

# Teaching Macroeconomics via One Equation

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April 15, 2023  
The 8th Maine Economic Conference

# Learning and Teaching Macroeconomics: Key Challenges

**The complex macroeconomic system poses the greatest challenge.**

- ① What measurements and data to use? Relationships?
- ② What are the underlying principles and theories?
- ③ Is there a simplified and unified framework?

# Macroeconomics: Data and Measurements

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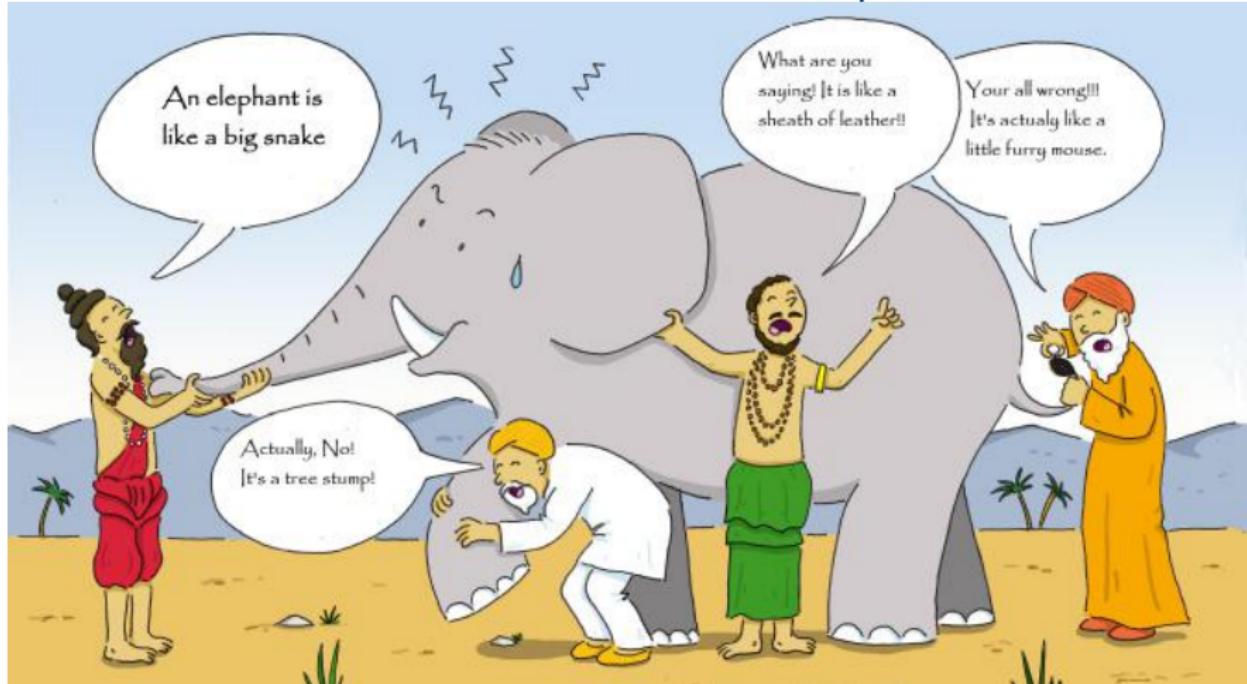
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# Macroeconomics: Blind Men and the Elephant



The parable of the blind men and the elephant is used to illustrate how inaccurate perception can be, how biases can blind us, and how the entire truth of something might be misunderstood despite accurate observation. This parable is often used as a cautionary tale against the adoption or promotion of "absolute truths."

<http://www.wisehypnosis.com/articles/stories-parables/the-blind-men-and-the-elephant-parable/>

# Which Equation? Why One Equation?

**My goal is to teach macroeconomics in an accessible way**

- ① Sketch a big picture to help students connect the dots
- ② Bridge the gaps between theories (models) and practice (data)
- ③ Create authentic learning experiences that spark interest and foster skills

