

GDP: Data and Problems

- The Official data
 - Average annual growth (1979-2004): 9.6%
 - 2003: 10.0%
 - 2004: 10.1%
 - 2005: 10.2%
 - 2006: 10.7% (preliminary)
- Questions
 - Is the official data reliable?
 - Is the growth rate overstated?
- Alternative method of estimation
 - Using electricity consumption growth rate, if elasticity of electricity consumption is constant

GDP: Data and Problems

- Possible problem (1)
 - Miscalculation of the GDP deflator
 - Growth rates could be overstated by 1-2%
 - If so, growth is around 8% and growth per capita is around 7%
- Possible problem (2)
 - Reporting incentives by local officials
 - Overstating at trough and understating during boom
 - Overstating in poor areas and understating in rich areas
- Possible problem (3)
 - Missing data (small-scale, private firms)

Growth is Real

- Growth is still very impressive even under possible downward revision
 - Comparable growth to fastest growing economies
 - Population almost three times 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

2004 Economic Census and GDP Revision

- GDP revision based on the first economic census in 2004
- Announcement on December 20, 2005
 - Upward revision of 2004 GDP by 16.8% (2.3 trillion yuan or \$285 billion) to 16 trillion yuan
 - 2.13 trillion yuan was added to service sector
 - 19 provinces were up, 12 provinces down
- Main reasons
 - To collect data in a more inclusive way

2004 Economic Census and GDP Revision

- Growth rates adjustment from 1993 to 2004
 - 2000: from 8.0% to 8.4%
 - 2001: from 7.5% to 8.3%
 - 2002: from 8.3% to 9.1%
 - 2003: from 9.5% to 10.0%
 - 2004: from 9.5% to 10.1%
- As a result adjustment for average growth rate in 1979-2004: from 9.4% to 9.6%

2004 Economic Census and GDP Revision

- Is this revision reliable?
 - Not a surprise to international investment banks
 - Not a surprise to economists
- Independent evidence
 - Tax revenue (more reliable data)
 - Export (more reliable data)
 - Service sector (data very unreliable)

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 |

Compound Growth Math

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

- Rule of 70: number of years to double = 70/growth rate
- 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

China's Economy in 2020

- Which exchange rate should be used?
 - current exchange rate: US\$1 = RMB7.78 yuan
 - purchasing power parity (PPP) in terms of “Big Mac Index:”
US\$1 = 3.9 Yuan
(Big Mac prices: US\$ 2.54 in US and 9.9 yuan in China)
 - purchasing power parity (PPP) in World Bank studies:
US\$1 = 2 Yuan

China's Economy in 2020

- GDP sizes of China and US in 2000 under alternative exchange rates
 - At current exchange rate: China US\$ 1 trillion; US US\$ 10 trillion
 - At purchasing power parity (US\$1 = 2 Yuan): US per capita GDP US\$ 35,000; China per capita GDP: US\$ 3,500
 - At purchasing power parity (US\$1 = 2 Yuan): China US\$ 4.5 trillion (China's population is about 4.5 times of US)

China's Economy in 2020

Per capita GDP (World Bank, 1998-99)

| | at exchange rate | at PPP |
|-------------|------------------|--------|
| Malaysia | 4,680 | 10,920 |
| Mexico | 3,680 | 8,120 |
| Thailand | 2,800 | 6,590 |
| Brazil | 4,720 | 6,240 |
| Philippines | 1,220 | 3,670 |
| China | 860 | 3,570 |
| Indonesia | 1,110 | 3,450 |
| Egypt | 1,180 | 2,940 |
| India | 390 | 1,650 |
| Pakistan | 490 | 1,590 |
| Bangladesh | 270 | 1,050 |

China's Economy in 2020

- Assuming China's economy in 2000 is 0.5 of US
 - If the growth rate difference between China and US is 5% (China 8% and US 3%), then China will overtake US in total GDP in 2015
 - If the growth rate difference between China and US is 4% (China 7% and US 3%), then China will overtake US in total GDP in 2018
- Assuming China's economy in 2000 is 0.4 of US
 - If the growth rate difference between China and US is 5% (China 8% and US 3%), then China will overtake US in total GDP in 2020
 - If the growth rate difference between China and US is 4% (China 7% and US 3%), then China will overtake US in total GDP in 2024

