ECO 209Y
Macroeconomic Theory and Policy

Lecture 10:
Neo-Keynesian View on Money and Banking

The Neo-Keynesian Determination of the Money Supply

- Following ***Keynes***, we have assumed that the ***money supply*** was an ***exogenous*** variable (determined by the central bank)
  - But the central bank does not set **M** directly

- According to the ***Neo-Keynesian*** theory, **M** is determined by the interaction among the ***central bank***, the ***commercial banks***, and the ***public*** (households and firms)
  - Therefore, **M** is seen as an ***endogenous*** variable

- For simplicity, we will consider the **M1** definition of money supply: $\mathbf{M = CU_P + D}$
  - Therefore, anything that affects $\mathbf{CU_P}$ and/or **D** will affect **M**

The Role of the Public

$$M = CU_P + D$$

- The ***public*** has a role in the determination of the money supply because their demand for currency affects CU_P
- The ***public*** also determines jointly with the ***commercial banks*** the level of deposits (**D**)
- What is important from the point of view of the public is thus the ***currency-deposit ratio***:

$$cu = CU_P/D$$

The Role of the Commercial Banks

$$M = CU_P + D$$

- As we have seen, the ***commercial banks*** determine jointly with the ***public*** the level of deposits (**D**)

- The role of the ***commercial banks*** in the determination of the money supply is summarized by the (desired) ***cash reserve ratio***:

$$re = R/D$$

- ***Cash reserves*** (**R**) consists of the currency the commercial banks hold in their vaults (CU_B) and deposits they hold at the Bank of Canada (D_{CB}):

$$R = CU_B + D_{CB}$$

The Role of Cash Reserves

$$re = R/D$$

$$R = CU_B + D_{CB}$$

- Commercial banks hold ***cash reserves*** (**R**) in order to meet:
  - Their customers' demands for currency
  - Payments their customers make by cheques (or debit) which are deposited in other banks

- The commercial banks can determine the ***cash reserve ratio*** (**re**) they consider optimum and thus they can determine (jointly with the public) the level of deposits (**D**)
  - In this way, commercial banks can affect the component **D** of the money supply

THE ROLE OF THE BANK OF CANADA

- The role of the ***Bank of Canada*** in the determination of the supply of money is summarized by the stock of ***high-powered money*** or the ***monetary base*** (**B**)
- High-powered money consists of currency (**CU**) and deposits of the chartered banks at the Bank of Canada (D_{CB})

$$B = CU + D_{CB}$$
$$= (CU_P + CU_B) + D_{CB}$$
$$= CU_P + R$$

- The Bank of Canada cannot determine by itself the component CU_P of the money supply
- The Bank of Canada can affect **R** and most particularly D_{CB}, and thus indirectly the level of **D**

High-Powered Money and Money Supply

- ***Assumption:*** The ***Bank of Canada*** controls the supply of high-powered money (i.e., it determines the level of **B**)
  - As we will see later, the Bank can also ***affect*** the decisions of the commercial banks regarding the optimum level of **re**
- The demand for high-powered money comes from the public ($\mathbf{CU_P}$) and the chartered banks (**R**)
- ***Assumption:*** The ***public*** has a preferred ratio of currency to deposits ($\mathbf{cu = CU_P/D}$) and the ***banks*** have a desired ratio of reserves to deposits (**re = R/D**)
  - Therefore, given **cu** and **re**, we can estimate the total ***money*** stock that can be supported by any given stock of ***high-powered money***

The Money Multiplier

- ***Assumption:*** There is a relationship between the stock of high-powered money (**B**) and the money stock (**M**)
  - They are related by the ***money multiplier*** (**mm**)
- By definition, the ***money multiplier*** is the ratio of the stock of money to the stock of high-powered money:

$$mm = M/B$$

- Given **mm** and **B**, then

$$M = mm\ B$$

- Therefore, given **mm**, a change in the stock of high-powered money affects the money stock as follows:

$$\Delta M = mm\ \Delta B$$

MONETARY EQUILIBRIUM

- ***Assumption:*** Suppose that there is equilibrium between the supply and the demand for money

$$M = CU_P + D$$

- ***Assumption:*** Also suppose that there is equilibrium between the supply of high-powered money and the demand for high-powered money

$$B = CU + D_{CB} = (CU_P + CU_B) + D_{CB} = CU_P + R$$

- If these two conditions hold, then there is ***monetary equilibrium***
  - People hold the composition of their money balances in the preferred ratio (**cu**)
  - Banks hold just the right ratio of reserves to deposits (**re**) and **R** are held in the right composition

