Macroeconomic Theory: Lecture 6

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Autumn, 2014

Last week

- Neoclassical Growth Models and technical change.

Today

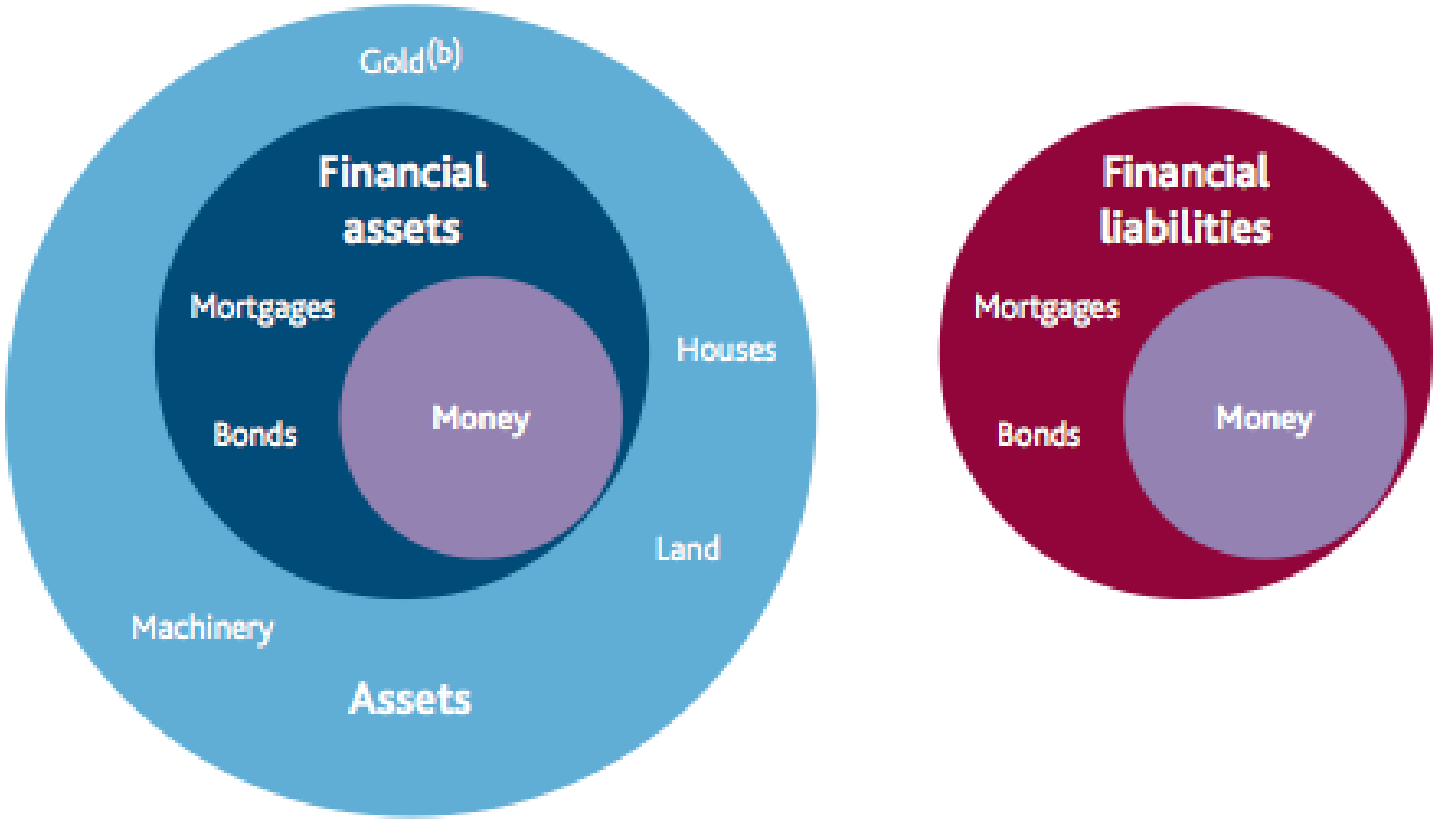
- Endogenous Money
- Public debt and public deficit, and fiscal and monetary policies
- The overlapping generation models

