GDP: Data and Problems

Table 7.1

Growth of per capita GDP (average annual growth rates, percentage).

	GDP	Population	GDP per capita
1952–1978	6.0	1.9	4.1
1978–2000	9.7	1.3	8.3
2000–2010	10.5	0.6	9.9
2010–2016	7.7	0.5	7.1

Source: *SAC* (2017, 16, 21–37).

GDP: Data and Problems

- Questions
  - Is the official data reliable?
  - Is the growth rate overstated?
- Alternative methods of estimation
  - Using electricity consumption growth rate, if elasticity of electricity consumption is constant
  - New method: light data at night.

GDP: Data and Problems

- Possible problem (1)
  - Miscalculation of the GDP deflator
  - Growth rates could be overstated by 1-2%
- Possible problem (2)
  - Reporting incentives by local officials
- Possible problem (3)
  - Missing data (small-scale, private firms)
  - 1998 data collection reform implied sample survey of small scale firms.
- Possible problem (4)
  - expanding scope of products

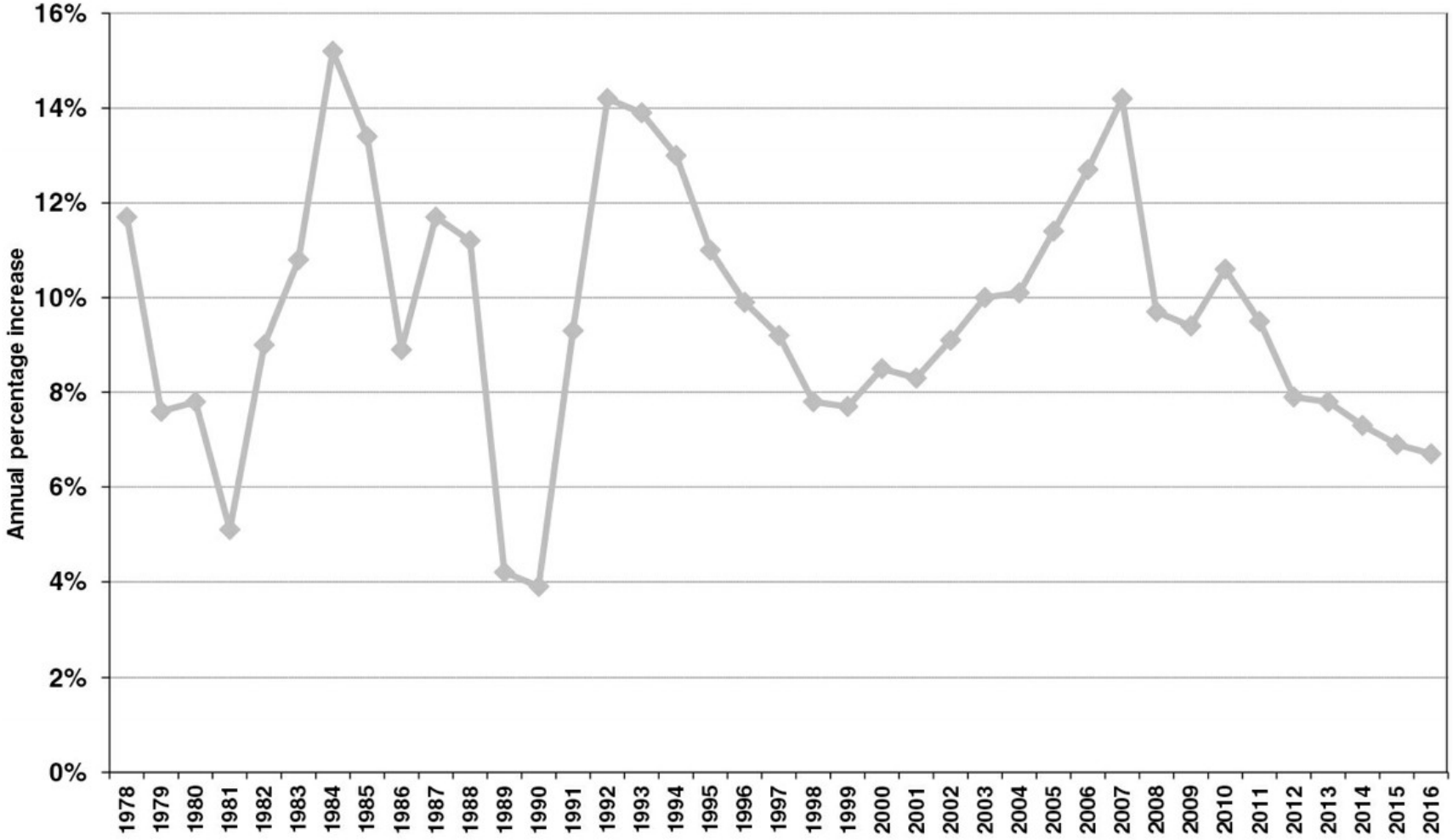
Growth is Real

- Growth has been very impressive even under possible downward revision
  - Comparable growth to fastest growing economies
  - Population almost three times that of 8 high performing economies: Japan, South Korea, Taiwan, Hong Kong, Singapore, Malaysia, Thailand, and Indonesia
- Growth measurement in physical terms (not in value)
  - Production in steel, automobile, housing, highway etc.
  - Consumption per capita

Economic census, every five years

- First census (2004)
  - Upward adjustment by 16.8%, or 2.3 trillion yuan, service sector alone 2.13 trillion yuan
- Second census (2008)
  - Upward adjustment by 4.46%, or 1.34 trillion yuan
- Third census (2013)
  - Upward adjustment by 3.4%, or 1.9 trillion yuan (2013: $9.5 trillion, 56.5% of the U.S.)

