HE1002 Macroeconomics I

Problem Sheet 10 – Problems & Solutions

Academic Year 2025/2026, Semester 1

Quantitative Research Society @NTU

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Problem 10-1

Two series of hypothetical price index values used to calculate headline and core inflation for 2014 through 2018 are found in Table 16P-1.

(a) Calculate the annual inflation rate for each series.

Solution:

Formula: Inflation rate $= \frac{\text{Index}_{\text{current year}} - \text{Index}_{\text{prior year}}}{\text{Index}_{\text{prior year}}} \times 100\%$

Series 1:

$$2015: \quad \frac{137.22 - 134}{134} \times 100 = \mathbf{2.40\%}$$

$$2016: \quad \frac{141.26 - 137.22}{137.22} \times 100 = \mathbf{2.94\%}$$

$$2017: \quad \frac{146.24 - 141.26}{141.26} \times 100 = \mathbf{3.53\%}$$

$$2018: \quad \frac{148.81 - 146.24}{146.24} \times 100 = \mathbf{1.76\%}$$

Series 2:

$$2015: \quad \frac{127.56 - 125.00}{125.00} \times 100 = \mathbf{2.05\%}$$

$$2016: \quad \frac{129.68 - 127.56}{127.56} \times 100 = \mathbf{1.66\%}$$

$$2017: \quad \frac{132.72 - 129.68}{129.68} \times 100 = \mathbf{2.34\%}$$

$$2018: \quad \frac{135.72 - 132.72}{132.72} \times 100 = \mathbf{2.26\%}$$

(b) Which series represents core inflation and which represents headline inflation?

Solution:

Series 1 represents **headline inflation**.

Series 2 represents **core inflation**.

(c) How do you know? Is there inflation or deflation in each year?

Solution:

Series 2 rises smoothly and steadily, indicating that it is core inflation, which is more smooth and stable compared to Series 1, which portrays larger swings and volatility (characteristic of headline inflation that includes volatile food and energy prices).

Inflation vs. Deflation: All annual rates are positive for both series, so there is **inflation** (no deflation) in every year from 2015–2018.

Problem 10-2

Determine whether each of the following events is likely to cause deflation, disinflation, no change in the price level, or inflation.

(a) A bubble in the biomedical industry just burst.

Solution:

Disinflation. When a bubble bursts, demand decreases and asset prices fall. Overall price levels reduce, indicating disinflation (prices still rising but at a slower rate).

(b) A new technology is introduced into the economy, sparking an economic boom.

Solution:

Inflation. During an economic boom, demand for goods and services increases faster than supply can respond. Firms raise prices, leading to inflation.

(c) The Federal Reserve conducts contractionary monetary policy.

Solution:

Disinflation. Contractionary monetary policy increases interest rates, reducing borrowing and spending. This slows inflation (it's still increasing but at a slower rate).

(d) The Federal Reserve is successful at meeting its dual mandate of full employment and price stability.

Solution:

No change in the price level. Price stability means inflation remains constant at the Fed's target (2

Problem 10-3

Identify whether the following individuals will be affected by bracket creep next year given the rates of taxation and levels of inflation found in Table 16P-2.

Marginal tax rate (%)	Income level ($)
10	0–10,000
15	10,001–30,000
18	30,001–50,000
20	50,001–100,000
23	100,001–150,000
25	150,001 and up

(a) Gabriela makes $9,500, and inflation is at 5 percent.

Solution:

New nominal income: $\$9{,}500 \times 1.05 = \$9{,}975$

NO bracket creep. She remains in the same tax bracket.

(b) Cooper makes $160,000, and inflation is at a record high of 20 percent.

Solution:

New nominal income: $\$160{,}000 \times 1.20 = \$192{,}000$

NO bracket creep. He is already in the top tax bracket.

(c) Shawna makes $140,000, and inflation is at 8 percent.

Solution:

New nominal income: $\$140{,}000 \times 1.08 = \$151{,}200$

YES, bracket creep. She now enters the bracket above $150,000.

(d) Samuel makes $45,000, and inflation is at 6 percent.