The Money Multiplier

- Given $M = CU_P + D$ and $B = CU_P + R$, then the money multiplier is:

$$mm = \frac{M}{B} = \frac{CU_P + D}{CU_P + R}$$

- And if we divide both the numerator and the denominator by **D**, we obtain

$$mm = \frac{cu + 1}{cu + re}$$

THE MONEY MULTIPLIER (CONT'D)

- The size of **mm** depends on **cu** and **re**
  - That is, it depends on the ***assumed*** preferences about the public's and the banks' composition of balances
- The ratio **cu** is determined primarily by payments habits
- One of the major determinant of **re** is the Bank of Canada's target of the ***overnight rate***
  - The overnight rate is the rate at which banks borrow and lend among themselves for settlement payment purposes
- Neither **cu** nor **re** is fixed → and thus **mm** is not fixed either
  - For instance, **re** changes with the ***overnight rate*** and with ***expectations*** about the future
  - If **mm** is not fixed, then **M** is not ***exogenous***

MONETARY POLICY

- The Bank of Canada implements ***monetary policy*** by targeting either **M** or **i**
  - ***Money supply rule:*** It targets **M** by changing the stock of ***high-powered money***
  - ***Interest rate rule:*** It targets **i** by changing its target for the ***overnight rate*** of interest

- The Bank of Canada cannot target **i** and **M** at the same time
  - If it targets the **M**, it must allow **i** to adjust to equate $\mathbf{M^S}$ and $\mathbf{M^D}$
  - If it targets **i**, it must allow $\mathbf{M^S}$ to change until it matches the $\mathbf{M^D}$ at that level of **i**

Summary of the Roles of the Public, the Chartered Banks, and the Bank of Canada

$$M = CU_P + D$$

1) The ***public*** determines **$cu = CU_P/D$**

2) The ***commercial banks*** determine **$re = R/D$**

3) The ***Bank of Canada*** determines:
   - **R** and particularly **D_{CB}** but not **D**
   - The target for the ***overnight rate*** but neither **re** nor **i**

THE MONEY SUPPLY RULE

LIABILITIES OF THE BANK OF CANADA

- The components of ***high-powered money*** or ***monetary base*** (**B**) represent a liability in the balance sheet of the Bank of Canada

$$B = CU_P + CU_B + D_{CB}$$

Also recall that $R = CU_B + D_{CB}$

- Another liability in the balance sheet of the Bank of Canada is Government of Canada's deposits at the Bank of Canada
  - However, Government of Canada's deposits are neither part of the monetary base nor of the money supply

CREATION OF HIGH-POWERED MONEY

- ***High-powered money*** is created when the Bank of Canada acquires ***assets*** or reduces its liabilities in the form of ***Government of Canada's deposits***
  - When the Bank of Canada acquires ***assets*** (e.g., when it buys Government Bonds from the public), it increases its liabilities (and, therefore, the monetary base) by the same amount
  - When the Bank of Canada reduces ***Government of Canada's deposits***, it changes the form of liability to high-powered money

OPEN MARKET OPERATIONS

- The main means by which the Bank of Canada changes the monetary base is through ***open market operations***
- By ***open market operations*** we mean the Bank of Canada purchasing or selling Government Bonds from or to the public or the commercial banks
  - An open market ***purchase*** will increase the monetary base, and thus the money supply
  - An open market ***sale*** will decrease the monetary base, and thus the money supply
- The use of this policy instrument to increase the money supply is known as ***quantitative easing***
  - Let's look at some illustrations

Open Market Purchase

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
GB –100		D_{CB} +100	D +100	GB +100	D_{CB} +100
D +100					

- Suppose the Bank of Canada buys bonds from the public in the amount of $100 million
- Therefore, since $B = CU_P + CU_B + D_{CB}$
  - $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = +100$
- And $\Delta M = \Delta CU_P + \Delta D = 0 + 100 = +100$