Growth cycles, but decline since 2007

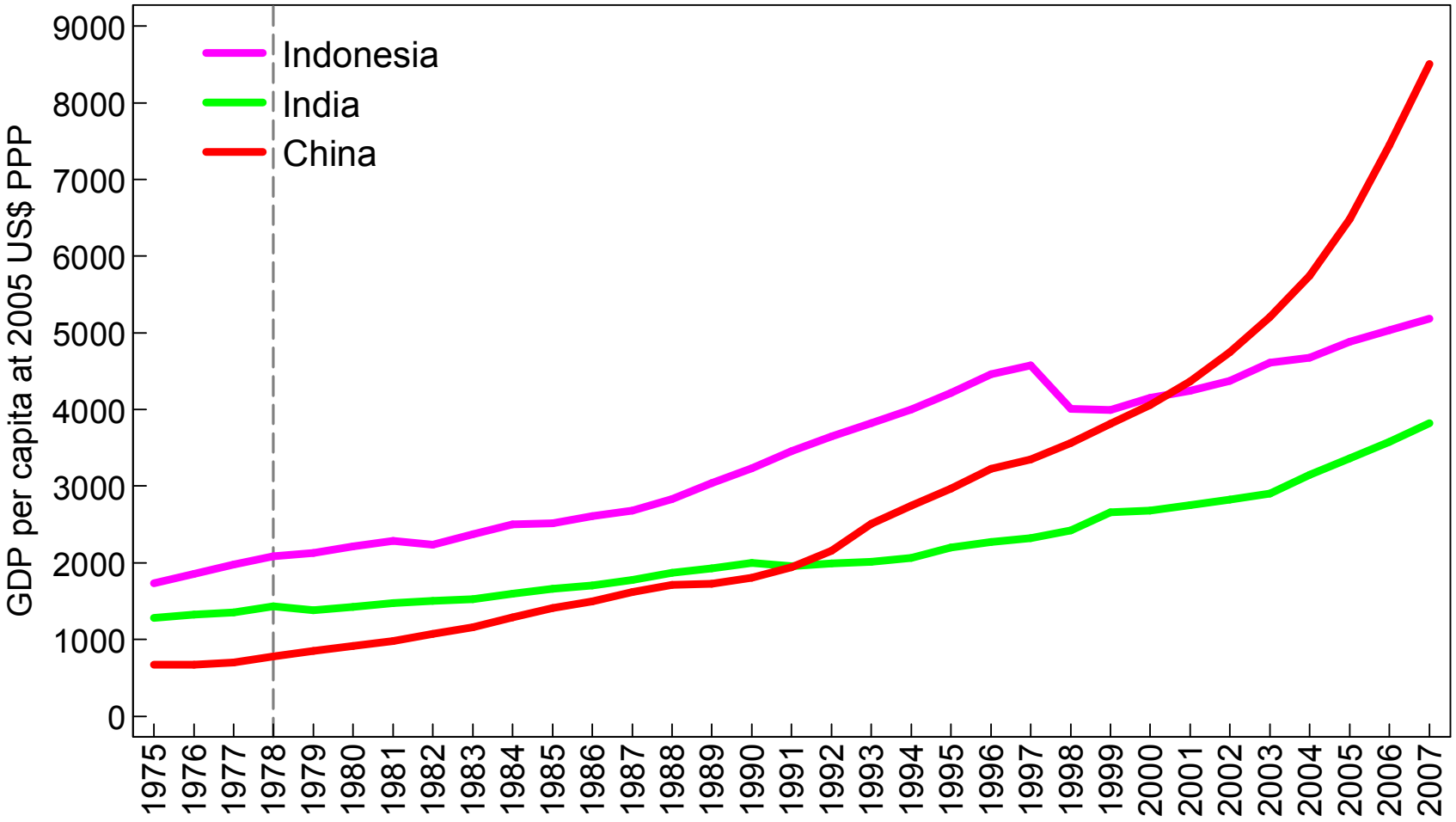


The magic of compounding and growth

$$GDP_{t+n} = GDP_t (1+g)^n$$

- g = 9%: double every 8 years
- g = 7%: double every 10 years
- g = 6%: double every 12 years
- g = 5%: double every 15 years
- g = 4%: double every 18 years

Growth of GDP per capita: China, India, and Indonesia (2005 US$ PPP)

