INTERMEDIATE MACROECONOMICS

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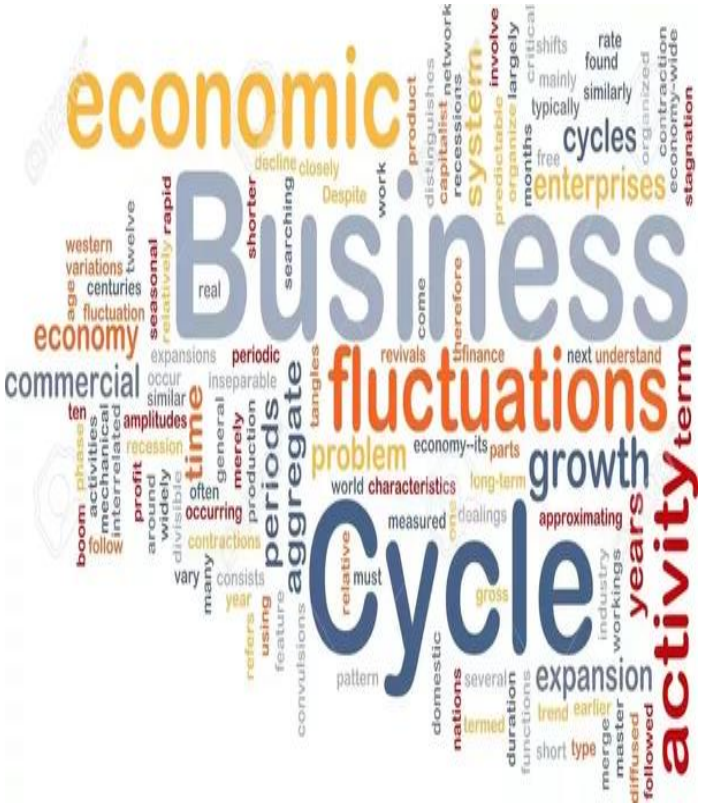
AGENDA



- **Data and measuring business cycles**
  - **Measuring economic activities**
  - **Measuring business cycles**

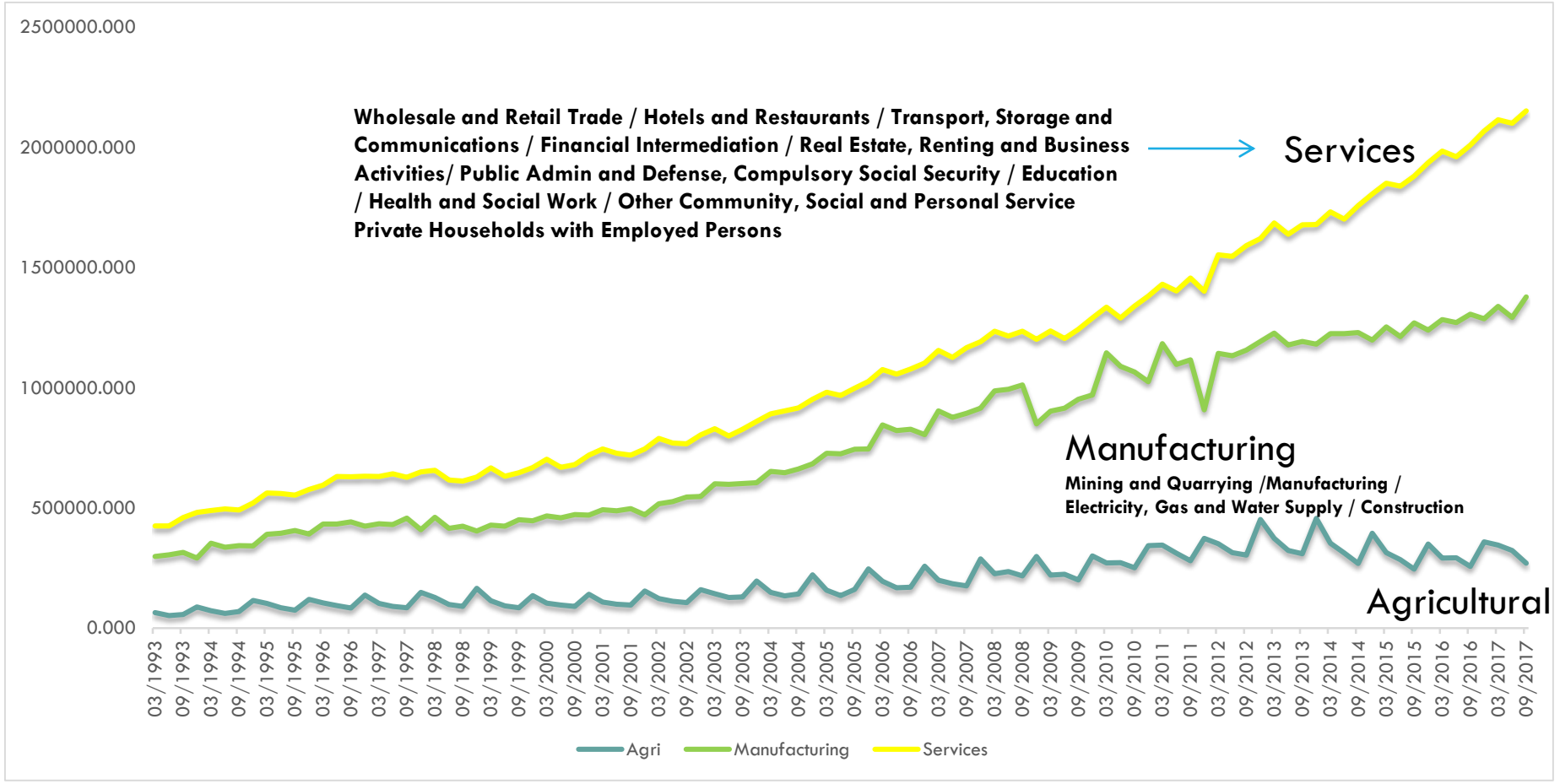
MEASURE ECONOMIC (*AGGREGATE*) ACTIVITIES?

- Policy-making decision; Information and data needed.
- Need to know if we are experiencing a "slack (weak)" or a "tight (strong)" conditioin.
- Good indicators for the economic condition?
- Commonly used are GDP (aggregate output), inflation (cost of living) and unemployment rate (labor market outcomes.)

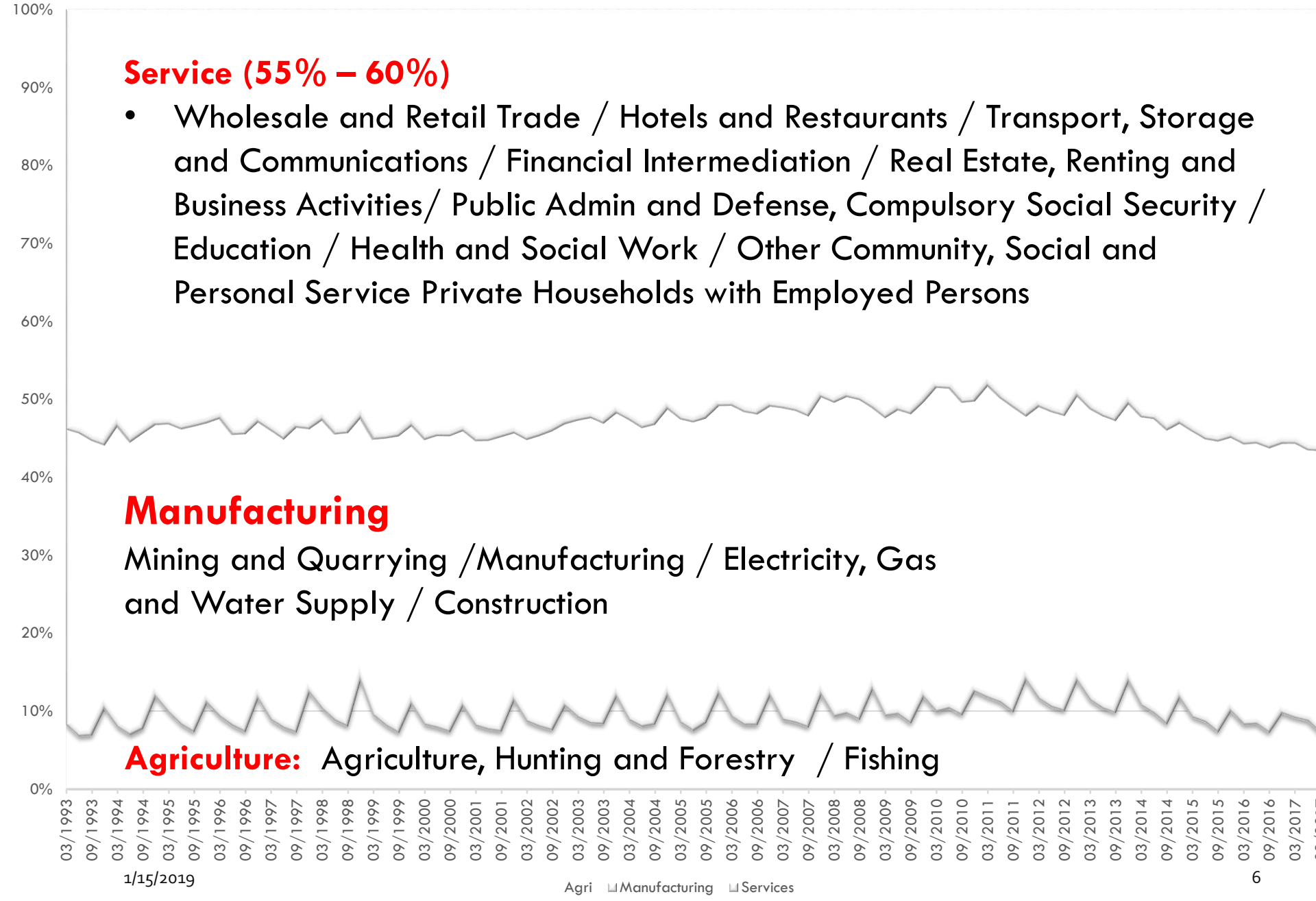
MEASURING GDP

- In Thailand, the statistical agency that is responsible for measuring and producing data for these aggregate activities is NESDB (สภาพัฒน์ฯ).
- Starting from 1993, NESDB has made available the data in quarterly basis.
- Reporting statistic has some lagged periods of the announcement for 1.5 months.
- Approach for the calculation: Income, Production (value-added), Expenditure.

DEEPER LOOK INTO THAI DATA: PRODUCTION-BASED *NOMINAL* GDP



Sectoral share to market-value GDP (Nominal GDP)



Service (55% – 60%)

- Wholesale and Retail Trade / Hotels and Restaurants / Transport, Storage and Communications / Financial Intermediation / Real Estate, Renting and Business Activities/ Public Admin and Defense, Compulsory Social Security / Education / Health and Social Work / Other Community, Social and Personal Service Private Households with Employed Persons

Manufacturing

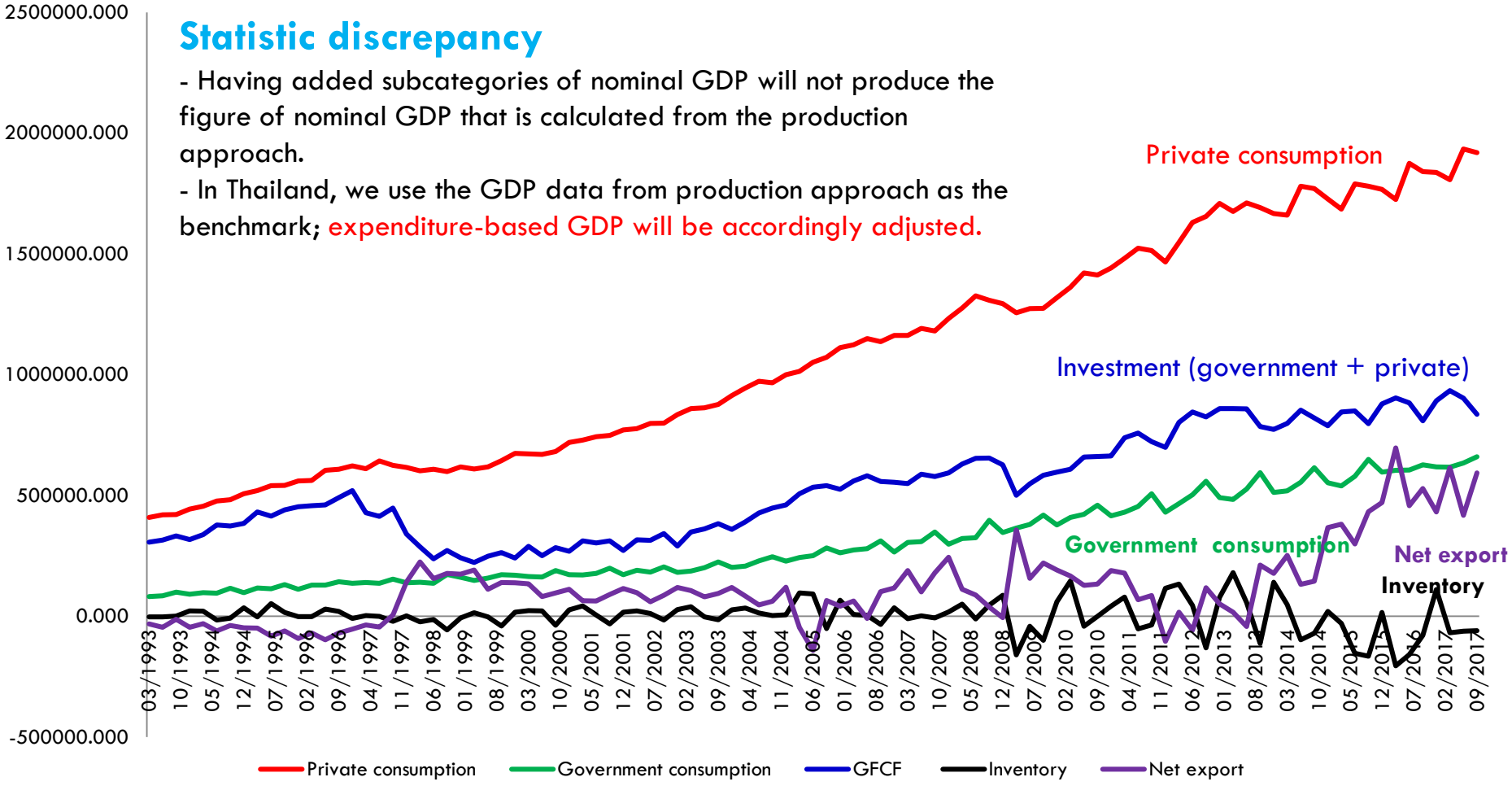
Mining and Quarrying /Manufacturing / Electricity, Gas and Water Supply / Construction

Agriculture: Agriculture, Hunting and Forestry / Fishing

EXPENDITURE-BASED GDP: ITS NOMINAL COMPONENT

Statistic discrepancy

- Having added subcategories of nominal GDP will not produce the figure of nominal GDP that is calculated from the production approach.
- In Thailand, we use the GDP data from production approach as the benchmark; expenditure-based GDP will be accordingly adjusted.



