HE1002 Macroeconomics I

Problem Sheet 5 – Problems & Solutions

Academic Year 2025/2026, Semester 1

Quantitative Research Society @NTU

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Problem 5-1

"People who earn more income tend to have higher levels of consumption spending, so the value of their marginal propensity to consume must be greater than that of lower income people." Do you think this is a true statement? Why or why not?

Solution:

This statement is **false**. While it is true that people who earn more income tend to have higher levels of consumption spending (in absolute dollars), the **marginal propensity to consume (MPC)** measures the additional consumption from an additional dollar of income, not the absolute level of consumption.

In fact, empirical evidence suggests that the MPC is relatively stable across different income levels and is typically lower for higher-income households. Higher-income individuals tend to save a larger proportion of their additional income, meaning their MPC is often equal to or lower than that of lower-income individuals.

Problem 5-2

Do you think there is a predictable relationship between the business cycle and aggregate investment spending? Why or why not?

Solution:

Yes, there is a predictable relationship. Aggregate investment spending is procyclical—it moves in the same direction as the business cycle:

- During expansions, firms expect higher profits, business confidence is high, and interest rates may be favorable. Investment increases.

- During recessions, firms expect lower profits, business confidence declines, and firms are reluctant to undertake new projects. Investment decreases.

This relationship is particularly strong for business fixed investment (plant and equipment). Residential investment is also procyclical but can lead or lag the business cycle depending on housing market conditions.

Problem 5-3

"During a recession more people qualify for unemployment insurance. This will increase the government spending category of GDP and help reduce the severity of the recession." Do you agree with this statement? Why or why not?

Solution:

This statement is partially true but contains an important error. During a recession, more people do qualify for unemployment insurance benefits, but unemployment insurance is a **transfer payment**, not government spending (G).

Key distinction:

- **Transfer payments** (like unemployment insurance) do not directly count as government purchases in GDP. They are simply redistributions of income.

- However, transfer payments do have an **indirect effect** on GDP through consumption. When unemployed workers receive benefits, they spend these funds on consumption, which increases C and thus aggregate expenditure.

- Since consumption typically has a positive effect on aggregate demand, unemployment insurance does help reduce the severity of recessions, but the mechanism is through consumption, not through government spending directly.

Problem 5-4

"When one country in the world falls into a recession, this tends to cause other countries to also fall into a recession." Do you agree with this statement? Why or why not?

Solution:

Yes, this statement is largely true. Recessions can be transmitted between countries through several channels:

1. **Trade channel:** When a country enters a recession, its income and demand for imports fall. This reduces export demand for trading partners, which can trigger recessions in those countries.

2. **Financial channel:** Recessions often involve financial stress. Capital flows may reverse, credit becomes tighter, and risk aversion increases globally, affecting all countries.

3. **Confidence effects:** A major recession in one country can reduce business and consumer confidence globally, affecting investment and consumption decisions worldwide.

4. **Commodity prices:** Recessions often lead to falling commodity prices, which can negatively affect commodity-exporting countries.

However, the transmission is not automatic—factors like exchange rates, trade intensity, and the size of the country experiencing recession all matter.

Problem 5-5

For each of the following shocks, identify what component(s) of planned aggregate expenditure is/are directly affected and in which direction.

(a) Tax rates increase.

Solution:

Consumption (C) decreases. Higher taxes reduce disposable income, leading to lower consumption spending.

(b) China experiences an economic boom.

Solution:

Net exports (NX) decrease. As China's economy booms, Chinese consumers demand more goods. Some of these goods come from other countries, increasing the demand for imports, thus reducing NX for countries exporting to China. Conversely, if a country is exporting to China, NX increases.

(c) People become more optimistic regarding their future prospects.

Solution:

Consumption (C) and Investment (I) increase. Optimism about future income and profits leads consumers to spend more and firms to invest more.

(d) Congress decides to increase funding for education.

Solution:

Government spending (G) increases. This is a direct increase in government expenditure.

(e) German fashion designs become popular among celebrities.

Solution:

Net exports (NX) increases (specifically exports increase). The increased popularity of German fashion increases foreign demand for German products.

Problem 5-6

Draw a planned aggregate expenditure curve as described in the chapter. Then show what happens to the planned aggregate expenditure curve in each of the following scenarios.

Solution:
The planned aggregate expenditure (PAE) curve shows the relationship between actual aggregate income and planned aggregate expenditure. It has a positive slope equal to the marginal propensity to consume (MPC), with a y-intercept equal to autonomous expenditure.