# Macroeconomics in One Equation: MV=PY

$$MV = PY$$

$$Y = F(K, L)$$

$$AD = Y^* = AS$$

$$Y = C + I + G + NX$$

$$\pi = \frac{\Delta P}{P} \approx \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

$$M_D = M_D(P, Y, i) = \overline{M_S}$$

$$i \approx r + \pi^e$$

- ① Y: National income
- ② L: Labor market condition
- ③ P: Price level and inflation
- ④ M: Money and interest rate
- ⑤ Y: Long-run economic growth
- ⑥ Y: Short-run economic fluctuation
- ⑦ Y: Consumption and investment
- ⑧ P-L: Inflation and unemployment
- ⑨ Y-L: Economic growth and employment
- ⑩ G: Government budget and fiscal policy
- ⑪ M: Central banking and monetary policy

# Effectiveness: Student Poll

13 - What are the major challenges to you studying macroeconomics? [choose all applicable to you]				
Response Option	Weight	Frequency	Percent	Percent Responses
Scientific methods	(1)	1	9.09%	<div style="width: 9.09%;"></div>
Data and measurements	(2)	1	9.09%	<div style="width: 9.09%;"></div>
Numerical calculation	(3)	2	18.18%	<div style="width: 18.18%;"></div>
Quantitative reasoning	(4)	2	18.18%	<div style="width: 18.18%;"></div>
Theoretical concepts & models	(5)	10	90.91%	<div style="width: 90.91%;"></div>
Response Rate	11/13 (84.62%)			

14 - Do you think learning macroeconomics via the quantity equation approach ( $MV=PY$ ) is helpful?				
Response Option	Weight	Frequency	Percent	Percent Responses
Strongly agree	(1)	2	18.18%	<div style="width: 18.18%;"></div>
Agree	(2)	8	72.73%	<div style="width: 72.73%;"></div>
Disagree	(3)	1	9.09%	<div style="width: 9.09%;"></div>

0 25 50 100

Note: Taught at Colby College in Fall 2022 - Principles of Macroeconomics

## Learning Activity 1: FOMC Press Conference



<https://www.federalreserve.gov/videos.htm>

## Monetary Policy Decisions

Watch the Fed chair report and prepare for two questions.

- ① What are the most essential macroeconomic indicators watched by the Federal Reserve? Please list only four.
- ② According to the Fed, how was/is the U.S. economy doing?

More important for today, we want to reverse-engineer the policy logic.

- ① Why does the Fed focus on these four indicators?
- ② Is there a (simplified) theoretical foundation?
- ③ What are the policy implications?

Text **BCHEN003** to **37607** once to join, then text your message

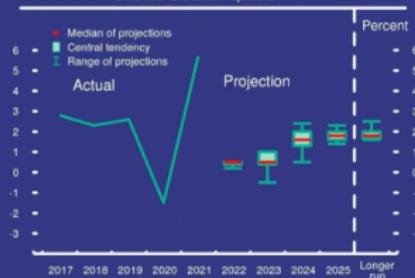
## What are the key economic indicators watched by the Fed chair?

The word cloud is centered around the word "inflation" in large, bold, blue font. Other prominent words include "rate" (brown), "gdp" (purple), "labor" (orange), "employment" (pink), "unemployment" (teal), and "market" (green). Smaller words scattered around the center include "demand", "growth", "stability", "interest", "interest-rate", "job", "availability", "rates", "aggregated-demand", "labor-market", "supply", "(price)", "housing-market", "mortgage", "job-interest", "price-stability", "mortgage", "interest", "consumer-price-index", "labor-demand-supply-gdp", "unemployment-rate", "inflation-rate", "aggravated-supply", and "text". The words are in various colors including blue, brown, purple, orange, pink, teal, green, and yellow.