REAL VS NOMINAL MEASUREMENT

- We can not aggregate units of production; we then aggregate the value of products.
- Problematic of the measurement using nominal value?
- Real-based measurement: eliminate the price effect (extract the volume effect or real quantity)
- Methods: Fixed base year and Chain methods

REAL GDP: FIXED BASE YEAR

- Real GDP is obtained by using base-year prices in calculation.
  - For example, assume the base year = 1988

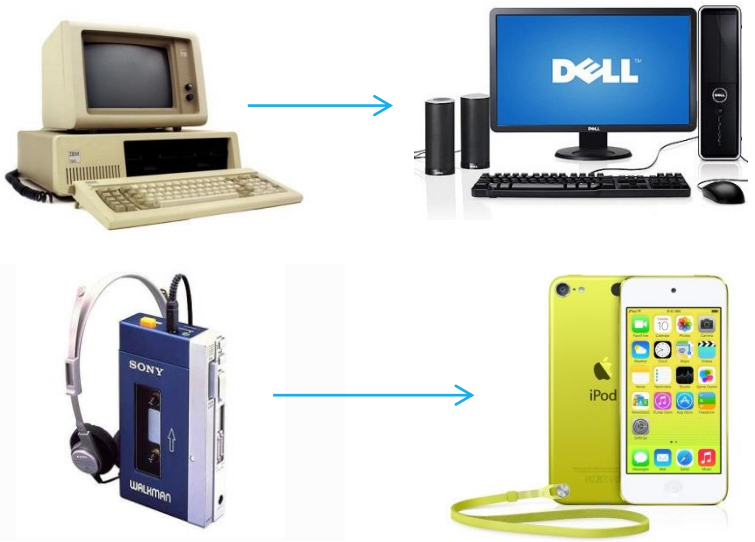
$$rGDP^{2016} = \sum_i (P_i^{1988} * Q_i^{2016})$$

$$rGDP^{2015} = \sum_i (P_i^{1988} * Q_i^{2015})$$

$$g^{2016} = \left[\frac{rGDP^{2016}}{rGDP^{2015}} - 1 \right] * 100\%$$

REAL GDP: FIXED BASE YEAR

- If the base year changes, GDP figures also change --- the NESDB has used four base years (1956 1962 1972 1988). Problem?
  - Main problem: fixed base years do not reflect economic changes over time.
    - Changes in the composition of output and relative prices. (USB in 1998 / USB in 2016)
    - Improved quality of existing products.
    - New goods come to markets; old goods die out.



CHAIN-WEIGHTED REAL GDP

- Updating fixed-base year revises not only historical series of real GDP, but also the entire historical path of growth rate.

- Generate series of real GDP using the most accurate growth estimation.
  - Avoid the biased estimation of real GDP growth!

CHAIN-WEIGHTED REAL GDP

- The geometric mean of the real GDP growth rates between the two-year period.
  - Calculate the real GDP growth using year-1 prices.
  - Calculate the real GDP growth using year-2 prices.
  - Compute their geometric mean to get the annual chain-weighted growth rate from Year 1 to Year 2.
  - Do the same for any pair of the successive two-year set.

$RGDP_P^Q$ → Base-year price

Using 2011 as the base year

$$RGDP_{2011}^{2011} = 130; \quad RGDP_{2011}^{2012} = 135$$

$$g_{2011}^{2012} = \left[\frac{RGDP_{2011}^{2012}}{RGDP_{2011}^{2011}} - 1\right] = \left[\frac{135}{130} - 1\right] = 0.038 \quad (= 3.8\%)$$

Using 2012 as the base year

$$RGDP_{2012}^{2011} = 133; \quad RGDP_{2012}^{2012} = 139$$

$$g_{2012}^{2012} = \left[\frac{RGDP_{2012}^{2012}}{RGDP_{2012}^{2011}} - 1\right] = \left[\frac{139}{133} - 1\right] = 0.045 \quad (= 4.5\%)$$

$$(1 + g_c^{2012}) = \sqrt{(1 + g_{2011}^{2012}) \times (1 + g_{2012}^{2012})} = \sqrt{(1.038) \times (1.045)} = 1.041$$

$$g_c^{2012} = 0.041 \quad (= 4.1\%)$$

CHAIN-VOLUME-MEASURE GDP

- **Step 1:** calculate **Direct Index (DI).**
  - GDP for Year 2 using prices in Year 1.
  - GDP for Year 1 using prices in Year 1.
- Direct Index for Year 2 is the annual growth rate of Year 2 using Year 1 prices.
  - Do the same for Year 3, Year 4, ….
- Each year has its own DI based on the previous year's prices.
  - *Rolling-over base year*: 2001→ 2000 and 2002 → 2001

$$GDP_{t-1}^{t} = \sum_{i} (P^{t-1} * Q^{t})$$

$$GDP_{t-1}^{t-1} = \sum_{i} (P^{t-1} * Q^{t-1})$$

$$DI^{t} = \frac{GDP_{t-1}^{t}}{GDP_{t-1}^{t-1}} = \frac{\sum_{i} (P^{t-1} * Q^{t})}{\sum_{i} (P^{t-1} * Q^{t-1})}$$

$$DI^{2016} = \frac{GDP_{2015}^{2016}}{GDP_{2015}^{2015}} = \frac{\sum_{i} \left(P^{2015} * Q^{2016} \right)}{\sum_{i} \left(P^{2015} * Q^{2015} \right)}$$

$$DI^{2015} = \frac{\sum (P^{2014} * Q^{2015})}{\sum (P^{2014} * Q^{2014})}$$

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$$DI^{2012} = \frac{\sum (P^{2011} * Q^{2012})}{\sum (P^{2011} * Q^{2011})}$$

CHAIN-VOLUME-MEASURE GDP

- **Step 2:** create the **Chain Index (CI).**
- Link the series of DI's into CI for each year.
- CI = cumulative growth rate from 2013.

$$C_{2013}^{2016} = CI^{2016} = DI^{2016} * DI^{2015} * DI^{2014} * DI^{2013}$$

$$C_{2013}^{2015} = CI^{2015} = DI^{2015} * DI^{2014} * DI^{2013}$$

$$C_{2013}^{2014} = CI^{2014} = DI^{2014} * DI^{2013}$$

$$C_{2013}^{2013} = CI^{2013} = DI^{2013}$$

CHAIN-VOLUME-MEASURE GDP

- **Step 3**: calculate chain-volume-measure GDP value using CI and the base-year value.
  - Use the value of nominal GDP 2013 as reference.

$$cvmGDP_{2013}^{2014} = GDP^{2013} * CI^{2014}$$

$$cvmGDP_{2013}^{2015} = GDP^{2013} * CI^{2015}$$

$$cvmGDP_{2013}^{2016} = GDP^{2013} * CI^{2016}$$

NOTES ON CVM GDP

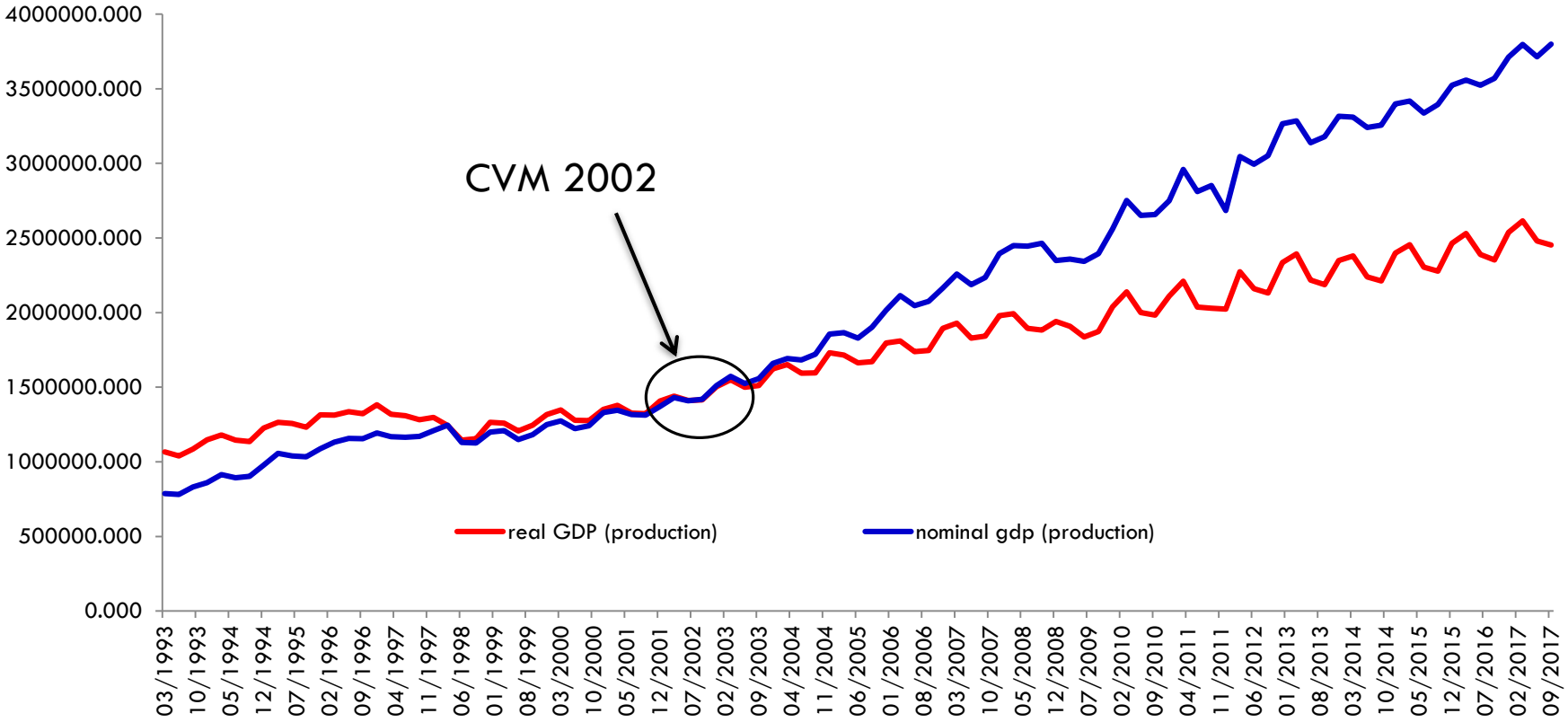
- The calculated growth rates are closer to reality.
  - Growth rates from DI, CI and CVM are identical.
- CVM series are ***non-additive***.
  - For the base year, GDP subcategories sum up to total GDP.
  - For other years, subcategories do not sum up.

$$RGDP \neq RGDP\_SERVICE + RGDP\_MANU + RGDP\_AGRI$$

$$RGDP \neq RC + RI + RG + RX - RM$$

  - In terms of accounting, this is technically adjusted by "residual terms".

REAL V.S. NOMINAL GDP MEASUREMENT



IMPLICIT GDP PRICE DEFLATOR

- The ratio of the nominal GDP to the real GDP of a given year.

- The most comprehensive *price index*.
  - includes prices of all final goods and services.

$$\text{Implicit GDP price deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} * 100$$

COST OF LIVING AND CONSUMER PRICE INDEX

- Prices change all the time; policymaker wishes to know how difficulty households have faced.

- **Cost of living index (COL):** how much expenditure would a typical household need to ensure **the same standard of living** as in the base year?

COST OF LIVING AND CONSUMER PRICE INDEX

- Consumer price index is constructed to serve for this purpose.

- **Consumer Price index: current-period expenditure** required by a typical household so that he/she can acquire **the same fixed basket of consumption goods as in the base year**.

CONSUMER PRICE INDEX: CONCEPTUAL METHOD

- **The consumer price index (CPI)** uses the current-year prices and the base-year quantities of the goods.
  - Base year = 2007; $CPI_{2007} = 100$

$$CPI^{2012} = \frac{\sum (Q^{2007} * P^{2012})}{\sum (Q^{2007} * P^{2007})} * 100$$

$$CPI\ \ Inflation = \left[\frac{CPI^{2012}}{CPI^{2011}} - 1 \right] * 100\%$$

PROBLEMS WITH PRICE INDICES

- Changes in the quality of the goods over time.
- Emergence of new goods.
- Changes in the relative prices over time.
  - Assuming no change in consumers' choice despite changes in relative prices.
  - The items with rising prices will be over-weighted; **substitution biased**.

BIASED MEASUREMENT OF CPI INDEX

- The last problem leads to an over-estimation of COL.
- COL: **same standard of living?**
  - Same bundle *or*
  - Same level of happiness.
- Following the latter, you can just substitute expensive items with cheaper ones.
  - Lower expenditure required then!

