ECON4033 Money and Finance in China

Week 2: National Income and Growth Accounting[1]

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[1] These lecture notes are largely based on the materials prepared by Prof. Siu Kee Wong for the same topic.

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I. A Brief History of National Income Accounting System in China

- China only began using the United Nation's System of National Accounts (SNA) for GDP measurement in 1995, abandoning the old Soviet system of National Material Product (NMP).
- The NMP approach used in the pre-reform period (1950 – 78), had two major underpinnings:
  1) an emphasis on the production of physical volumes (as opposed to intangible production such as services), and
  2) a reliance on the input–output approach consistent with that of a planned economy.

II. Basics of GDP Accounting

- There are four basic approaches to measuring GDP:

    1) Value of final goods and sales approach;

    2) Expenditure (uses) approach;

    3) Value-added approach;

    4) Income approach.

    If all four measures were taken without error, they would provide an equivalent measure of GDP.

- All four approaches are used because they enable us to

    1) Cross-check our measurement of GDP, and

    2) Allow additional insights into the basis for the creation of GDP.

III. Current GDP Accounting System in China

- China's official GDP estimate continues to be presented primarily in terms of value added and secondarily in terms of expenditure.

- While estimates for GDP on a quarterly basis (as opposed to an annual basis) have been available using the Value-Added approach since 1992, they are still not calculated using the Expenditure (Uses) approach.

- Data sources:

  1) Annual GDP data (value-added approach, expenditure approach):

     http://data.stats.gov.cn/english/easyquery.htm?cn=C01

  2) Quarterly GDP data (value-added approach)

     http://data.stats.gov.cn/english/easyquery.htm?cn=B01

- The next two pages present some examples for GDP data of China, in comparing to those from the U.S.

- The expenditure approach to GDP shows that consumption accounts for much more GDP in the United States as compared to China. China uses much more of its GDP for net exports and investment as compared to the US.

Table: GDP by Type of Expenditure at constant (2010) prices - (Billion US dollars)

Year	Item	Value (Billion)		% of GDP	
		China	US	China	US
2010	**Final consumption expenditure**	**2939.29**	**12695.98**	**48.18%**	**84.68%**
	Household consumption expenditure	2157.34	10185.84	35.36%	67.94%
	General government final consumption expenditure	781.96	2510.14	12.82%	16.74%
	Gross capital formation	**2904.66**	**2809.98**	**47.61%**	**18.74%**
	Gross fixed capital formation	2744.76	2756.06	44.99%	18.38%
	Changes in inventories	159.90	53.92	2.62%	0.36%
	Net Export	**222.40**	**-513.90**	**3.65%**	**-3.43%**
	Exports of goods and services	1602.48	1846.28	26.27%	12.32%
	Imports of goods and services	1380.08	2360.18	22.62%	15.74%
	Gross Domestic Product (GDP)	**6100.65**	**14992.05**	**100.00%**	**100.00%**
2017	**Final consumption expenditure**	**5213.66**	**14425.22**	**51.32%**	**83.15%**
	Household consumption expenditure	3801.53	12021.14	37.42%	69.29%
	General government final consumption expenditure	1412.13	2405.74	13.90%	13.87%
	Gross capital formation	**4702.06**	**3698.08**	**46.29%**	**21.32%**
	Gross fixed capital formation	4517.09	3653.82	44.46%	21.06%
	Changes in inventories	184.97	42.59	1.82%	0.25%
	Net Export	**177.08**	**-782.88**	**1.74%**	**-4.51%**
	Exports of goods and services	2513.01	2287.07	24.74%	13.18%
	Imports of goods and services	2335.92	3069.95	22.99%	17.70%
	Gross Domestic Product (GDP)	**10158.90**	**17348.63**	**100.00%**	**100.00%**