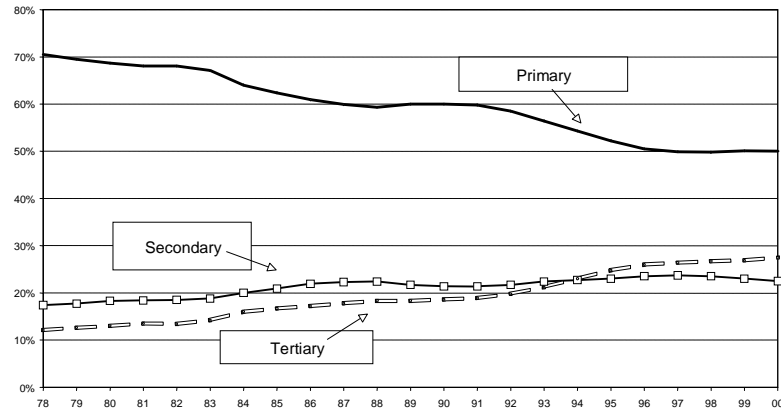
Structural Change: Labor

- Three sectors
 - Primary sector: agriculture
 - Secondary sector: manufacturing, mining, utilities, construction
 - Tertiary (service) sector: restaurants, transportation, communication, trade, education, health care, etc.
- Labor force
 - Those in population: 16-59 for male, 16-54 for female
 - High labor force participation: > 80%
 - Mainly because of high female labor force participation

Structural Change: Labor

- Patterns of structural change
 - Labor moving from the agricultural sector to the non-agricultural sector (development story)
 - Correcting the initial distortion by expanding the service sector (distortion correction story)
 - Labor moving from the domestically oriented sector to the export oriented manufacturing sector (globalization and the world's factory story)

Structural Change: Labor



Structural Change: GDP Components

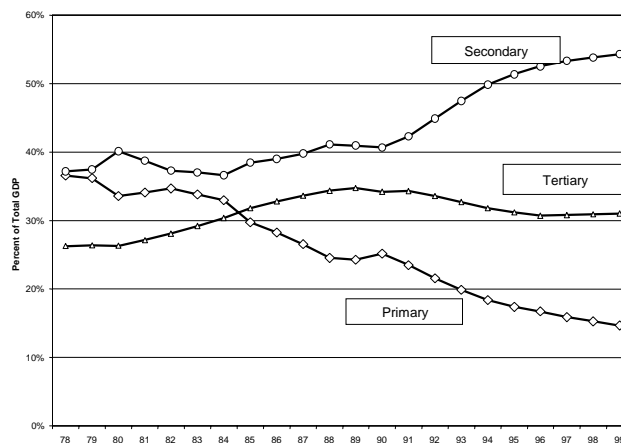
- Distortions in measuring structure change (relative importance of agriculture and industry) using distorted prices
 - Low agricultural prices underestimate the share of primary sector
 - High industrial prices overestimate the share of secondary sector

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

Structure of GDP at 1993 Prices



Structural Problems in China

| 2004 data | Before revision | After revision |
|---|-----------------|----------------|
| Service/GDP | 32.01% | 40.07% |
| Capital formation/GDP | 44.20% | 37.84% |
| Savings/GDP | 46.03% | 39.41% |
| Export/GDP | 35.95% | 30.78% |
| Energy consumption/GDP (ton of standard coal/10k yuan) | 1.44 | 1.23 |