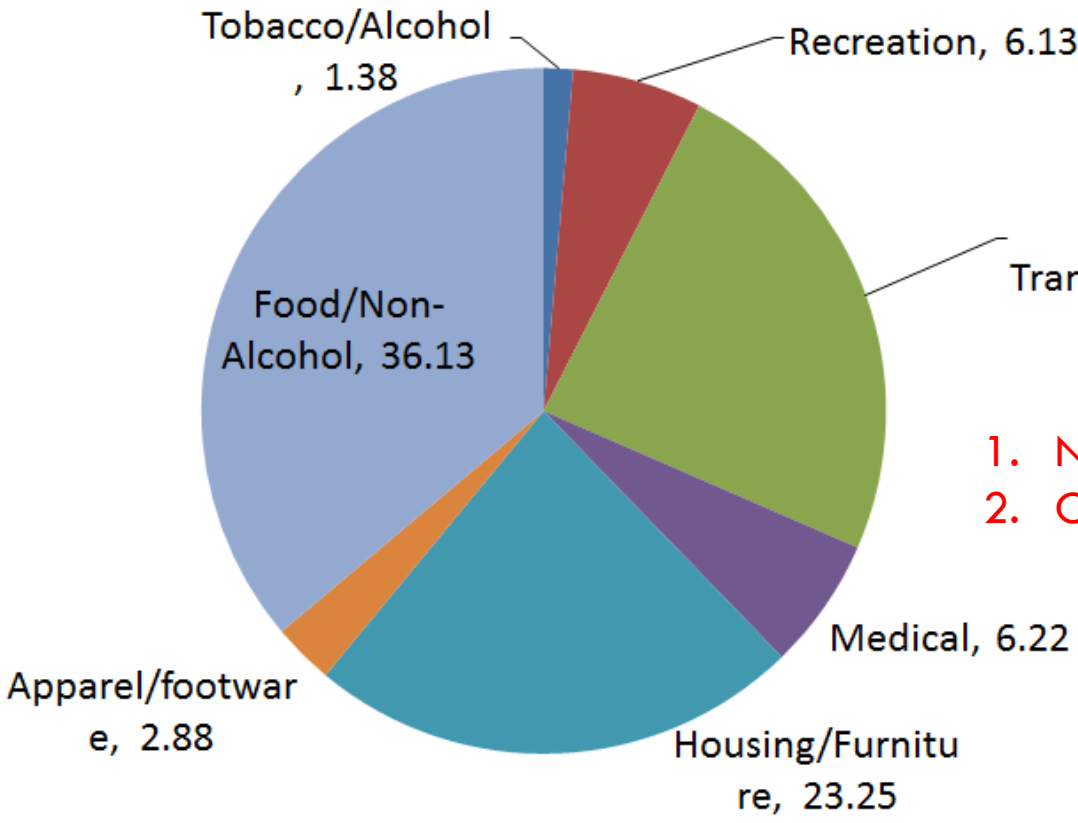
BIASED MEASUREMENT OF PRICE INDEX

- In the US, CPI inflation was found to be approximately 1% over-estimate the true COL index. (See Boskin 1996)
- Miscalculation matters a lot for public policy.
  - Social security payments are typically tied to inflation.
  - Upward biased calculation of COL generated in CPI inflation hence results in over-budgeting.

THAILAND'S INFLATION FIGURES

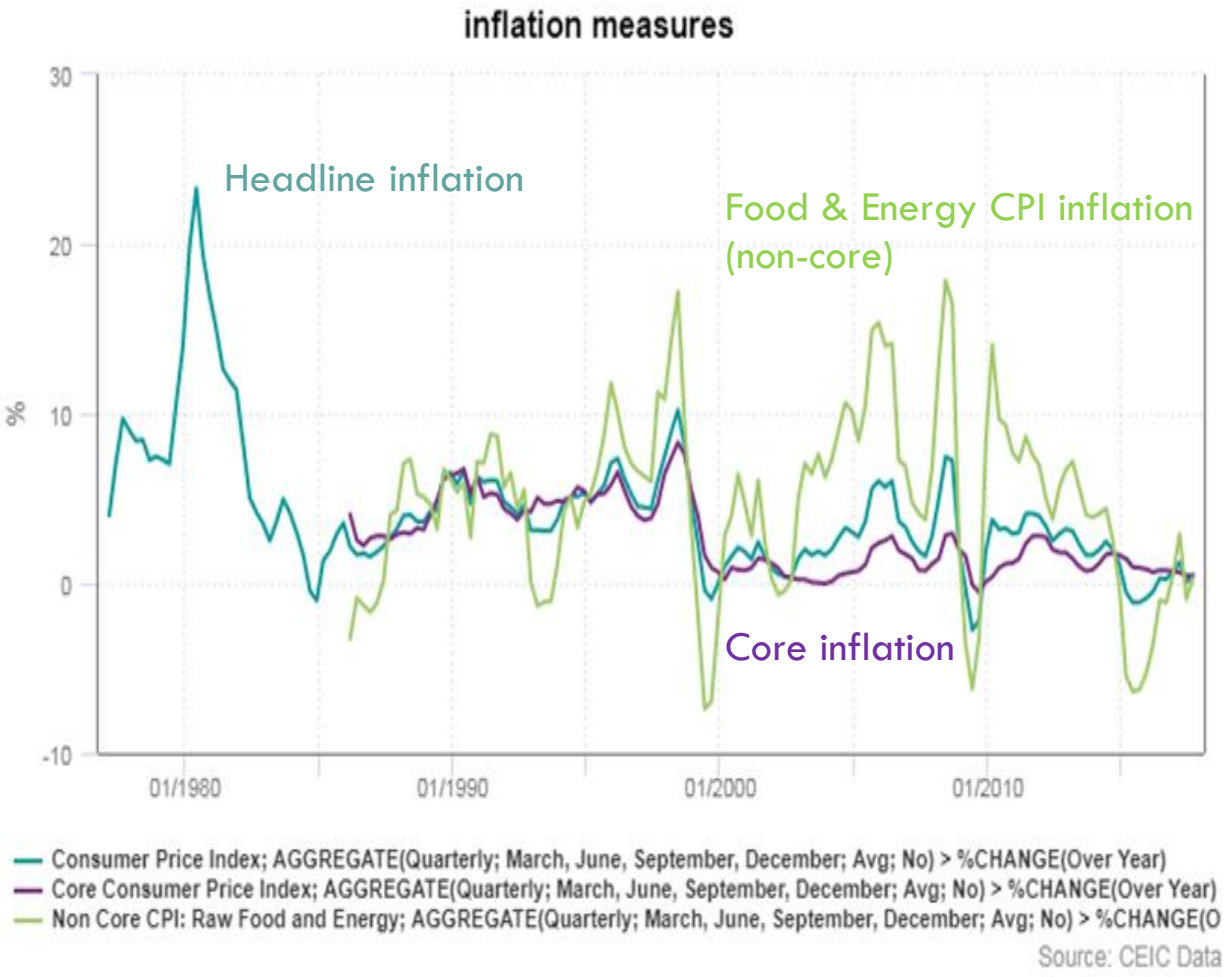
- The series are calculated monthly by the **Bureau of Trade and Economic Indices**, Internal Trade Department Ministry of Commerce (สำนักดัชนีเศรษฐกิจการค้า กรมการค้าภายใน)
- Data is collected, based on the survey.
  - **Headline (General) CPI**: prices of 7 groups (373 items) of goods and services.
  - **Core CPI**: prices of 266 items, excluding fresh food and energy group (107 items).

WEIGHT IN THE CALCULATION OF CPI



1. Non core items count for 27.40%
2. Overall weights for the whole kingdom.

HEADLINE AND CORE INFLATION



1. Core inflation appears to be more smooth than headline one.
2. Non-core component is highly fluctuate.
3. Central bank targets headline inflation; the band is [1%,4%]
4. In recent years, headline inflation has been off the target interval.

LABOR MARKET MEASUREMENT

- Real GDP provides us several key information on how strong economy is performing.

- CPI Inflation measures the rise of cost of living, and hence reflects welfare.

- Another counterpart measurement for the slackness/tightness economics activities is the labor market indicators such as *unemployment rate*.

HOW DO WE MEASURE LABOR MARKET ACTIVITIES

- Labor market indicators are reported by ***survey (LFS)***.
- **Working-age population**: 15 years above, not incapacitate to work.
  - labor force plus + not in labor force.
- **Labor force** = the employed + unemployment.
- **Unemployment** = those who look for the job, but not currently being employed
- **Unemployment rate** = the unemployed/labor force.

THAILAND'S LABOR FORCE FIGURES

- Two sources: NESDB (and also NSO.)
- Labor force: persons with the age of 15-59.
- **Underemployment**: work less than 35 hours and available for more.

	2017/Q1
1.Population	67,555.03
1.1 Below 15 years	11,726.48
1.2 Above 15 years	55,828.55
2. Labor force (2.1 + 2.2 + 2.3) 3/	38,216.14
2.1 Employed	37,443.2
Underemployed	335.65
2.1.1.Agri	11,002.54
2.1.2.Manu	8,837.86
2.1.3 Service	14,689.65
2.2 Unemployment	463.38
2.3.seasonal unemployed	309.56
3.Not in the labor force with 15 years of age above	17,612.41
3.1 housework	5,169.94
3.2 study	4,444.33
3.3 Young / old / in capacitate to work	6,196.75
3.4 others	1,801.4
Labor force participation rate (2 divided by 1.2)	68.45%
unemployment rate (2.2 divided by 2)	1.21%

HOW DO WE MEASURE LABOR MARKET ACTIVITIES

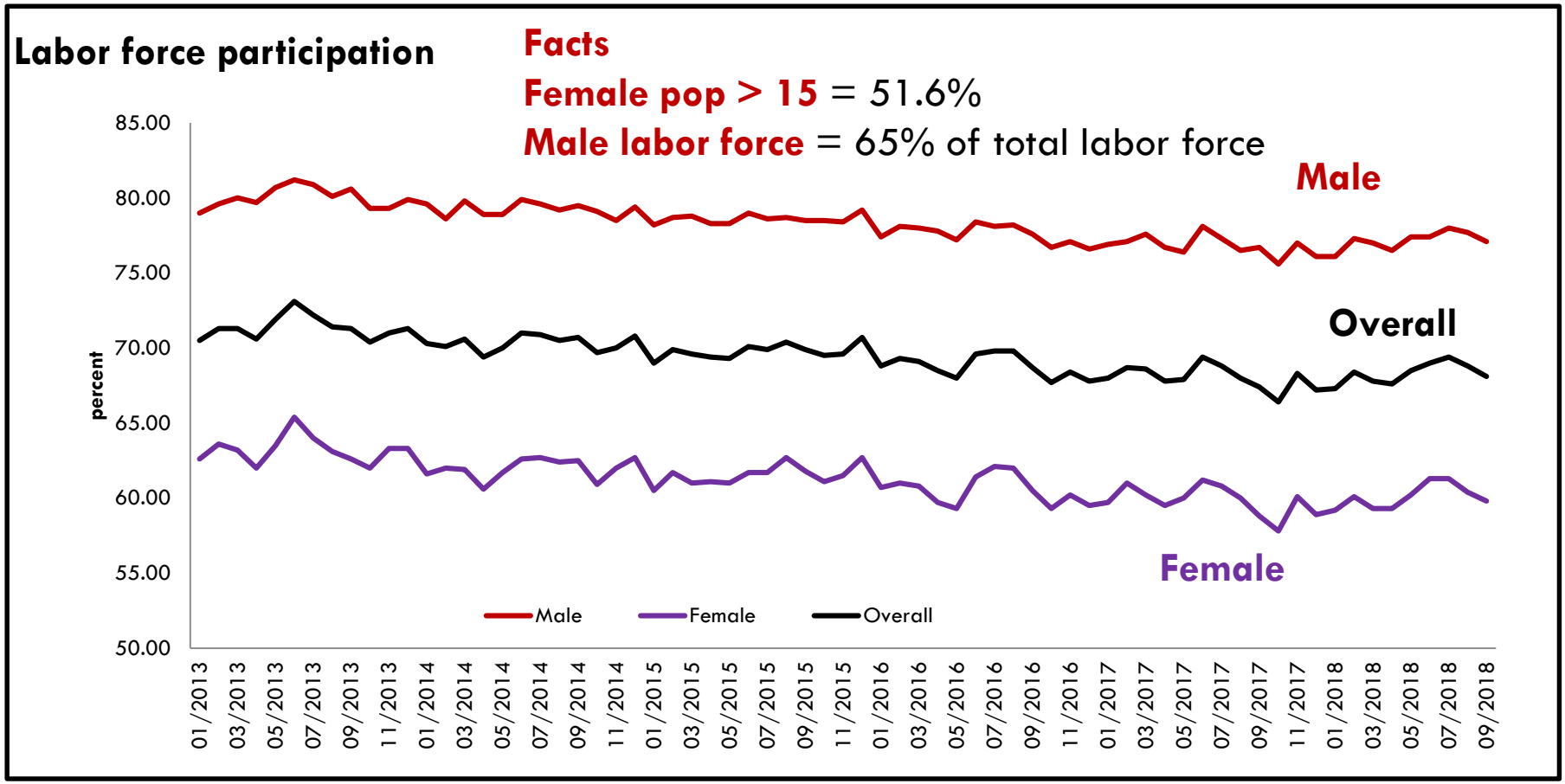
- **Labor-force participation rate** = total labor force / working-age population

- **Discouraged workers**: those who wish to work but have stopped searching for jobs and thus are dropped out of the labor force.

- **Employment rate** = Employed person / working-age population

LABOR FORCE PARTICIPATION RATE

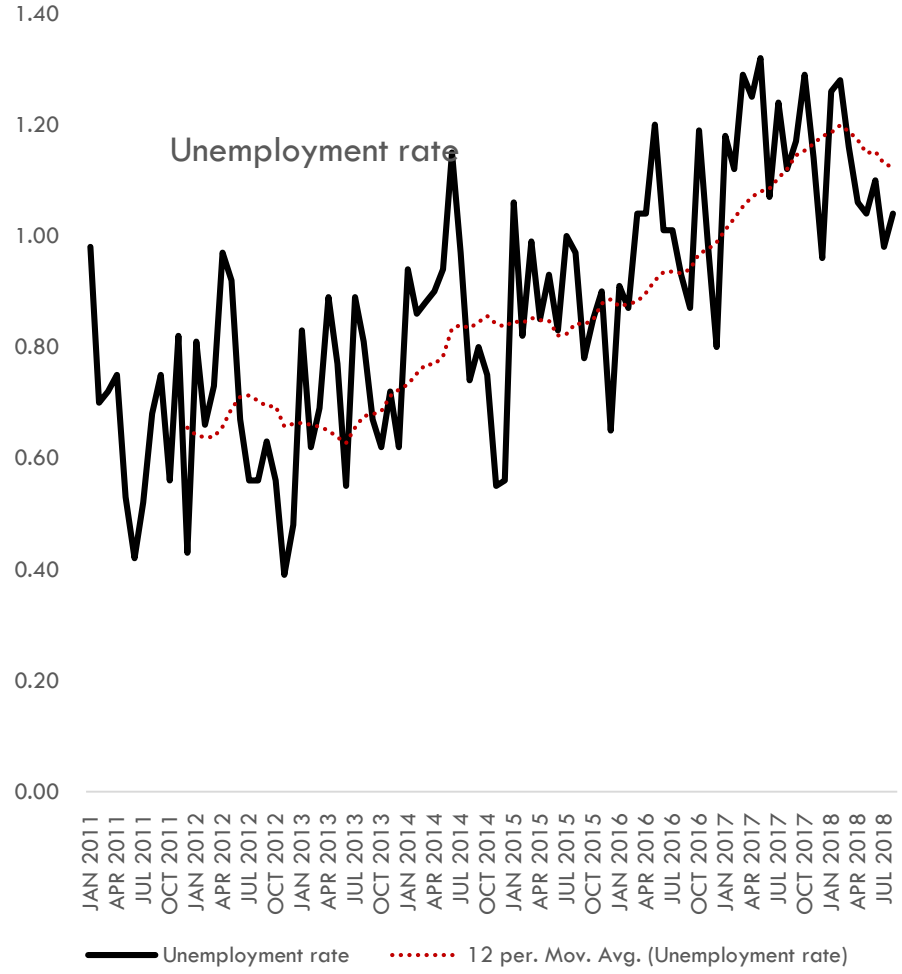
1. **Labor force participation** = Labor force / Pop > 15
2. Male participation rate is higher than that of female.