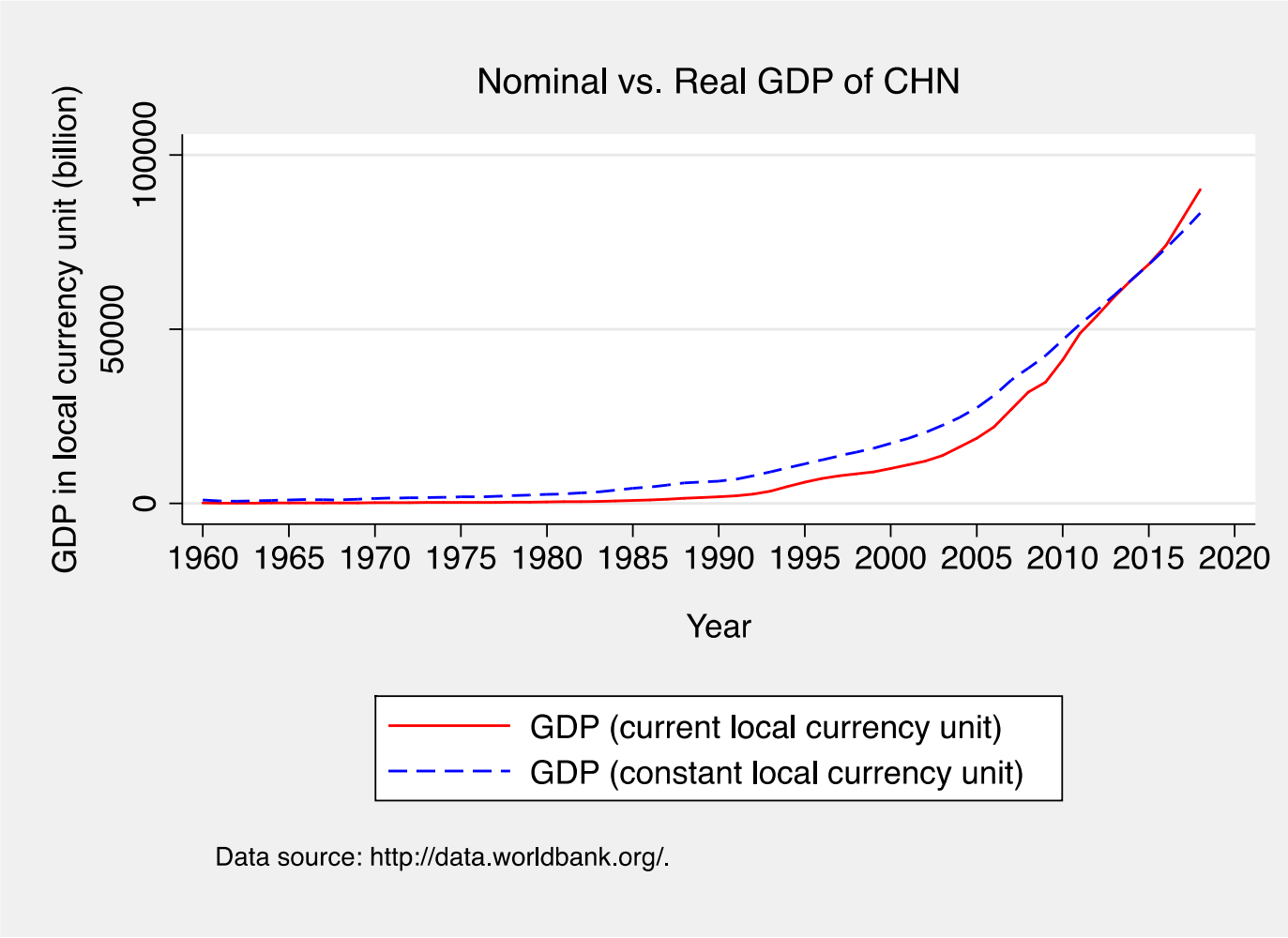
Data source: http://data.un.org/.

- The income approach remains a weak spot in China's GDP estimation. No official data is available. A calculation reported in Schramm (2015) textbook shows that labor receives a significantly smaller share of income than owners of capital (companies or shareholders) and property than in the United States.