Money in the modern economy, McLeay et al. (2014a)

- Roles of money
  - Store of value
  - Unit of account
  - Medium of exchange
- Money in the modern economy is an IOU, or a financial asset
- Hence money is an asset for someone *and* and a liability for someone else

Balance sheet

Figure 1 Money and other assets and liabilities[a]



(a) Figure is highly stylised for ease of exposition: the quantities of each asset/liability shown do not correspond to the actual quantities in the economy.

(b) By statistical convention, some holdings of gold (such as by the government) are classed as a financial asset rather than a non-financial asset in economic accounts.

Figure 1: Money and assets and liabilities, source: McLeay et al. (2014a)

Money in the modern economy, McLeay et al. (2014a)

- In principle, anyone could emit its own IOU, but money is a *social institution* that everyone trusts.
- Different types of money (Exercise: what is it, why people use it?)
  - Currency
  - Bank deposits
  - Central bank reserves

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    - 94%, fiat, i.e. not convertible to other assets
    - No link to any assets, thus no limitations to creation
    - Tax payments and trusts (technical and sociological)
  - Bank deposits
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    - No link to any assets, thus no limitations to creation
    - Tax payments and trusts (technical and sociological)
    - Created by central banks
  - Bank deposits
    - 97% of amount of money in circulation
    - Trust in bank, ease of use
    - Created by commercial banks
  - Central bank reserves

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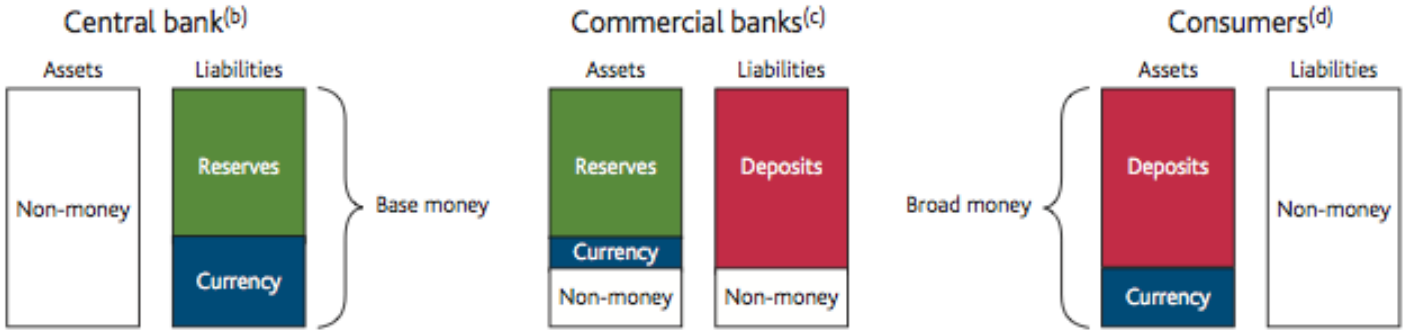
    - 97% of amount of money in circulation
    - Trust in bank, ease of use
    - Created by commercial banks
  - Central bank reserves
    - Electronic money
    - Medium of exchange for banks
    - Created by central bank

Types of money

Figure 2 Stylised balance sheets of different types of money holders and issuers in the economy[a]



(a) Balance sheets are highly stylised for ease of exposition: the quantities of each type of money shown do not correspond to the quantities actually held on each sector's balance sheet.
(b) Central bank balance sheet only shows base money liabilities and matching assets. In practice the central bank holds other non-money liabilities. Its non-money assets are mostly made up of government debt. Although that government debt is held by the Bank of England's Asset Purchase Facility, so does not appear directly on the Bank of England's consolidated balance sheet.
(c) Commercial banks' non-money assets would include government debt and non-money liabilities would include long-term debt and equity.
(d) Consumers represent the private sector of households and companies. Balance sheet only shows broad money assets and corresponding liabilities. Consumers' non-money liabilities would include secured and unsecured loans.