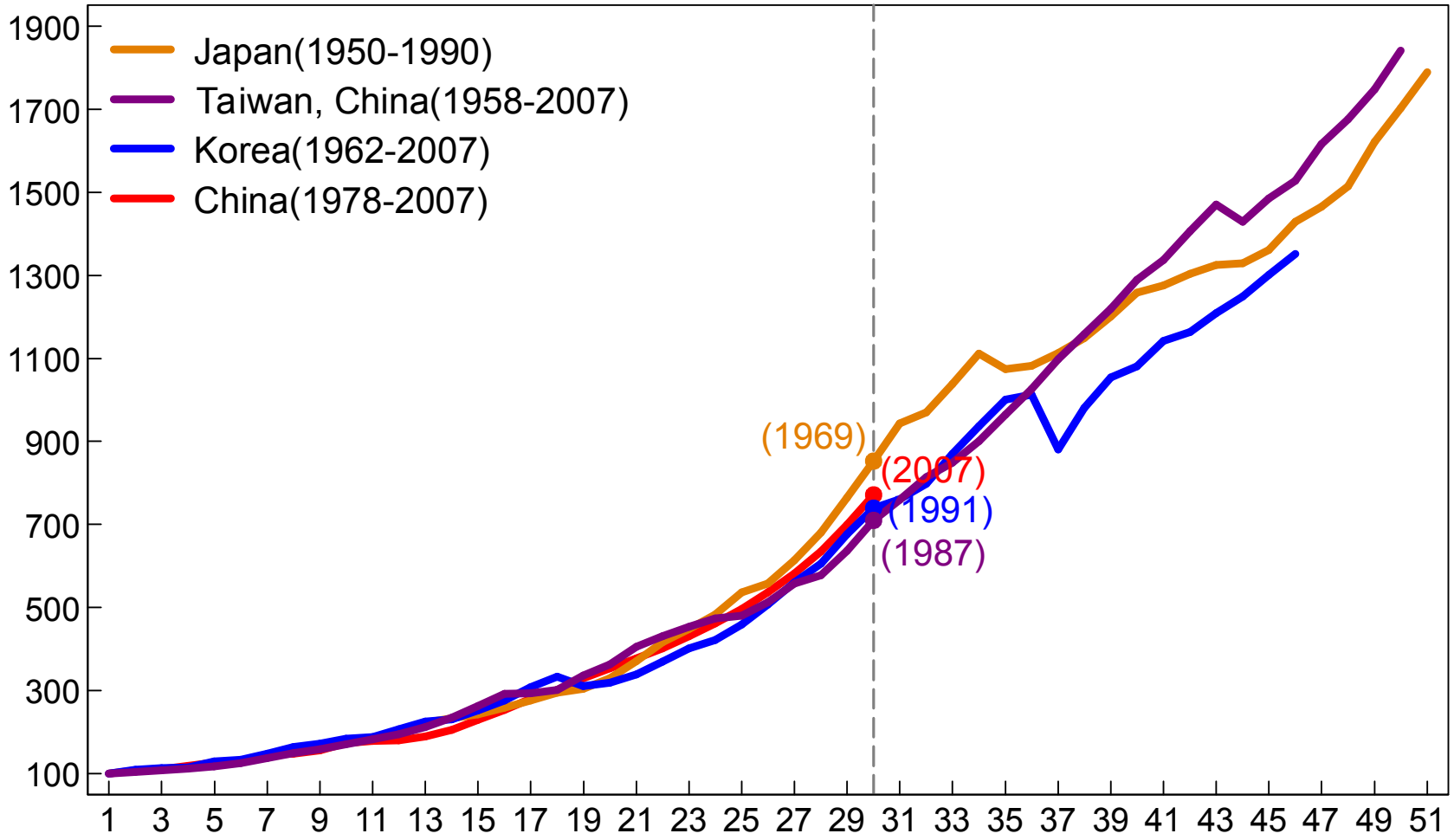


Source：Penn World Table 6.3, 2005 US$ PPP

Is China's growth the fastest?

