maintain its place and draw the benefits from an integrating Asia, Thailand needs to keep pace with advancing technology and innovation.

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- While foreign investment will remain important to provide advanced technology and innovation, this needs to be supplemented with domestic efforts to ensure that technology infuses the sectors of the economy and is not isolated in a few specific, albeit key, subsectors.
- Thailand's research and innovation capacity remains weak, however, stemming from the lack of interest and investment and the reliance on foreign investment for its key technological inputs.
- Thailand ranks 55th out of 141 countries in the Global Innovation Index 2015 (Cornell University, INSEAD, and WIPO 2015) put out by the World Intellectual Property Organization.
- Adequate research infrastructure and activity needs to emerge to provide new breakthrough and improvements on products and production processes.

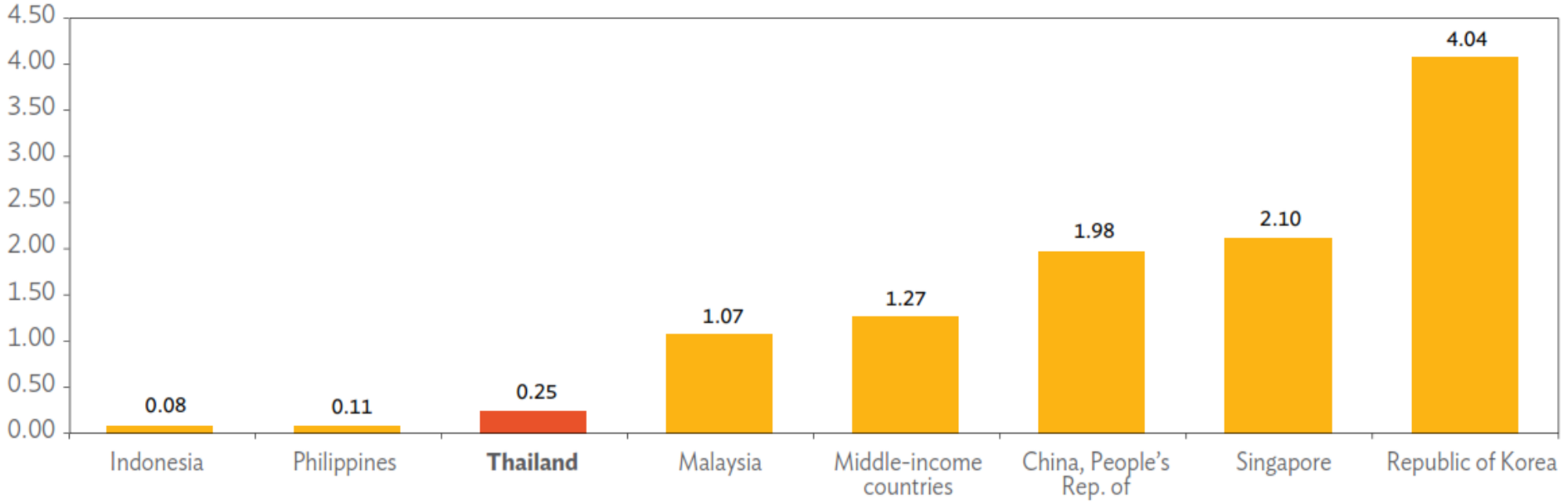
Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Evidence of insufficient innovation capacity is seen in the standard measures.
- In terms of R&D expenditure, Thailand lags behind a number of middle-income countries and behind the now high-income countries.
- While its R&D is higher than Indonesia's and the Philippines', it falls considerably below Malaysia's, the average level of middle-income countries, and the PRC's, which was at the same per capita income level in 2014, when both countries graduated to upper middle-income Status (Figure 3.1).

Source: ADB(2015)

Figure 3.1: Research and Development Expenditure, Selected Economies, 2014 (% of GDP)



GDP = gross domestic product.
Note: Data for the Republic of Korea and middle-income countries are for 2011; data for the People's Republic of China and Singapore are for 2012.
Source: World Bank. World Development Indicators. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2015).

