

Thailand's Rapid Urbanization and Environmental Challenges

Bhanupong
Lecture 30

**WHAT WE LEARN
WITH PLEASURE
WE NEVER FORGET.**
-Alfred Mercier

Outline

1. Decentralization process of the primate cities
2. Characteristics of sustainable urbanization
3. Environmental Kuznets Curve
4. China's success stories
5. Climate change economics

Stages of Decentralization

- First stage: Declining population density in the primal city: slowdown population growth and residential relocation
- Second stage: Standardized industries are relocated from the primal city.
- Third stage: declining share of the primal city's GDP

Characteristics of sustainable Urbanization

(A) Declining population density in the primal cities

(B) Declining urban poverty (lecture 27)

(C) Improving income equality (lecture 28)

(D) Improving quality of city life and environment

(A) Declining population density:

The first stage of **decentralization**

- Urban population growth in China and India has slowed down (Figure 1).
- Thailand has experienced *declining* population growth rate.
- Growth rate of Thailand's urban population has slowed down (Figure 2).
- Bangkok population has been increasing at a decreasing rate (Figure 3)
- As a result, the *population density* in Bangkok has been on a declining trend (Figure 4)

Figure 1. Urban population growth (%)

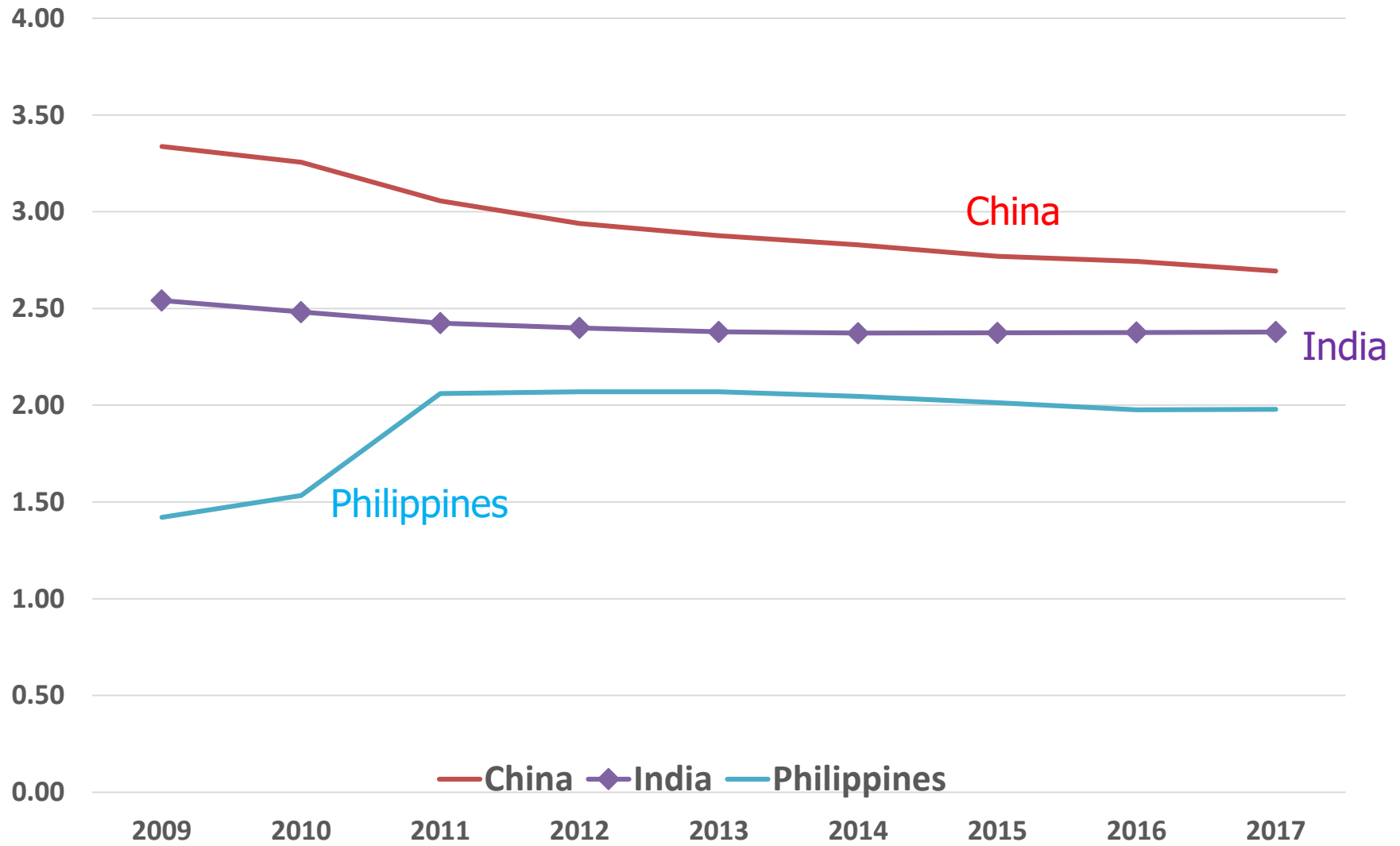


Figure 2. Urban population growth (%)