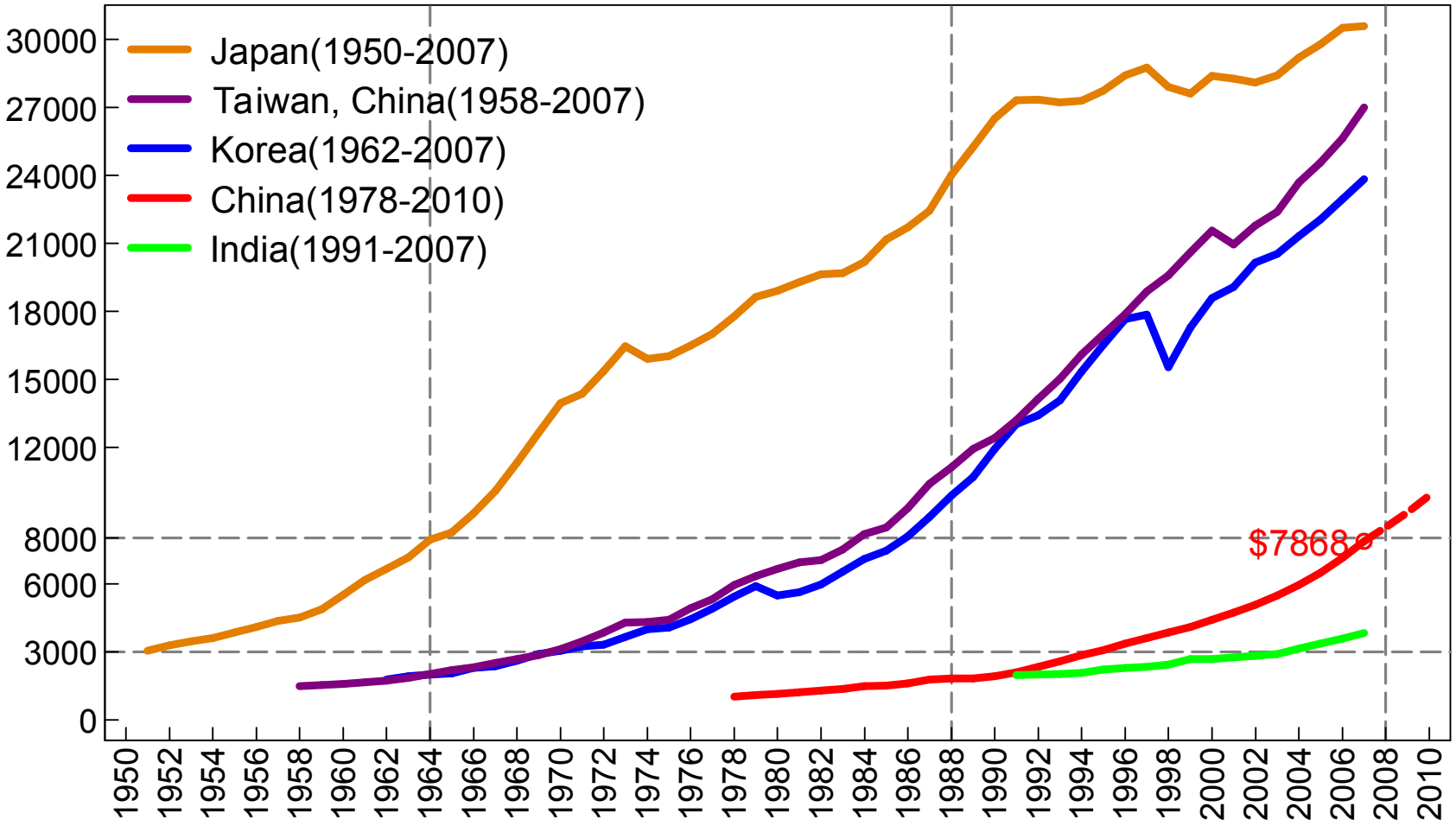
- China started in 1978 but other Asian countries started earlier their growth spurt.
  - Japan: 1950
  - Taiwan: 1958
  - South Korea: 1962
  - China: 1978
- China's growth is similar to other high-performing East Asian economies

China's fast growth is not so special (Indices of GDP per capita at 2005 US$ PPP)



Source：Penn World Table 6.3,2005 US$ PPP

Growth comparison between China and other Asian economies (GDP per capita at 2005 US$ PPP)



Source：Penn World Table 6.3, 2005 US$ PPP, post-2007 values for China extrapolated at 1995-2007 growth rate

Theory of economic growth

- Growth rate is negatively correlated with the level of per capita income
  - The law of diminishing returns
  - Potential growth rate of a poorer country is higher than a richer country
  - “Catch-up effect”
  - “Convergence theory”
  - “Conditional convergence theory”

Three general lessons from China's economic success

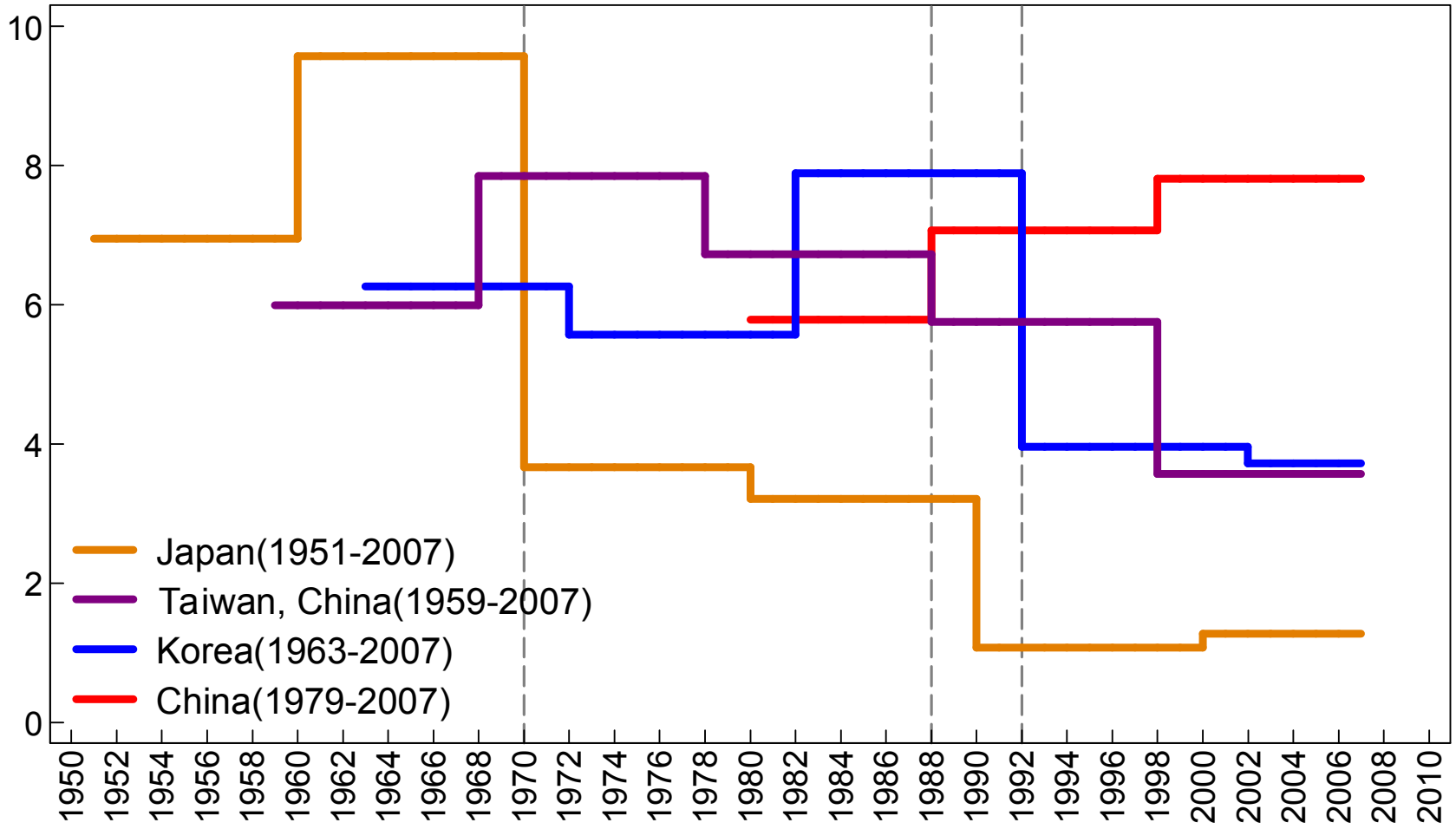
- Getting incentives right
- Making the market work
- Opening up the economy