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Thailand spends a quarter of 1% of GDP on R&D, even lower than India, which also spend less than 1% of GDP on research (Table 3.1).
- In comparison, the Republic of Korea spends more than 4%; Japan, about 3.4%; and the PRC almost 2%. Private sector spending on research in Thailand is the second lowest in the sample group after India.
- Deliberate R&D is an important driver of technological change. The phenomenon of science and technology takeoff is one characterized by abrupt increases in national R&D intensity, as it approaches 1% of GDP, and accelerates abruptly to the vicinity of 2%, before leveling off in the range of 2% to 3% of GDP, based on historical data during 1987–1997 in the PRC (Jefferson and Su 2006).

Source: ADB(2015)

Table 3.1: Expenditure on Research and Development by Source (% of GDP)

Economy	Total Research and Development Expenditure	By Business Enterprises	By Government	By Higher Education	By Private Nonprofit Organizations
PRC	1.980	1.509	0.323	0.150	...
India	0.810	0.288	0.490	0.033	...
Republic of Korea	4.040	3.091	0.473	0.408	0.065
Malaysia	1.070	0.607	0.154	0.309	...
Thailand	**0.250**	**0.103**	**0.082**	**0.062**	**0.003**
Germany	2.920	1.953	0.432	0.534	...
Japan	3.390	2.610	0.285	0.447	0.051
United States	2.790	1.947	0.343	0.385	0.112

... = data not available, PRC = People's Republic of China, GDP = gross domestic product.
Note: Data for Thailand are for 2009; India, the Republic of Korea, Malaysia, and Japan are for 2011; and the PRC, Germany, and the United States are for 2012. Some numbers do not add up because of rounding.
Source: UNESCO Institute for Statistics. Data Centre. http://www.uis.unesco.org/datacentre/pages/default.aspx (accessed September 2015).

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- The average ratio for 23 Organisation for Economic Co-operation and Development (OECD) countries stood at 2.0%, while that for non-OECD countries was a very low 0.7%.
- The seven largest OECD countries in the sample have average R&D intensity equivalent to 2.4%, while the average for 16 small OECD countries is 1.8%.
- R&D spending has been low and stable over the past decade in Thailand.
- Thailand's 11th National Economic and Social Development Plan targets R&D spending of 1% of GDP by 2016, suggesting that the government recognizes that technology and innovation are too low to support a higher growth process.

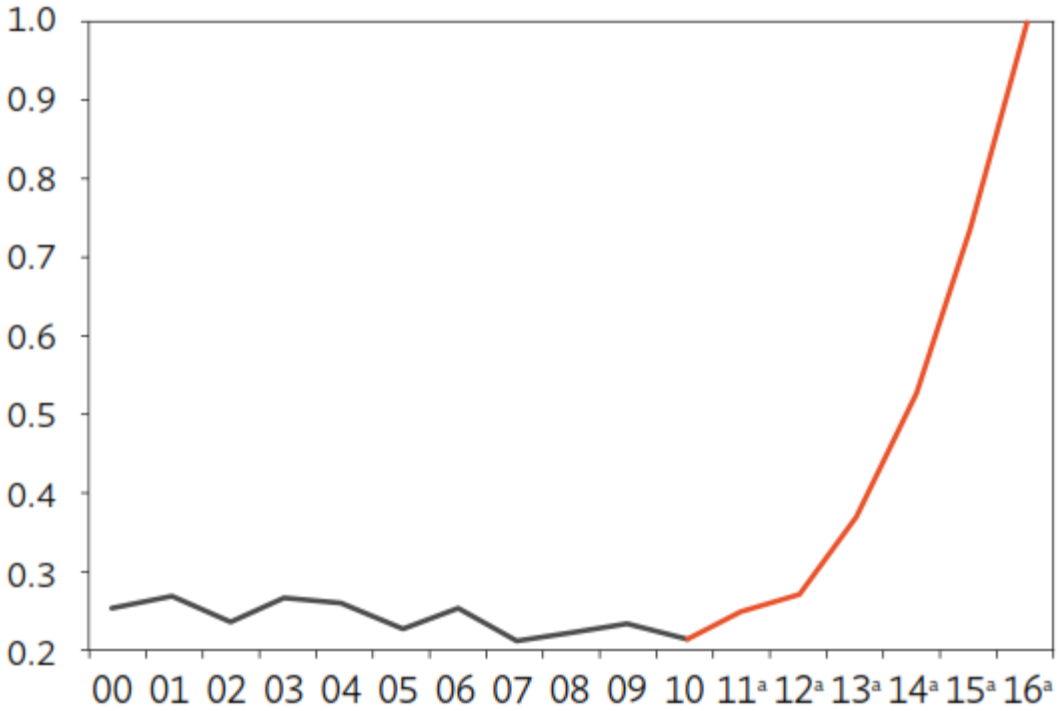
Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Whether it can be achieved remains in question, given that spending has hovered near 0.25% for more than a decade (Figure 3.2).
- It should be noted that even the PRC, which has recognized the importance of technology and innovation as vital to moving beyond the middle-income stage, tried to raise R&D spending to 2% by the end of the 10th Five-Year Plan, but failed to do so.
- The country raised the target further in its 12th Plan to 2.2%.
- R&D targets are difficult to achieve because they represent a combination of public and private sector activity.
- Governments can allocate more funds to research, but private firms need to play their part.
- The Thailand government hopes that the share of private sector R&D will rise to 70% by 2016, a considerable increase from its current level of about 40%–45%.