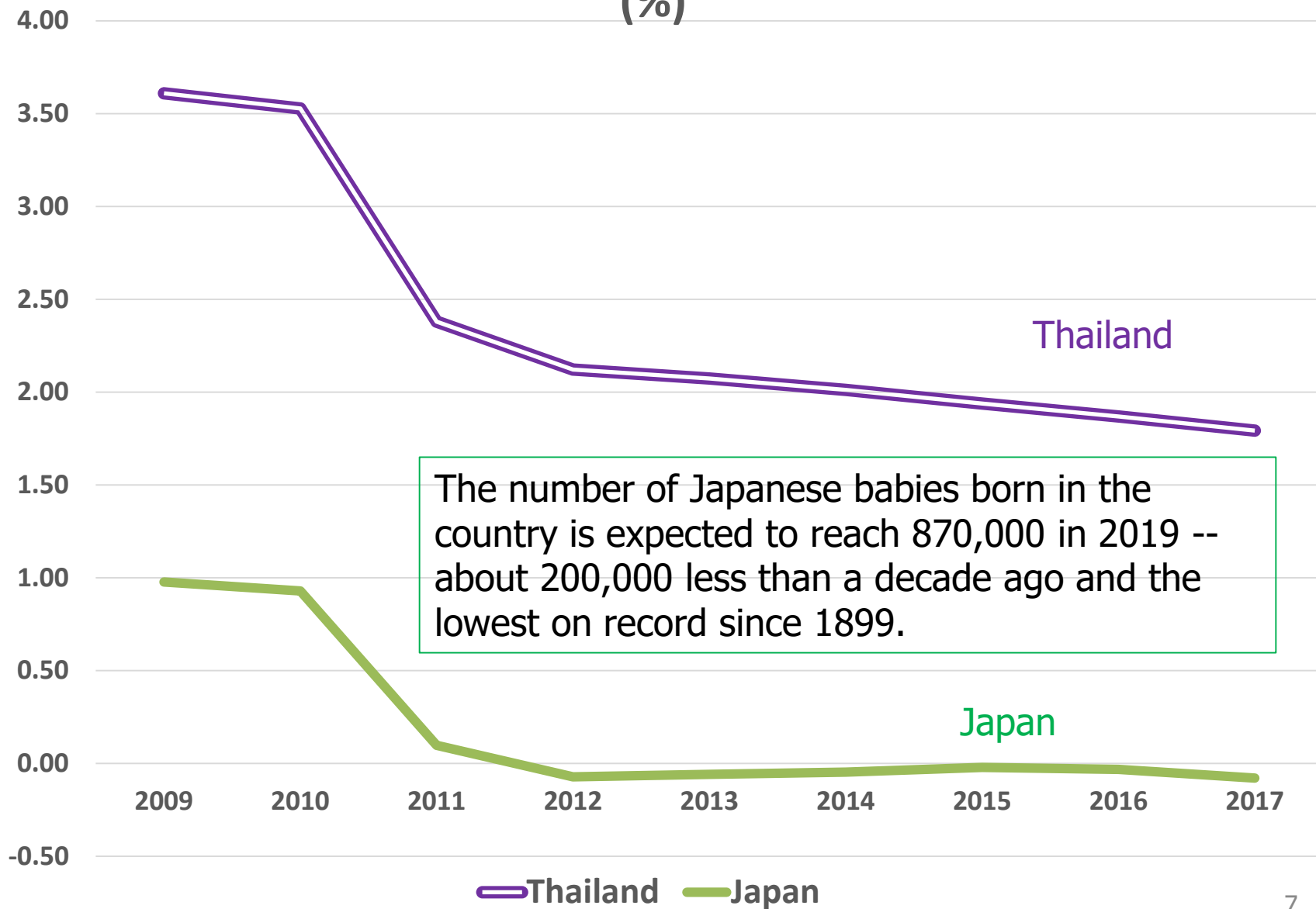


Figure 3. Bangkok Population: Increase at a decreasing rate

Source: UN World Urbanization Prospects

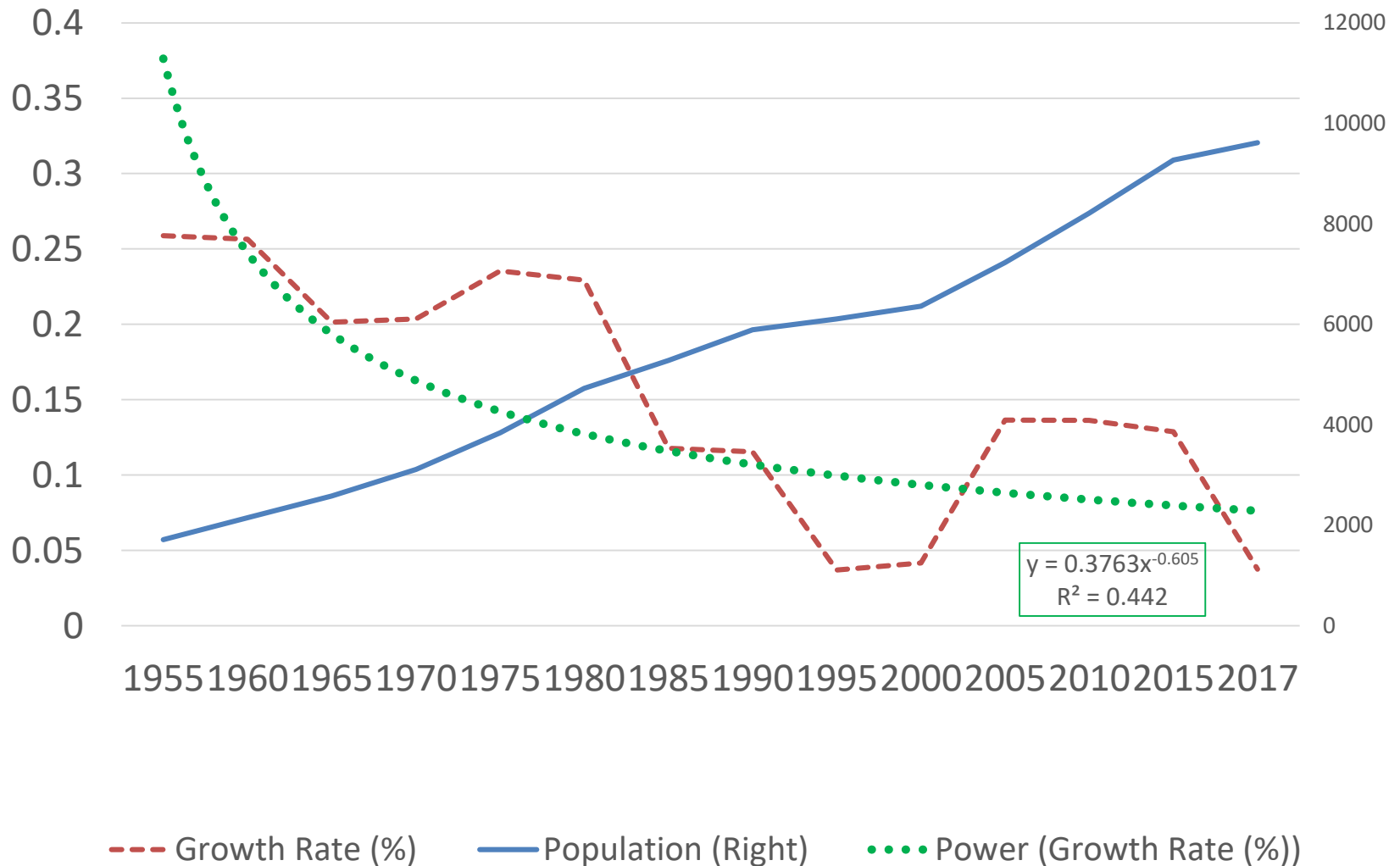


Figure 4. Size and growth of population in large cities in 2000

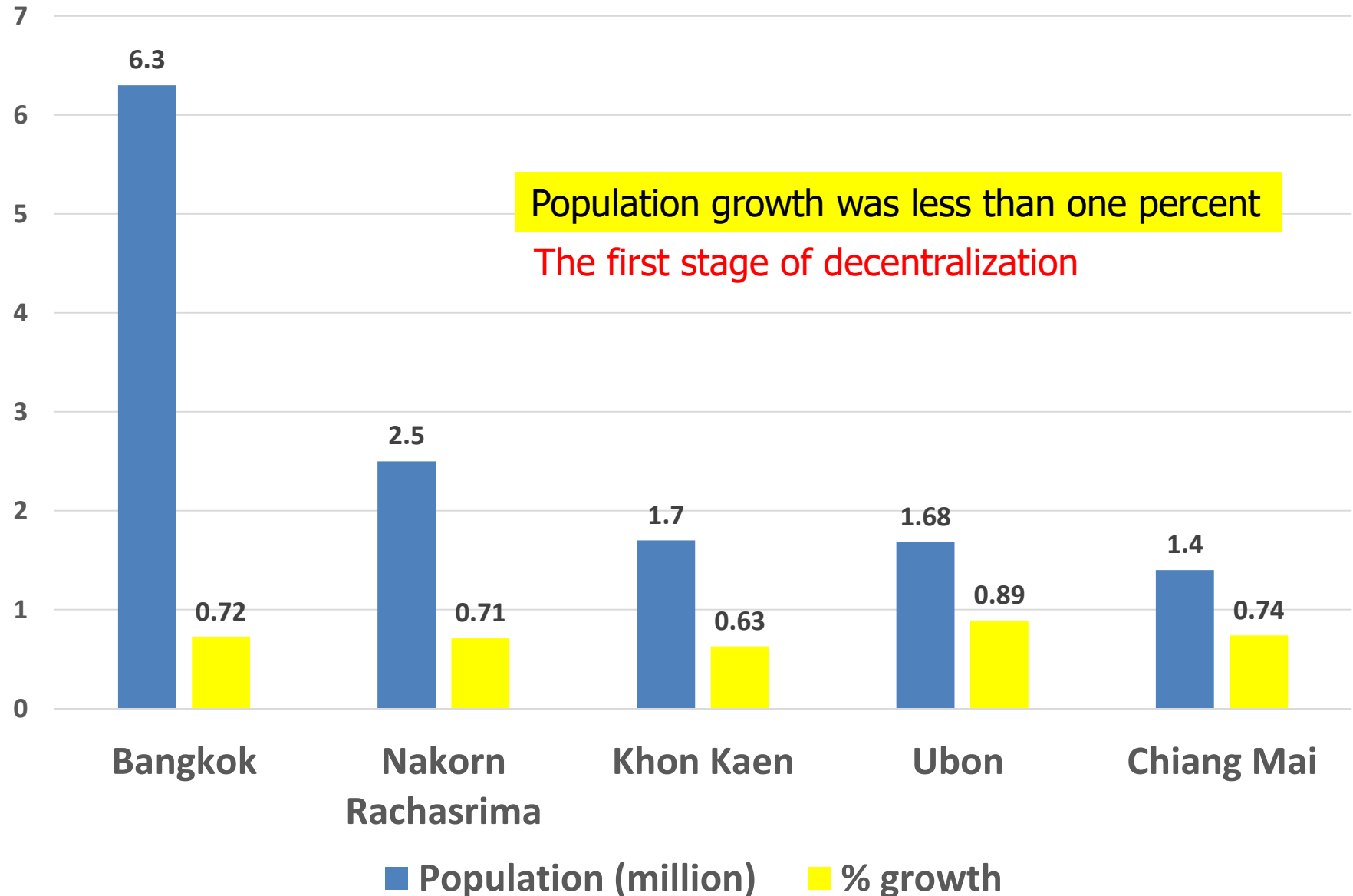


Figure 5. Rapid expansion of population in the **periphery** of Bangkok: Booming population in neighboring cities in 2000

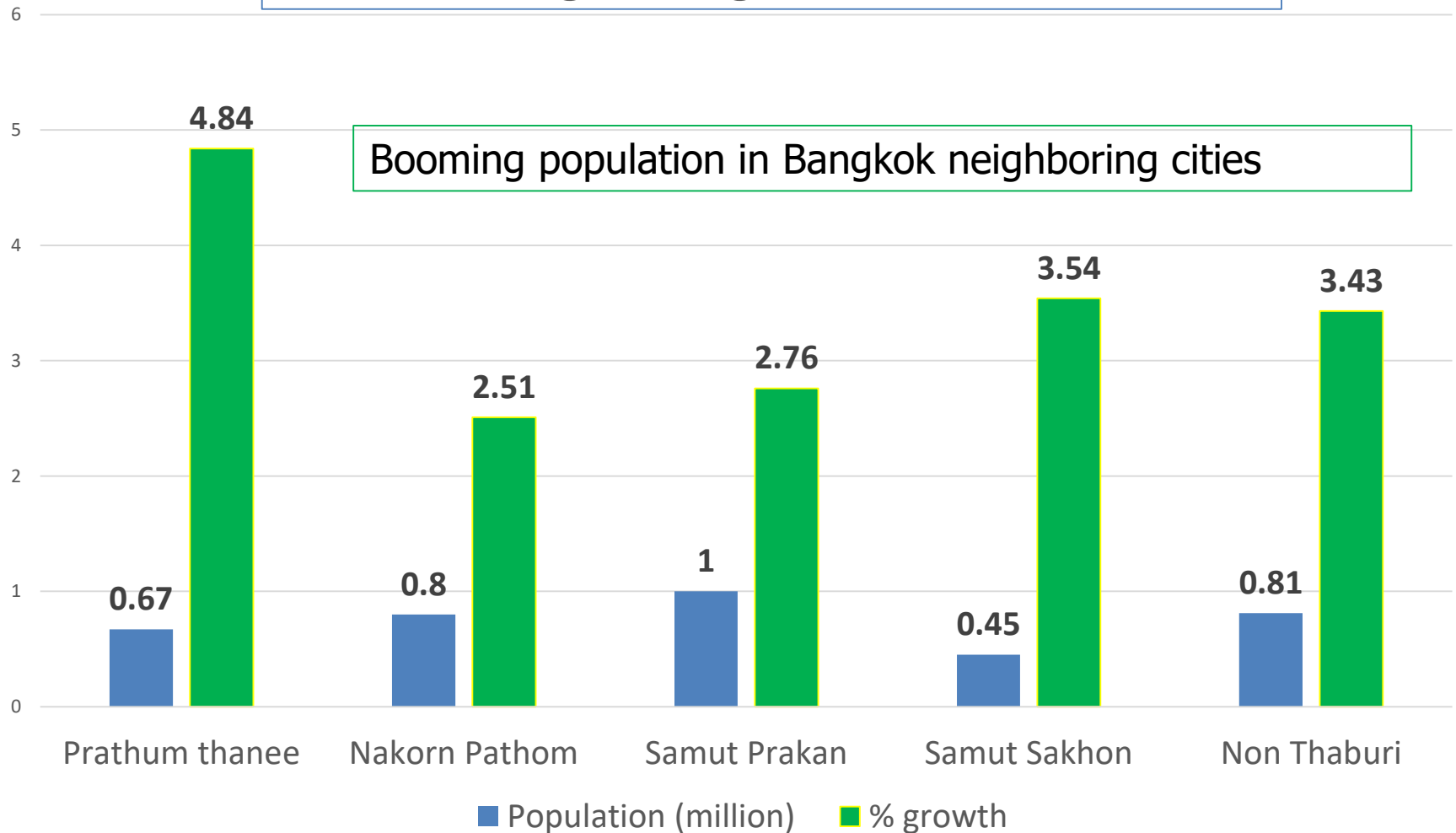
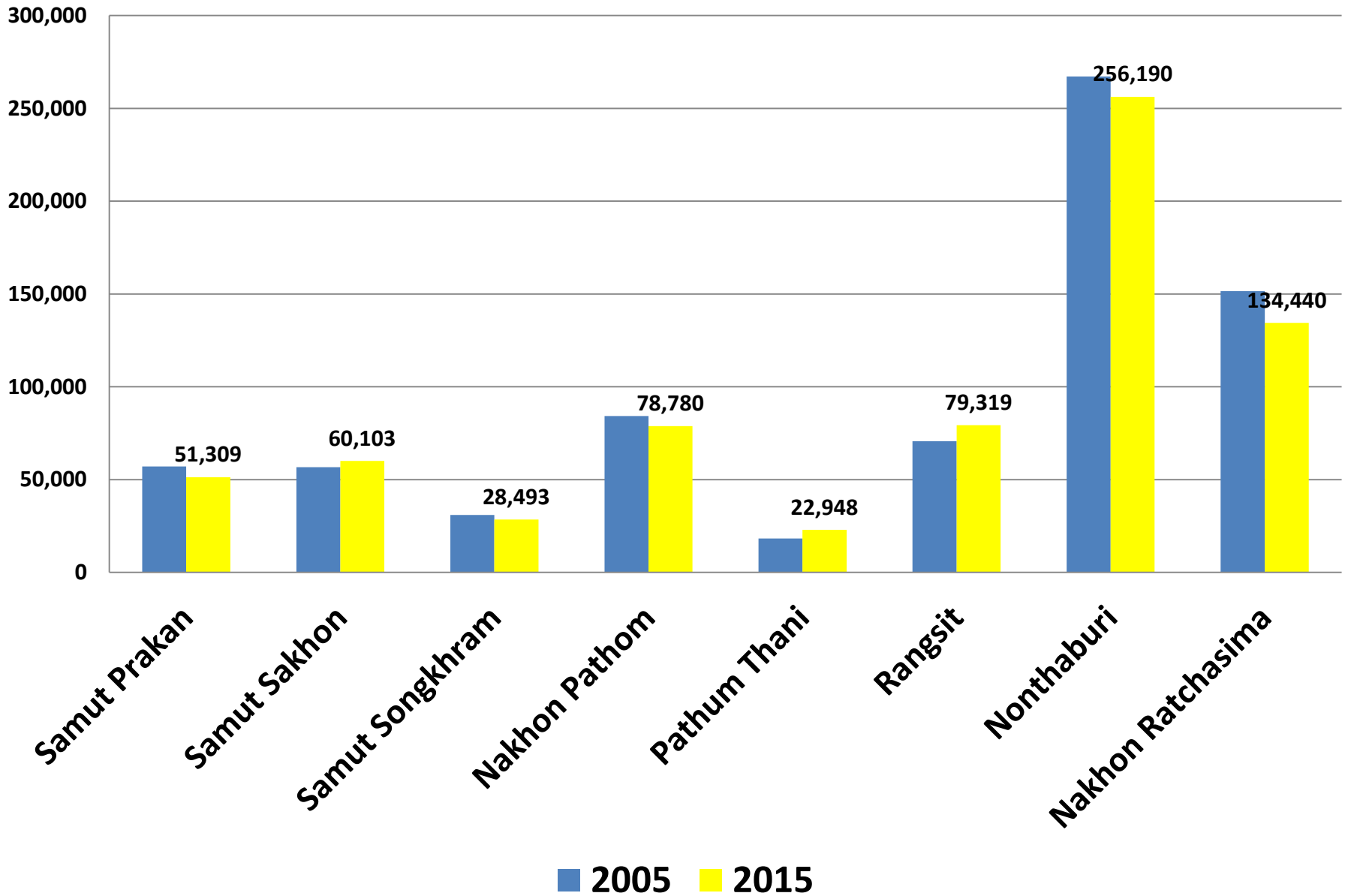