Solution:

New nominal income: $\$45{,}000 \times 1.06 = \$47{,}700$

NO bracket creep. He remains in the same tax bracket.

(e) Marguerite makes $96,000, and inflation is at 6 percent.

Solution:

New nominal income: $\$96{,}000 \times 1.06 = \$101{,}760$

YES, bracket creep. She now enters the bracket above $100,000.

Problem 10-4

Cookie Monster has decided to channel his love of cookies into a new business, "Me Want Cookies Inc.," a new partnership he has formed with Miss Piggy. They are considering different countries in which to start their venture and would like to rank the countries based on the inflationary environment. They decide to give a country 10 "menu-cost" points for each percent of actual inflation in the last year, since inflation will cause their menu costs to increase. They also dislike unstable inflation, so they will give a country 20 "uncertainty" points for each percent difference in the actual inflation rate when compared to the projected inflation rate. Countries with the least total points will receive the highest rankings. Complete Table 16P-3 for Cookie Monster.

Table 16P-3

Country	Projected inflation (%)	Actual inflation (%)	Uncertainty points	Menu-cost points	Total points	Rank
Kermikopia	2	4	40	40	80	1
Gonzoland	4	5	20	50	70	1
Elmostan	7	8	20	80	100	3
Oscaria	10	13	60	130	190	5
Bertico	14	14	0	140	140	4

Solution:

Calculate for each country: - **Menu-cost points**: $10 \times$ Actual inflation - **Uncertainty points**: $20 \times |\text{Actual inflation} - \text{Projected inflation}|$ - **Total points**: sum of Menu-cost and Uncertainty points. - **Rank**: 1 = lowest total points, 5 = highest.

Calculations:

- Kermikopia: Menu-cost $= 10 \times 4 = 40$, Uncertainty $= 20 \times |4 - 2| = 40$, Total $= 80$
- Gonzoland: Menu-cost $= 10 \times 5 = 50$, Uncertainty $= 20 \times |5 - 4| = 20$, Total $= 70$
- Elmostan: Menu-cost $= 10 \times 8 = 80$, Uncertainty $= 20 \times |8 - 7| = 20$, Total $= 100$
- Oscaria: Menu-cost $= 10 \times 13 = 130$, Uncertainty $= 20 \times |13 - 10| = 60$, Total $= 190$
- Bertico: Menu-cost $= 10 \times 14 = 140$, Uncertainty $= 20 \times |14 - 14| = 0$, Total $= 140$

Ranking (least points = highest rank): 1. Gonzoland (70) 1. Kermikopia (80) 3. Elmostan (100) 4. Bertico (140) 5. Oscaria (190)

Note: Ties in ranking are listed with the same rank number above for countries with close total points.

Problem 10-5

Jack recently took out a loan from Diane at an interest rate of 6 percent. Diane expected this year's inflation rate to be 3 percent and the real interest rate to be 3 percent. The loan is due at the end of this year. Complete Table 16P-4, showing the real interest rate for each

possible inflation rate. For each situation, determine whether the unexpected inflation level benefits Jack or Diane.

Table 16P-4

This year's actual inflation rate (%)	Actual real interest rate (%)	Who benefits?
1	5	Diane
2	4	Diane
-1	7	Diane
-3	9	Diane

Solution:
To find the actual real interest rate, use:

$$\text{Real interest rate} = \text{Nominal interest rate} - \text{Actual inflation rate}$$

Given the nominal interest rate is 6%:

- For actual inflation rate 1%: $6 - 1 = 5\%$ (Diane benefits)
- For actual inflation rate 2%: $6 - 2 = 4\%$ (Diane benefits)
- For actual inflation rate -1%: $6 - (-1) = 7\%$ (Diane benefits)
- For actual inflation rate -3%: $6 - (-3) = 9\%$ (Diane benefits)

If actual inflation rate is lower than expected (expected was 3%), the real interest rate is higher than expected, which benefits the lender (Diane). If actual inflation were higher than 3%, Jack would benefit.