- None of the above is special

Growth slow down in East Asia after reaching middle income level

- East Asia economies slowed down after reaching $13,500
  - Japan: 1971
  - Taiwan: 1988
  - South Korea: 1992
  - China: $12,800 in 2022

Growth of GDP per capita slows down after attaining middle income level



Source: Penn World Table 6.3, average growth rate of GDP per capita (%,2005 US$ PPP)

What is special about China

- Size
- Openness
- Institutions

Size

- China's huge size
  - Population is close to three times the 8 high performing East Asia economies combined (Japan, Korea, Taiwan, Hong Kong, Singapore, Indonesia, Thailand, Malaysia)
  - About 20% of the world's total
- Size matters
  - Benefits: scale economies

Openness

- China has been unusually open among large economies
  - Country with largest imports and exports; largest trade partner with 120 countries and the number is increasing every year
  - Inward and Outward FDI: each way over US$100 billion/year before Covid.
- Openness matters
  - Benefits: markets, technologies, competition

Institutions

- An emerging market economy with the legacy of central planning
  - More government intervention than other East Asia economies
  - Unfinished economic reforms
  - Political institutions (see slides on China's specific institutions)
- Institutions matter
  - Delay of structural adjustments
  - Slow moving from imitation to innovation

Sources of growth

- Classical theory of growth
  - Physical capital
  - Human capital
  - Labor
  - Technical progress (from innovation)
- Extended theory of growth
  - Geography: Jared Diamond
  - Opening: Jeffrey Sachs
  - Institutions: Acemoglu, Johnson, and Robinson
  - Culture: David Landes, Gorodnichenko and Roland

Sources of growth

- The neoclassical growth model (Robert Solow, 1987 Nobel Laureate)

$$Y_t = Ae^{\alpha t}K_t^{\beta}L_t^{\gamma}$$

- Explanations
  - Y: output
  - K: capital
  - L: labor
  - t: time
  - β: elasticity of capital
  - γ: elasticity of labor
  - If $\beta + \gamma = 1$, constant return to scale (Cobb-Douglas production function)

Sources of growth

- Why are economists interested in estimating this equation?

$$\text{Ln } Y_t = \text{LnA} + \alpha t + \beta \text{Ln } K_t + \gamma \text{Ln } L_t$$

$$\text{Ln } Y_{t+1} = \text{LnA} + \alpha(t+1) + \beta \text{Ln } K_{t+1} + \gamma \text{Ln } L_{t+1}$$

$$\text{Ln } Y_{t+1} - \text{Ln } Y_t = \alpha + \beta(\text{Ln } K_{t+1} - \text{Ln } K_t) + \gamma(\text{Ln } L_{t+1} - \text{Ln } L_t)$$

$$\text{Ln } (Y_{t+1}/Y_t) = \alpha + \beta(\text{Ln } (K_{t+1}/K_t)) + \gamma(\text{Ln } (L_{t+1}/L_t))$$

$$\text{Ln } (1+\Delta Y_t/Y_t) = \alpha + \beta(\text{Ln } (1+ \Delta K_t/K_t)) + \gamma(\text{Ln } (1+ \Delta L_t/L_t))$$

$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t)$$

Sources of growth

$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t)$$

- Explanations
  - $\Delta Y_t/Y_t$: GDP growth rate
  - $\Delta K_t/K_t$: capital growth rate
  - $\Delta L_t/L_t$: labor growth rate
  - α: “Solow Residuals” or “technical progress” or “Total Factor Productivity” (TFP)

Growth accounting: U.S.