	China (100 Mill. ¥)	*Percent of GDP*	*USA (US$ Bill.)*	*Percent of GDP*
Gross Domestic Product	472,882	100%	16,244.0	100%
Labor income	212,488	45%	8,611.6	53%
Capital, land and renter income	260,393	55%	7,632	47%
Net factor payments abroad	−767	0%	253	2%
Gross National Product	472,115	100%	16,497	102%
Depreciation	67,388	14%	2,543	16%
Net National Product NNP	404,727	86%	13,954	86%

Source: Schramm (2015).

- China's GDP has surged since economic reforms began in 1978.



IV. Prices and GDP Measurement

- Several key issues must be discussed within this broad area:

  1) First, GDP is ideally measured at market prices (prices we would actually pay for the good or service in a competitive market).

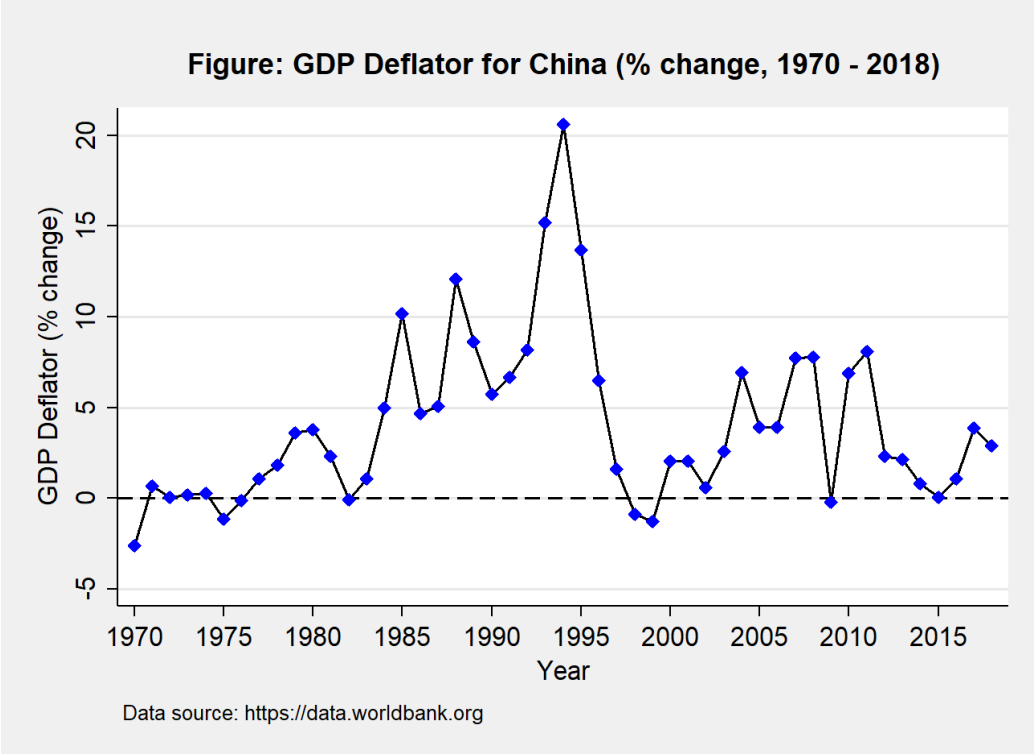
  2) Second, we often are interested in real or constant dollar GDP as opposed to nominal GDP. Real GDP attempts to measure output in physical volumes rather than in current dollars, as is the case with "nominal GDP."

  3) Third, we may be interested in measuring output using international prices rather than domestic prices. We would describe this as a measure of purchasing power parity (PPP) GDP.

- By 2004, Chinese officials estimated that 96 percent of all prices were market determined, but these were mainly consumer prices and did not include the many investment goods that were subsidized. In addition, local price bureaus still control the prices for certain critical products including electricity, transportation, fertilizer, medicine, and fuel.

- Creating a price index generally involves picking a representative basket of goods and services for a particular year (the "base year"), then measuring how the prices of that same basket (the same goods in the same amounts) evolves over time.

- GDP Deflator: $\text{GDP Deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100\%$.
  - The GDP deflator is a price index which measures price changes on all output produced by a country. It represents price movements for all classes of output: consumption, investment, exports, and government spending.
  - China established base years every five years beginning in 1952, then switched to every ten years beginning in 1970. Though a GDP deflator is not published per se, it is implicit in official estimates of nominal GDP and real GDP. It is also only available on an annual basis.