Figure 6. Stabilized Population in big cities



Second stage of decentralization:

Standardized industries are moving out of Bangkok

- It has already begun as *industries* are gradually moving away from Bangkok Metropolitan Region, because of higher production and transactions costs in BMR.
- Bangkok has encountered diseconomies of agglomeration, thanks to higher land prices and rent. If the trend continues, a more balanced process of urbanization will emerge with less concentration of industries in large cities.
- The degree of urbanization in Thailand has been slowing down in all regions.

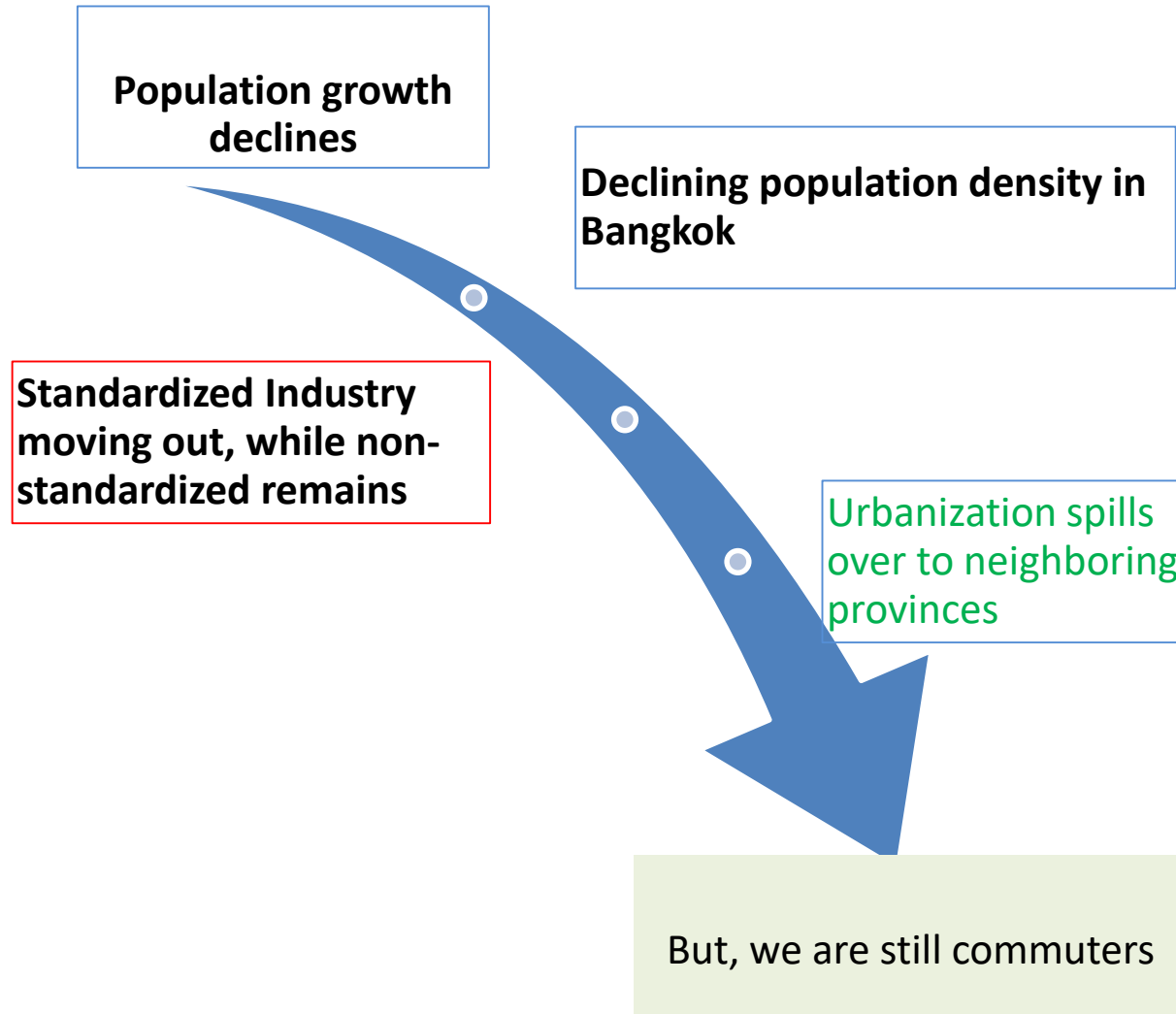
Declining Bangkok Primacy

- As the impact of diseconomies of scale became apparent, **Bangkok started to lose its comparative advantage in production.**
- ***Both*** shares of output and population in Bangkok has been declining.
- Output share of BMR declined from 53 percent in 1993 to 47.4 percent in 2000—confirming the second stage of de-concentration in suburban areas of Bangkok.
- The share in 2015?

Slowing down urbanization speed

- This encouraging trend implies that urbanization process in Thailand may be sustainable, because large cities of Bangkok Metropolitan Region would not be expanding without limit, although there is a lingering problem on the air quality in Bangkok.
- The major factor behind the slow urbanization process is the **sharp drop** in the **population growth rate**, reflecting the successful family planning programs.
- The relative size of economic activity in Bangkok Metropolitan Region has been declining gradually.

While share of output and population in Bangkok has been declining, as we are experiencing diseconomies of agglomeration



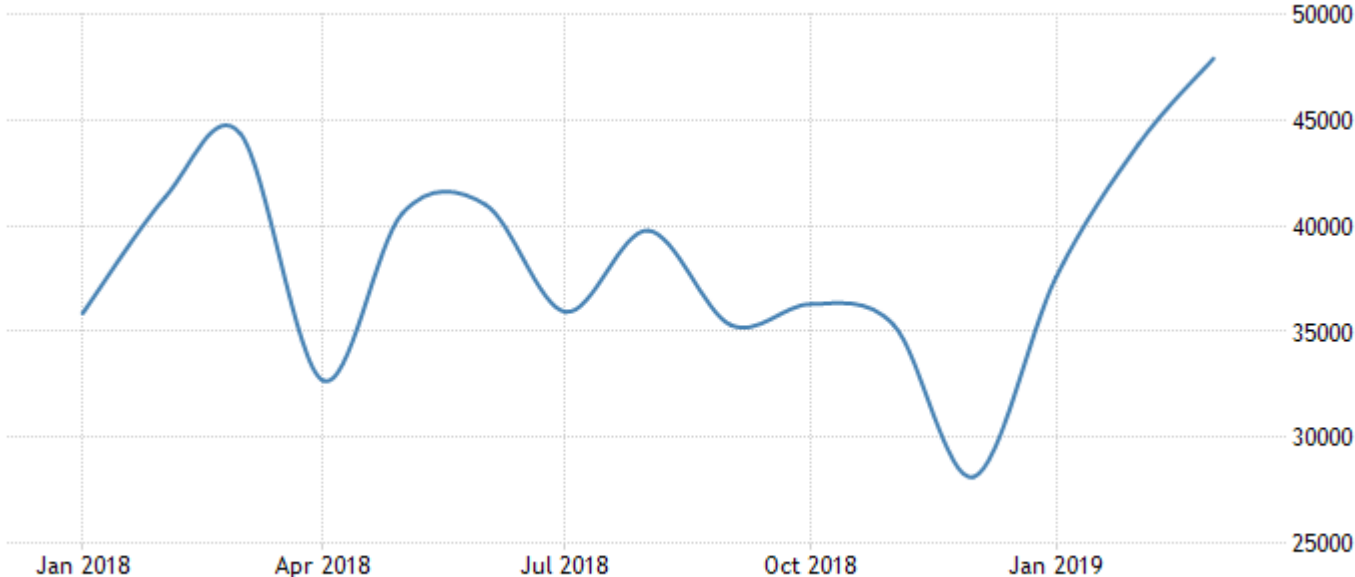
How to make urbanization desirable

- If the urban sector can provide better job opportunities with more stable income, urbanization is **not** a disaster and therefore should be **welcome**.
- The important question is *how* to prepare labors from rural areas to make them suitable for working in the urban sector and how to manage traffic jams caused by excessive concentration within the primate city.
- Industrial competitiveness declines as Bangkok starts experiencing *diseconomies of agglomeration*
- Lack of management to maintain effective and efficient institutional capability (Kor Tor Mor's Blunders)

We are commuters

- Urbanization has already spilled over from Bangkok into surrounding provinces.
- A large number of Bangkok's 10 million people now commute between their residences in Bangkok's suburbs or these five provinces and their offices are in downtown Bangkok.
- Bangkok should learn from the experience of other well-run cities around the world.
- The concept of **satellite towns** should be explored and introduced in metropolitan Bangkok when and where relevant.

Car Registrations in Thailand increased to 47916 in March from 43879 in February of 2019. Car Registrations in Thailand averaged 22673.87 from 1989 until 2019, reaching an all time high of 66668 in March of 2013 and a record low of 1690 in December of 1998.



SOURCE: TRADINGECONOMICS.COM | DEPARTMENT OF LAND TRANSPORT, THAILAND

A Satellite Town Model

- A satellite town can be understood by thinking of the concept of a satellite itself. *A man-made satellite is launched into orbit.*
- This object is within Earth's orbit. *A satellite orbits the earth. However, it is not part of Earth itself.*
- This is exactly how a satellite town comes to be, as it is a smaller city that is near a larger metropolis.
- It might even have small degree of influence from the nearby metropolis
- In urban planning, a satellite town is a smaller metropolitan area located close to a bigger metropolitan area.