Figure 2: Types of money, source: McLeay et al. (2014a)

Amounts of money in circulation

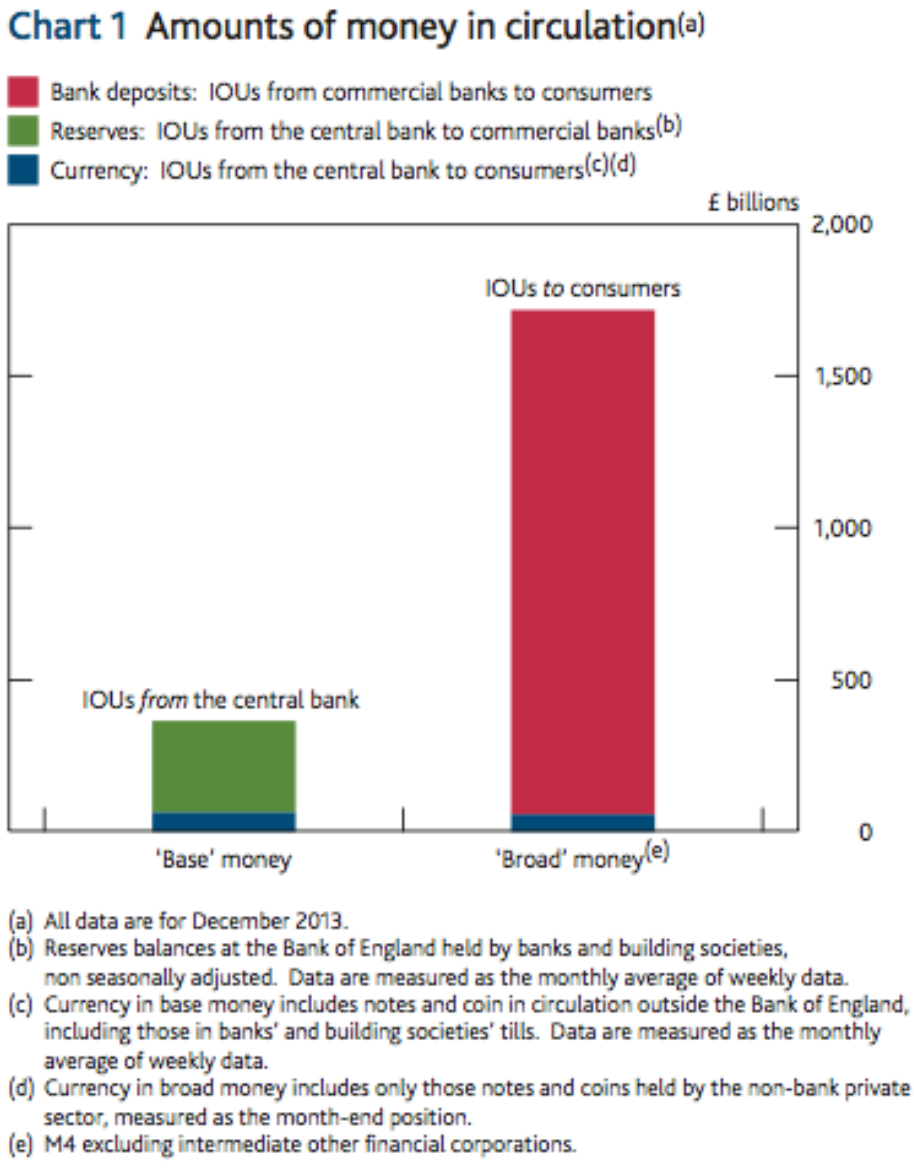


Figure 3: Amounts of money, source: McLeay et al. (2014a)