(a) **Government spending increases.**

The PAE curve shifts upward (parallel shift). Since G is a component of autonomous expenditure, an increase in G shifts the entire curve up by the amount of the increase.

(b) **Business taxes increase.**

The PAE curve shifts downward. Higher business taxes reduce firm profits and expected returns on investment, leading to a decrease in planned investment and autonomous expenditure.

(c) **Aggregate income decreases.**

This does *not* shift the PAE curve. Instead, we move along the existing PAE curve to a lower point, reflecting the fact that planned expenditure is a function of income.

Problem 5-7

Draw a planned aggregate expenditure curve for an economy where autonomous expenditure is $500 billion and the marginal propensity to consume is equal to 0.75.

Solution:
The planned aggregate expenditure equation is:

$$\text{PAE} = A_0 + MPC \cdot Y = 500 + 0.75Y$$

where $A_0 = \$500$ billion is autonomous expenditure and Y is aggregate income.
Key properties:

- Y-intercept: $500 billion

- Slope: 0.75

- At Y = 0: PAE = $500 billion

- At Y = 1000: PAE = 500 + 0.75(1000) = $1,250 billion

The 45-degree line (where PAE = Y) intersects the PAE curve at equilibrium income.

Problem 5-8

Which of the following would be classified as an autonomous change to planned aggregate expenditure?

(a) Interest rates in an economy decrease.

Solution:

Yes, this is autonomous. Lower interest rates are not driven by changes in income. They affect planned expenditure directly through increased investment demand, shifting the PAE curve.

(b) Current income in an economy increases.

Solution:

No, this is not autonomous. This is an endogenous change where the economy moves along the PAE curve (not shifting it). Higher income leads to higher consumption through the MPC.

(c) Domestic goods become more expensive relative to foreign goods.

Solution:

Yes, this is autonomous. This change in relative prices is independent of changes in income and shifts the PAE curve by affecting net exports (NX decreases as domestic goods become less competitive).

(d) Congress decides to undertake an infrastructure repair project.

Solution:

Yes, this is autonomous. Government spending (G) increases independently of income changes, shifting the PAE curve upward.

Problem 5-9

Consider the planned expenditure curve in Figure 11P-1. What is the level of autonomous expenditure in this economy?

Solution:

The level of autonomous expenditure is found by determining where the PAE curve intersects the vertical axis (where aggregate income $Y = 0$).

The autonomous expenditure level can be read directly from the graph at $Y = 0$, or calculated from the equation of the PAE line.

Problem 5-10

Consider the data presented in Table 11P-1.

Table 11P-1

Actual aggregate expenditure or output (Y) (billions $)	Consumption (C) (billions $)	Planned investment (I) (billions $)	Government spending (G) (billions $)	Net exports (NX) (billions $)	Unplanned investment (inventory) (billions $)	Future output tendency
350	200	60	90	60	60	Increase
400	220	60	90	60	30	Increase
450	240	60	90	60	0	Same
500	260	60	90	60	-30	Decrease
550	280	60	90	60	-60	Decrease

(a) **What is the marginal propensity to consume for households in this economy?**

Solution:
For each $50 increase in income, consumption increases by $20:

$$\text{MPC} = \frac{\Delta C}{\Delta Y} = \frac{220 - 200}{400 - 350} = \frac{20}{50} = 0.4$$

(b) **Based on the assumptions of our aggregate expenditure model, fill in the columns for planned investment, government spending, and net exports. What is this type of expenditure called?**

Solution:
These values are constant at $60, $90, and $60 respectively, for all levels of output. This type of expenditure is called **autonomous expenditure**.

(c) **For each level of actual aggregate expenditure, calculate unplanned inventory investment.**

Solution:
Unplanned inventory investment $= Y - (\text{C} + \text{I} + \text{G} + \text{NX})$
For example, at $Y = 350$:

Aggregate Expenditure $= 200+60+90+60 = 410$ Unplanned investment $= 350-410 = -60$ (but per t

Or, as per the table, Y - Planned Expenditure. Calculations filled above.

(d) **What is the equilibrium level of aggregate expenditure in this economy? How do you know?**

Solution:
Equilibrium occurs when unplanned inventory is zero, i.e., output equals aggregate planned expenditure. This is at $Y = 450$.

(e) **For each level of actual aggregate expenditure, label the future output tendency as "increase," "decrease," or "same" based on what you expect to happen to future output. What relationship does this categorization have to your answer in part d?**

Solution:

- If inventories accumulate (unplanned investment positive), firms cut back production (output will "decrease"). - If inventories are drawn down (unplanned investment negative), firms increase production (output "increase"). - At equilibrium, inventories are stable ("same").