Satellite-town model of city development

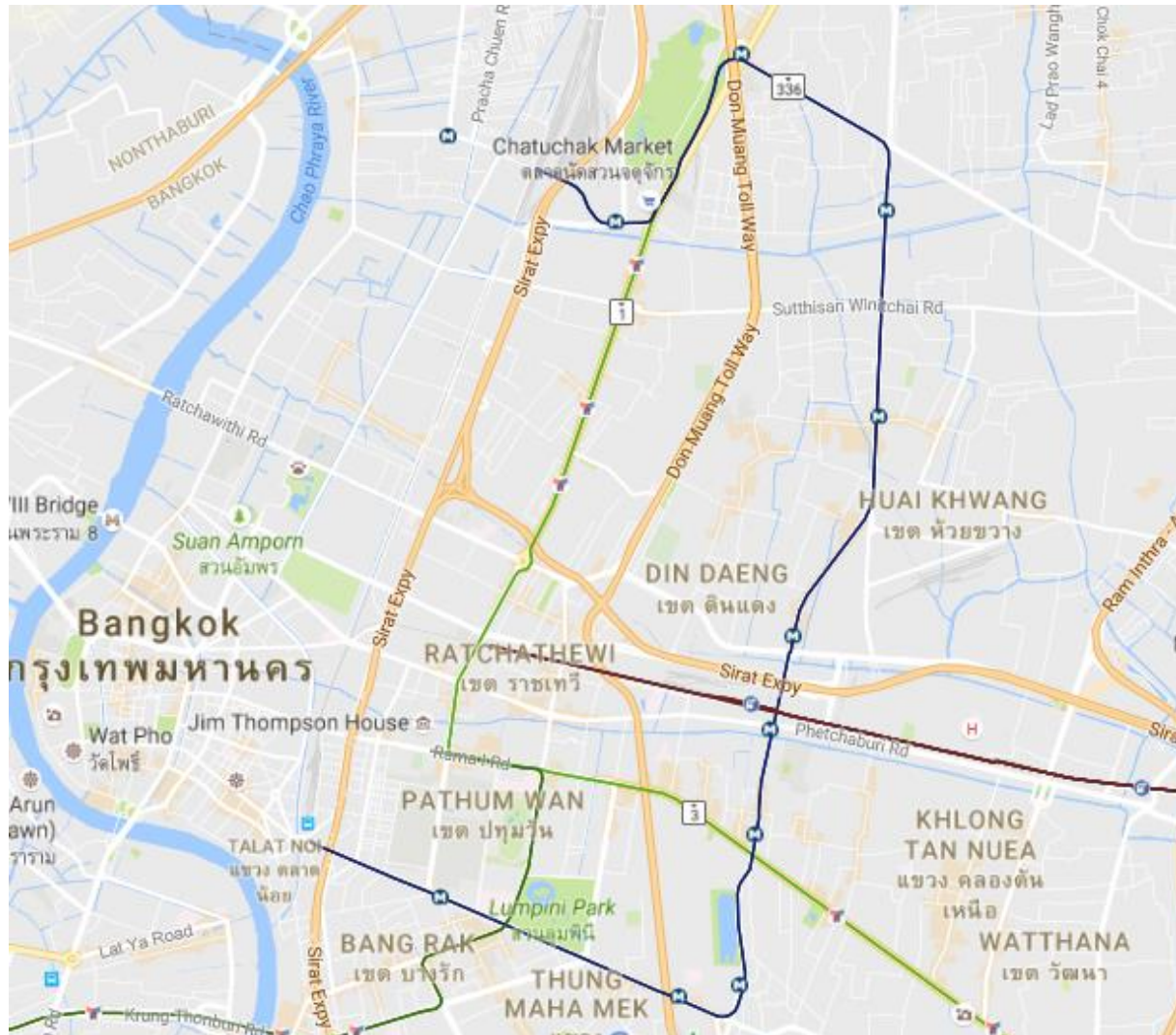
- Under the satellite-town concept, now widely applied in many major cities in Germany and other European countries, **a city should be divided into many residential areas and suburbs.**
- *Each area is made self-sufficient, complete with office and commercial buildings, schools, hospitals, shopping centers and other facilities.*
- This should **reduce the necessity of residents having to take long commute hours.**
- It thereby does away with many urban problems related to **large numbers of people moving about**, including traffic snarls and air pollution, among other problems, improving people's quality of life.

(D) Quality of city life and environment

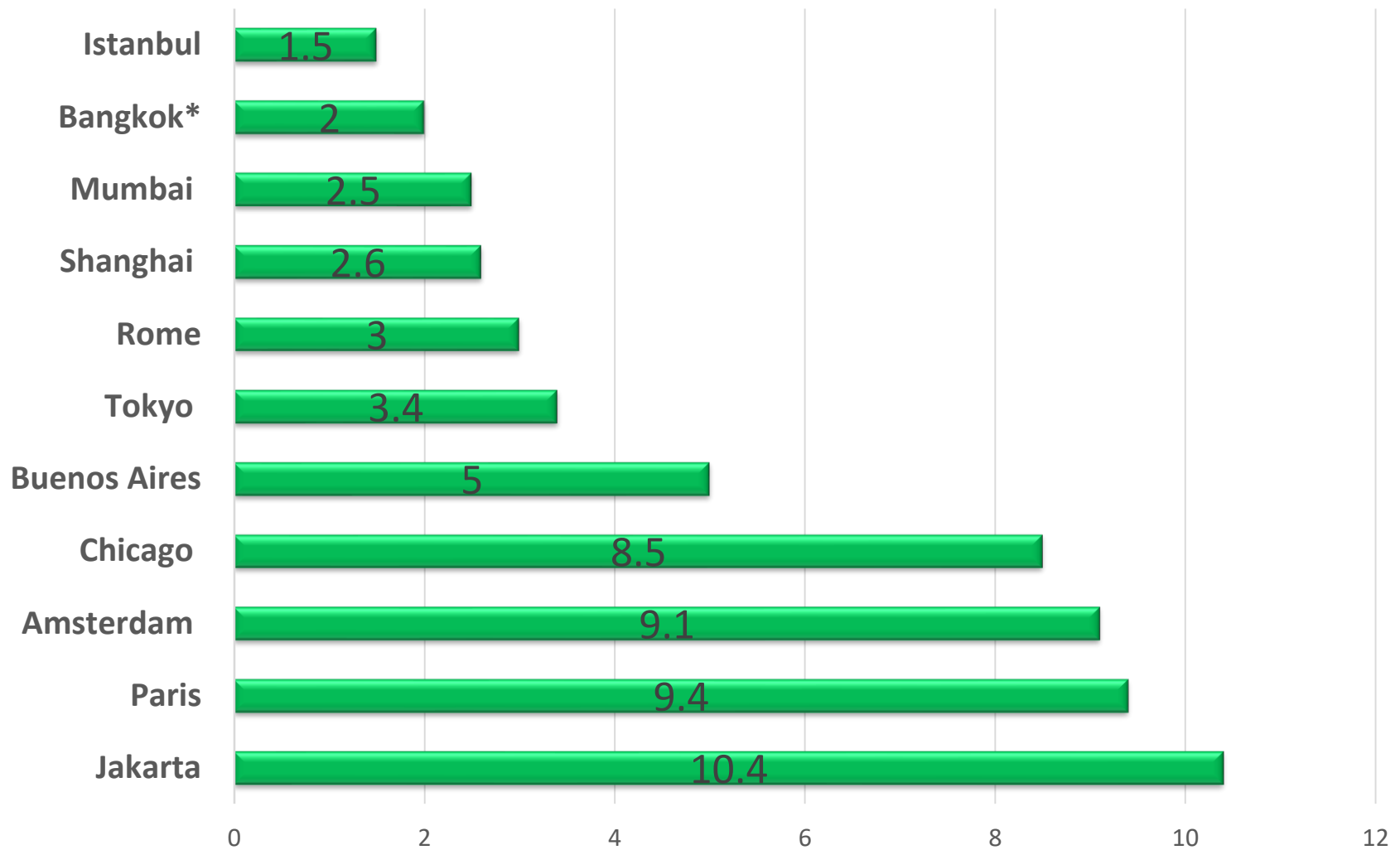
The fourth characteristic of sustainable urbanization

- Bangkok has several parks, although the amount to a per-capita total **park area** is only 1.8 square meters.
- There is only **3.3** m² of **green space** per person in Bangkok, compared to an average of **39** m² in other cities across Asia.
- Bangkok thus **has 10 times less green space** than the region's urban areas.

Insufficient green area



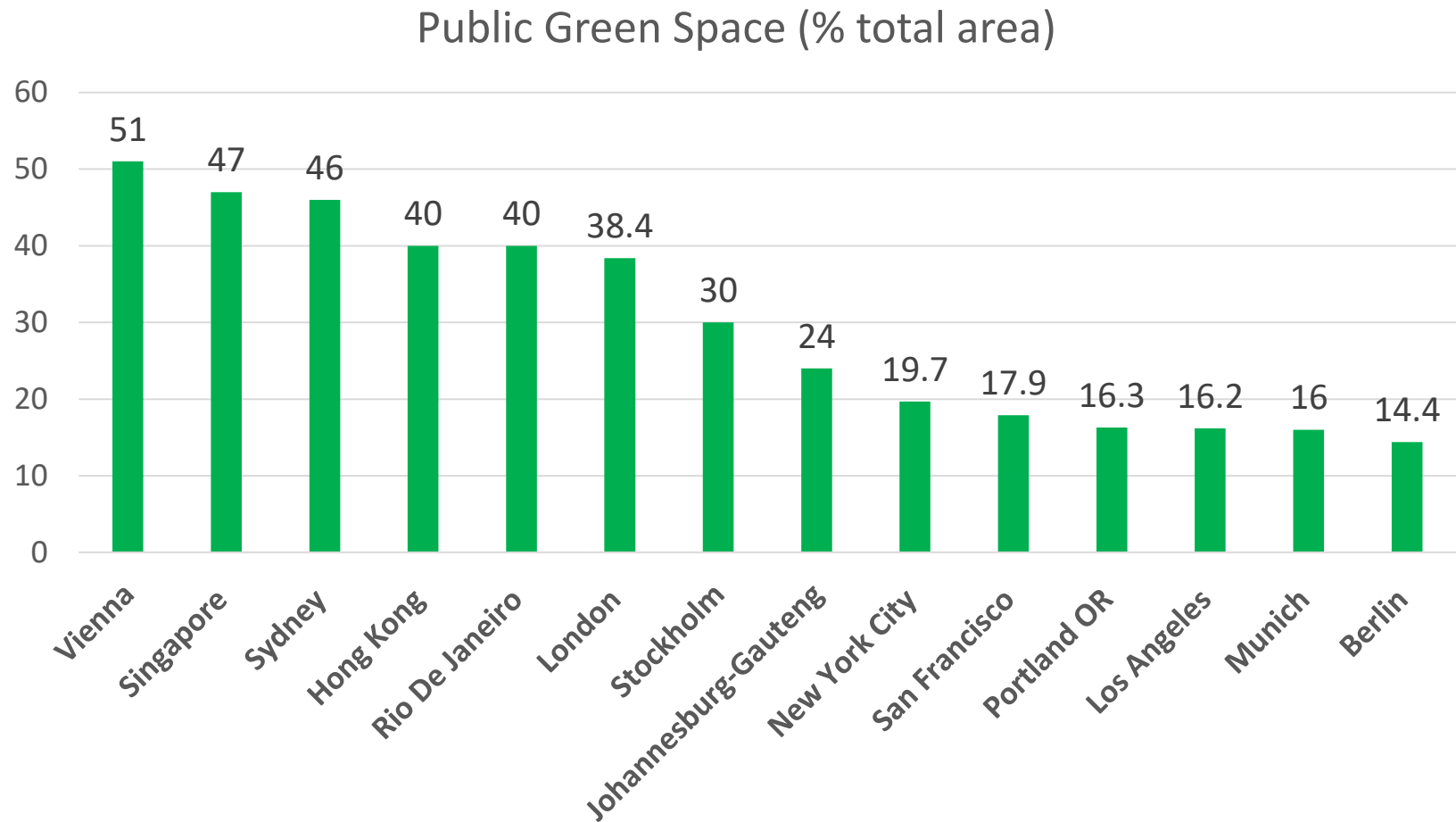
Public Green Space (% total area) Source: World Culture Report