Money creation in the modern economy, McLeay et al. (2014b)

- Two misconceptions about money creation
  - Banks act simply as intermediaries, lending out the deposits that savers place with them
  - The central bank determines the quantity of loans and deposits by controlling the quantity of central bank money
- Lending creates deposits
- Limits to money creation
  - Banks' limits
  - Household and businesses' behaviours
  - Monetary policy

Money creation - part I

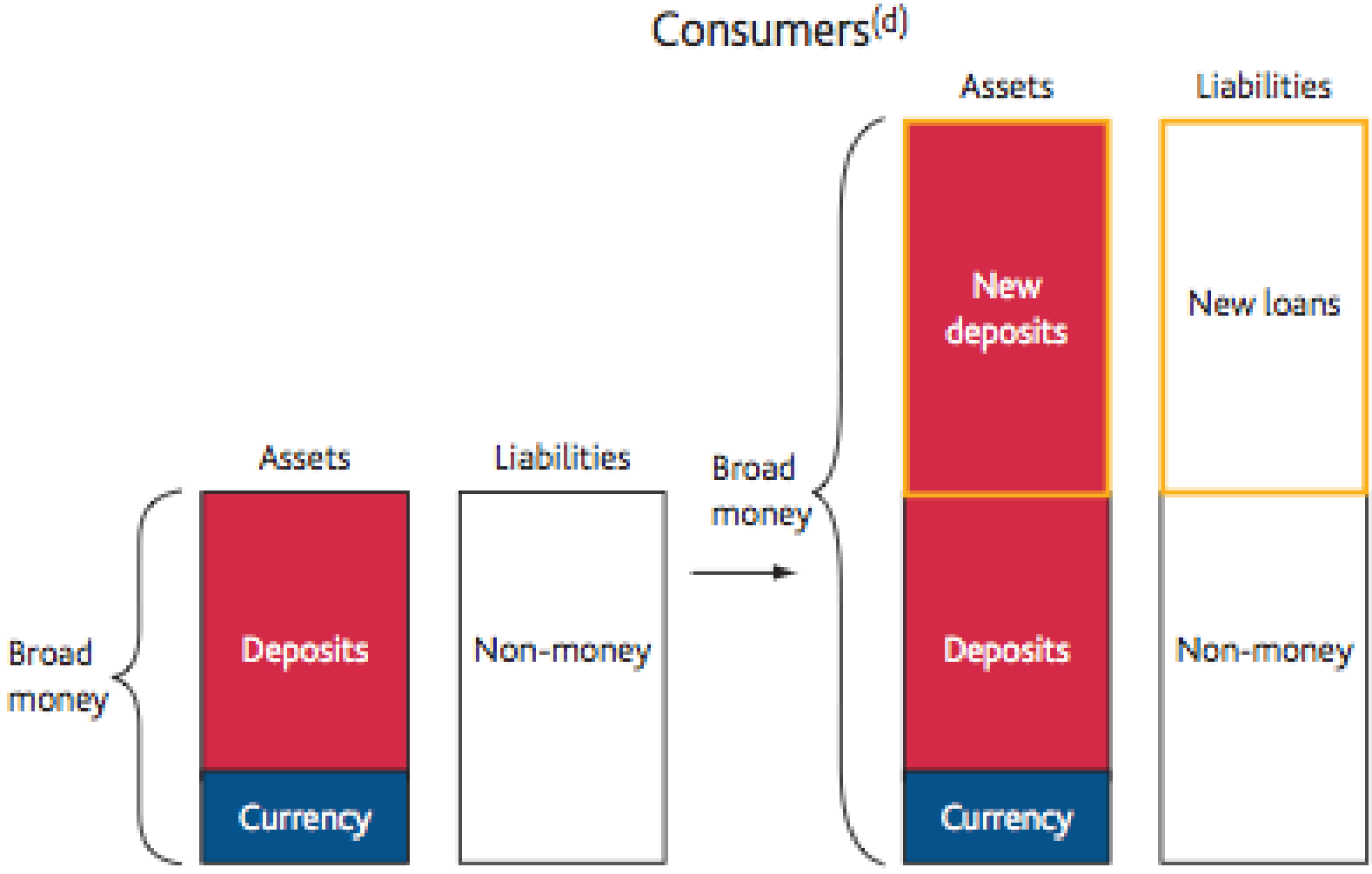


Figure 4: Consumer balance sheet, source: McLeay et al. (2014b)