$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t)$$

- 1990-95:

$$2.5\% = 0.6\% + (1/3)(3.7\%) + (2/3)(1\%)$$
$$= 0.6\% + 1.2\% + 0.7\%$$

- 1995-98:

$$3.5\% = 1.4\% + (1/3)(4.3\%) + (2/3)(1\%)$$
$$= 1.4\% + 1.4\% + 0.7\%$$

Growth accounting: China

$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t)$$

- Before reform (1952-78)

$$5.5\% = 0\% + (3/4)(6.1\%) + (1/4)(3.6\%)$$
$$= 0\% + 4.6\% + 0.9\%$$

- After reform (1978-98)

$$9.3\% = 2.7\% + (3/4)(7.6\%) + (1/4)(3.6\%)$$
$$= 2.7\% + 5.7\% + 0.9\%$$

Growth accounting: China

$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t)$$

- What do we learn
  - Capital accumulation has been the most important factor for growth, contributing about 62% of growth
  - Labor reallocation from agriculture to industry contributes to about 10% of growth
  - TFP growth contributes to about 28% of growth

Growth accounting of China's economy

$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t)$$

- Growth prospects
  - Capital accumulation
  - Labor reallocation from rural to urban areas
  - TFP growth rate α will mainly depend on reform and innovation

Structural issues in China

- Sectoral changes
- Labor reallocation
- Urban-rural shift
- Consumption, investment, export
- Savings: government, corporate and households

Three sectors

- The primary sector: agriculture
- The secondary sector: manufacturing, mining, utilities, construction
- The tertiary (service) sector: restaurants, trade, transportation, telecommunications, financial services, real estate, education, health care, government administration, etc.

Sector structural changes

- Labor moving from the agricultural sector to the non-agricultural sector
- Labor moving from the domestically oriented sector to the export oriented manufacturing sector
- Labor moving to the service sector

GDP by Sector

	Primary Sector/GDP	Secondary Sector/GDP	Tertiary Sector/GDP
1978	28.2%	47.9%	**23.9%**
1990	27.1%	41.3%	**31.5%**
2000	15.1%	45.9%	**39.0%**
2010	10.1%	46.7%	**43.2%**
2013	10.0%	43.9%	**46.1%**
2013*	9.4%	43.7%	**46.9%**
2014	9.2%	42.6%	**48.2%**

Labor Allocation by Sector

	Primary	Secondary	Tertiary
1978	**70.5%**	17.3%	12.2%
1990	**60.1%**	21.4%	18.5%
2000	**50.0%**	22.5%	27.5%
2010	**36.7%**	28.7%	34.6%
2013	**31.4%**	30.1%	38.5%

Consumption and investment

	Consumption/ GDP	Investment /GDP
1978	62%	38%
1990	62%	35%
2000	62%	35%
2007	50%	42%
2010	**48%**	**48%**
2013	**50%**	**48%**