London has 39% of public green spaces



Cities with the most percentage of public green space



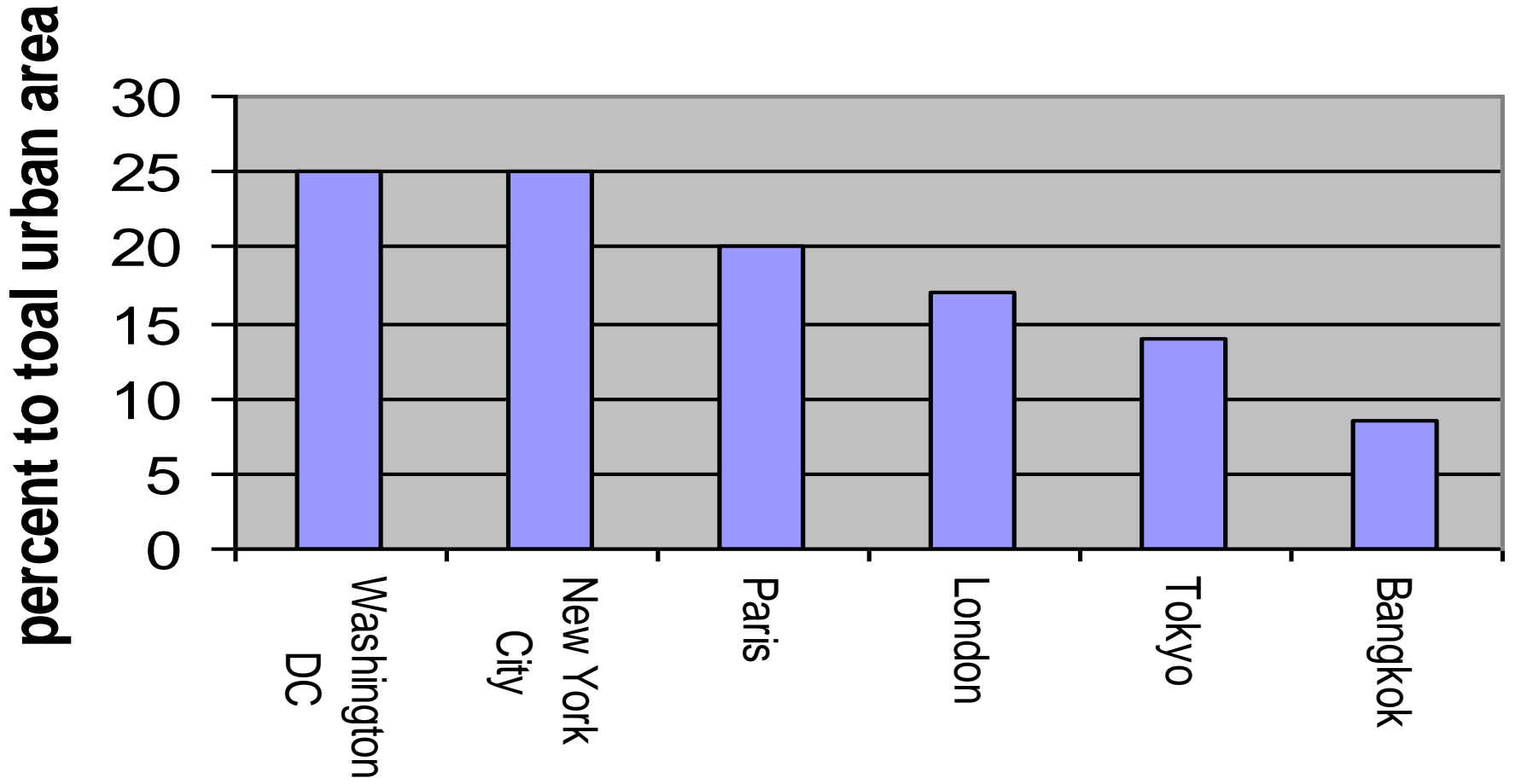
2. Costs of excessive concentration

- **Why too much concentration in mega cities?**
- Underdeveloped institutions for urban planning and management
- Inadequate human resources
- **Externalities of congestion** and pollution are relatively *underpriced* in megacities, encouraging overpopulation in larger cities.
- Excessive concentration significantly **reduces** economic growth.

Saturation is a cause of traffic jam

- Saturation happens when a city's population grows faster than its infrastructure.
- The most common form of traffic occurs when there are more cars than the roadway can support.
- This form of congestion is recurring, and makes up about half of all traffic.
- Because sitting in highway traffic is seen as an unproductive and undesirable activity, recurring congestion can have adverse effects on both the economy and citizens' well-being.
- **Other factors** include construction, car crashes, road blocks, distracted driving, and floods (*Bangkok is sinking*).

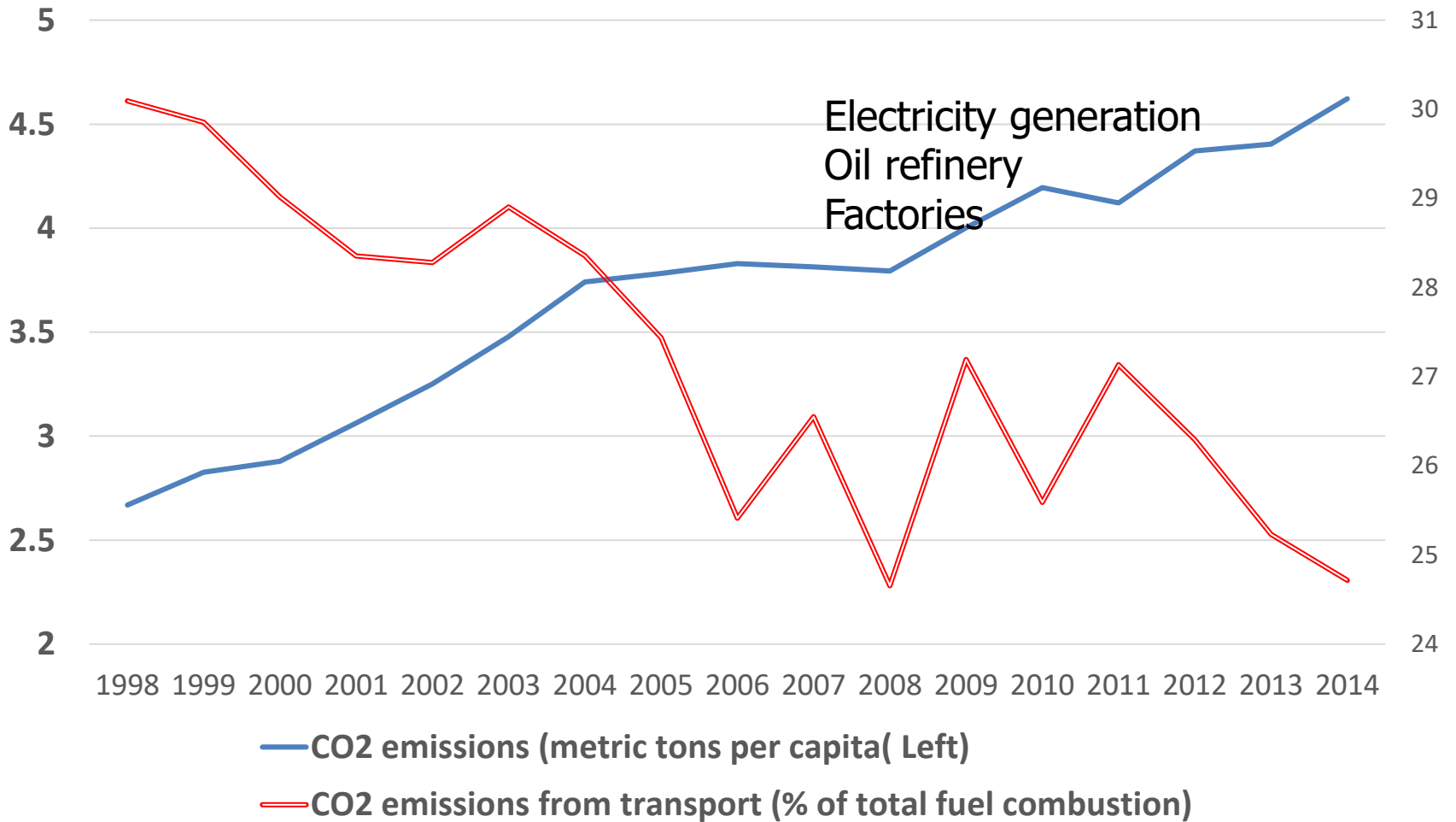
Urban Road Area



Consequences of traffic congestion

- Huge economic cost in terms of time lost and energy consumption and cost of health treatment
- Alarming levels of CO, black smoke, Hydrocarbon, noise level and *particulate matters* (PM) .
- Road traffic is responsible for 70% of the dust.
- The main sources of dust are diesel and motor cycle exhaust and construction sites.

Thailand's CO₂ Emissions per capita (Rising) (declining as % from transportation source)



Further costs of excessive concentration

- Traffic accidents
- Poor air quality
- *Noise pollution*
- Health costs from exposure to high level of air and water pollution
- Contamination of ground water
- Gastrointestinal and infectious diseases
- Time lost due to long commutes

Extra travel time: 64 minutes per day

Source: Tom Tom Traffic index

- **Extra travel time** during *peak hours* vs. an hour of driving during a *free flow situation*.
- 64 minutes per day
- Multiply 64 by 230 days to annual figure of extra travel time of **244** hours per year

EXTRA TRAVEL TIME IN PEAK HOURS

Additional time spent in the car during peak hours



+ 24 min










per 30 min trip
in the morning

+ 29 min

per 30 min trip
in the evening



World Rank in 2018

RANK BY FILTER	WORLD RANK	CITY	COUNTRY	CONGESTION LEVEL
1	1	Mumbai	 India	65% ↓ 1%
2	2	Bogota	 Colombia	63% ↑ 1%
3	3	Lima	 Peru	58% ↑ 8%
4	4	New Delhi	 India	58% ↓ 4%
5	5	Moscow region (oblast)	 Russia	56% ↓ 1%
6	6	Istanbul	 Turkey	53% ↓ 6%
7	7	Jakarta	 Indonesia	53% ↓ 8%
8	8	Bangkok	 Thailand	53% ↓ 2%
9	9	Mexico City	 Mexico	52% – 0%

How to alleviate urban concentration

- ***Investment in interregional transport*** and telecommunications to facilitate de-concentration of industry.
- The government creates ***investment promotional zoning*** to attract investors to rural areas.
- ***Fiscal de-concentration***: small cities can raise fiscal resources and provide services need to compete with primate cities for industry and population.