Bank Lending and the Money Multiplier

- A change in **B** affects **M** as follows:

$$\Delta M = mm\ \Delta B$$

- We have also seen that

$$mm = \frac{cu + 1}{cu + re}$$

- If we assume cu = 0.25 and re = 0.1, then

$$mm = 1.25/0.35 = 3.57$$

- Therefore, if ΔB = +100, then

$$\Delta M = 3.57\ (+100) = +357$$

INDIVIDUALS' MONEY HOLDINGS

- Individuals' total money holdings are $CU_P + D$
- The fraction of currency in total money holdings is:

$$\frac{CU_P}{CU_P + D} = \frac{cu}{cu + 1} = \frac{0.25}{1.25} = 0.2 \text{ or } 20\%$$

- The fraction of deposit in total money holdings is:

$$\frac{D}{CU_P + D} = \frac{1}{cu + 1} = \frac{1}{1.25} = 0.8 \text{ or } 80\%$$

Open Market Purchase (Step 1)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
GB –100		CU_B –20	D +80	GB +100	D_{CB} +100
CU_P +20		D_{CB} +100			
D +80					

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = 20 - 20 + 100 = +100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = -20 + 100 = +80$
- $\Delta M = \Delta CU_P + \Delta D = 20 + 80 = +100$
- ΔDesired Reserves = +8
- Excess Reserves = $\Delta R - \Delta$Desired Reserves = +72

This implies that the actual **re** is greater than the desired **re**.

Open Market Purchase (Step 2)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
GB –100 CU_P +20 D +80	L +72	D_{CB} +100 CU_B –20	D +80 D +57.6	GB +100	D_{CB} +100
CU_P +14.4 D +57.6		L +72 CU_B –14.4			

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = 34.4 - 34.4 + 100 = +100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = -34.4 + 100 = +65.6$
- $\Delta M = \Delta CU_P + \Delta D = 34.4 + 137.6 = +172$
- ΔDesired Reserves = +13.76
- Excess Reserves = $\Delta R - \Delta$Desired Reserves = +51.84

Open Market Purchase

- As the process continuous and all excess reserves are eliminated, the money stock increases by the full multiplying effect:

$$\Delta M = mm\ \Delta B = 3.57\ (+100) = +357$$

$$\Delta CU_P = 0.2\ \Delta M = 0.2\ (+357) = +71.4$$

$$\Delta D = 0.8\ \Delta M = 0.8\ (+357) = +285.6$$

$$\Delta L = +257$$

- At the end of the process, the banking system has created $257 in new money

Open Market Purchase (Final)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
GB –100	L +257	D_{CB} +100	D +80	GB +100	D_{CB} +100
CU_P +20		CU_B –20	D +205.6		
D +80		L +257			
CU_P +51.4		CU_B –51.4			
D +205.6					

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = 71.4 - 71.4 + 100 = +100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = -71.4 + 100 = +28.6$
- $\Delta M = \Delta CU_P + \Delta D = 71.4 + 285.6 = +357$
- ΔDesired Reserves = +28.6
- Excess Reserves = $\Delta R - \Delta$Desired Reserves = 0

Open Market Purchase from the Commercial Banks (Step 1)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
		GB –100 D_{CB} +100		GB +100	D_{CB} +100

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = +100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = +100$
- $\Delta M = \Delta CU_P + \Delta D = 0$
- Excess reserves = +100

Open Market Purchase from the Commercial Banks (Final)

- As the process continuous and all excess reserves are eliminated, the money stock increases by the full multiplying effect:

$$\Delta M = mm\ \Delta B = 3.57\ (+100) = +357$$

$$\Delta CU_P = 0.2\ \Delta M = 0.2\ (+357) = +71.4$$

$$\Delta D = 0.8\ \Delta M = 0.8\ (+357) = +285.6$$

$$\Delta L = +357$$

- At the end of the process, the banking system has created $357 in new money

Open Market Purchase from the Commercial Banks (Final)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
CU_P +71.4 D +285.6	L +357	GB –100 D_{CB} +100 L +357 CU_B –71.4	D +285.6	GB +100	D_{CB} +100