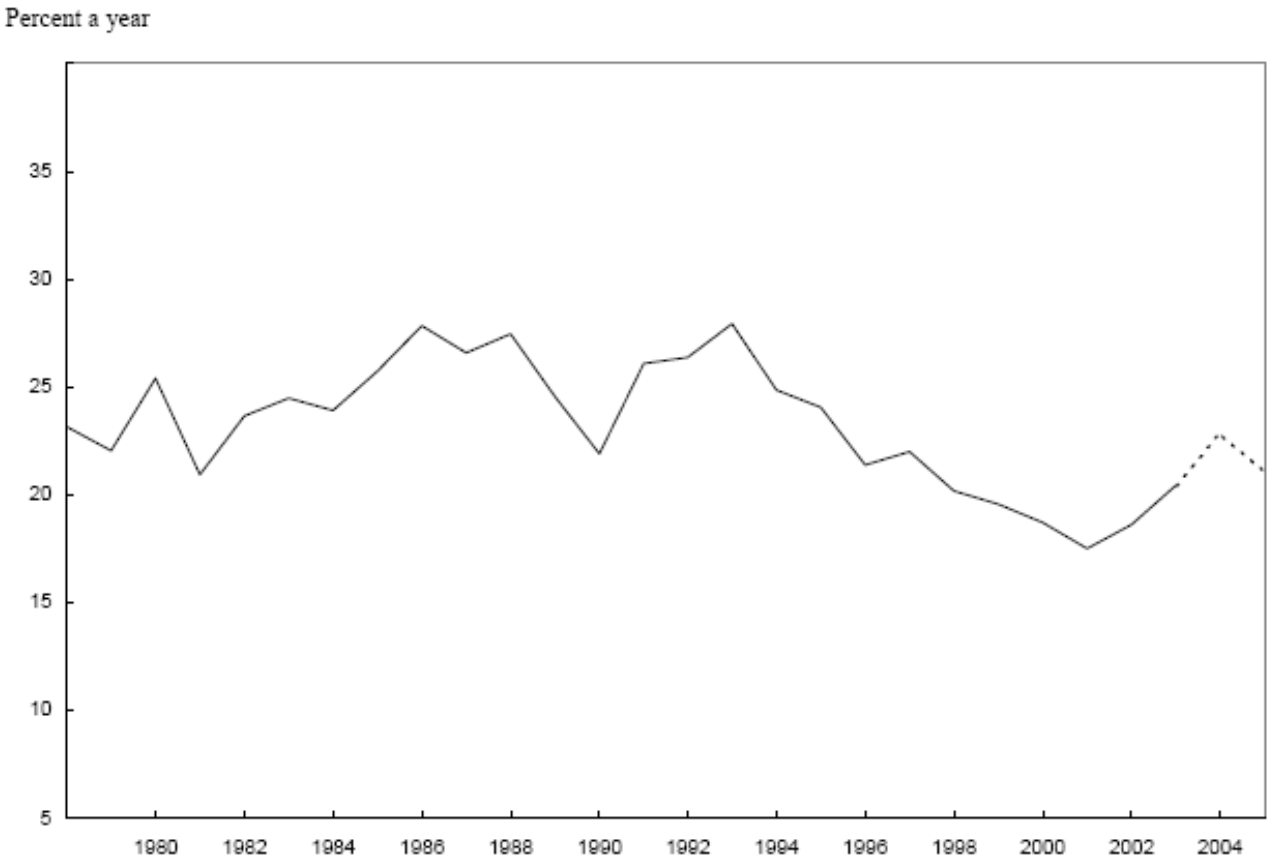
Urban-rural

	Rural	Urban
1978	82.08%	17.92%
1990	73.59%	26.41%
2000	63.78%	36.22%
2010	50.05%	49.95%
2013	46.27%	53.73%
2014	45.20%	54.80%

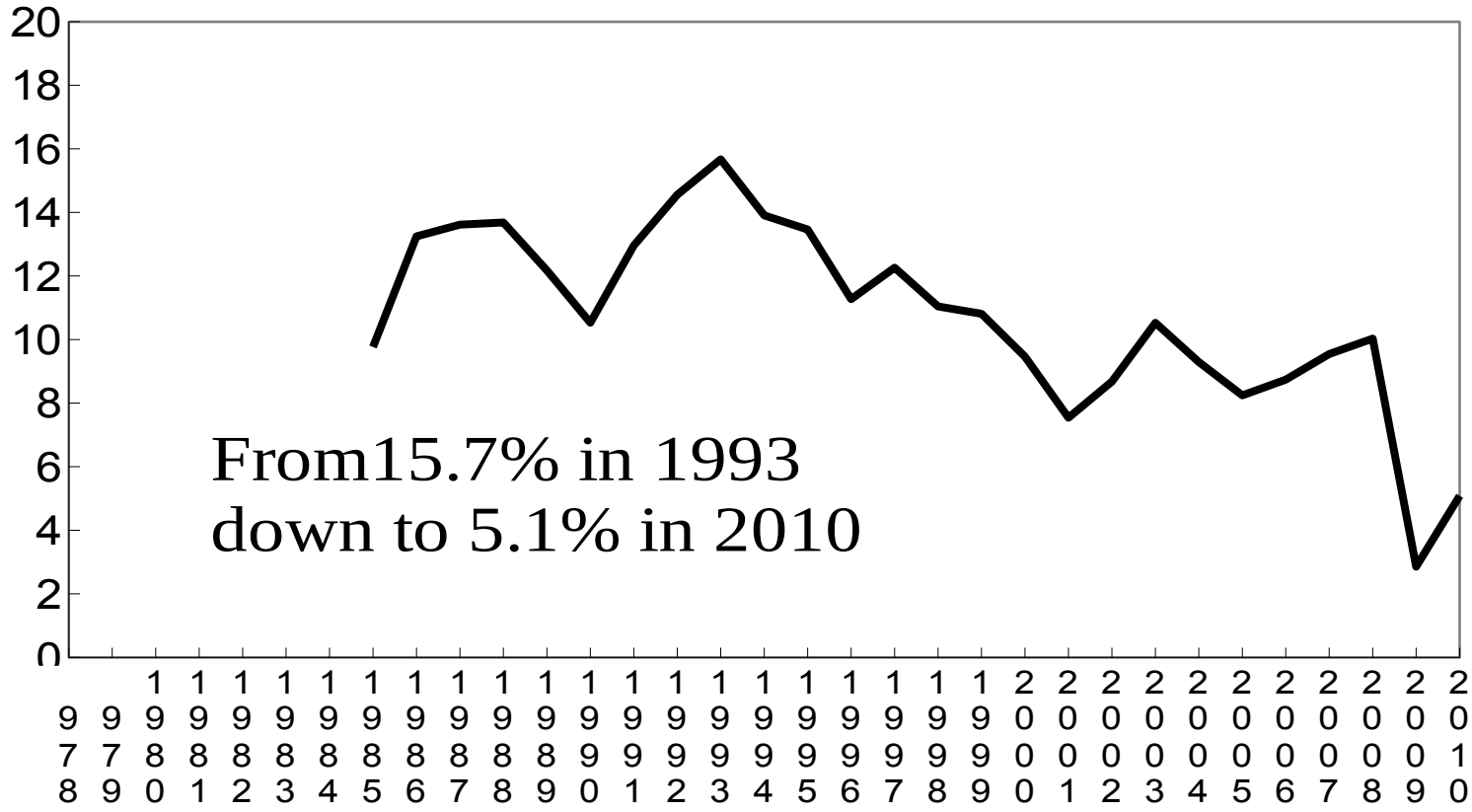
Does China invest too much?