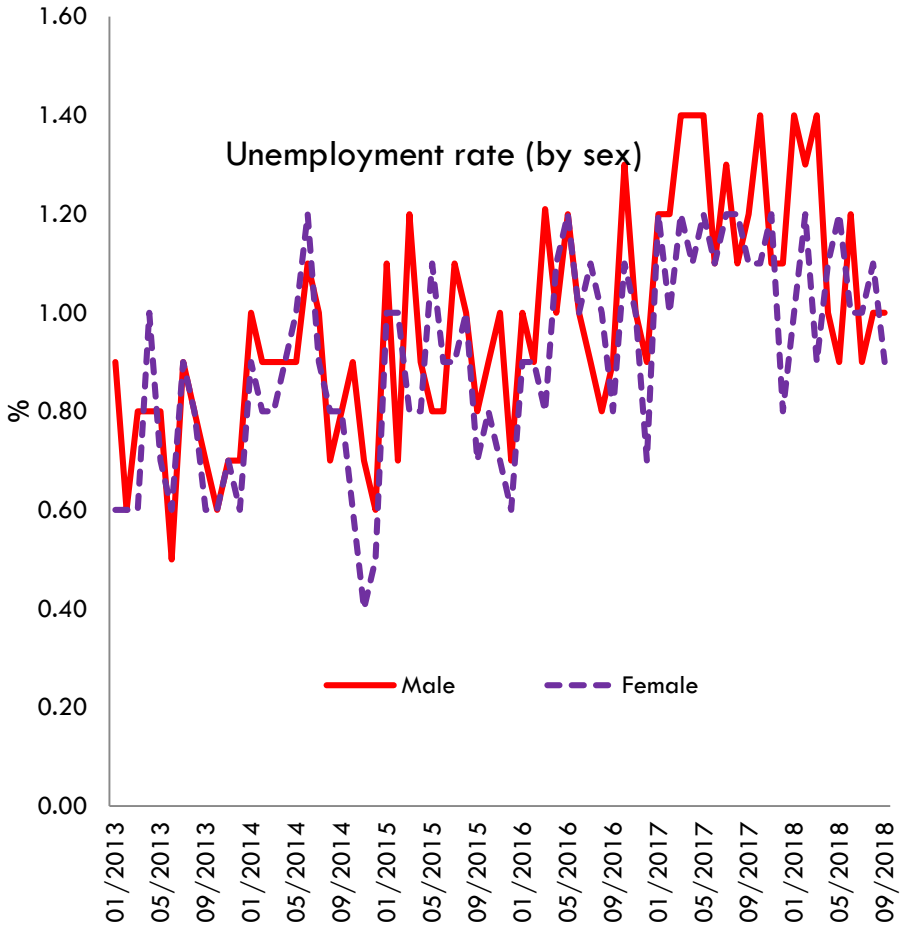


UNEMPLOYMENT RATE (1/2)

unemployment rate = unemployment / Labor force

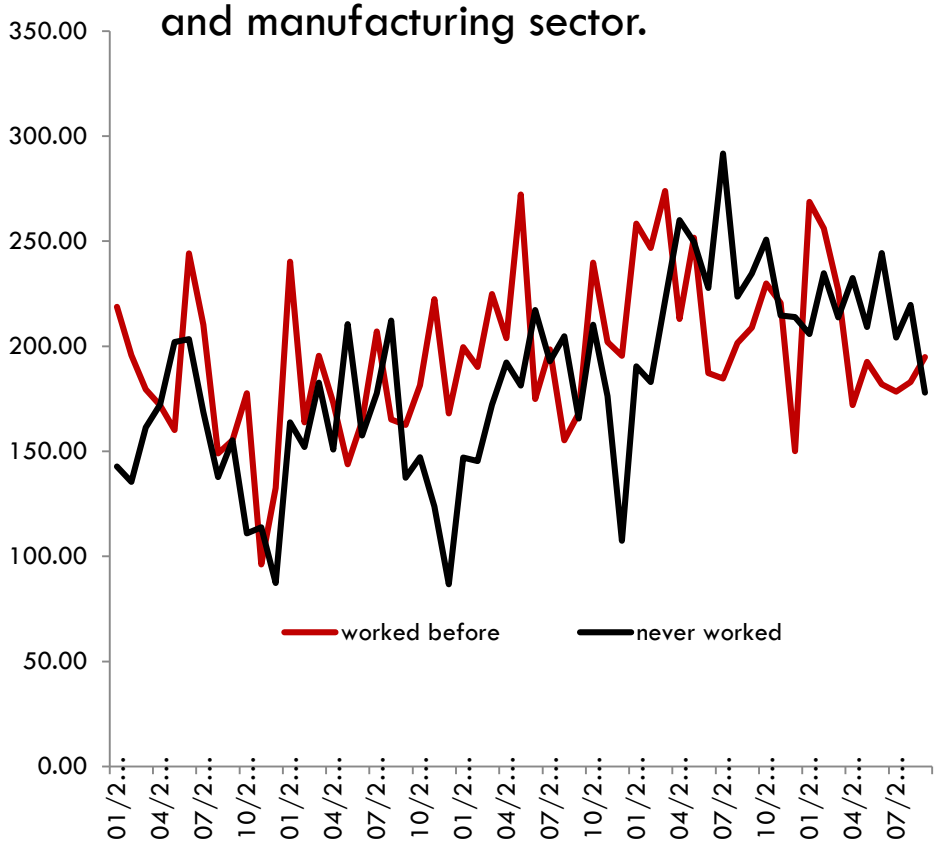
Unemployment rates are roughly comparable across sex.

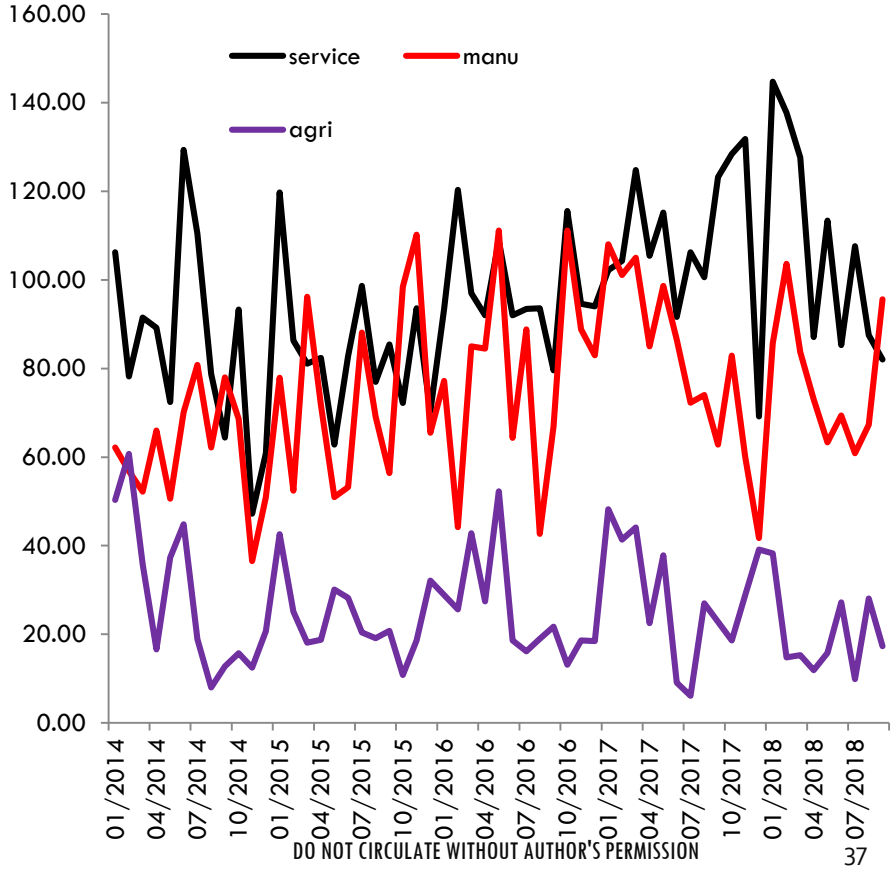




UNEMPLOYMENT RATE (2/2)

1. First-time unemployed persons are roughly comparable to repeating unemployed persons
2. Unemployed persons, classified by last job, are relatively high among service and manufacturing sector.



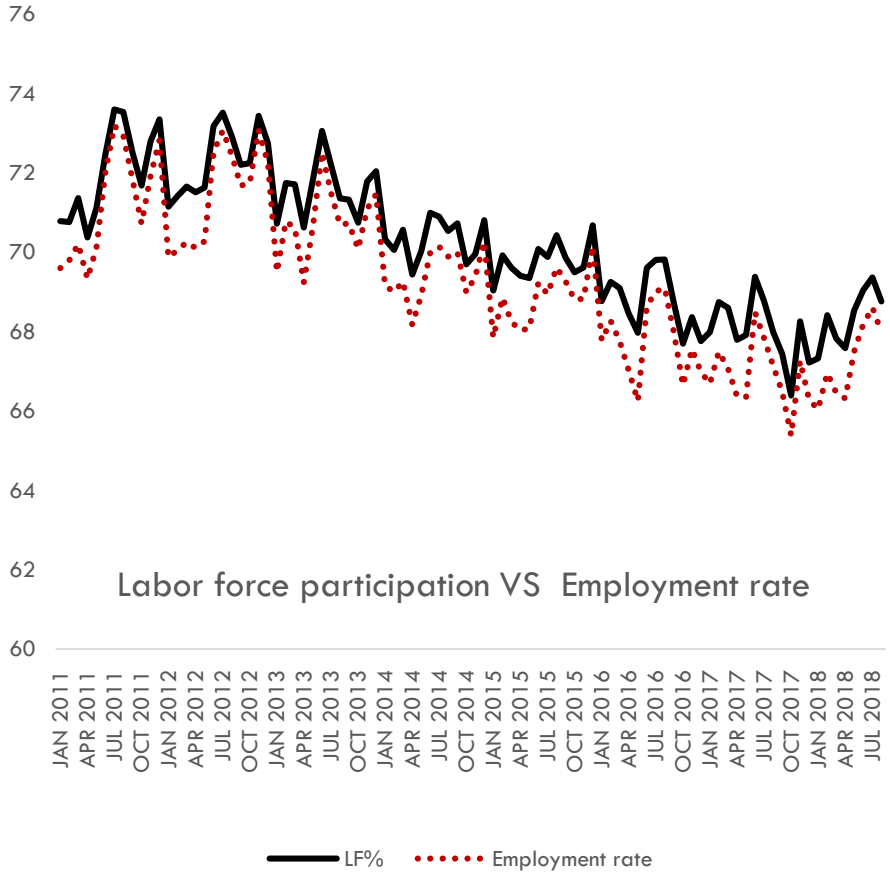


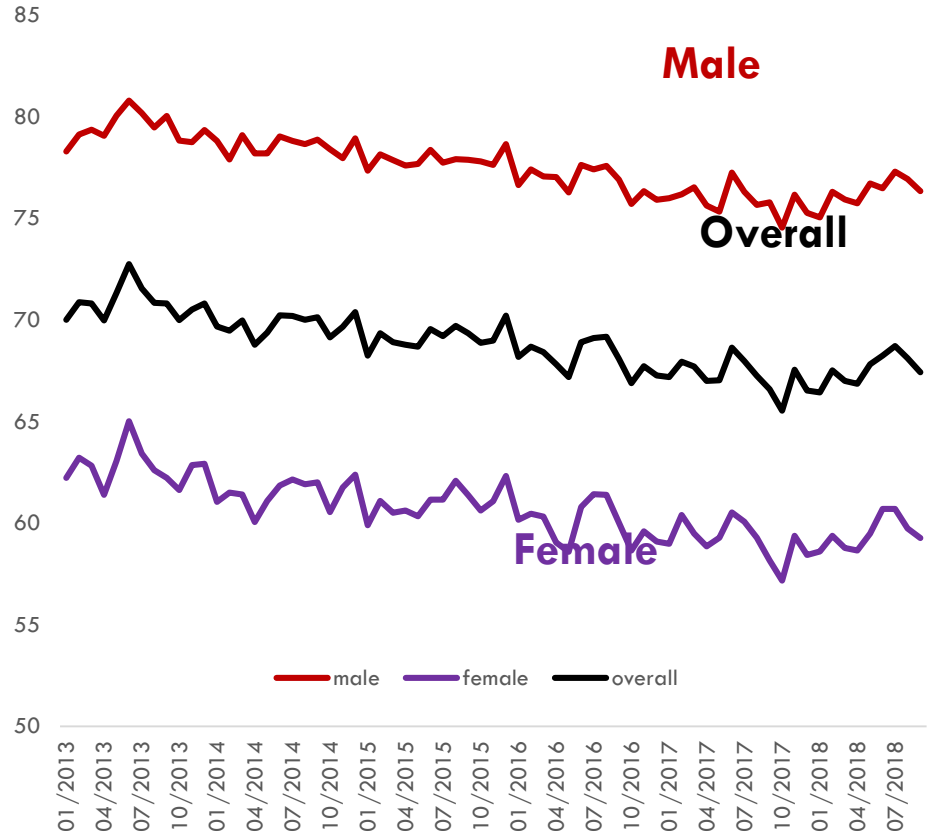
EMPLOYMENT RATE (1/3)

Employment rate = Employment / Pop > 15

= (Employment / Labor force) * LF participation rate

Female employment rate is due to lower female LF participation rate.





EMPLOYMENT RATE (2/3): WHEY DO THEY GO?