Noise pollution may cause irrecoverable damage if louder than 85 decibel

- A normal conversation is about 60db
- **Maximum permissible** level of noise was at **70 decibel (db)**.
- Noise that is ***Louder than 85db*** may damage your ears.
- When exposing yourself to noise, think of three things: ***How loud, how long, and how close?***
- Repeated exposure to ***noise-emitting machines*** and engines such as motorcycles (***big bikes***) can erode hearing more slowly but result in irrecoverable damaged ears.

As much as possible, avoid loud people

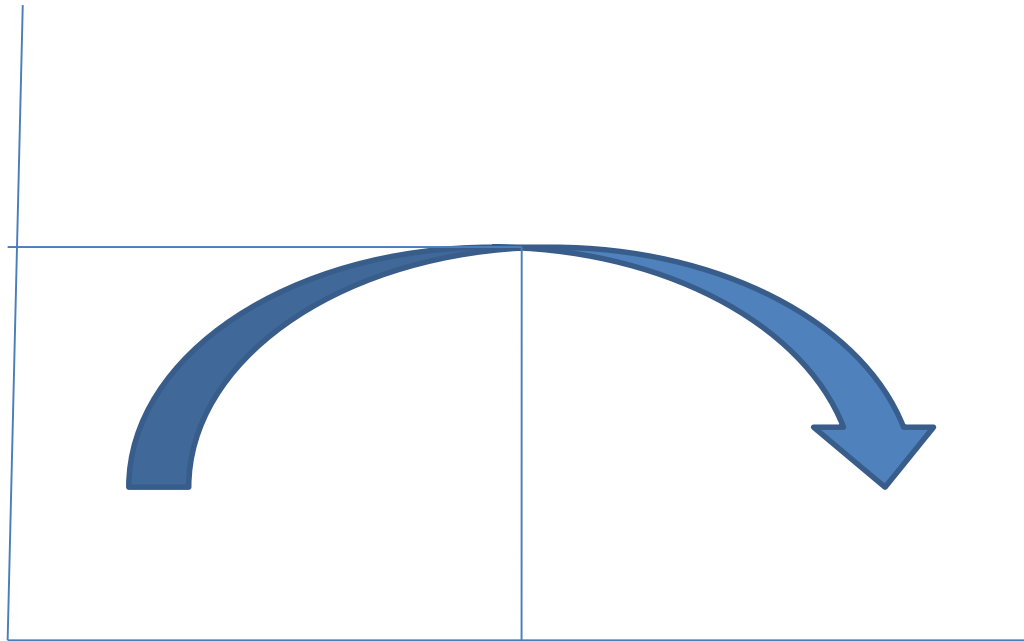
- Children become **aggressive** as their parents shout at one another.
- It inadvertently breeds a society full of *aggressive people* who cannot communicate with one another.
- Some even become suicidal, having suffered from persistent ringing in their ears.
- 21.4 % of Bangkok's population who lived alongside the roads suffered from sensory neural hearing loss.
- Environmental noise pollution is a threat to health and well being.
- *Silence is the secret sauce of success*

3. Environmental Kuznets Curve (EKC)

- Environment quality declines as economic development has intensified up to a turning point, where the relationship between growth and pollution become delinked.
- Past the turning point, it appears that greater wealth increased environment quality
- Technology in advanced countries increases efficiency and reduce environment degradation.
- Wealth means you can afford EV and the government can enforce them (case of Singapore)

Environmental Kuznets Curve

Pollution level



Threshold level

Wealth

Environmental Quality and Wealth

- Environmental quality depends on population desire
- Rising wealth means environment is a luxury good for the well-to-do countries.
- EKC only observed in countries where is less ability to hold polluters accountable.
- Wealth alone therefore is not enough for high environmental quality. It requires government's willpower and the ability to hold polluters accountability.

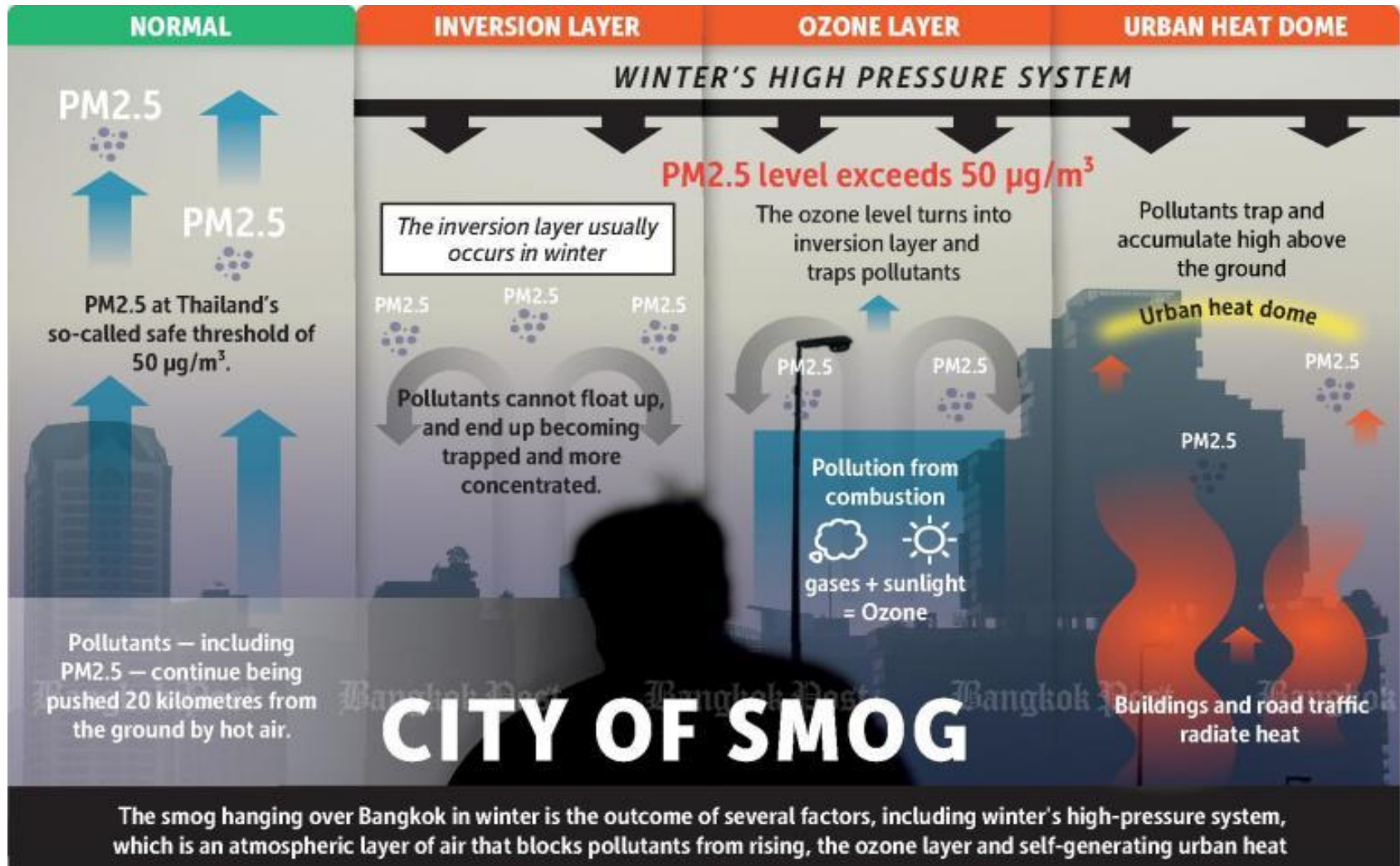
Inversion layers

- Rapid urbanization has transformed Bangkok's landscape, creating a heat-island effect that helps stimulate the formation of inversion layers during winter, and trapping the area's self-generated pollutants.

Particulate matter (PM 2.5)

- The effects of inhaling particulate matter: asthma, *lung cancer, cardiovascular disease, respiratory diseases, premature delivery, birth defects, and premature death.*
- The World Health Organization (WHO) estimated in 2005 that “Fine particulate air pollution less than 2.5 microns (PM_{2.5}), causes about 3% of mortality from cardiopulmonary disease, about 5% of *mortality from cancer of the trachea, bronchus, and lung*, and about 1% of mortality from acute respiratory infections in children under 5 years, worldwide.

The pollution sources themselves help build up the **inversion layers** that trap the dust underneath



Unit: Microgrammes per cubic metre ($\mu\text{g}/\text{m}^3$)

Only brief exposure

- **Short-term exposure** at very high concentrations can significantly contribute to heart disease.
- **Traffic exhaust** is the single most serious preventable cause of **heart attack** in the general public, the cause of 7.4% of all attacks

PERILOUS PARTICLES

PM2.5 are fine particles emitted by cars, trucks and buses, as well as construction equipment and locomotives. They also result from the burning of fuels such as wood, heating oil or coal, and from blazes such as forest and grass fires. Fine particles are also emitted from power plants. PM2.5 refers to the diameter of dust particles, equivalent to 1/20 of a human hair, enabling the dust to penetrate deep into lung passageways and enter the bloodstream, causing serious cardiovascular problems.



Note: µm = Microns in diameter

SOURCES OF PM2.5 IN THAILAND

Burning
209,937 tonnes/year

Manufacturing
65,140 tonnes/year

Transport
50,240 tonnes/year

Generating electricity
31,793 tonnes/year

DANGERS FROM PM2.5



Lung cancer



Rhinitis, burning sensation of the nose, coughing with phlegm



Coronary artery disease, cerebrovascular disease



Newborns with lower-than-average weight

PROTECTIVE MEASURES



Wear a dust-proof mask



Daily house cleaning



Monitor news from the press and authorities



Plant trees



Prepare medicines or seek medical service if an abnormal symptom occurs

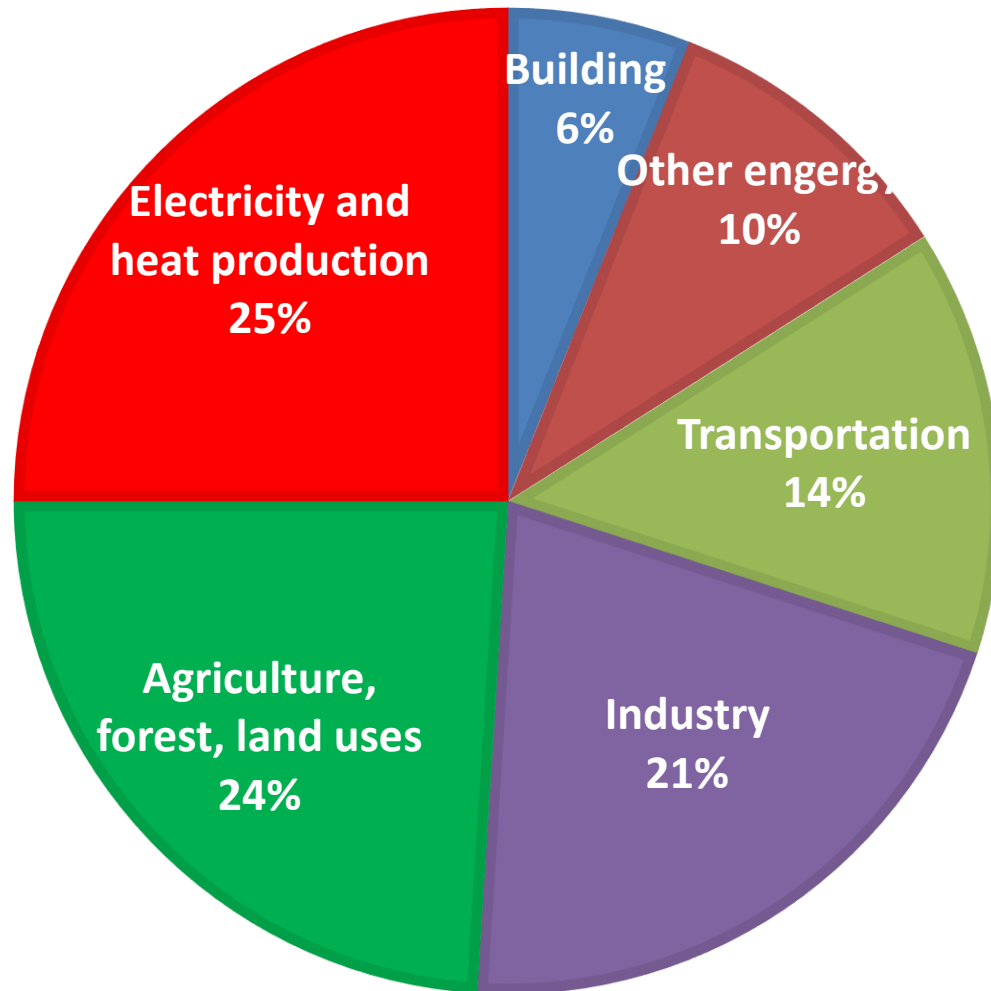
Sources: Pollution Control Department, Public Health Ministry