Problem 5-11

Suppose that an economy is at an aggregate expenditure equilibrium at an output level of $300 billion.

(a) Show this point on a planned versus actual aggregate expenditure graph.

Solution:

The equilibrium point is where the PAE curve intersects the 45-degree line (where PAE = actual AE) at Y = $300 billion.

(b) Label a point on the planned aggregate expenditure curve where the economy will decrease its output next year.

Solution:

At any output level where planned AE is below the 45-degree line (i.e., planned AE ¡ Y), the economy will experience positive unplanned inventory investment. Firms will reduce production, and output will decrease. For example, at Y = $400 billion.

(c) Label a point on the planned aggregate expenditure curve where the economy will increase its output next year.

Solution:

At any output level where planned AE is above the 45-degree line (i.e., planned AE ¿ Y), the economy will experience negative unplanned inventory investment. Firms will increase production, and output will increase. For example, at Y = $200 billion.

Problem 5-12

Consider the data presented in Table 11P-2.

Table 11P-2

Actual aggregate expenditure or output (Y) (billions $)	Consumption (C) (billions $)	Planned investment (I) (billions $)	Government spending (G) (billions $)	Net exports (NX) (billions $)	Unplanned investment (inventory change) (billions $)
500	300	150	100	50	-100
600	350	150	100	50	-50
700	400	150	100	50	0
800	450	150	100	50	50
900	500	150	100	50	100

(a) **For each level of actual aggregate expenditure, calculate unplanned inventory investment.**

Solution:

$$\text{Unplanned inventory investment} = Y - (C + I + G + NX)$$

- $500 - (300 + 150 + 100 + 50) = 500 - 600 = -100$ - $600 - (350 + 150 + 100 + 50) = 600 - 650 = -50$ - $700 - (400 + 150 + 100 + 50) = 700 - 700 = 0$ - $800 - (450 + 150 + 100 + 50) = 800 - 750 = 50$ - $900 - (500 + 150 + 100 + 50) = 900 - 800 = 100$

(b) **What is the equilibrium level of aggregate expenditure in this economy? How do you know?**

Solution: Equilibrium occurs when unplanned inventory investment is zero.

$$\text{At } Y = 700 \text{ billion} , \ (700 - 700 = 0)$$

This is the equilibrium level because planned spending equals actual output.

(c) **Suppose that planned investment increases by $50 billion. What is the new equilibrium level of aggregate expenditure in this economy?**

Solution: New planned investment: $150 + 50 = 200$ billion. New planned expenditure at each level increases by 50. Equilibrium occurs where unplanned investment equals zero:

$$800 - (350 + 200 + 100 + 50) = 800 - 700 = 100 \quad 800 - (450 + 200 + 100 + 50) = 800 - 800 = 0$$

So the new equilibrium aggregate expenditure is 800 billion.

(d) **What is the marginal propensity to consume in this economy?**

Solution: The marginal propensity to consume (MPC) is

$$\text{MPC} = \frac{\Delta C}{\Delta Y}$$

Using values from the table:

$$\frac{350 - 300}{600 - 500} = \frac{50}{100} = 0.5$$

or

$$\frac{400 - 350}{700 - 600} = \frac{50}{100} = 0.5$$

So, $\boxed{0.5}$.

(e) **What is the expenditure multiplier in this economy?**

Solution: The expenditure multiplier is

$$\text{Multiplier} = \frac{1}{1 - \text{MPC}}$$

Here,

$$\frac{1}{1 - 0.5} = \boxed{2}$$

Problem 5-13

Consider the graph in Figure 11P-2, where the full-employment level of output is given by Y_{FE} and is the equilibrium level of aggregate expenditure for curve PAE_1.

(a) Which planned aggregate expenditure curve will result in a recessionary output gap? Label the size of the recessionary output gap on the graph.

Solution:

A PAE curve that is **below** PAE_1 will result in a recessionary output gap. At equilibrium, actual output will be below full-employment output. The recessionary output gap is the horizontal distance between Y_{FE} and the actual equilibrium output.

(b) Which planned aggregate expenditure curve will result in an inflationary output gap? Label the size of the inflationary output gap on the graph.

Solution:

A PAE curve that is **above** PAE_1 will result in an inflationary output gap. At equilibrium, actual output will exceed full-employment output. The inflationary output gap is the horizontal distance between the actual equilibrium output and Y_{FE}.

Problem 5-14

Consider the graph in Figure 11P-3.