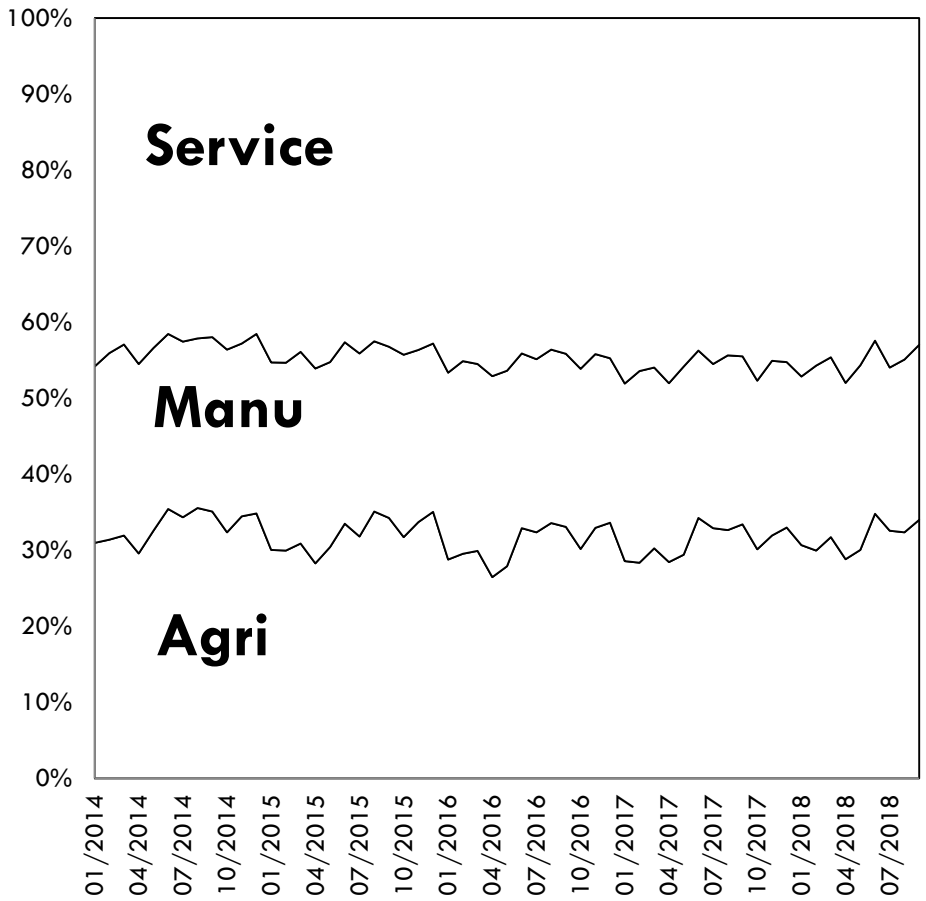
- Having classified by sex, male employment accounts for 55% of the total labor employment in Thailand
- **Informal sector** accounts for over 55% of the total labor employment in Thailand, both male and female.

	Male	**Female**	
Employment share	54.20	45.80	
	Overall	**Male**	**Female**
Informal	55.86	56.31	55.33
Formal	44.14	43.69	44.67

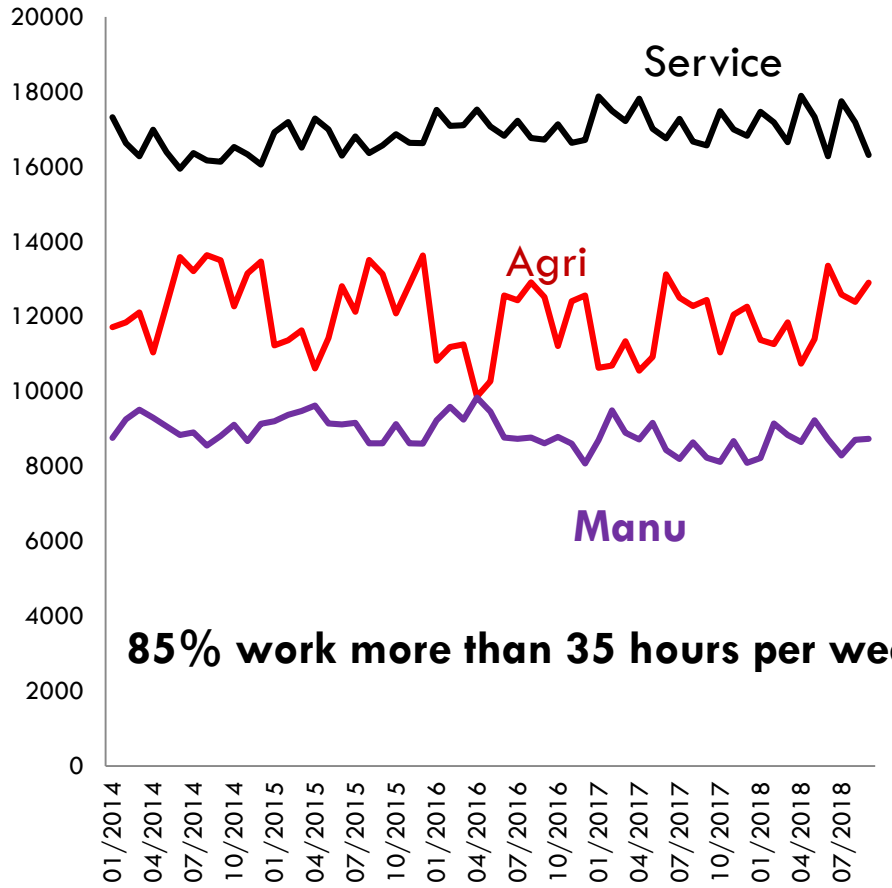
Source: NSO, informal sector survey, 2017

EMPLOYMENT RATE (3/3): WHEY DO THEY GO?

Sectoral employment by ISIC code (Share)

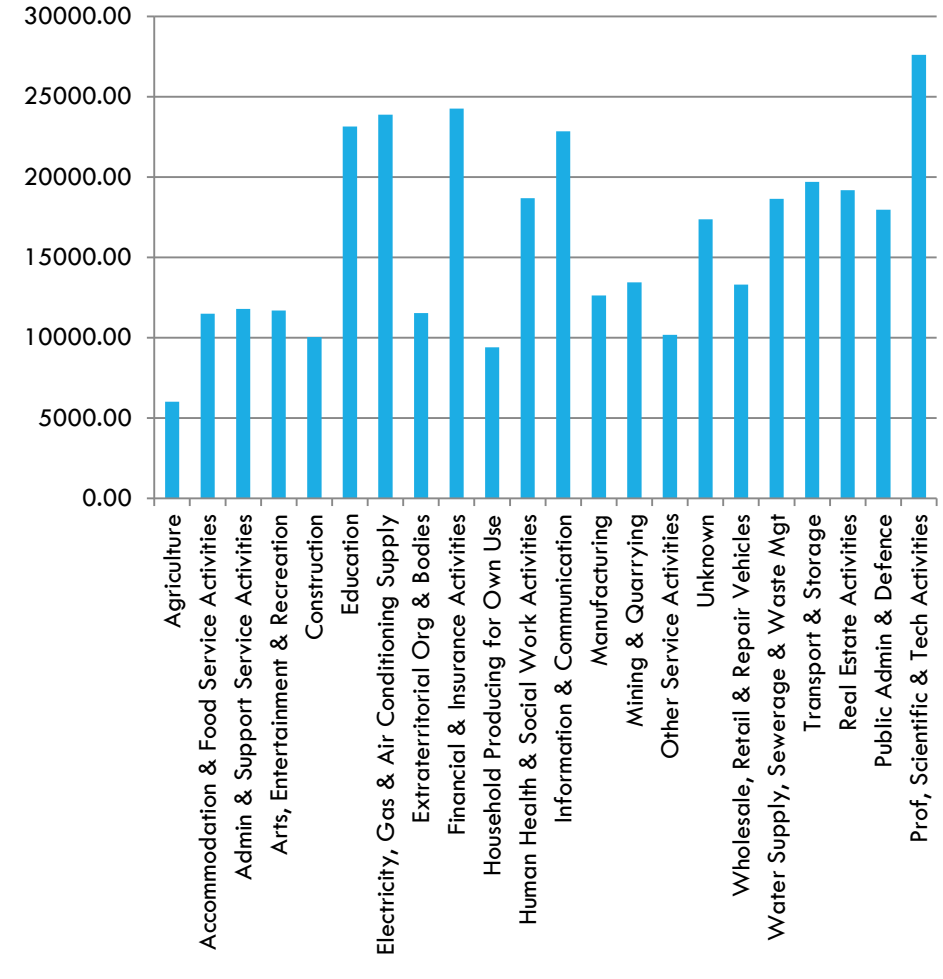


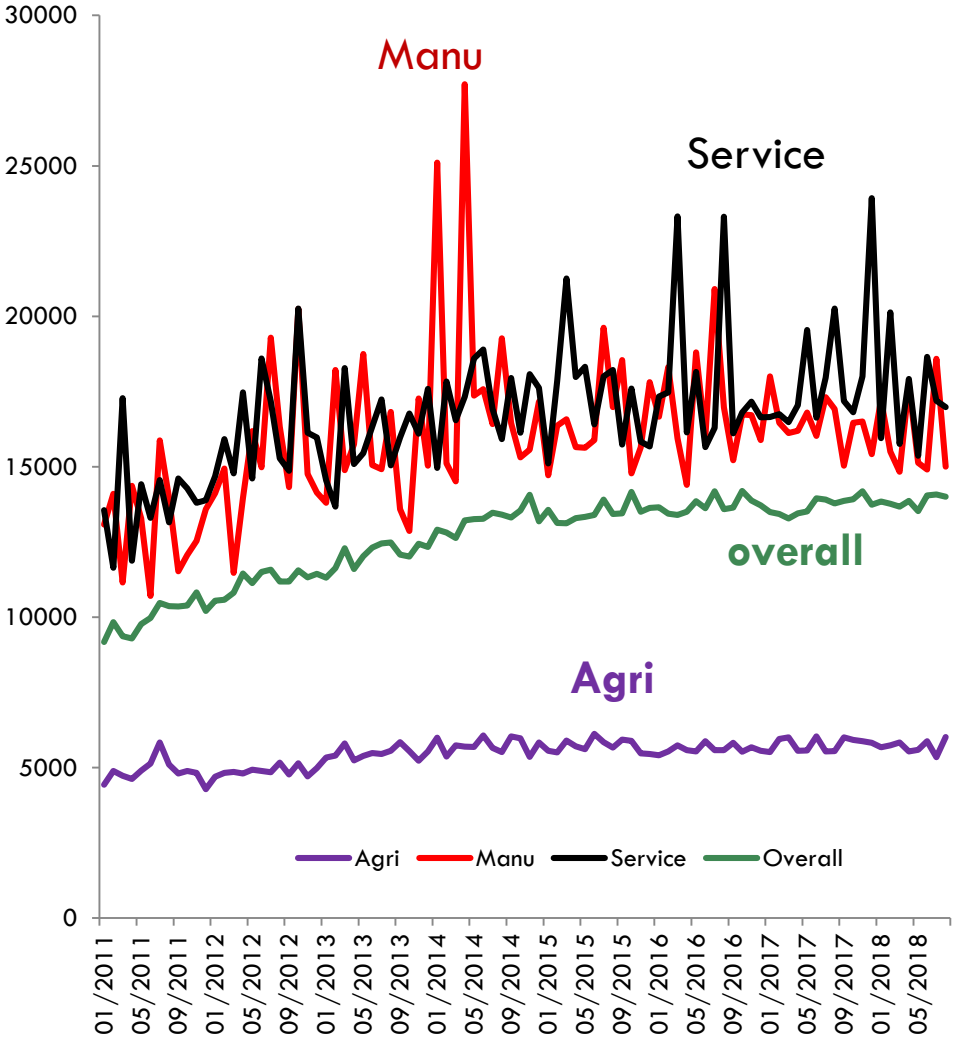
Sectoral employment (level)



85% work more than 35 hours per week

AVERAGE WAGE





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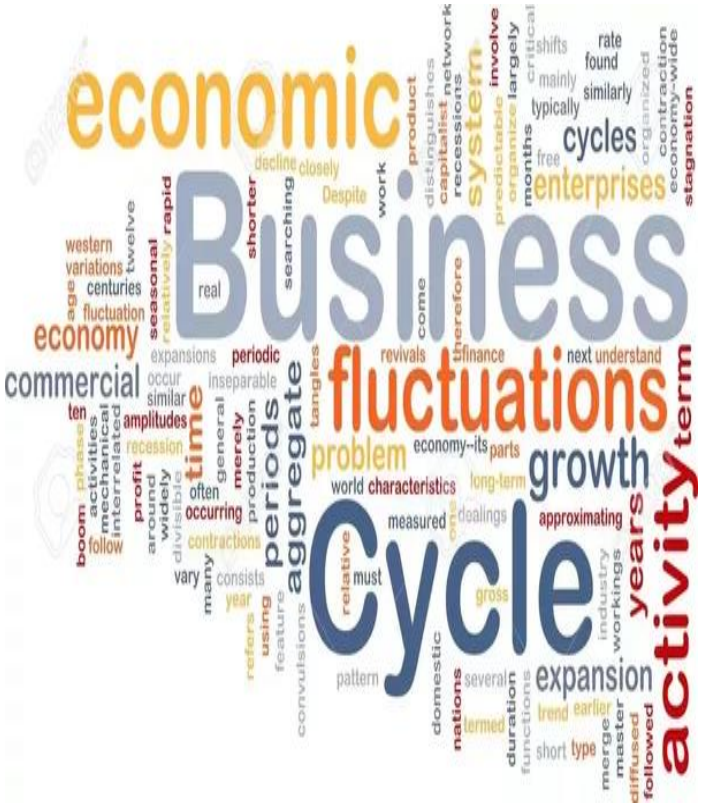


- **Data and measuring business cycles**
  - **Measuring economic activities**
  - **Measuring business cycles**

TIME SERIES DATA: SOME TECHNICAL JARGONS

- Most aggregate variables are time series; data value can be observed at each point of time.
- Having referred to time-series data, one common approach is to characterize behavior of the data is to think about the **decomposition**.