Money creation - part II

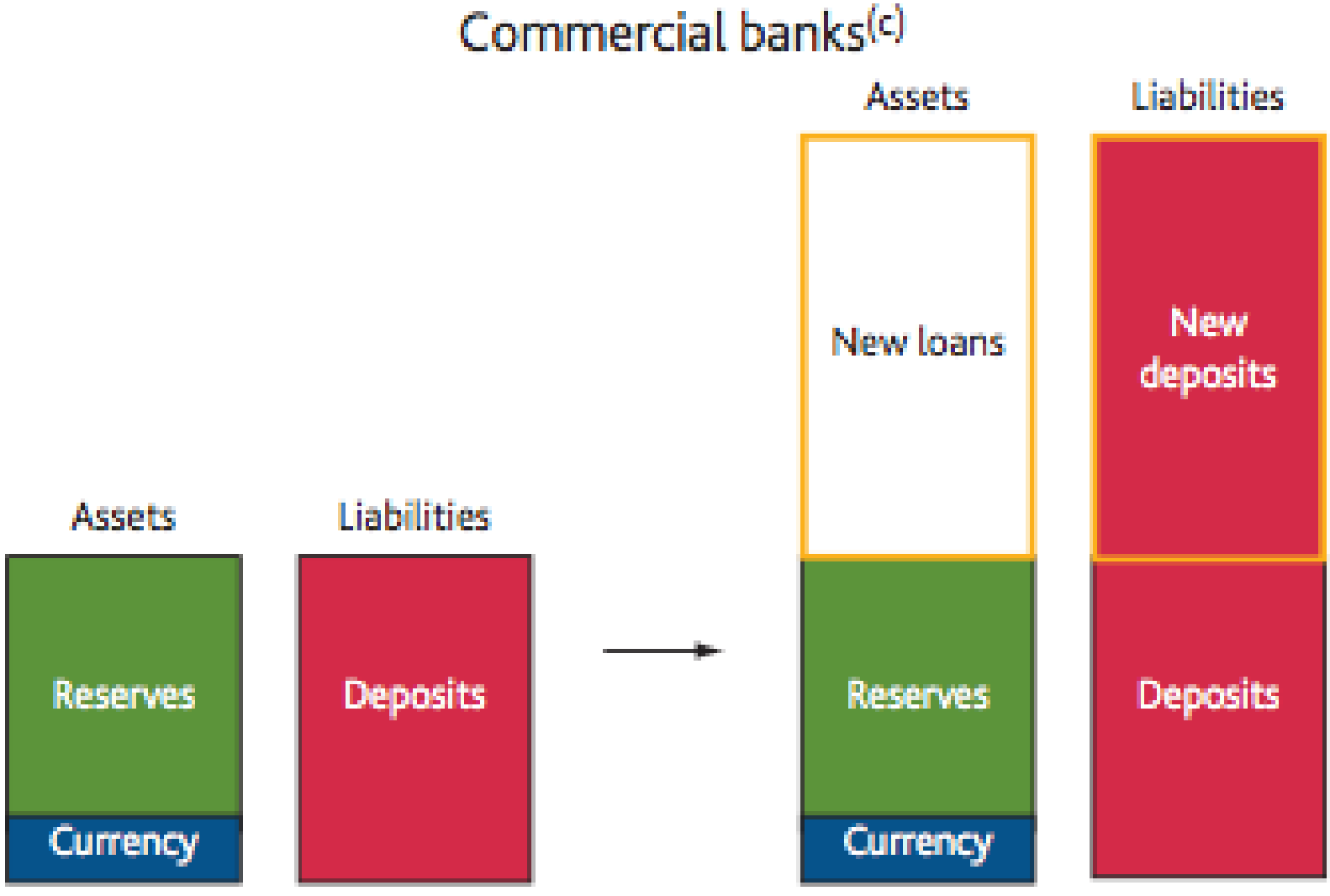


Figure 5: Comercial Bank balance sheet, source: McLeay et al. (2014b)

Money creation - part III