Sources of PM2.5

- About 90% of the dangerous particles in the air in and around Bangkok are generated by vehicle exhaust, biomass burning to cut reduce harvesting costs, factories and dust from construction sites.
- And as the pollution readings ratchet up, so do health-related economic costs.
- Estimates of damages associated with concentration of larger air particles PM10 in Bangkok are around 446 billion baht per year

Thailand's share of Green House Gas

SHARE OF GHG



More cars, more new roads, and more crop burning

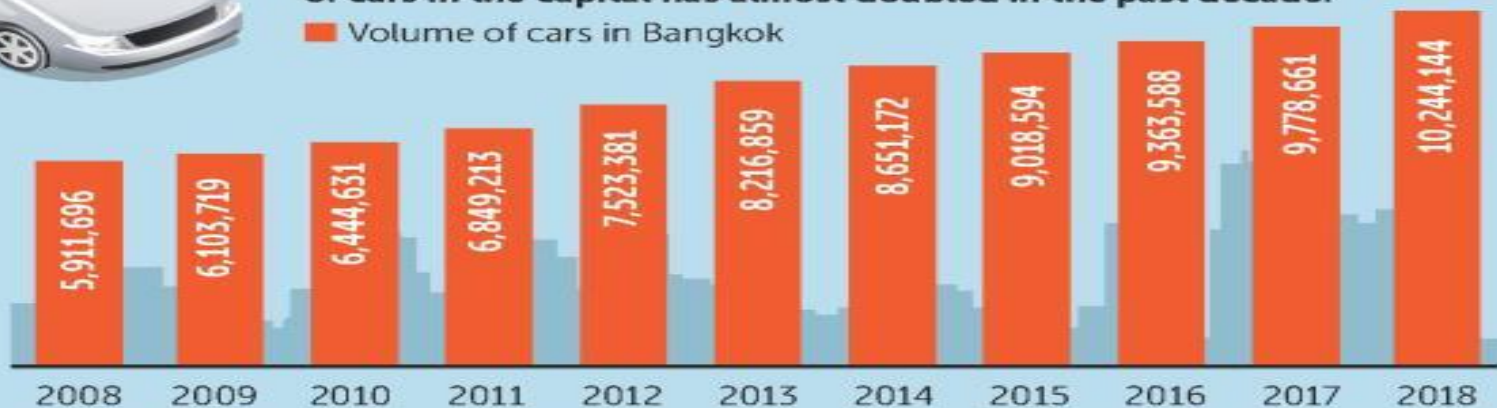
- Despite Bangkok's pollution and traffic challenges, the number of registered vehicles has more than doubled in the past decade to 10.5 million vehicles
- Transportation plans call for another 1,047 km of new roads and expressways over the next decade.
- Vehicles emitting dangerous black exhaust remain in widespread use.
- Moreover, despite anti-burning regulations, 66% of the sugarcane that entered mills this year was burned prior to harvesting.



THE AIR THAT YOU BREATHE

The government has tried to cut down on Bangkok's pollution by urging people to use public transport more often, yet the number of cars in the capital has almost doubled in the past decade.

Volume of cars in Bangkok

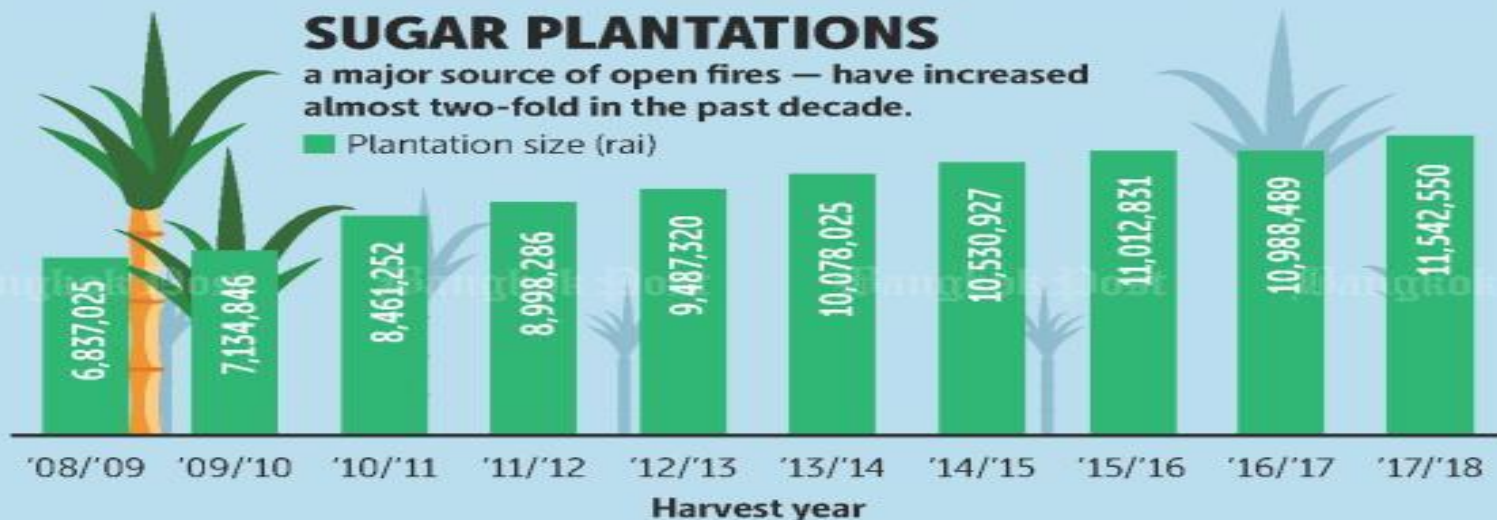


Source: Department of Land Transport

SUGAR PLANTATIONS

a major source of open fires — have increased almost two-fold in the past decade.

Plantation size (rai)



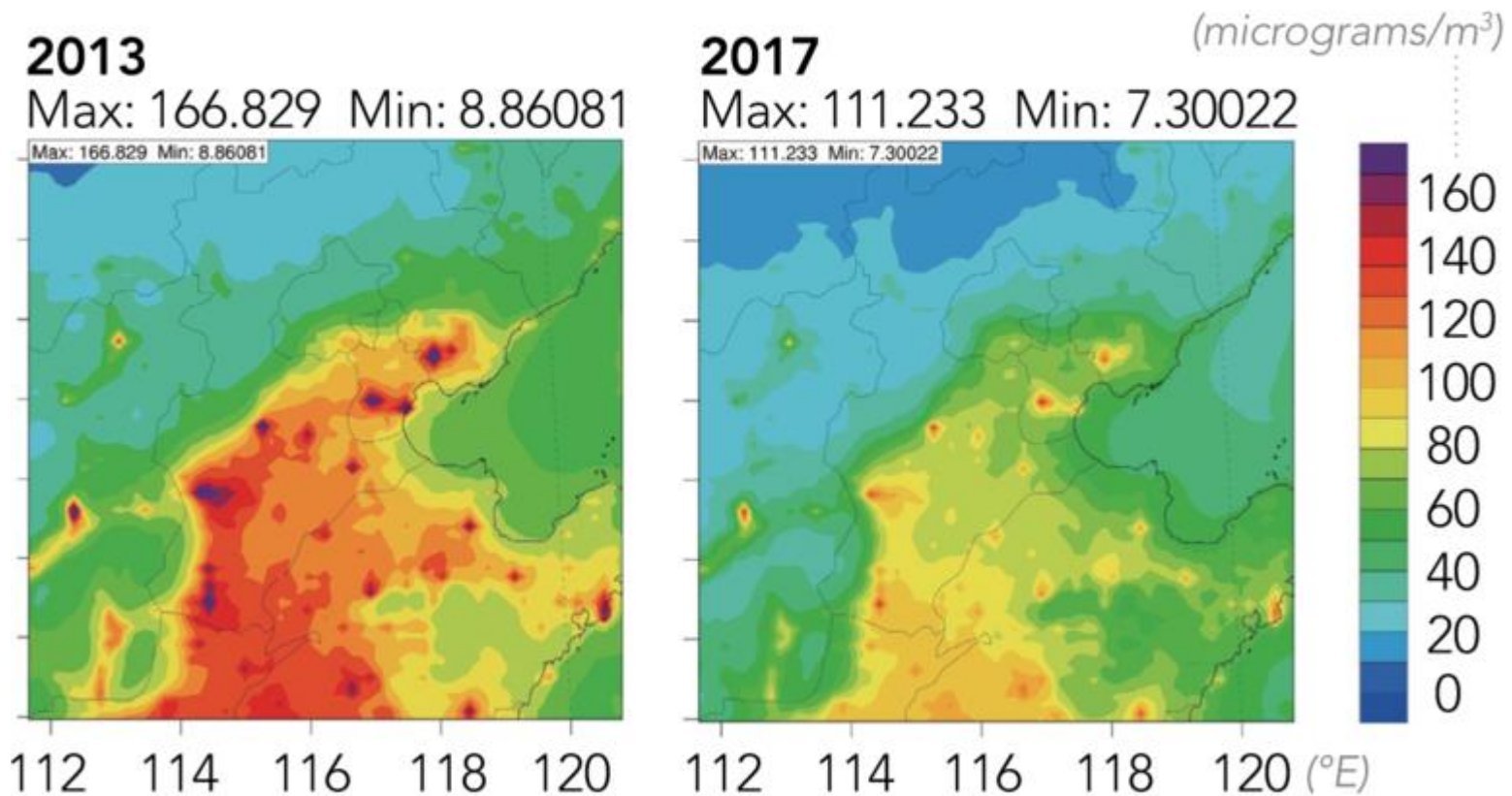
Source: Office of Cane and Sugar Board

BKPgraphics

4. China's success story

Beijing's pollution progress

Annual average concentration of PM2.5 in Beijing-Tianjin-Hebei and surrounding areas