Source: ADB(2015)

Figure 3.2: Research and Development Expenditure in Thailand, 2000–2016
(% of GDP)



[a] Ministry of Science and Technology targets.
Source: Oxford Business Group (OBG). 2011. *The Report: Thailand 2014*. London: OBG.

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- The National Research Council of Thailand's 2010 Science, Technology and Innovation Survey estimates that only 24.9% of firms actually had a budget for innovation activities, of which 15.8% see no change in budget in the next 5 years, 8.9% see an increase, and 0.2% see a decrease (NRCT 2011).
- Among companies with a budget for innovation, the majority of it is spent on R&D done by the company itself, while about a fifth of the budget is spent on the acquisition of equipment (Table 3.2).
- However, spending on innovative activities is estimated to total B9.8 billion in 2010, just 0.10% of GDP. This figure is down from the estimated B13.2 billion spent on innovation in 2009, or 0.15% of GDP.
- Thailand also has a lot of catching up to do in recruiting and training more researchers. Currently, only 0.57 researchers are available for each 1,000 members of the labor force (Table 3.3). In comparison, there are 1.75 researchers per 1,000 workers in the PRC, more than 10 in the Republic of Korea, and 3.8 in Malaysia.

Source: ADB(2015)

Table 3.2: Allocation of Budget for Innovation Activities (%)

Innovation Activities	2009	2010
Intramural research and development	57.5	51.6
Extramural research and development	5.0	9.8
Acquisition of machinery and equipment (including computer hardware) for product or process innovation	20.2	18.1
Acquisition of other external knowledge such as licenses to use intellectual property or specialized services (such as consultants)	0.6	0.5
Training	5.4	6.0
Marketing of innovations	3.5	3.7
Design and other preparations	2.5	3.0
Marketing of improved services (market research and launch advertising)	4.9	3.7
Others	0.5	0.4

Source: National Research Council of Thailand (NRCT). 2011a. Innovation Survey: Business Sector (Summary). Presentation at the UNESCO Institute of Statistics Statistical Capacity Building Workshop 2011. http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop Documents/ST Workshop dox/Vietnam 2011/Thailand Innovation Survey (2).pptx.