$$X = T + C + S$$

X = actual T = trend; C=Cycle; S = Seasonal

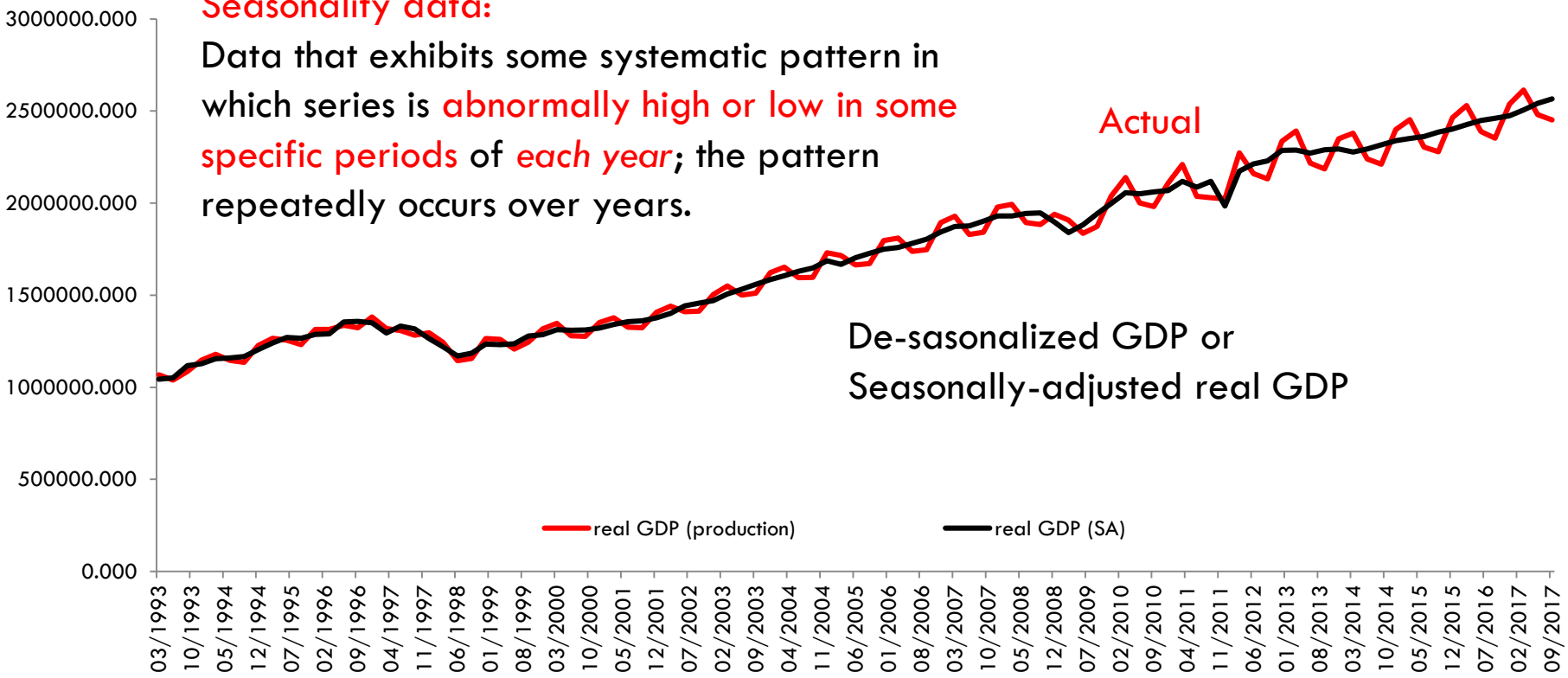
For example:

GDP = Trend GDP + Cycle GDP + Seasonal part

ACTUAL REAL GDP HAS CONTAINED SOME SEASONAL EFFECTS.

Seasonality data:

Data that exhibits some systematic pattern in which series is abnormally high or low in some specific periods of *each year*; the pattern repeatedly occurs over years.



SEASONALLY-ADJUSTED REAL GDP HAS SLOWLY MOVED AND GROWN OVER TIME.

Trend:

- The series has slowly moved and grown over time. The *slow-moving part* of the series is called "trend".
- In economics, this trend is given by long-term factors, i.e. potential growth of the economy.

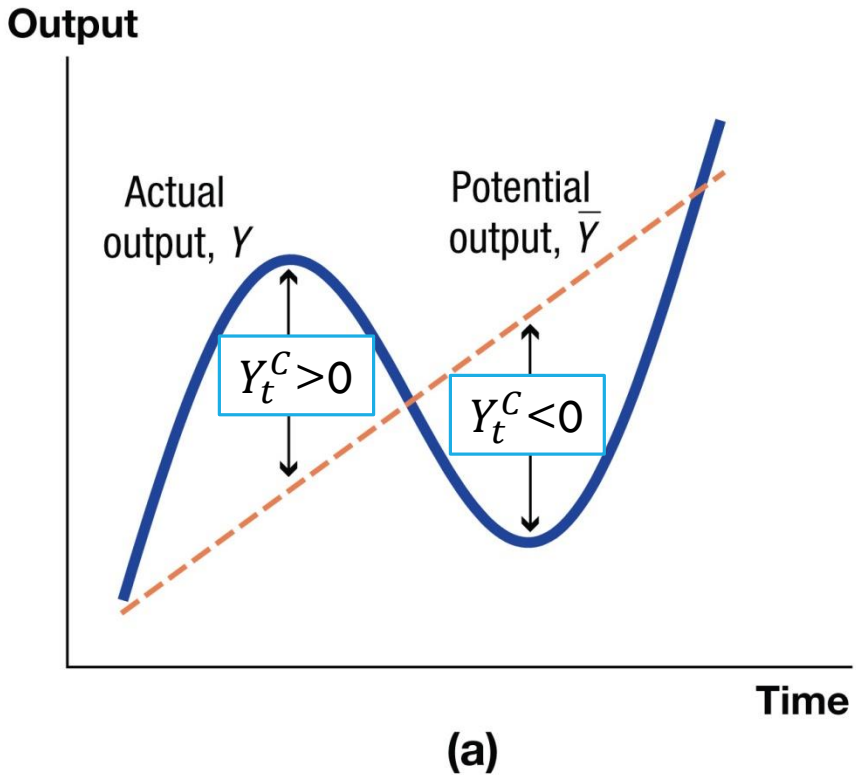
Detrending and Cyclical Fluctuations: measurement?

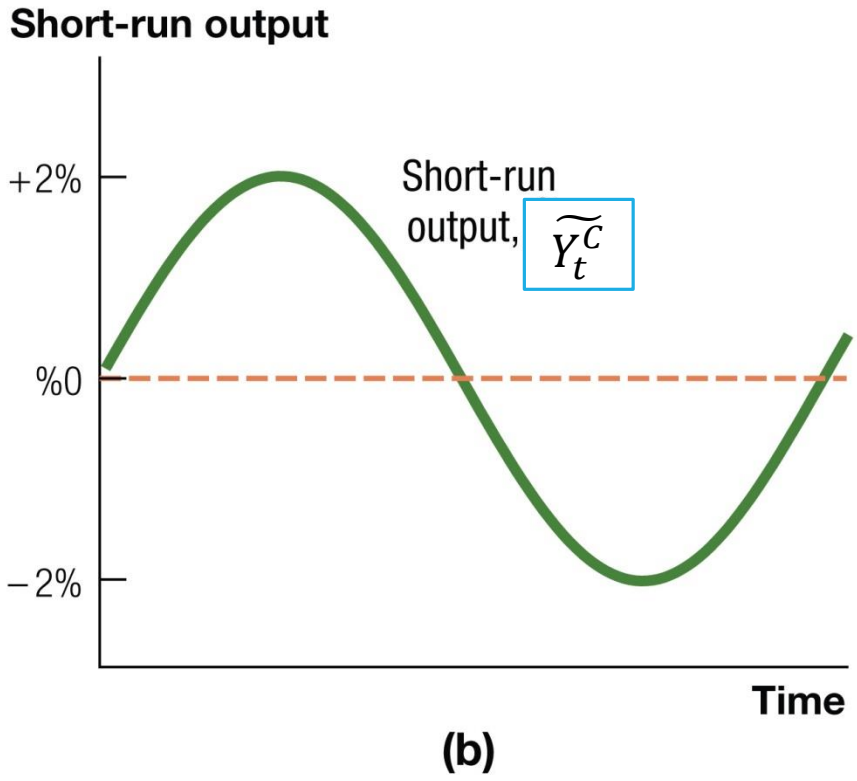
Output is equal to the long-run trend plus de-trended component. The latter is called the cyclical part, i.e. short-run fluctuations:

$$Y_t = \overline{Y_t} + Y_t^C$$

- The long-run trend is referred to potential output.
- Cyclical measurement is usually made in percentage (why? Normalization!): the short-run fluctuations are the percentage deviations from potential GDP.

$$\widetilde{Y_t^C} = \frac{Y_t - \overline{Y_t}}{Y_t}$$

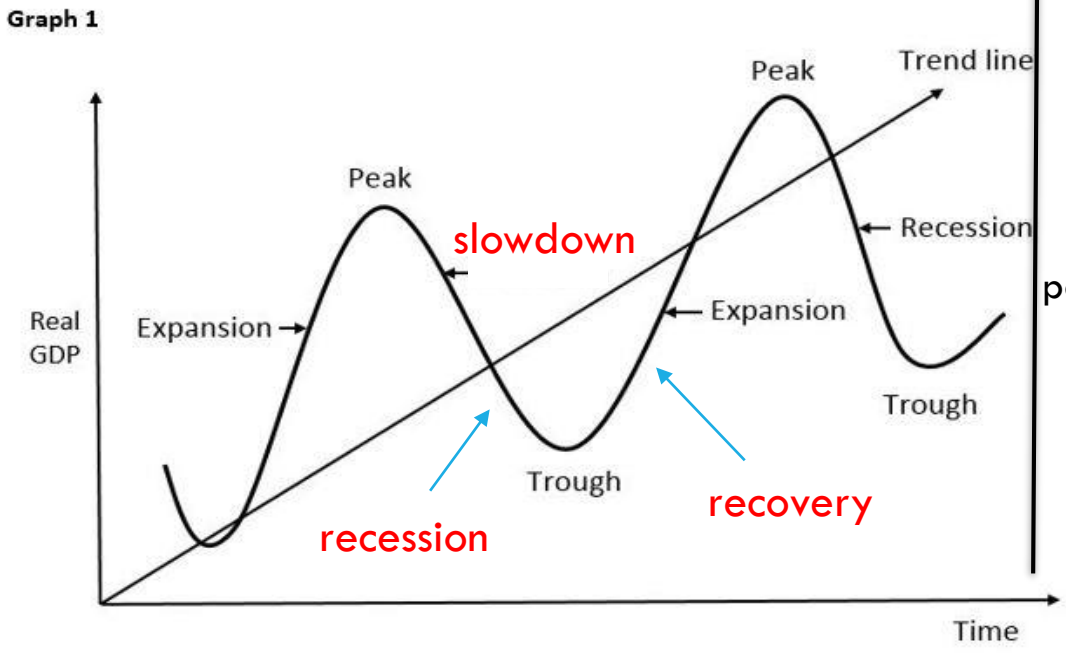

Output
Actual output, Y
Potential output, $\bar{Y}$
$Y_t^C > 0$
$Y_t^C < 0$
Time
(a)

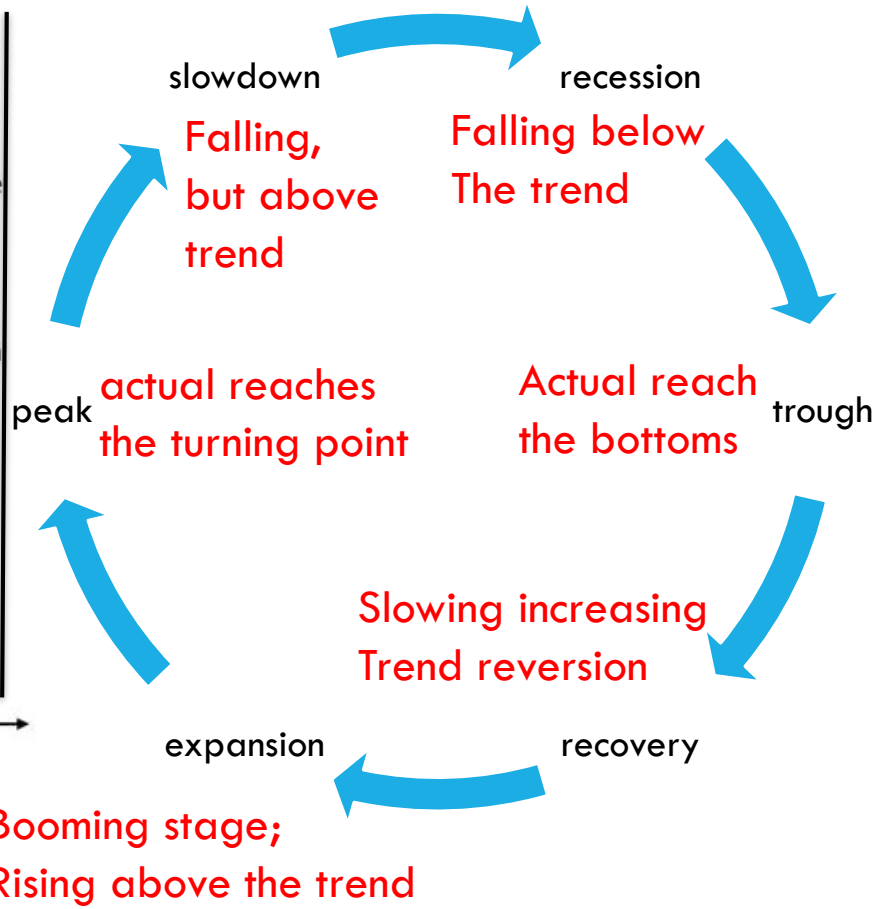

Short-run output
+2%
%0
−2%
Short-run output, $\widetilde{Y_t^C}$
Time
(b)

PHASE OF MOVEMENT AROUND TREND: CYCLICAL FLUCTUATIONS

Recurrent fluctuations of economics variables that have repeatedly occurred.