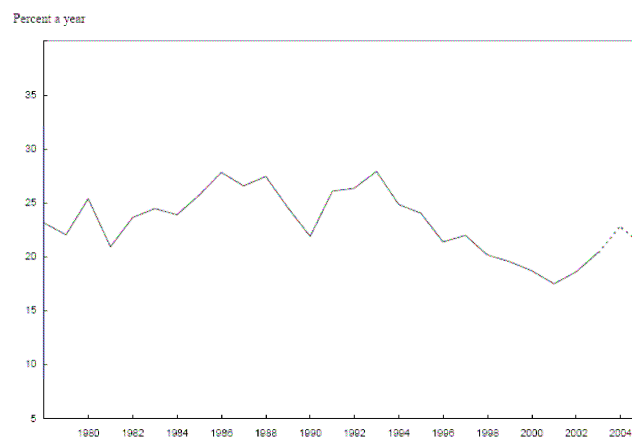
Structural Problems in China

- Is China's service sector too small (or is China's industrial sector too large)?
- Is China's investment rate too high (or is China's investment inefficient)?
- Is China's saving rate too high (or is China's consumption too low)?
- Does China rely too much on export (or does China rely less on domestic consumption)?
- Does China consume too much energy?

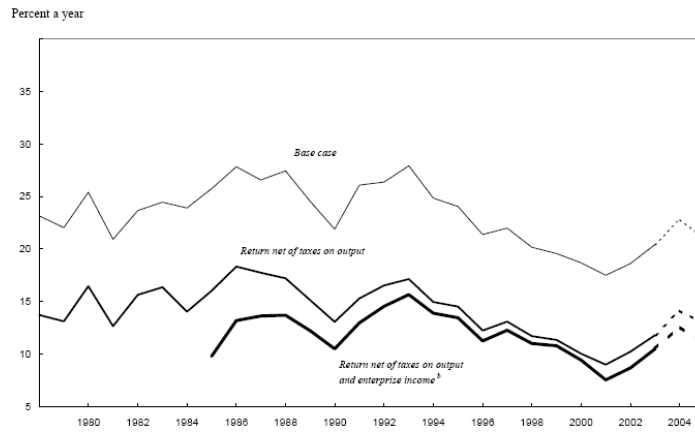
The Return to Capital in China

$$r(t) = i(t) - \hat{P}_Y(t) = \frac{\alpha(t)}{P_K(t)K(t)/P_Y(t)Y(t)} + (\hat{P}_K(t) - \hat{P}_Y(t)) - \delta(t).$$