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = 71.4 - 71.4 + 100 = +100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = -71.4 + 100 = +28.6$
- $\Delta M = \Delta CU_P + \Delta D = 71.4 + 285.6 = +357$
- ΔDesired Reserves = +28.6
- Excess Reserves = $\Delta R - \Delta$Desired Reserves = 0

Open Market Sale to the Public (Step 1)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
GB +100		D_{CB} –100	D –100	GB –100	D_{CB} –100
D –100					

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = -100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = -100$
- $\Delta M = \Delta CU_P + \Delta D = -100$
- ΔDesired Reserves = –10
- Excess (Insufficient) Reserves = $\Delta R - \Delta$Desired Reserves = –90

This implies that the actual **re** is less than the desired **re**.

Open Market Sale (Final)

- Since actual decrease in reserves is greater than the desired decrease, the cash reserve ratio is now below the desired level
  - **re = R/D**
  - **D** must, therefore, decrease (by recalling loans)

- As the process continuous and **re** returns to the desired level, the money stock decreases by the full multiplying effect:

  $\Delta M = mm\ \Delta B = 3.57\ (-100) = -357$

  $\Delta M = \Delta CU_P + \Delta D = -71.4 - 285.6 = -357$

  $\Delta L = -257$

- At the end of the process, the banking system has destroyed $257 in money (by recalling loans)

Open Market Sale to the Public (Final)

Public		Commercial Bank		Bank of Canada	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
GB +100	L –257	D_{CB} –100	D –80	GB –100	D_{CB} –100
CU_P –20		CU_B +20	D –205.6		
D –80		L –257			
CU_P –51.4		CU_B +51.4			
D –205.6					

- $\Delta B = \Delta CU_P + \Delta CU_B + \Delta D_{CB} = -71.4 + 71.4 - 100 = -100$
- $\Delta R = \Delta CU_B + \Delta D_{CB} = +71.4 - 100 = -28.6$
- $\Delta M = \Delta CU_P + \Delta D = -71.4 - 285.6 = -357$
- ΔDesired Reserves = –28.6
- Excess (Insufficient) Reserves = ΔR – ΔDesired Reserves = 0

Impact of Government Borrowing to Cover a Deficit

- When the Government borrows from the public, the ***money supply*** doesn't change
  - That is, the ***monetary base*** doesn't change and thus the ***money supply*** doesn't either
- When the Government borrows from the Bank of Canada, the ***money supply*** increases
  - That is, the ***monetary base*** increases and thus the ***money supply*** also increases
  - In this case, it is said that the Government is ***monetizing*** the deficit

Financing a Deficit by Borrowing from the Public

Public			
GB	+100		
D	–100		
D	+100		

Commercial Banks			
D_{CB}	–100	D	–100
D_{CB}	+100	D	+100

Bank of Canada			
		D_G	+100
		D_{CB}	–100
		D_G	–100
		D_{CB}	+100

Federal Government			
D_G	+100	GB	+100
D_G	–100		

When the Government borrows from the public, B decreases and so does M; and when the Government spends the borrowed money, B increases and so does M.