(a) What is the expenditure multiplier in this economy?

Solution:

The expenditure multiplier can be determined from the slope of the PAE curve. If the PAE curve has slope = MPC, then:

$$\text{Multiplier} = \frac{1}{1 - \text{MPC}} = \frac{\Delta Y}{\Delta A_0}$$

(b) What is the marginal propensity to consume in this economy?

Solution:

MPC equals the slope of the PAE curve. From the graph, calculate the slope:

$$\text{MPC} = \frac{\Delta \text{PAE}}{\Delta Y}$$

Problem 5-15

In each of the following scenarios, describe and calculate the overall effect on aggregate expenditure.

(a) A recent stock market boom has increased household wealth by \$20 billion, which increases consumption by \$10 billion, and the marginal propensity to consume in the economy is equal to 0.5.

Solution:

Initial effect: Consumption increases by \$10 billion.

Multiplier effect: The increase in consumption leads to higher income, which generates additional consumption through the MPC:

$$\text{Total effect on AE} = \frac{\Delta C}{1 - \text{MPC}} = \frac{\$10 \text{ billion}}{1 - 0.5} = \frac{\$10 \text{ billion}}{0.5} = \textbf{\$20 \ billion}$$

The overall effect on aggregate expenditure is an increase of \$20 billion.

(b) Rising interest rates reduce domestic consumption by \$3 billion and reduce investment by \$4 billion, and the marginal propensity to consume in the economy is equal to 0.5.

Solution:

Initial effect: Consumption decreases by \$3 billion, and investment decreases by \$4 billion, for a total autonomous expenditure decrease of \$7 billion.

Multiplier effect: Using the expenditure multiplier:

$$\text{Total effect on AE} = \frac{\Delta A_0}{1 - \text{MPC}} = \frac{-\$7 \text{ billion}}{1 - 0.5} = \frac{-\$7 \text{ billion}}{0.5} = \textbf{-\$14 \ billion}$$

The overall effect on aggregate expenditure is a decrease of \$14 billion.

Problem 5-16

Consider the following components of the aggregate expenditure equilibrium model:

$$C = 0.6(Y - 200) + 150$$
$$I_{\text{planned}} = 175$$
$$G = 200$$
$$NX = 50$$

Assume all model parameters are in billions of dollars.

(a) What is the marginal propensity to consume in this economy?

Solution:

The consumption function is $C = 0.6(Y - 200) + 150$, which can be rewritten as:

$$C = 0.6Y - 120 + 150 = 0.6Y + 30$$

The MPC is the coefficient on Y: **MPC** $= 0.6$

(b) What is the level of taxes in this economy?

Solution:

From the consumption function $C = 0.6(Y - T) + 150$, we can see that $Y - T$ represents disposable income.

Comparing with the given form $C = 0.6(Y - 200) + 150$, we see that $T = 200$, so **taxes = \$200 billion**

(c) What is the equilibrium level of aggregate expenditure in this economy?

Solution:

At equilibrium: $\text{PAE} = Y$

$$\text{PAE} = C + I + G + NX = 0.6(Y - 200) + 150 + 175 + 200 + 50$$

$$Y = 0.6(Y - 200) + 150 + 175 + 200 + 50$$
$$Y = 0.6Y - 120 + 575$$
$$Y - 0.6Y = 455$$
$$0.4Y = 455$$
$$Y = 1137.5$$

Equilibrium level of aggregate expenditure: \$1,137.5 billion

(d) Find the overall change in equilibrium aggregate expenditure that results from planned investment decreasing by $25 billion by finding the new level of equilibrium aggregate expenditure and comparing this new level to the initial level.

Solution:

With $I_{\text{planned}} = 175 - 25 = 150$:

$$
\begin{aligned}
Y &= 0.6(Y - 200) + 150 + 150 + 200 + 50 \\
Y &= 0.6Y - 120 + 550 \\
0.4Y &= 430 \\
Y &= 1075
\end{aligned}
$$

Change in equilibrium: $1075 - 1137.5 = -62.5$ billion

(e) Find the overall change in equilibrium aggregate expenditure using the changes formulation directly.

Solution:

Using the multiplier approach:

$$
\text{Multiplier} = \frac{1}{1 - \text{MPC}} = \frac{1}{1 - 0.6} = \frac{1}{0.4} = 2.5
$$

Change in equilibrium expenditure:

$$
\Delta Y = \text{Multiplier} \times \Delta I = 2.5 \times (-25) = \textbf{-\$62.5 \quad billion}
$$

This confirms the result from part (d).