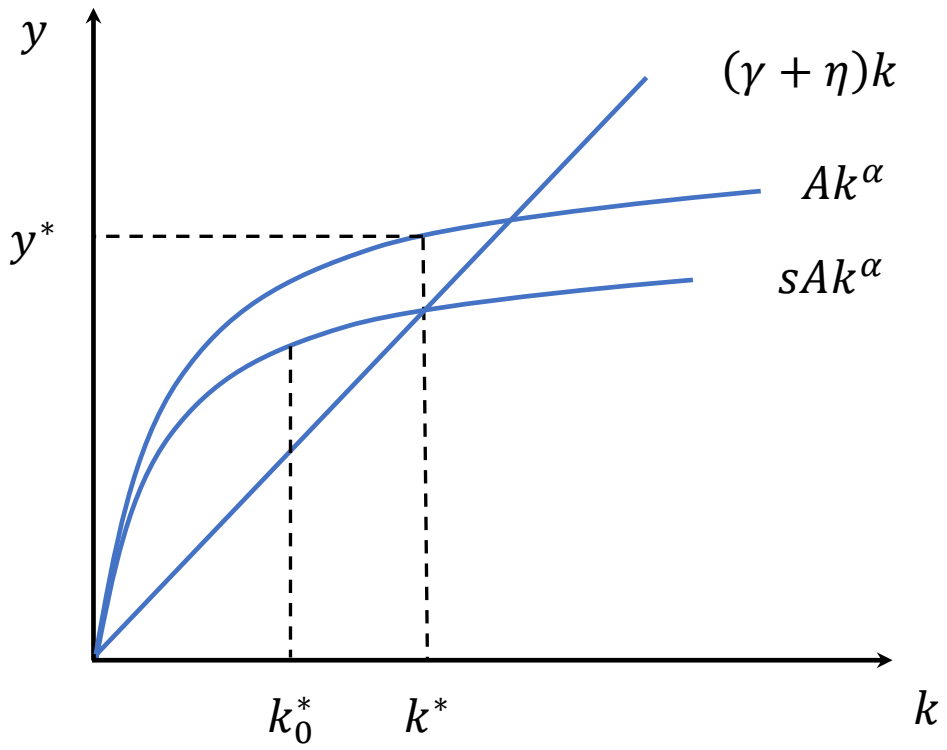
V. Solow Model: A Recap

- An output (Y) is produced by using two factors of production: capital (K) and labor (L).
- The production function is given by $Y = Af(K, L)$ where A is a technology parameter. Specifically, we assume Cobb Douglas production function $Y = AK^{\alpha}L^{\beta}$ with $0 < \alpha, \beta < 1$ and $\alpha + \beta = 1$.
- Saving rate s is fixed. Investment is equal to saving $I = sY$. Growth rate of labor force $\eta = \Delta L/L$ and depreciation rate of capital γ are also exogenous.
- Define small letter variables to represent per capita versions of the corresponding capital letters. So $y = Y/L$ and $k = K/L$. Express the production function in per capital terms $y = Ak^{\alpha}$. The change in capital stock is:

$$\frac{\Delta k}{k} = \frac{\Delta K}{K} - \frac{\Delta L}{L} = s\frac{y}{k} - \gamma - \eta.$$

- At steady state equilibrium, $\Delta k/k = 0$ or

$$\begin{aligned} \Delta k &= sAk^{\alpha} - (\gamma + \eta)k = 0 \\ &= \text{source of capital} - \text{use of capital} = 0. \end{aligned}$$



The source of capital exceeds the use of capital for developing countries with low capital-labor ratios. Capital accumulation raises the K/L ratio until the the steady state k^* is reached.

VI. Growth Accounting

- The Solow accounting framework decomposes growth into component factors of production including capital (K), labor (L), and an exogenously determined factor "technological progress" (A) which is also called Total Factor Productivity (TFP).

$$Y = Af(K, L) \tag{1}$$

in which Y represents GDP or output. Here, we combine capital and labor in our economy in order to get output or GDP. For now, we assume a closed economy, full employment of resources, the absence of short-run business cycle fluctuations.