# FOMC Economic Projections

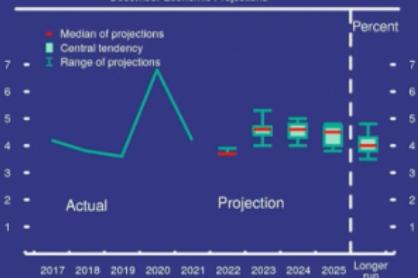
## Change in Real GDP

December Economic Projections



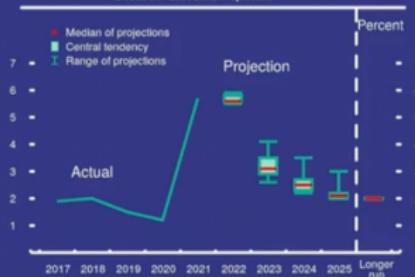
## Unemployment Rate

December Economic Projections



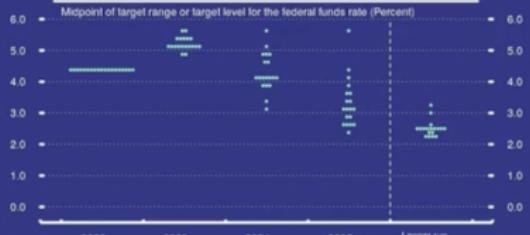
## PCE Inflation

December Economic Projections



## Assessments of Appropriate Monetary Policy

December Economic Projections



Source: FOMC Press Conference December 14, 2022

# KEY ECONOMIC INDICATORS

The five key series the Federal Open Market Committee (FOMC) highlights in its projection materials

[VIEW KEY SERIES](#)

**Real GDP Growth: 2.6%**

*Q4 2022*

**Unemployment Rate: 3.5%**

*March 2023*

**PCE Inflation: 5.0%**

*February 2023*

**Core PCE Inflation: 4.6%**

*February 2023*

**Federal Funds Rate: 4.8%**

*April 11, 2023*



## Labor Markets

More on employment  
and participation



## Inflation

More on prices and  
expectations



## GDP Breakdown

More on GDP and its  
components

<https://stlouisfed.shinyapps.io/macro-snapshot>

## Learning Activity 2: Monetary Experiment

A simple economy produces one type of good—apple.

Money is introduced to measure the value of the good.

- ① In the first period, the economy produces 1 apple and has 1-dollar bill in use. What should be the price of apple? 2-dollar bill?
- ② In the second period, the economy prints out an extra 10-dollar bill. What should be the unit price of apple?
- ③ In the third period, the economy produces 2 apples and has 12 dollar bills in total. What should be the unit price of apple?
- ④ If the same apple is sold for 1 dollar in the US and 100 yen in Japan, what should be the exchange rate between USD and JPY?

An experimental approach to economic studies: Controlled settings enable students to disentangle causes and effects clearly.

## Learning Activity 2: Gadgets for the Experiment



Two apples & Two One Dollar Bills & One Ten Dollar Bill

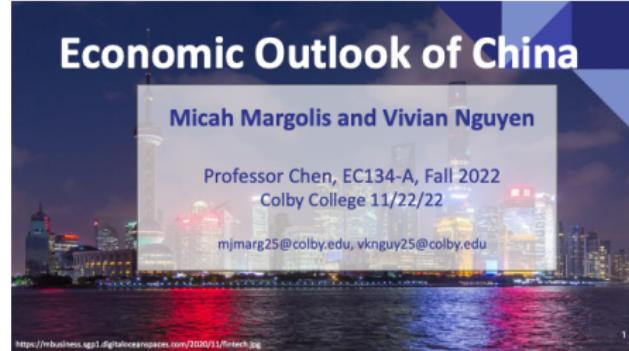
## Learning Activity 3: Economic and Policy Outlooks

Two students can work as a team and choose a country (non-US) or region of your interest and report its economic conditions based on the most recent data available. Collect data on the key economic indicators, present their patterns and provide descriptions/interpretation for each indicator, including the outlooks. Time series trends and cross-country comparisons recommended.

- ① National income/output
- ② Labor market conditions
- ③ Price level and inflation
- ④ Money and interest rates
- ⑤ Financial markets (optional)

Economic outlook must present current economic conditions as well as near-future outlooks. Focus on the most essential economic indicators in the following five categories.

# Learning Activity 3: Students Presentations



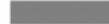
<https://sites.google.com/view/money-theory/projects>

## Learning Activity 3: Effectiveness Measure

### 15 - Do you think learning macroeconomics via the Economic Outlook project is helpful?

Response Option	Weight	Frequency	Percent	Percent Responses					
Strongly agree	(1)	6	54.55%						
Agree	(2)	4	36.36%						
Disagree	(3)	1	9.09%						
0	25	50	100						
Response Rate	Mean	STD	Median	Department	Mean	STD	Median	Division	
11/13 (84.62%)	1.55	0.69	1.00	11	1.55	0.69	1.00	11	