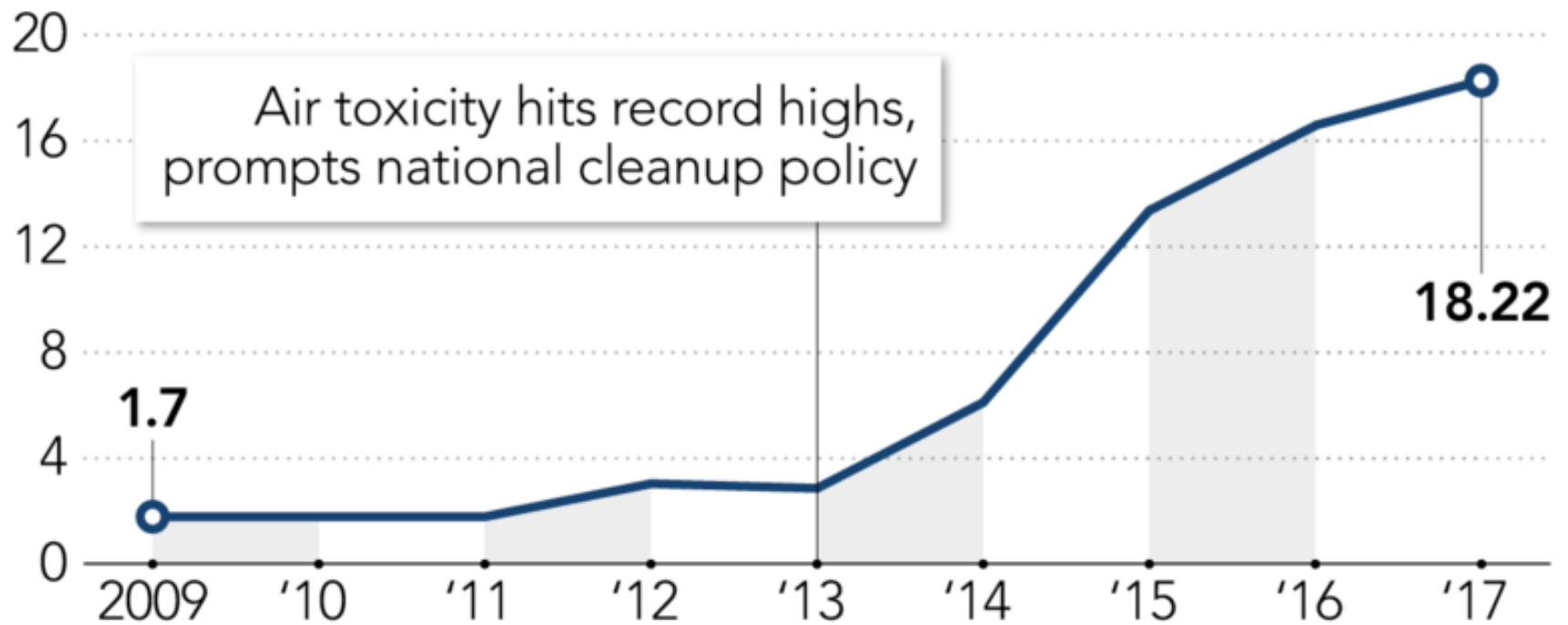
Source: Tsinghua University

The most air-polluted cities in the world

- When it comes to what China is doing well, experts also point to its model afforestation, and soil and water improvement projects.
- China is also in the vanguard developing **electric vehicles and battery technology.**
- Only **five of the 30** most air-polluted cities in the world are in China, while 22 are in India.

Blue-sky thinking: Beijing's clean air investment soars

Spending on air pollution control, in billions of yuan



Source: U.N. Environment Program, Beijing Municipal Bureau of Finance

Hydropower plants do not produce GHG but it obstructs river flows

- China's damming of the Mekong, and a proposal to blow up the great river's rapids to ease navigation, have been widely condemned.
- Chinese hydropower projects in Cambodia have overestimated water flows, prompting regular blackouts in Phnom Penh -- a problem only exacerbated by heavy power demand from Chinese construction projects.

Objections to China's electricity plants in Myanmar and Thailand

- And renewed Chinese pressure to complete the \$3.6 billion Myitsonne **hydropower project** on a stretch of the Irrawaddy River in Myanmar's Kachin state has caused demonstrations and widespread resentment, particularly as most of the power produced by the project would be for export to China; work begun in 2009 was suspended in 2011.
- In Thailand, a proposed 800-megawatt **Thai-Chinese coal-fired power** project in the southern province of **Krabi** along a relatively pristine stretch of coast has been stalled by strong public opposition.

The myth of the Kuznets Environmental Curve

- "When we talk about economic growth, it usually means more pressure on the environment and more use of natural resources,"
- But it doesn't have to be that way, as China's success stories show.
- China can change the environment by using innovation and decouple economic growth from resource use and environmental degradation.
- In other words, there can be zero trade off between growth and pollution.

Chinese tourists in Chiang Mai

- A quarter of all visitors to Thailand arrive by air from China, generating an estimated 4% of the kingdom's GDP.
- However, Chinese arrivals in Thailand fell more than 12% year on year in February 2019 and nearly 2% in March.
- Ironically, one reason is thought to be exceptionally severe air pollution, particularly in the north, where Chiang Mai has recorded some of the highest readings of PM2.5 in the world this year.

Chinese demand for mushrooms

- A significant contributor to the pollution has been the unregulated **burning of forest floors** to facilitate the collection of **wild mushrooms**, demand for which is insatiable among China's increasingly affluent middle class.
- Major suppliers in Yunnan Province cannot meet demand from inside the country, where ***there are fines for lighting forest fires***, and pay cash for imported black market forest products.
- As a result, Thailand's environment is damaged along with its tourism prospects -- and China figures on both sides of the equation.

5. Climate Change Economics

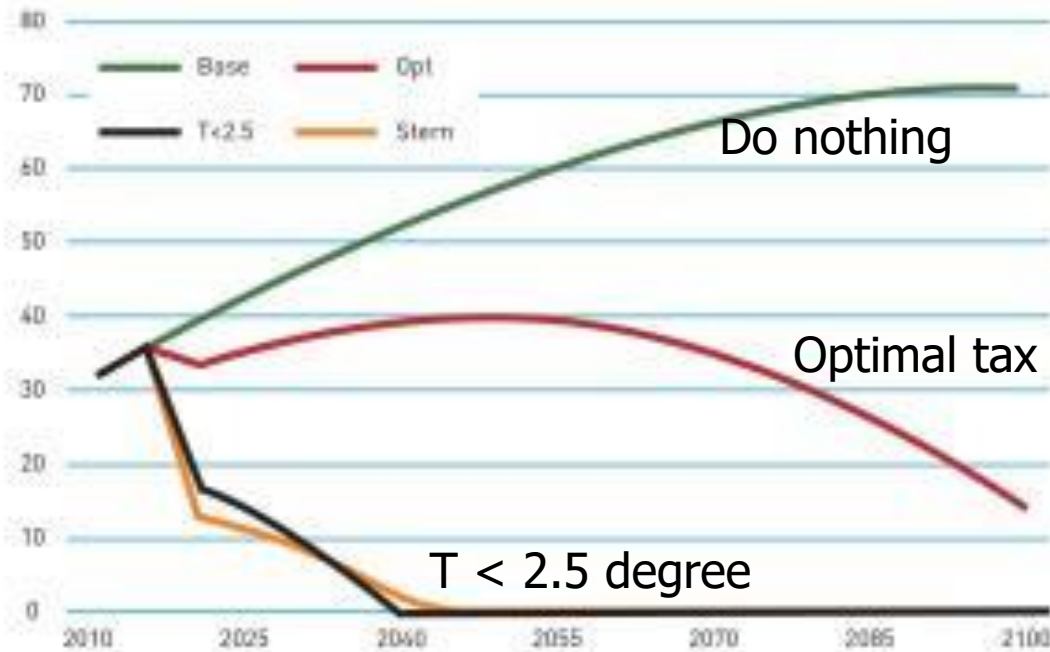
William Nordhaus: 2018 Nobel Prize in Economics

- Nordhaus is the founding father of the study of climate change economics.
- Economic models he has developed since the 1990s are now widely used to weigh the costs and benefits of curbing **greenhouse gas** emissions against those of inaction.
- His studies are central to determining the social cost of carbon, an attempt to quantify the total cost to society of greenhouse-gases, including hidden factors such as extreme weather and lower crop yields.

A universal carbon tax can reduce CO₂ emissions

CO₂ emissions over time

FOUR CLIMATE POLICIES



1. Base: no new climate change policies beyond those in place in 2010.
2. Opt: carbon taxes that maximise global welfare, using conventional economic assumptions about the importance of the welfare of future generations.
3. Stern: carbon taxes that maximise global welfare, with substantially more emphasis on the welfare of future generations than in scenario 2, as suggested in *The Economics of Climate Change: The Stern Review*, from 2007.
4. T < 2.5: carbon taxes high enough to keep global warming from ever exceeding 2.5°C are implemented at minimum global welfare cost.

©Johan Jarnestad/The Royal Swedish Academy of Sciences

Nordhaus was an early advocate for a universal carbon tax

- Nordhaus modelled out the global emissions of carbon under four universal policies.
- The first scenario is a baseline estimate, in which no policies are adopted.
- In the second scenario (“Opt,” which stands for “optimal,” meant in the economic sense of maximizing welfare), carbon taxes start out at around \$30 per metric ton of carbon dioxide and rise over time at about the same rate as global GDP.
- The third and fourth scenarios show what happen with carbon taxes *six to eight times higher* than the “optimal” level—and lead to far more drastic drops in CO2 emissions.

Paris accord: The target of not letting global warming exceed 2°C above pre-industrial levels

- In 2016, Nordhaus argued that the target of not letting global warming exceed 2°C above pre-industrial levels—the goal agreed in the Paris accord—was **unlikely to achieve** even if ambitious policies are introduced in the near term.
- Instead, “a target of 2.5°C is technically feasible but would **require extreme, virtually universal, global policy measures.**”

Conclusion

- There is a stylized fact of urbanization process in developed and developing countries: urbanization speed is faster over time.
- Bangkok primacy has been declining, as the second stage of de-concentration is taking place.
- But Bangkok is still a far cry from being a city offering high quality of life because of environmental degradation.
- The target of not letting global warming exceed 2°C above pre-industrial levels is unlikely to achieve.

Review questions

- Compare and contrast urbanization in Thailand and Africa.
- Provide evidence indicating the sustainability of urbanization process in Thailand.
- What can the public sector do to ease the adverse consequences of urbanization?
- Why has urbanization in Thailand been **slowing down** in all regions?
- “All happy families resemble one another, but each unhappy family is unhappy in its own way” *Anna Karenina* by Leo Tolstoy. Do you think that happy families in Buri Rum and Bangkok resemble one another, but differ when they are unhappy?

George W. Bush, on returning to Yale to accept an honorary degree (The Sunday Times, May 2001)

“To those of you who received honors, awards and distinctions, I say well done. And to the C students, I say, you too can be president of the United States”

Robert Frost: The road less traveled

**I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I,
I took the one less traveled by,
And that has made all the difference.**

Mr. Bhanupong

**I shall be telling you this with a sigh
For forty years, my students have gone by
Some excelled, some did not do so well,
Because of their passion and perseverance
And that has made all the difference.**