Financing a Deficit by Borrowing from the Bank of Canada

Public	
D +100	

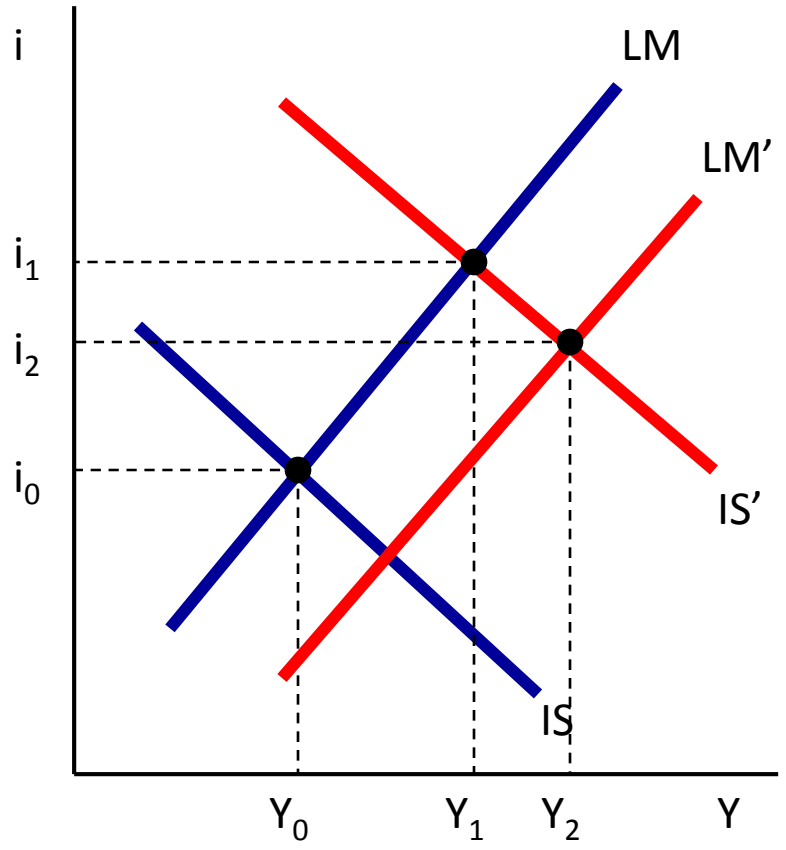
Commercial Banks	
D_{CB} +100	D +100

Bank of Canada	
GB +100	D_G +100 D_G −100 D_{CB} +100

Federal Government	
D_G +100 D_G −100	GB +100

When the Government borrows from the Bank of Canada, B increases and so does M.

Impact of Borrowing from the Public or the Bank of Canada



The money supply doesn't change when the Government borrows from the public. Therefore, income increases to Y_1.

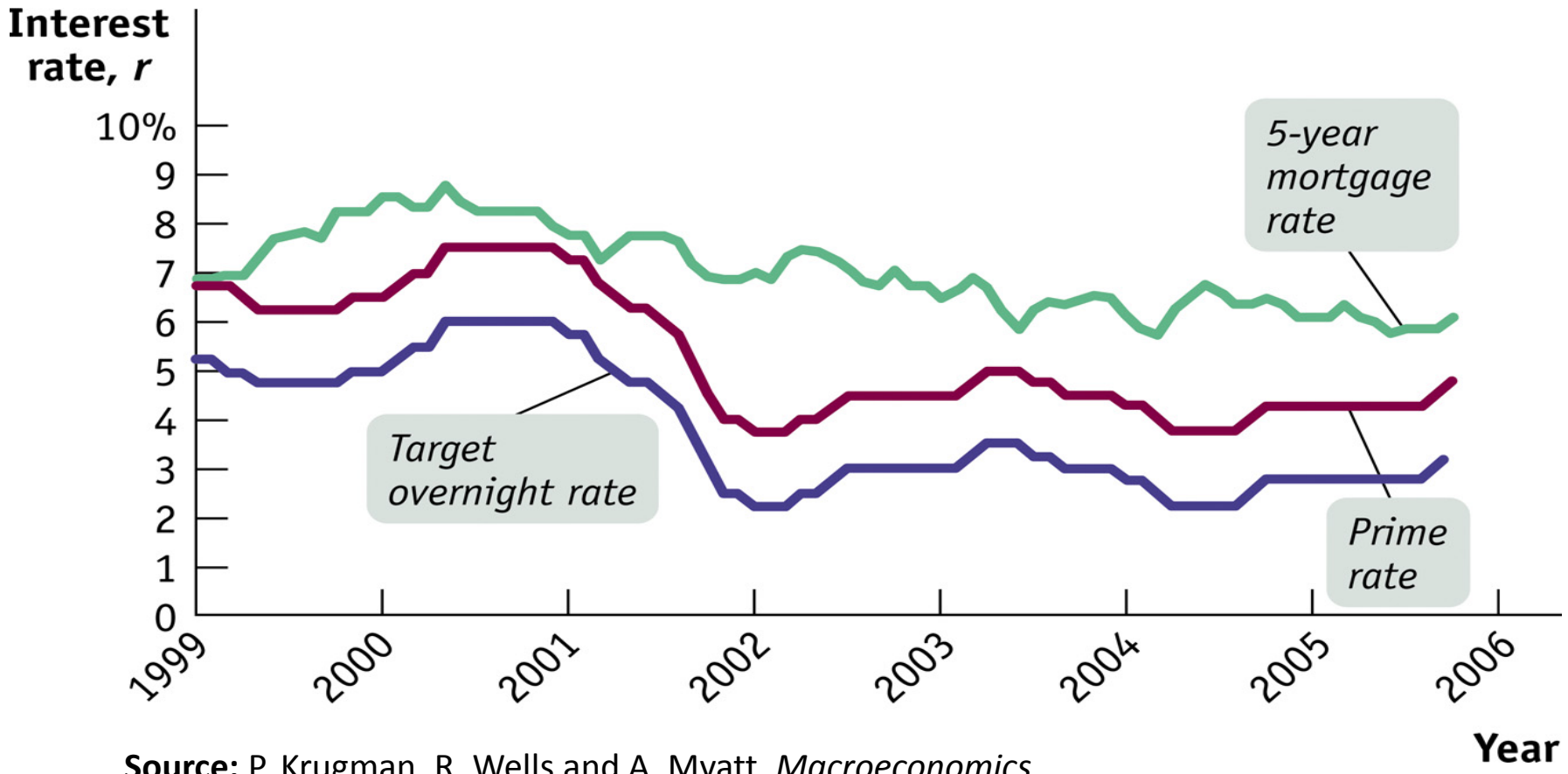
The money supply increases when the Government borrows from the Bank of Canada. Therefore, income increases further to Y_2.