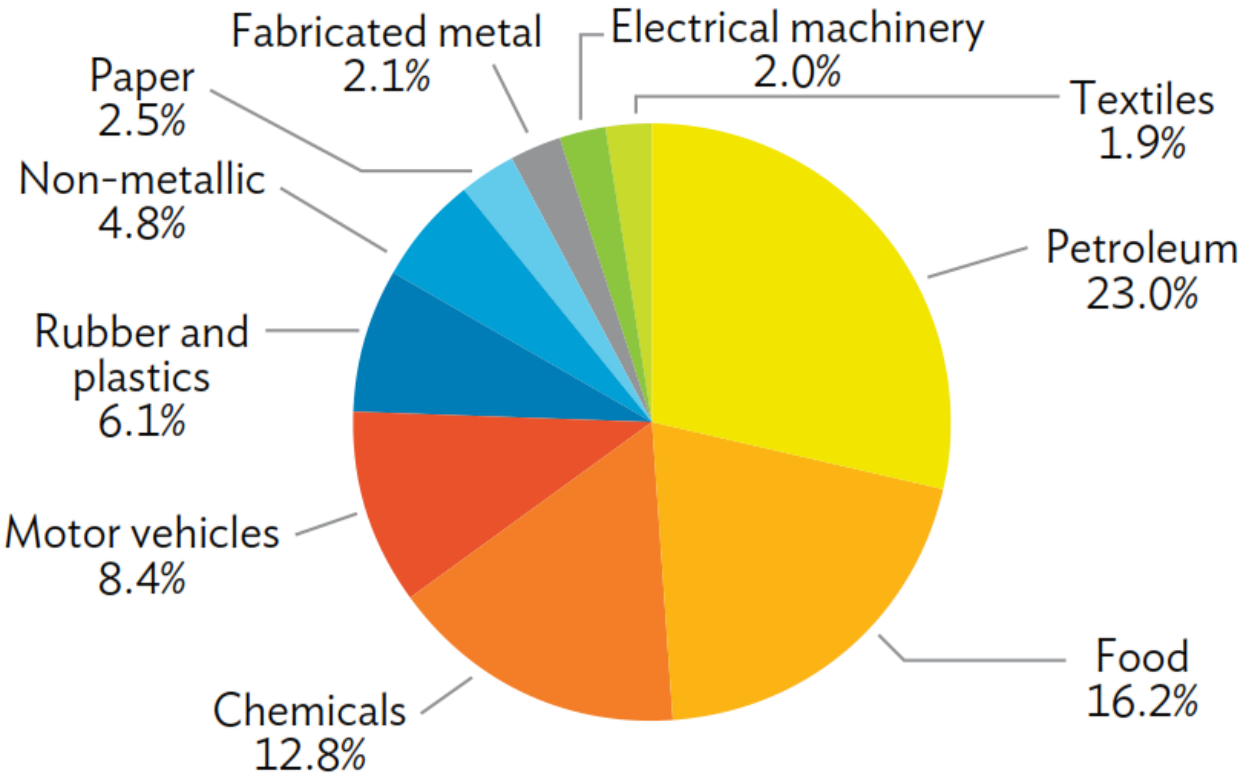
Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Allocation of R&D is also highly interesting, in that there is relatively little private R&D in the prominent manufacturing sectors of automobiles and electronics, which account for 8.4% and 2.0%, respectively, of total private sector R&D.
- Indeed, R&D in electronics is only slightly ahead of textiles, at 1.9% (Figure 3.3).
- This may reflect the heavy influence of foreign producers in these sectors, for which research work is done in the home country.
- In Thailand, the three sectors that account for just over half (52%) of all private research are petroleum, food, and chemicals, which are also areas that government has encouraged.

Source: ADB(2015)

Figure 3.3: Private Investment in Research and Development, Thailand, 2009



Source: Oxford Business Group (OBG). 2011. *The Report: Thailand 2014*. London: OBG.

Source: ADB(2015)

3. Challenges in the Transition to High-Income Status

- Strategic collaboration between institutions of higher education and the manufacturing sector are not enough to foster indigenous innovation.
- Few joint, integrated research projects are found for innovative product and process development.
- Universities seldom engage in basic research, which is not always of good quality, and offer few ideas for business to turn into commercially viable innovation.

Source: ADB(2015)