- Further, we can assume the production function is in the Cobb-Douglas form and make each variable dependent on time (t), as seen in Equation 2:

$$Y(t) = A(t)K^{\alpha}(t)L^{\beta}(t) \tag{2}$$

  - Here, α and β can be interpreted as, in the case of constant returns-to-scale, shares of national income received by the two factors as compensation.

- It can be more clearly seen if we take the natural logarithm of each side of Equation 2, yielding, Equation 3:

$$\ln Y(t) = \ln A(t) + \alpha \ln K(t) + \beta \ln L(t). \quad (3)$$

Taking the first derivative of Equation 3, with respect to time and using Δ to indicate change, we have, Equation 4:

$$\frac{\Delta Y(t)}{Y(t)} = \frac{\Delta A(t)}{A(t)} + \alpha \frac{\Delta K(t)}{K(t)} + \beta \frac{\Delta L(t)}{L(t)}. \quad (4)$$

Equation 4 provides an obvious but important finding: economic growth relies on growth in inputs and the degree to which technological progress $\frac{\Delta A(t)}{A(t)}$ occurs. Simply put, if we lack capital accumulation, labor growth or technology progress, it will be difficult to increase output.

- Some empirical work in the literature for estimating the source of China's growth:

Estimates of the Sources of China's Growth

	Hu and Khan (1996)		World Bank (1997)
	1953–78	1979–94	1978–95
Growth rates (% p.a)			
Output	5.8	9.3	9.4
Contribution to growth (%)[a]			
Physical-capital input	3.8	4.2	3.5
Labour input	1.0	1.2	0.7
Human-capital input			0.8
Total-factor productivity	1.0	3.9	4.3

a. Given that percentages are rounded, it is possible that the numbers do not exactly add up.

Source: Francis, Painchaud, and Morin (2005)

https://www.bankofcanada.ca/wp-content/uploads/2010/06/francis2.pdf.

- Total factor productivity (TFP) growth has been a major source of China's economic growth since reforms began in 1978. A key component of this source was the movement of labor from agriculture to manufacturing and construction.

Estimates of Sources of TFP Growth in China

	Heytens and Zebregs (2003)				
	1971–78	1979–94	1985–89	1990–94	1995–98
Total-factor productivity, of which:[a]	-0.53	2.78	2.11	2.81	2.30
Structural reform	0.38	0.94	0.76	0.83	0.39
Labour migration out of primary sector	2.34	2.01	1.52	2.15	2.08
Exogenous trend	-3.25	-0.17	-0.17	-0.17	-0.17

a. Given that percentages are rounded, it is possible that the numbers do not exactly add up.

Source: Francis, Painchaud, and Morin (2005)

https://www.bankofcanada.ca/wp-content/uploads/2010/06/francis2.pdf.

- **Labor Productivity**

In the literature, other than TFP, labor productivity (i.e., output per labor) is also used to measure production efficiency. We can define average productivity as

$$y = \frac{Y}{L}.$$

The growth in y is approximately

$$\frac{\Delta y}{y} = \frac{\Delta Y}{Y} - \frac{\Delta L}{L}. \tag{5}$$

Recall equation (4):

$$\frac{\Delta Y(t)}{Y(t)} = \frac{\Delta A(t)}{A(t)} + \alpha \frac{\Delta K(t)}{K(t)} + \beta \frac{\Delta L(t)}{L(t)}. \tag{4}$$

As we assume that $\alpha + \beta = 1$, Equations (4) and (5) imply

$$\frac{\Delta y}{y} = \frac{\Delta A(t)}{A(t)} + \alpha \left[\frac{\Delta K(t)}{K(t)} - \frac{\Delta L(t)}{L(t)}\right].$$

The last equation provides an important finding: economic growth relies on growth in K/L ratio and the degree to which technological progress $\frac{\Delta A(t)}{A(t)}$.

References:

Ronald M. Schramm (2015), *The Chinese Macroeconomy and Financial System: A U.S. Perspective*, Taylor and Francis, London.