Phase of movements around the trend

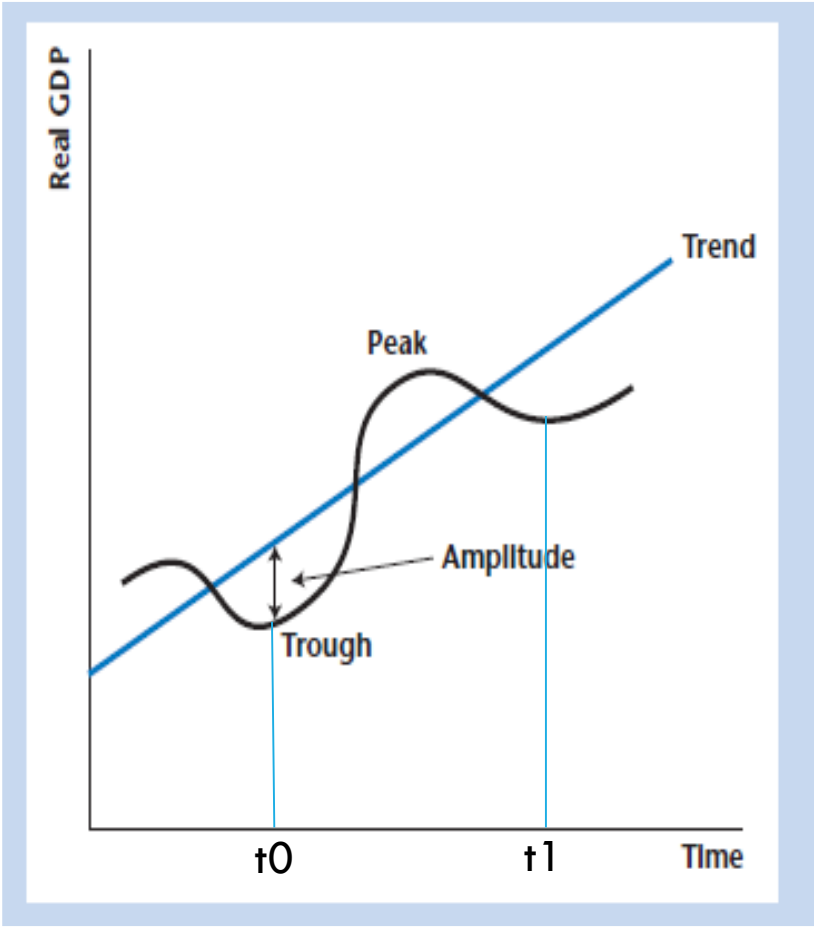




HOW DO WE DOCUMENT THE PATTERN OF BUSINESS CYCLES?

1. Amplitude of the cycle: Trough-to-Peak or trough-to-trend

2. Periods of cycle: periods (in quarter) for having one complete cycle: trough to trough

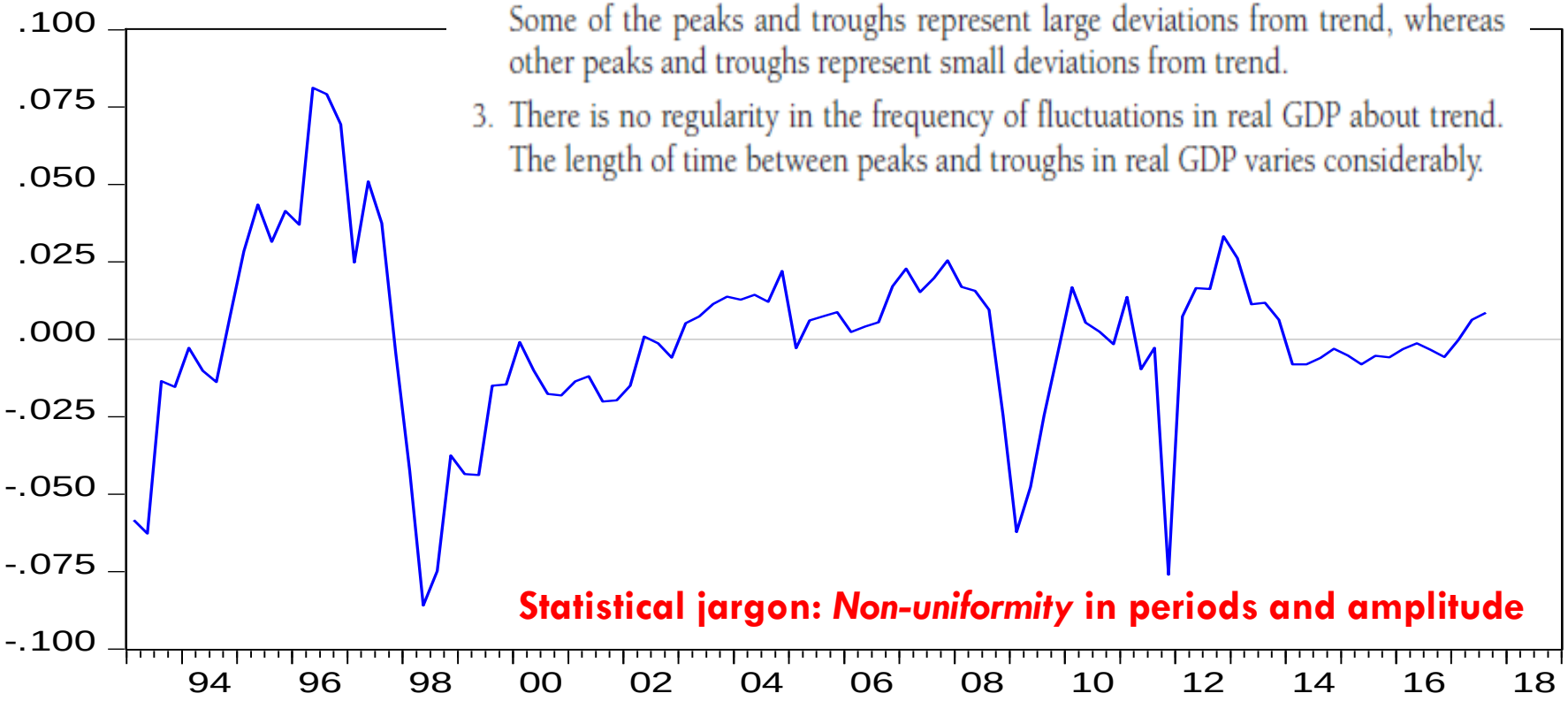


- Ideally, you would hope that information for the two things can be determined with certainty!
- Unfortunately, no. They are random!

HOW DO WE DOCUMENT THE PATTERN OF BUSINESS CYCLES?

1. The time series of deviations from trend in real GDP is quite choppy.
2. There is no regularity in the amplitude of fluctuations in real GDP about trend. Some of the peaks and troughs represent large deviations from trend, whereas other peaks and troughs represent small deviations from trend.
3. There is no regularity in the frequency of fluctuations in real GDP about trend. The length of time between peaks and troughs in real GDP varies considerably.

Decimal points



Statistical jargon: *Non-uniformity* in periods and amplitude

HOW DO WE DOCUMENT THE PATTERN OF BUSINESS CYCLES? → USING STATISTICAL TECHNIQUE

- Because cycles are random, economists then apply some **statistical methods** to describe/characterize the pattern of business cycles.
- Treating cyclical variable as a random variable, and describe its statistical properties using some statistic
- What statistic do business cycle economists usually look into?
  - Average length / Average amplitude of cycle
  - Volatility
  - Comovement
  - Leading and Lagging

STATISTICAL MEASUREMENT OF BUSINESS CYCLES

- **How volatile is the cyclical variable?**
  - Volatility can be measured by using the **standard deviation** concept

- **Comovement of cyclical variables**
  - Economists usually focus on the relationship among various cyclical variables
  - Types of comovement: **positive, negative and zero**

BUSINESS CYCLES COMOVEMENT

Figure 3.3 Time Series Plots of *x* and *y*

(a) Two time series that are positively correlated. When *x* is high (low), *y* tends to be high (low) as well. (b) Two time series that are negatively correlated. In this case, when *x* is high (low), *y* tends to be low (high).

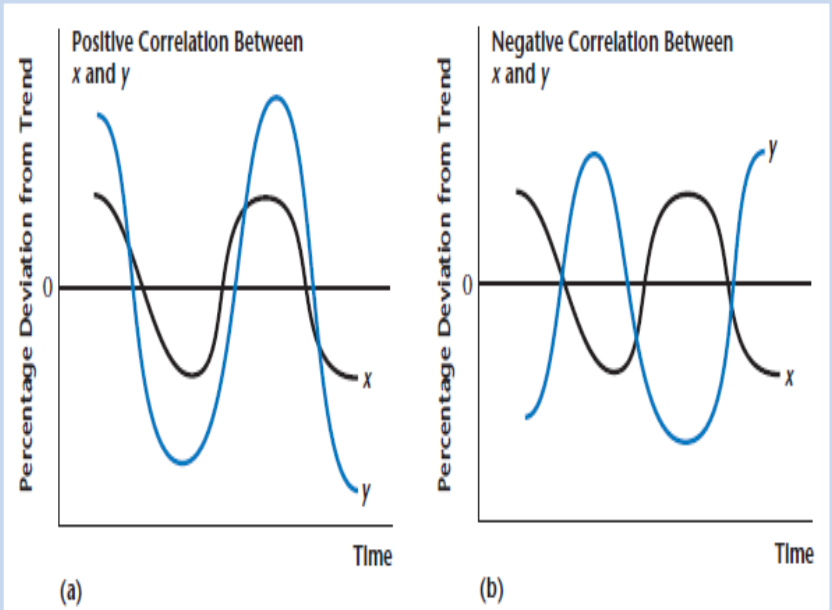
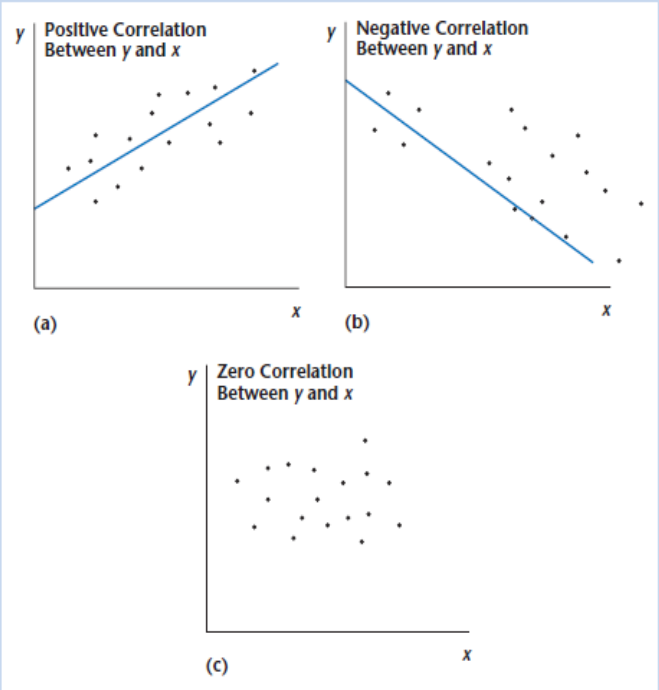


Figure 3.4 Correlations Between Variables *y* and *x*

(a) A scatter plot of two variables, *x* and *y*, that are positively correlated. (b) *x* and *y* are negatively correlated. (c) *x* and *y* are uncorrelated.



BUSINESS CYCLES COMOVEMENT

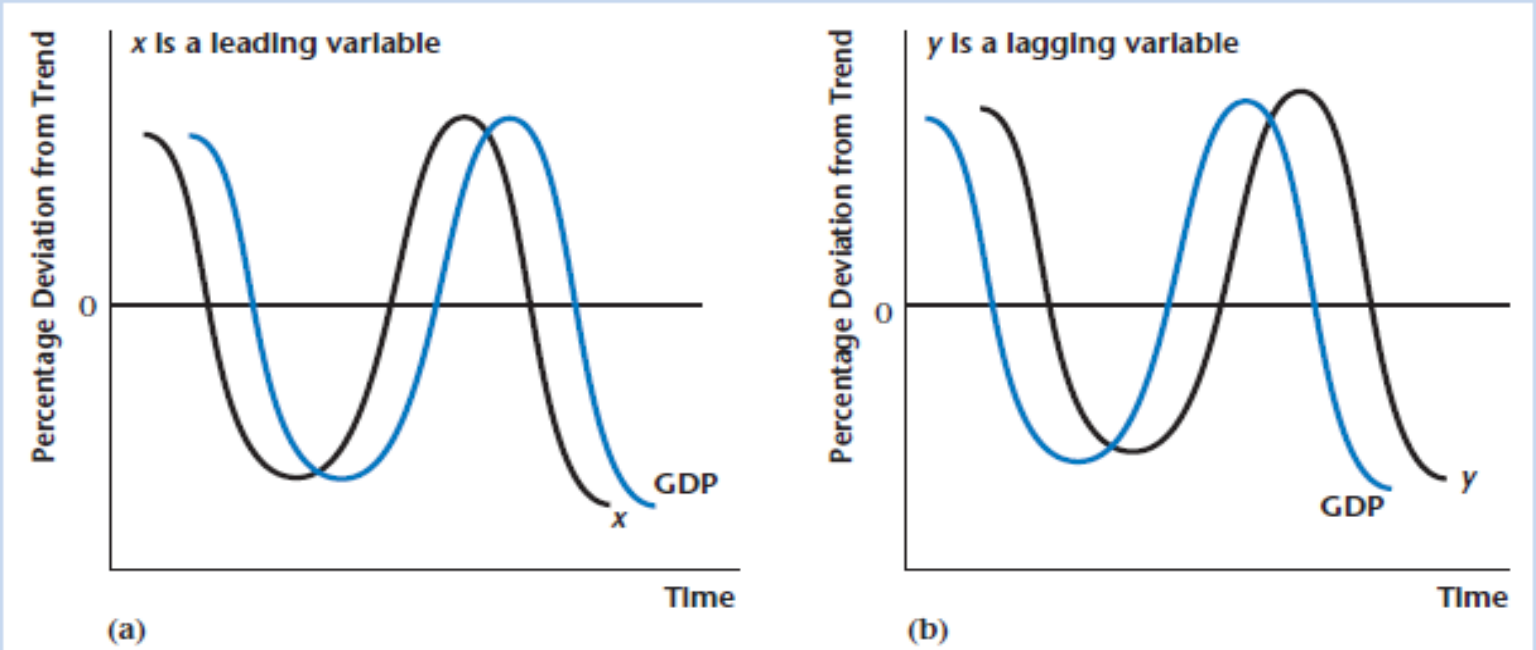
- Typically, we measure the degree of comovement using the "**correlation**", rather than the covariance. (Why?)