- The right answer depends on the estimate of the return to capital
- Chong-En Bai, Chang-Tai Hsieh, and Yingyi Qian, "The Return to Capital in China," NBER working paper 12755 (2006) and Brookings Papers on Economic Activity (2006)

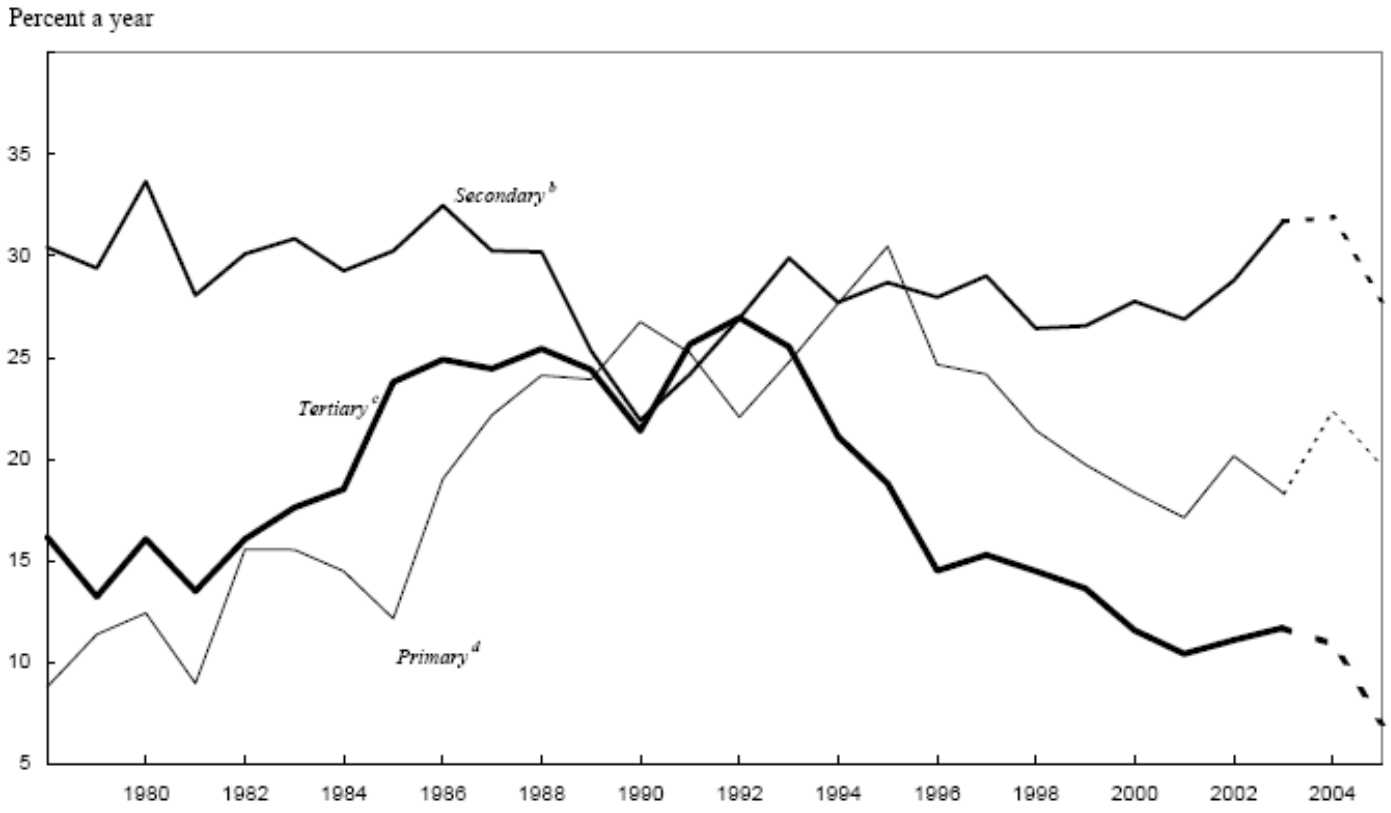
Return to Capital: Base Line



The estimated return to capital in China: Most recent years



Return to Capital: By Sector



Return to capital: International comparisons

- Return on fixed capital plus inventories, non-financial corporations and non-agricultural business, after indirect taxes (2000-2003)
  - UK 13.0%
  - Italy 11.1%
  - France 11.0%
  - Germany 10.2%
  - USA 7.4%
  - Japan 7.3%

Service/GDP: China vs. India

	China	India	Difference
Total service	34.3	50.7	-16.4
Retail, restaurants	8.1	14.8	-6.7
Real estate	2.0	6.7	-4.7
Transportation	3.5	6.1	-2.6
Government	2.7	6.2	-3.5
Financial service	5.7	7	-1.4
Telecomm	2.6	1.6	1

Structural Change: GDP Components

- Distortions in measuring structure change (relative importance of agriculture and industry) using distorted prices
  - Low agricultural prices underestimate the share of primary sector
  - High industrial prices overestimate the share of secondary sector

Structural Change: GDP Components

- 1978 GDP components at 1978 prices
  - Primary sector: 28%
  - Secondary sector: 48%
  - Tertiary sector: 24%
- 1978 GDP components at 1993 prices
  - Primary sector: 37%
  - Secondary sector: 37%
  - Tertiary sector: 26%

Structural Change: GDP Components at 2010 prices