THE INTEREST RATE RULE

CONTROL OF THE RATE OF INTEREST

- The Bank of Canada can also affect ***i*** and the commercial banks' **re** by changing a target for the ***overnight rate***
- The Bank of Canada sets the ***bank rate*** 8 times a year
  - The bank rate is the rate of interest the Bank of Canada charges for loans to commercial banks
  - This represents a ***ceiling*** for the overnight rate
- The Bank of Canada also accepts deposits from the commercial banks at a 0.5 percent below the bank rate
  - This represents a ***floor*** for the overnight rate
- The ***target overnight rate*** is the mid point in this interest rate band, i.e., 25 basis points below the bank rate

The Bank of Canada and the Rates of Interest



Source: P. Krugman, R. Wells and A. Myatt, *Macroeconomics*.

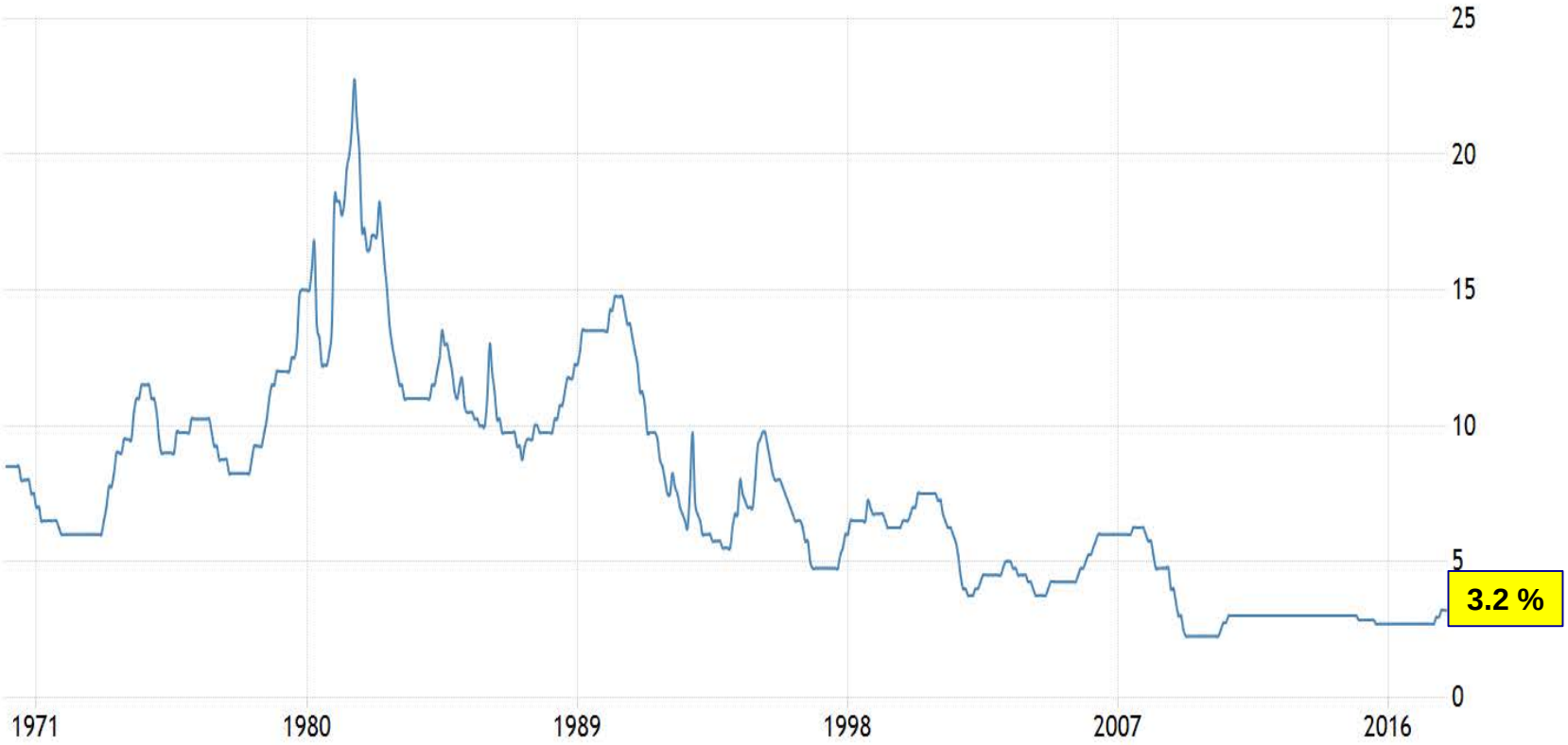
Overnight Rate of Interest
January 2000 to January 2018

Source: Trading Economics / Bank of Canada.

The U.S. Federal Fund Rate
From January 2000 to January 2018)

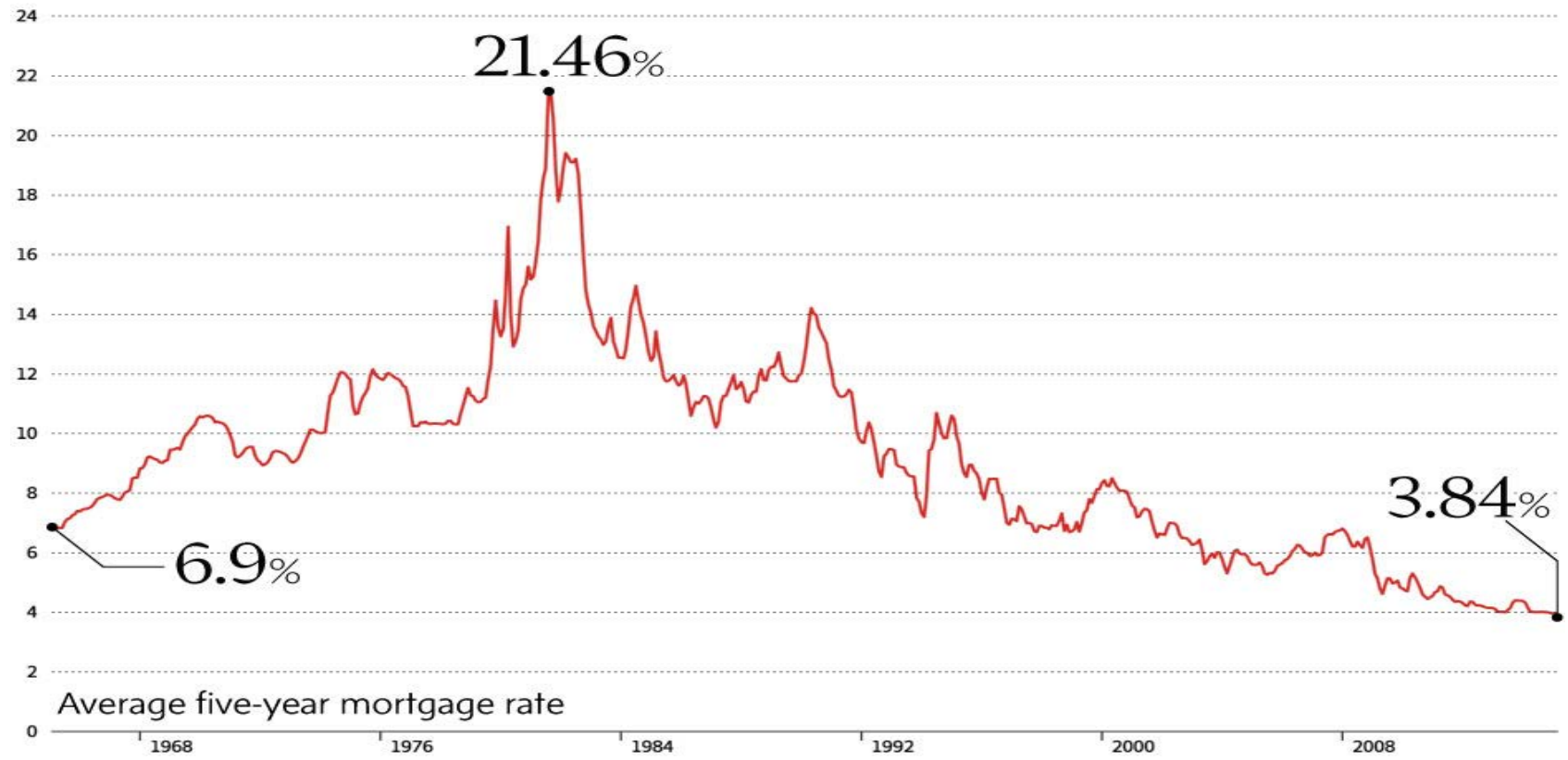
Source: Trading Economics / Federal Reserve.