### 16 - What materials and resources in this course are most helpful/valuable? [choose all applicable to

Response Option	Weight	Frequency	Percent	Percent Responses
Lectures and discussions	(1)	5	45.45%	
Lecture slides and notes	(2)	7	63.64%	
Office hours and newsletters	(3)	2	18.18%	
Weekly assignments and quizzes	(4)	9	81.82%	
Exam practices and exam guides	(5)	7	63.64%	
Course websites, readings, videos	(6)	3	27.27%	

Note: Taught at Colby College in Fall 2022 - Principles of Macroeconomics

# Learning Activity 4: Macro Data Analysis Projects

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## Macroeconomics Research Project III U.S. Unemployment, GDP Growth, and Inflation

In this project, our task is threefold: 1) examine the unemployment situation in 2008 financial crisis; 2) explore the long run relation between real GDP growth rate and unemployment rate; 3) investigate the long run relation between inflation rate and unemployment rate. Please follow the steps below and download relevant dataset.

1. Review lectures on GDP, inflation, and unemployment.
2. Access Labor Force Statistics at BLS <http://data.bls.gov/cgi-bin/surveymost?ln>
  - a. Select "Unemployment Rate - LNS14000000"
  - b. Click "Retrieve data", select years from "2006 to 2020"
  - c. Download the ".xlsx" file for this series in a spreadsheet
3. Access Labor Force Statistics at BLS <http://data.bls.gov/cgi-bin/surveymost?ln>
  - a. Select Unemployment Rate - "White - LNS14000003", "Black or African American - LNS14000006", "Asian - LNS14032183", "Hispanic or Latino - LNS14000009"
  - b. Click "Retrieve data", select years from "2006 to 2020"
  - c. Download the ".xlsx" files for each series in separate spreadsheet
4. Access Labor Force Statistics at BLS <http://data.bls.gov/cgi-bin/surveymost?ln>
  - a. Select Unemployment Rate - 25 Years & Over, "Less than a High School Diploma - LNS14027659", "High School Graduates No College - LNS14027660", "Some College or Associate Degree - LNS14027689", "Bachelor's Degree and Higher - LNS14027662"
  - b. Click "Retrieve data", select years from "2006 to 2020"
  - c. Download the ".xlsx" files for each series in separate spreadsheet
5. Access FRED Economic Data at Federal Reserve Bank of St. Louis and download the three series. From "Edit Graph" item, all select Frequency "Annual", Aggregation Method "Average", Data Range "1950 to 2020".
  - a. Civilian Unemployment Rate (UNRATE), select "Percent" in Units <https://research.stlouisfed.org/fred2/series/UNRATE/downloaddata>
  - b. Real Gross Domestic Product (GDPCL), select "Percent Change from Year Ago" <https://research.stlouisfed.org/fred2/series/GDPCL/downloaddata>
  - c. Consumer Price Index: All Items (CPIAUCSL), select "Percent Change from Year Ago" <https://research.stlouisfed.org/fred2/series/CPIAUCSL/downloaddata>

### I. Unemployment Situation during and after the 2008 financial Crisis

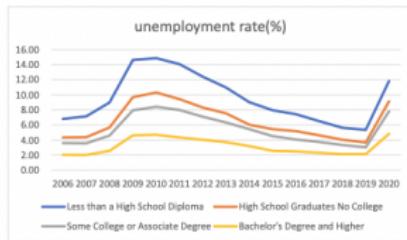
1. Employ the data from step 2 to analyze the overall unemployment situation during the sample period.
  - a. Calculate the average unemployment rate for each year from 2006 to 2020 using the monthly data. Plot this newly calculated time series in a graph.
  - b. What patterns can be observed from the calculated time series? What is the maximum and minimum? Any trends or cycles? Does the series coincide with the business cycle? Explain.
  - c. From the data, can you estimate the natural rate of unemployment for the past 10 years? Explain.