Problem 10-6

Assume the prices shown in Table 16P-5 are the prices of Big Macs in 2030, 2031, and 2032, and that changes in the price of Big Macs tend to closely keep up with inflation. For each of the four instances, determine the following.

Table 16P-5

	Price in 2030 ($)	Price in 2031 ($)	Price in 2032 ($)
a.	1.00	1.02	1.03
b.	1.00	0.99	0.97
c.	0.01	0.05	1.00
d.	1.00	1.10	1.15

(a) **The percentage changes in price levels between each consecutive year.**

Solution:

- a.
  2030–2031: $(1.02 - 1.00)/1.00 \times 100\% = 2\%$
  2031–2032: $(1.03 - 1.02)/1.02 \times 100\% \approx 0.98\%$

- b.
  2030–2031: $(0.99 - 1.00)/1.00 \times 100\% = -1\%$
  2031–2032: $(0.97 - 0.99)/0.99 \times 100\% \approx -2.02\%$

- c.
  2030–2031: $(0.05 - 0.01)/0.01 \times 100\% = 400\%$
  2031–2032: $(1.00 - 0.05)/0.05 \times 100\% = 1900\%$

- d.
  2030–2031: $(1.10 - 1.00)/1.00 \times 100\% = 10\%$
  2031–2032: $(1.15 - 1.10)/1.10 \times 100\% \approx 4.55\%$

(b) **Whether the economy was experiencing inflation, deflation, disinflation, or hyperinflation over each period. (Assume that inflation above 100 percent constitutes hyperinflation.)**

Solution:

- a. Inflation in both periods, disinflation in 2031–2032 (rate slows).
- b. Deflation in both periods (prices falling).
- c. Hyperinflation in both periods (rates: 400% and 1900%).
- d. Inflation in both periods, disinflation in 2031–2032 (rate slows).

Problem 10-7

Assuming that inflation above 100 percent is hyperinflation, categorize each of the inflation rates in Table 16P-6 as deflation, disinflation, inflation, or hyperinflation as we move from one year to the next.

Table 16P-6

	Year	Inflation rate (%)	Description
a.	1900	90	Inflation
b.	1901	80	Disinflation
c.	1902	120	Hyperinflation
d.	1903	40	Disinflation
e.	1904	-2	Deflation

Solution:

- 1900: Inflation (rate positive, under 100%)
- 1901: Disinflation (rate positive, but lower than previous year)
- 1902: Hyperinflation (rate above 100%)
- 1903: Disinflation (rate positive, but much lower than previous year)
- 1904: Deflation (rate negative)

Problem 10-8

In Frigidia, you earn \$100/month and can exchange at 1,000 frigids/\$. Your heating bill costs \$10 or you could burn frigid notes at 1 million per month.

Solution:

Current situation:

$$\begin{aligned} \text{Heating bill in frigids:} &\quad \$10 \times 1{,}000 = 10{,}000 \text{ frigids} \\ \text{Burning cost:} &\quad 1{,}000{,}000 \text{ frigids/month} \end{aligned}$$

Break-even exchange rate:

$$\frac{1{,}000{,}000}{10} = 100{,}000 \text{ frigids/\$}$$

At an exchange rate of 100,000 frigids/\$, burning bills becomes as expensive as paying the heating bill.

Inflation represented: This exchange rate is 100 times the original rate, representing **hyperinflation** of approximately 9,900%.

Problem 10-9

A central bank official says: "The problem wasn't having the wrong idea about interest rates, but rather not having the right idea about inflation rates." Explain.

Solution:

Key principle: Central banks target nominal interest rates, but what affects the economy is the **real interest rate**.

$$\text{Real interest rate} = \text{Nominal interest rate} - \text{Expected inflation rate}$$

The problem: Incorrect inflation predictions cause deviations from the target real rate.

- **Underestimating inflation:** Real rate ends up lower than intended → monetary policy is too loose → excess expansion and higher inflation.
- **Overestimating inflation:** Real rate ends up higher than intended → monetary policy is too tight → unnecessary contraction and slower growth.

Both scenarios lead to ineffective monetary policy and increased economic inefficiency.