Canada: Prime Rate of Interest
January 1970 to March 2017



Source: Trading Economics / Bank of Canada.

CANADA: MORTGAGE RATE OF INTEREST
JANUARY 1965 TO JANUARY 2015



Source: The Globe and Mail, 14 May 2015.

CONTROL OF THE RATE OF INTEREST (CONT'D)

- How does a decrease in the ***bank rate*** affect the level of ***credit*** in the economy (and thus **M**)?
- A decrease in the ***bank rate*** decreases the band of the ***overnight rate***, and thus the overnight rate decreases
  - A decrease in the ***overnight interest rate*** affects the entire spectrum of ***market interest rates***
  - A decrease in the ***overnight rate*** also affects the desired ***cash-reserve ratio*** of the commercial banks
- Therefore, a change in the ***bank rate*** affects in two ways the level of ***credit*** in the economy (and thus **M**)
  - That is, by affecting **re** and **i**

CONTROL OF THE RATE OF INTEREST (CONT'D)

- A reduction in the ***desired cash-reserve ratio***:
  - As the ***desired cash-reserve ratio*** decreases, banks find themselves with ***excess reserves*** (i.e., **re** is too high)
  - Banks start lending more money to increase **D** and reduce **re**, and thus the ***money supply*** increases
- A reduction in ***market interest rates***:
  - As the demand for new loans gradually adjusts, commercial banks may find their actual **re** falling below the desired level
    - Commercial banks need higher ***cash reserves*** (**R**)
  - The commercial banks will then sell government bonds to the Bank of Canada and **R** will increase

Summary: Control of the Money Stock or the Rate of Interest

- The Bank of Canada implements ***monetary policy*** by targeting either **M** or **i**
- But the Bank of Canada cannot simultaneously target both the **i** and the level of **M**
  - If it targets **M**, it must allow **i** to adjust to equate M^S and M^D
  - If it targets the ***rate of interest***, it has to allow the money supply to change until it matches the amount of money demanded at that interest rate
- That is, the Bank of Canada can implement monetary policy by following a ***money supply rule*** or an ***interest rate rule***
  - Since the late 1980s, the Bank of Canada has mostly followed an ***interest rate rule***