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2. Employ data from step 3 to analyze the unemployment rate by ethnicity during the sample period.
  - a. For each ethnicity, calculate the average unemployment rate in each year using the monthly data.
  - b. Open a new spreadsheet, copy and paste four calculated the unemployment rate series in it.
  - c. Plot the average unemployment rate series (2006-2020) for the four ethnicities in one graph.
  - d. What patterns can be observed? Any trends or cycles? Do they share any common features?
  - e. Which ethnicity has the lowest unemployment rate in the sample period? Highest rate?
  - f. Could you provide any explanations from the economic concepts or models studied?
3. Employ data from step 4 to analyze the unemployment rate by education in the sample period.
  - a. For each education level, calculate the average unemployment rate in each year using the monthly data in the spreadsheet.
  - b. Open a new spreadsheet, copy and paste four calculated the unemployment rate series in it.
  - c. Plot the average annual unemployment rate series (2006-2020) for the four educational levels in one graph. Comment on the patterns. Any trends or cycles? Do they share any similarities?
  - d. Which education level has the lowest unemployment rate in the sample period? Highest rate?
  - e. Could you provide any explanations from the economic concepts or models studied?
- II. U.S. Unemployment Rate, Output Growth, and Inflation Rate in the Long Run (1950-2020)
4. Employ data from step 5 to analyze the relations between unemployment rate and GDP growth rate.
  - a. Plot the two time series in the same graph for the entire sample period. For each series, what patterns can be observed from the date or the graph? Any trends or cycles? Do they follow any similar or common patterns? Explain in detail.
  - b. Do the unemployment series and real GDP growth rate series correlate with one another? Are they positively or negatively correlated? What is the economic explanation for such correlation?
  - c. Which series is the first mover? Which is the second? Is one always leading or lagging the other in the same sample period? Which series is more likely to cause the change in the other? Explain.
5. Employ data from step 5 to analyze the relations between unemployment rate and inflation rate.
  - a. Plot the two time series in the same graph for the sample period 1950-2020. What patterns can be observed from the data or the graph? Any trends or cycles? Explain in detail.
  - b. Plot the inflation rate against unemployment rate for the whole sample period (71 years). Calculate the sample correlation coefficient between them. Is there a tradeoff between the two?
  - c. Plot the inflation rate series against unemployment rate series in a graph for the period 1950 to 1959, and then for 1960 to 1969, and so on for every subsequent ten-year period until the last for last period 2010 to 2019. In total, there are seven graphs.
  - d. For each of the sub-period graphs, do you observe a tradeoff relation between unemployment rate and inflation rate? Can you find a period when the trade-off relation is most evident?
  - e. What are the economic models and explanations for the short-run and long-run relations between the two variables?

# Learning Activity 4: Student Project Sample



Unemployment rates of workers with different education levels share the same characteristics and change in the same direction. No matter what level of education workers are, when the economic cycle is upward, the unemployment rate will decrease.

4. Which education level has the lowest unemployment rate in the sample period? Highest rate?

The higher the level of education, the lower the unemployment rate. The unemployment rate of people with "bachelor's degree and higher" education level is the lowest, and the unemployment rate of people with "less than a high school diploma" education level is the highest.

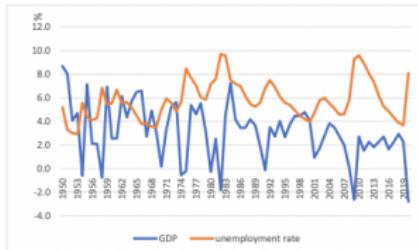
5. Could you provide any explanations from the economic concepts or models studied?

From the perspective of demand, education is an important human capital. Through education, we can improve the quality of labor, improve the working ability of workers, increase the productivity of workers, thus increasing the demand of the labor market for highly educated workers and reducing the unemployment rate. From the perspective of supply, education expenditure increases the opportunity cost of not working, so people with higher education levels tend to find jobs quickly and reduce unemployment costs.

## II. U.S. Unemployment Rate, Output Growth, and Inflation Rate in the Long Run (1950-2020)

4. Employ data from step 5 to analyze the relations between unemployment rate and GDP growth rate.

1. Plot the two time series in the same graph for the entire sample period. For each series, what patterns can be observed from the data or the graph? Any trends or cycles? Do they follow any similar or common patterns? Explain in detail.