- Conventional treatment: A variable "X" is said to be
  - A procyclical variable if corr(GDP,x) > 0.
  - A counter-cyclical variable if corr(GDP,x) < 0.
  - Acyclical variable if corr(GDP,x)=0

BUSINESS CYCLE: LEADING AND LAGGING VARIABLES

Figure 3.7 Leading and Lagging Variables

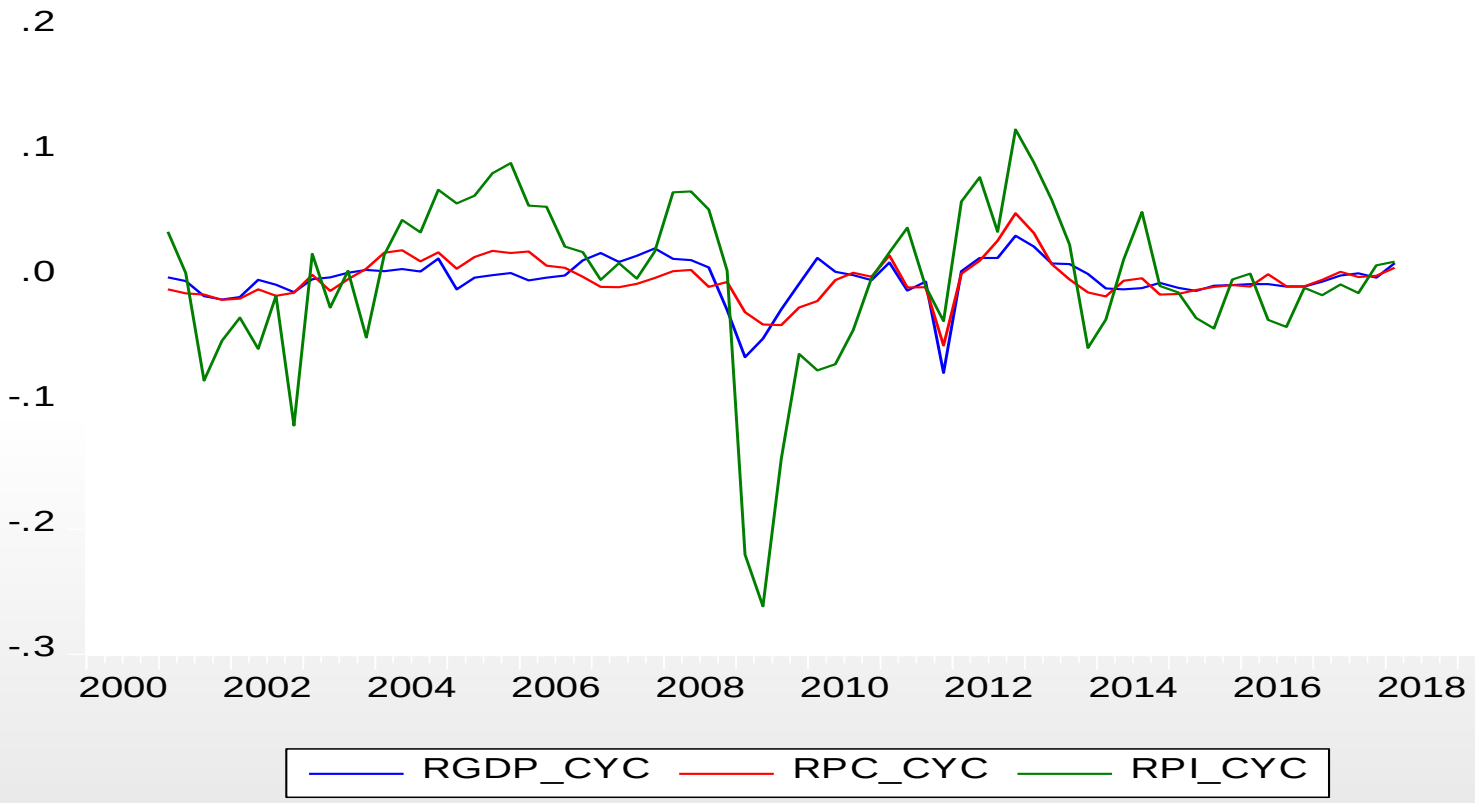
In (a), *x* is a leading variable, as its peaks and troughs tend to precede those of real GDP. In (b), *y* is a lagging variable, as the peaks and troughs in real GDP tend to lead those in *y*.



BUSINESS CYCLE: LEADING AND LAGGING VARIABLES

- How to detect "leading" and "lagging" relationship
- Simple approach: cross correlation
- A more sophisticate approach is to adopt the predictive regression method.
- Conventional understanding: financial variables, housing investment, retail sale etc…

CYCLICAL VARIATIONS OF GDP AND ITS SELECTIVE COMPONENTS



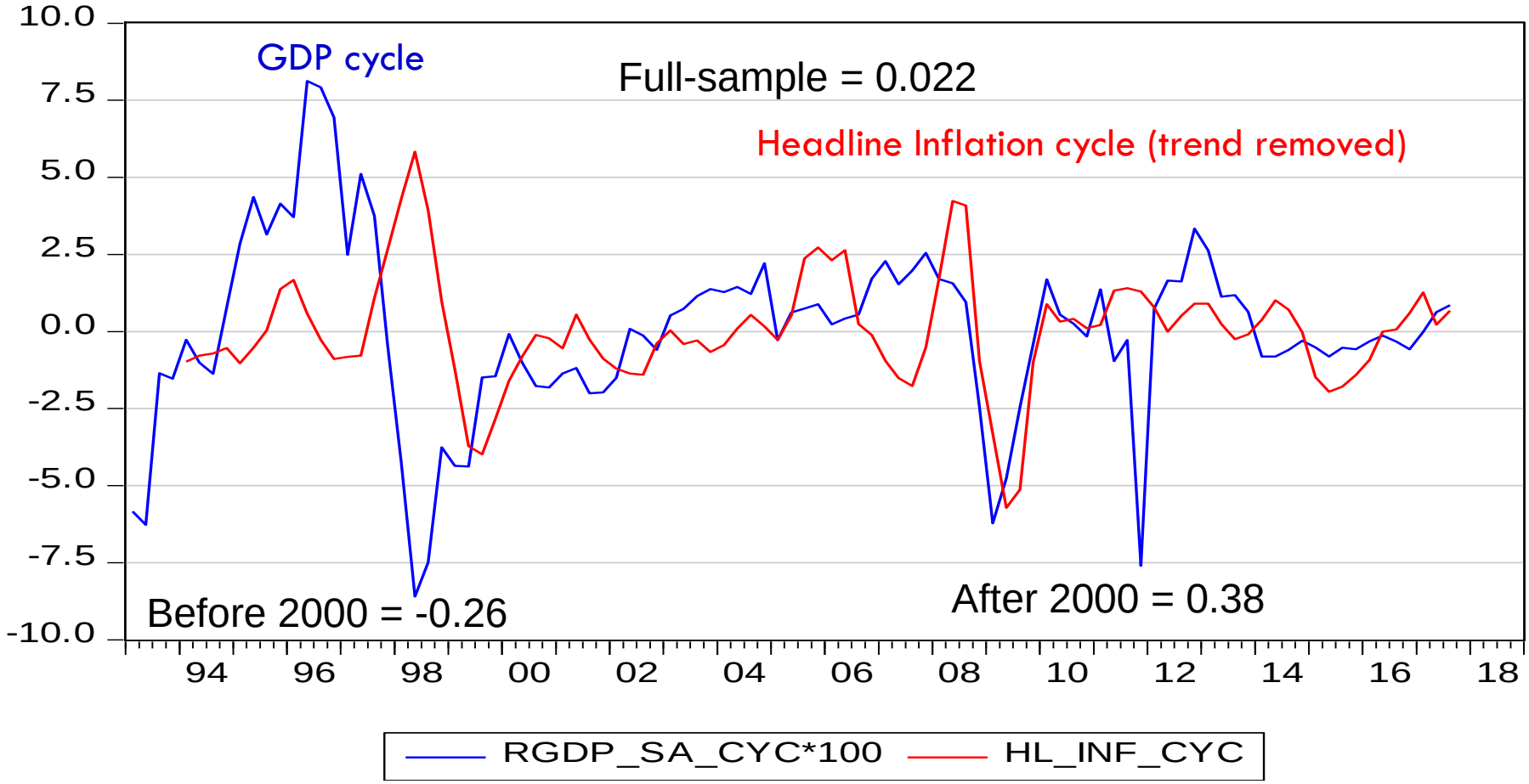
MEASURING BUSINESS CYCLES OF GDP AND ITS COMPONENT

Variable	GDP	RPC	RPI
S.D.	0.017 (1.7%)	0.016 (1.6%)	0.065 (6.5%)

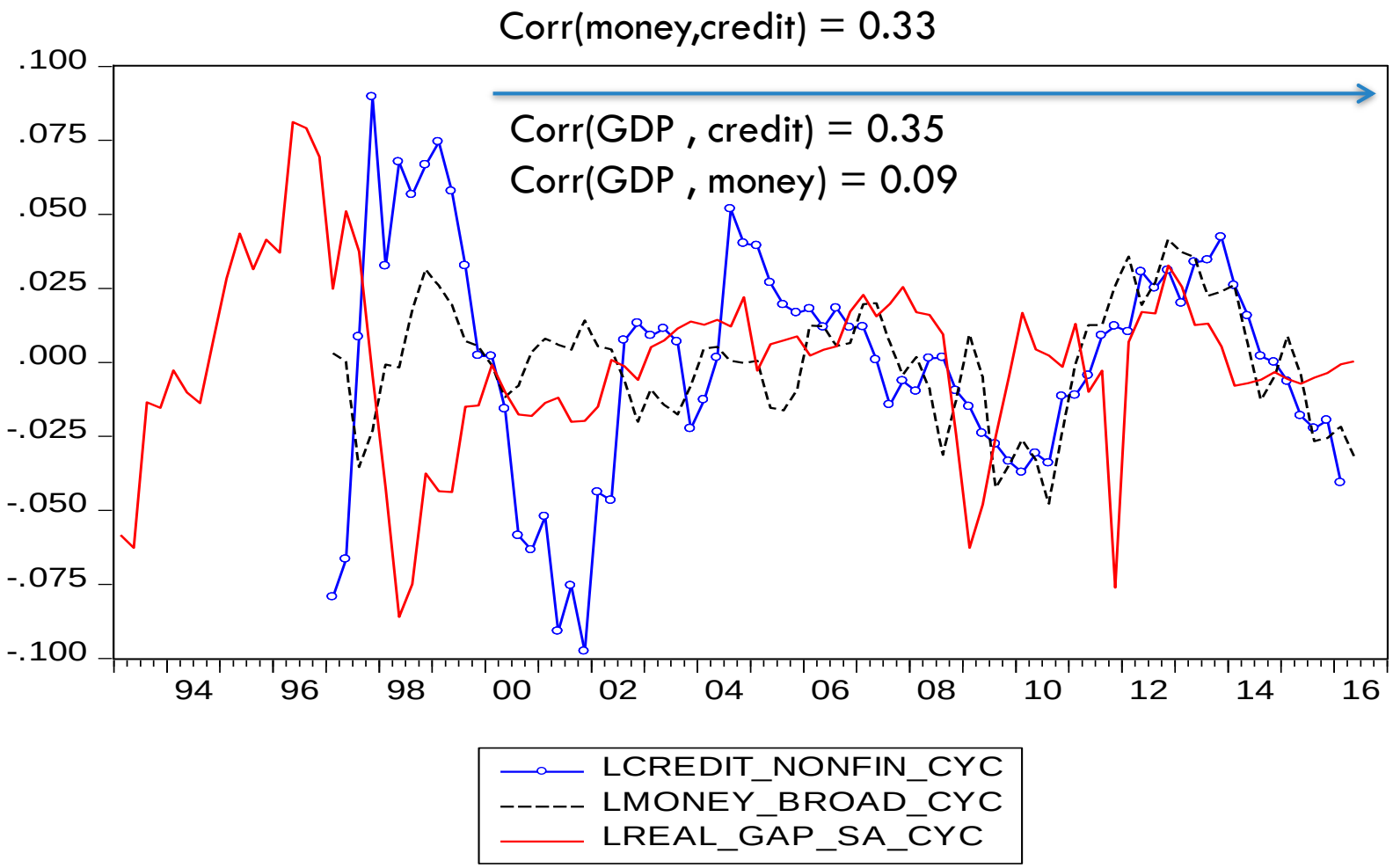
- Comovement:
  - Corr(GDP,RPC) = 0.72
  - Corr(GDP,RPI) = 0.64
  - Corr(RPC, RPI) = 0.74

- They are all procyclical variable

BUSINESS CYCLES: GDP AND INFLATION

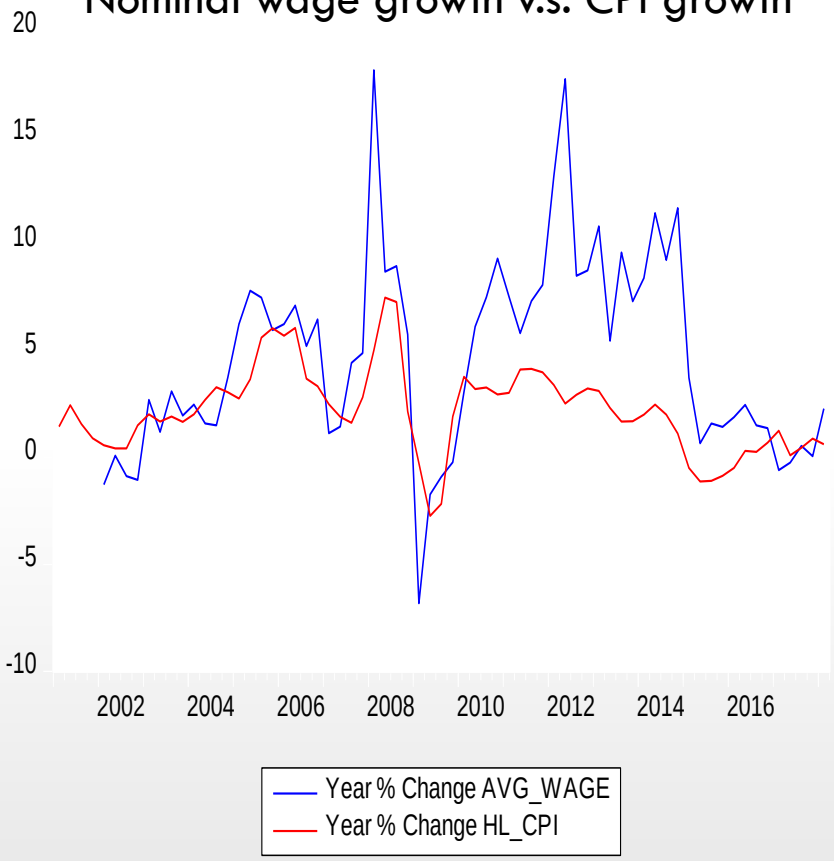


BUSINESS CYCLES: GDP, MONEY AND CREDIT



BUSINESS CYCLES: GDP, WAGE, PRICE, UNEMPLOYMENT

Nominal wage growth v.s. CPI growth



Cor(real wage, gdp) > 0

Cor(real wage, unemp_rate) < 0

Cor(gdp, unemp_rate) < 0