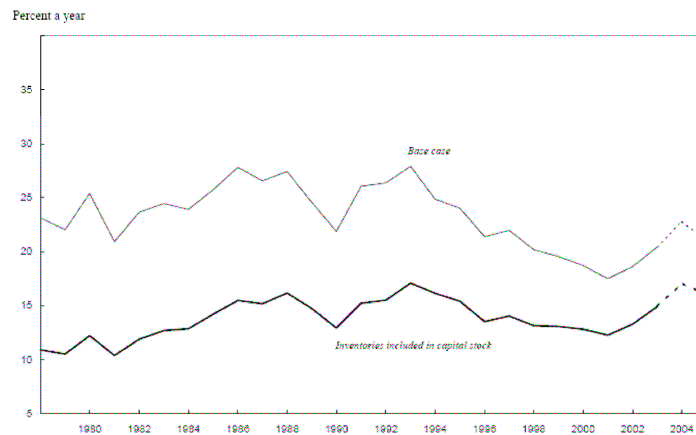
Return to Capital: Base Line



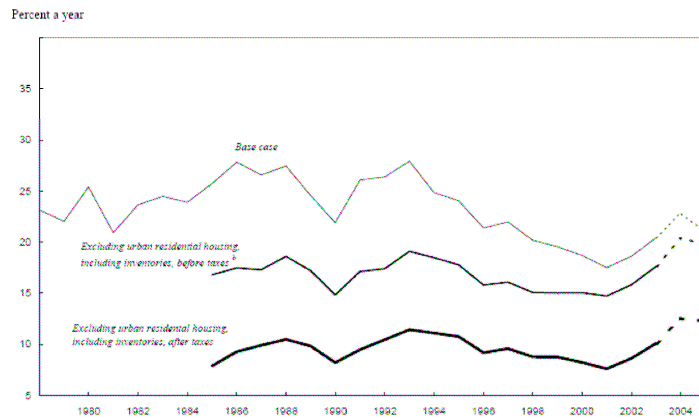
Return to Capita: After Taxes



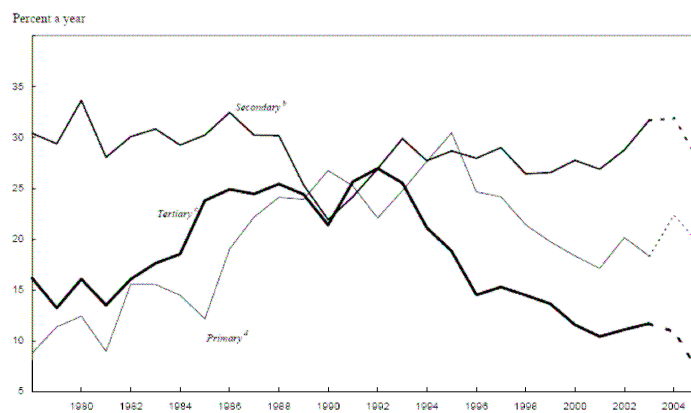
Return to Capital: Inclusive of Inventories



Return to Capital: Excluding Residential Housing, Taxes, Including Inventories



Return to Capital: By Sector



Productivity

- Labor productivity
 - Rough measure: Output per worker (Y/L)
 - Precise measure: Output per working hour (Y/H)
- Labor productivity depends on many factors
 - Physical capital
 - Human capital (skills)
 - Technology
 - Labor participation rate
 - Number of working hours

Productivity

- Different sector has different labor productivity
 - Labor productivity in both secondary and tertiary sectors is about 4 times as high as that in agriculture sector in 1978 (at 1993 prices)
- Sector reallocation
 - Movement of labor from low labor productivity sector to high labor productivity sector
 - The process of industrialization
- Total factor productivity: see below

Sources of Growth

- The neoclassical growth model (Solow model)

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

- 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?

$$\ln Y_t = \ln A + \alpha t + \beta \ln K_t + \gamma \ln L_t$$

$$\ln Y_{t+1} = \ln A + \alpha(t+1) + \beta \ln K_{t+1} + \gamma \ln L_{t+1}$$

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

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

$$\ln(1 + \Delta Y_t/Y_t) = \alpha + \beta(\ln(1 + \Delta K_t/K_t)) + \gamma(\ln(1 + \Delta L_t/L_t))$$

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

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)

Sources of Growth

- Estimation equations
$$\ln Y_t = \ln A + \alpha t + \beta \ln K_t + \gamma \ln L_t + \varepsilon_t$$
$$\Delta Y_t/Y_t = \alpha + \beta(\Delta K_t/K_t) + \gamma(\Delta L_t/L_t) + u_t$$
- Difficulties
 - Measurement of capital stock K_t
$$K_t = (1-d)K_{t-1} + I_t$$
 - Measurement of labor L_t
 - Deflators used for Y_t and K_t

Growth Accounting of the U.S. Economy

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

- 1990-95:

$$\begin{aligned} 2.5\% &= 0.6\% + (1/3)(3.7\%) + (2/3)(1\%) \\ &= 0.6\% + 1.2\% + 0.7\% \end{aligned}$$

- 1995-98:

$$\begin{aligned} 3.5\% &= 1.4\% + (1/3)(4.3\%) + (2/3)(1\%) \\ &= 1.4\% + 1.4\% + 0.7\% \end{aligned}$$

Growth Accounting of China's Economy

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

- Before reform (1952-78)

$$\begin{aligned} 5.5\% &= 0\% + (3/4)(6.1\%) + (1/4)(3.6\%) \\ &= 0\% + 4.6\% + 0.9\% \end{aligned}$$

- After reform (1978-98)

$$\begin{aligned} 9.3\% &= 2.7\% + (3/4)(7.6\%) + (1/4)(3.6\%) \\ &= 2.7\% + 5.7\% + 0.9\% \end{aligned}$$

Growth Accounting of China's Economy

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

- 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 prospect: sources
 - Capital accumulation will still be very high
 - Labor reallocation from rural to urban areas will continue for some time, but not forever
 - TFP growth rate α may still be moderate
 - Capital elasticity β (very high now) may start to decline (not yet)
 - Labor elasticity γ (very low now) may start to increase (not yet)