Problem 10-10

In which scenario is monetary policy likely to be more effective: (A) inflation near zero for 3 years, or (B) inflation averaging 3% for 3 years?

Solution:

Scenario B (3% inflation) is more effective.

Reasoning:

- **Effective Lower Bound problem:** When inflation is near zero, nominal interest rates are also near zero, leaving little room for the Fed to lower rates further during a recession.
- **Flexibility with moderate inflation:** With 3% average inflation, the Fed can lower nominal rates to accommodate expansionary policy in downturns.
- **Policy space:** Moderate positive inflation provides greater flexibility for counter-cyclical monetary policy.

Problem 10-11

A country experiences a 2% decline in equilibrium real wage. Consider two inflation scenarios.

(a) If inflation rate is zero percent, what must happen to nominal wages?

Solution:

Nominal wages must decrease by 2%.

With zero inflation: Real wage change = Nominal wage change - 0%

To reduce real wages by 2%, nominal wages must fall 2%.

(b) If inflation rate is 4 percent, what must happen to nominal wages?

Solution:

Nominal wages must increase by 2%.

With 4% inflation: Real wage change = Nominal wage change - 4%

-2% = Nominal wage change $- 4\%$

Nominal wage change = 2%

(c) Do workers and employers prefer zero or 4 percent inflation?

Solution:

Both prefer 4% inflation.

- **Employers:** Can reduce real labor costs via nominal wage increases (2% raise) rather than cutting nominal wages. Moderate inflation "greases the wheels" of the labor market.

- **Workers:** Prefer receiving a 2% raise over a 2% wage cut, even though the real effect is the same. People exhibit downward nominal wage rigidity.

Problem 10-12

Which of the following can be affected by money supply in the long run?

Solution:

By the **neutrality of money**, money supply changes only affect nominal variables, not real variables, in the long run.

(a) Nominal GDP. **YES, affected**

(b) Real GDP. **NO, not affected**

(c) Inflation. **YES, affected**

(d) Unemployment. **NO, not affected** (returns to natural rate in long run)

Problem 10-13

Salaries and all prices reduced by 40%. Initial salary: \$62,000.

Solution:

(a) New salary: $60\% \times \$62{,}000 = \mathbf{\$37{,}200}$

(b) New spending:

$$\begin{aligned} \text{Housing:} &\quad 60\% \times \$24{,}800 = \$14{,}880 \\ \text{Food:} &\quad 60\% \times \$11{,}160 = \$6{,}696 \\ \text{Transportation:} &\quad 60\% \times \$11{,}160 = \$6{,}696 \\ \text{Other:} &\quad 60\% \times \$14{,}880 = \$8{,}928 \end{aligned}$$

(c) Real salary: **Unchanged.** Purchasing power remains the same since both income and prices fell proportionally.

Problem 10-14

Congress redefines "five pounds" as "one pound."

Solution:

(a) Someone who weighed 180 pounds would now weigh: $\frac{180}{5} = \mathbf{36}$ **pounds**

(b) **Nominal change:** Yes (the number changed from 180 to 36).

Real change: No (the person's actual mass didn't change).

(c) **Similarity to monetary policy:** Congress "shrunk the pound supply" by redefining it, just as contractionary monetary policy shrinks the money supply. Both are purely nominal changes that don't affect real quantities.

Problem 10-15

Is your friend overstating the Fed's control over price levels and output?

Solution:

Yes, the friend is overstating the Fed's control.

Explanation:

- **Short run:** The Fed can influence nominal interest rates and money supply, which affect output and employment through changes in aggregate demand.
- **Long run:** The neutrality of money means money supply changes affect only nominal variables (prices, wages), not real variables (output, unemployment).
- **The limitation:** The Fed can't permanently change the level of output beyond the natural rate or the unemployment rate beyond the natural rate. These are determined by real factors (productivity, labor force, capital stock).

Problem 10-16

Griffingate uses wizcoins; velocity is constant at 10,000 transactions/year. Real GDP = 1,000 wizcoins; Money supply = 2,000 wizcoins.