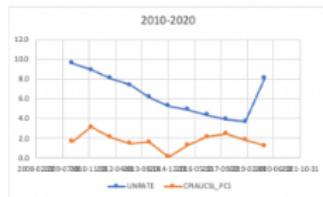
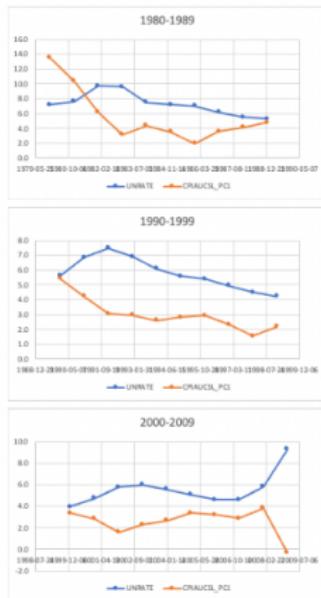
The changes of unemployment rate and GDP are cyclical and fluctuate around a certain value.

Because consumption is relatively stable, the fluctuations of investment bring about economic fluctuations. During the expansion period, the rapid expansion of investment drives the rapid expansion of industrial production, causes the rapid expansion of demand, drives the chain of various social demands to flourish, further drives the rapid expansion of industrial production and the entire social production, which drives the economic growth and decreases the unemployment rate. The economic expansion will eventually be constrained by supply and demand, which, according to the transmission chain during the expansion, will correspondingly lead to the contraction of direct demand and indirect demand. Thus, the economic growth and unemployment rate will fluctuate.

2. Do the unemployment series and real GDP growth rate series correlate with one another? Are they positively or negatively correlated? What is the economic explanation for such correlation?

There is a negative correlation between unemployment rate and GDP growth rate. If the economy grows rapidly, enterprises will expand production, increase investment, increase employment and reduce unemployment, and vice versa.

# Learning Activity 4: Student Project Sample



d. For each of the sub-period graphs, do you observe a tradeoff relation between unemployment rate and inflation rate? Can you find a period when the trade-off relation is most evident?

According to the Phillips curve, the only observable trade-off between the two variables happens in the short run. In the 1960's graph, we see this best exemplified. However, shortly after, in the 1970's, the idea that the Phillips curve could exist started to fade as less trade off was observed because both variables were on the rise due to stagflation. But, the idea that the tradeoff between the two variables still ensued only in the short run. In 2000-2009 we see this tradeoff happening again by what we see depicted in the graph. When one variable goes up, the other goes down, and vice versa. We could say the same about the year 2020, where we see an increase in unemployment and a decrease in inflation. All of these examples are short run examples.

e. What are the economic models and explanations for the short-run and long-run relations between the two variables?

In the long run, these two variables are unrelated. We see a vertical line representing the natural rate of unemployment. Any attempt to change the inflation rate would only move up and down on the vertical line of the natural rate of unemployment. See the figure below<sup>4</sup>.

<sup>4</sup> Libretexts. "23.1: The Relationship between Inflation and Unemployment." Social Sci LibreTexts. Libretexts, January 4, 2021. [https://socialsci.libretexts.org/Bookshelves/Economics/Book%3A\\_Economics\\_\(Boundless\)/23%3A\\_Inflation\\_and\\_Unemployment/23.1%3A\\_The\\_Relationship\\_Between\\_Inflation\\_and\\_Unemployment](https://socialsci.libretexts.org/Bookshelves/Economics/Book%3A_Economics_(Boundless)/23%3A_Inflation_and_Unemployment/23.1%3A_The_Relationship_Between_Inflation_and_Unemployment).

# Summary: Learning Activities for Integration

- ① FOMC policy brief as an overview introduction (the big picture)
  - Format: In-class learning, video watching Q&A, PollEverywhere
  - Purpose: US economy, policy relevance, monetary policy logic
- ② Classroom experiment as a theoretical illustration (the connection)
  - Format: In-class controlled experiment, authentic description, Q&A,
  - Purpose: help students develop the intuition, identify causal effects
- ③ Economic outlooks as a practical guide (application and extension)
  - Format: student group exercise and short presentation
  - Purpose: bridge the gap between theory and practice
  - Schedule: Before or after the midterm
- ④ Data projects as skill development (analysis and evaluation)
  - Format: supervised macro data analytical projects
  - Purpose: bridge the gap between model and data
  - Schedule: After the midterm exam

Enjoy Teaching!  
Thank you very much!