Quantity Equation: $MV = PY$

(a) What are M, V, and P?

Solution:

$$M = 2{,}000$$
$$V = 10{,}000$$
$$P = \frac{MV}{Y} = \frac{2{,}000 \times 10{,}000}{1{,}000} = 20{,}000$$

(b) For each scenario, indicate how variables respond:

(i) Money supply increases to 4,000; prices increase twofold.
Real GDP would **increase to 2,000 wizcoins**.

(ii) Real GDP drops to 500; money supply constant.
Price level would **drop to 10,000**.

(iii) Prices increase threefold; money supply constant.
Real GDP would **drop to 333.33 wizcoins**.

(iv) Money supply increases to 5,000; prices rise 350%.
Real GDP would **remain at 1,000 wizcoins** (determined by real factors).

Problem 10-17

Express relationships using the quantity theory: $MV = PY$

Solution:

(a) Money supply from nominal GDP and velocity:

$$M = \frac{\text{Nominal GDP}}{V} = \frac{PY}{V}$$

(b) Relationship of money supply to price level equals relationship of real GDP to velocity:

$$\frac{M}{P} = \frac{Y}{V}$$

(c) Real GDP from money flow and price level:

$$Y = \frac{MV}{P}$$

(d) Price level from money supply, velocity, and real GDP:

$$P = \frac{MV}{Y}$$

Problem 10-18

Economy experiencing positive output gap.

Solution:

(a) Inflation: **Increasing**

(b) Output vs. potential: **Greater than potential output**

(c) Unemployment: **Falling**

(d) Fed policy: **Contractionary monetary policy** (to cool overheating)

(e) Expansion or contraction: **Expansion** (actual output ¿ potential)

Problem 10-19

Economy experiencing negative output gap.

Solution:

(a) Inflation: **Decreasing** (or deflation)

(b) Output vs. potential: **Less than potential output**

(c) Unemployment: **Rising**

(d) Fed policy: **Expansionary monetary policy** (to stimulate economy)

(e) Expansion or contraction: **Contraction** (actual output ¡ potential)

Problem 10-20

When would the Fed pursue contractionary, expansionary, or no change in policy?

Solution:

(a) Inflation 10% (average 3%). **Contractionary** (inflation far above target)

(b) Positive output gap. **Contractionary** (economy overheating)

(c) Unemployment at record high. **Expansionary** (stimulate employment)

(d) Full employment. **No change** (economy at equilibrium)

(e) Brink of deflation. **Expansionary** (avoid deflationary spiral)

(f) New technology causes output surge. **No change** (favorable supply shock)

Problem 10-21

Phillips curve: $U = -I + 15$; NAIRU = 8%; inflation changes to 14%.

Solution:

Short-run unemployment:

$$U_{\text{SR}} = -14 + 15 = \mathbf{1\%}$$

Long-run unemployment: 8% (returns to NAIRU)

The economy initially experiences lower unemployment as inflation rises (Phillips curve tradeoff), but in the long run, unemployment returns to the natural rate as expectations adjust.

Problem 10-22

Using what you know about the Phillips curve, determine whether the following quantities will increase, decrease, or remain the same.

(a) Unemployment in the short run after an increase in inflation.

(b) Unemployment in the long run after an increase in inflation.

(c) Inflation in the short run after a decrease in unemployment.

(d) Inflation in the long run after a decrease in unemployment.

Solution:

(a) **Decrease**. According to the short-run Phillips curve, there is an inverse relationship between unemployment and inflation: when inflation increases, unemployment decreases in the short run.

(b) **Remain the same**. In the long run, the Phillips curve is vertical at the natural rate of unemployment (NAIRU). An increase in inflation does not affect the long-run equilibrium unemployment rate.

(c) **Increase**. In the short run, a decrease in unemployment is associated with higher inflation.

(d) **Remain the same**. In the long run, a decrease in unemployment below the natural rate is not sustainable; inflation may accelerate (if expectations adapt), but eventually unemployment returns to the natural rate so long-run inflation does not permanently change solely due to a temporary drop in unemployment.