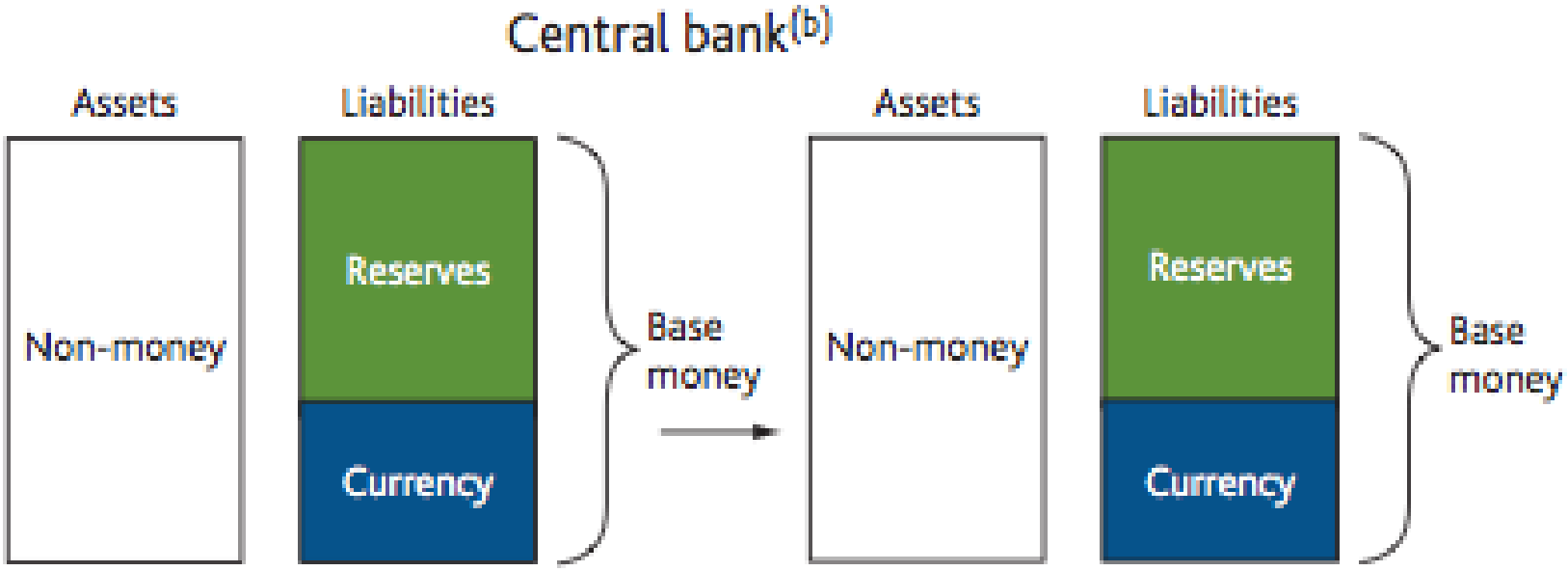


Figure 6: Central Bank balance sheet, source: McLeay et al. (2014b)

Money Cration - part IV, grande finale

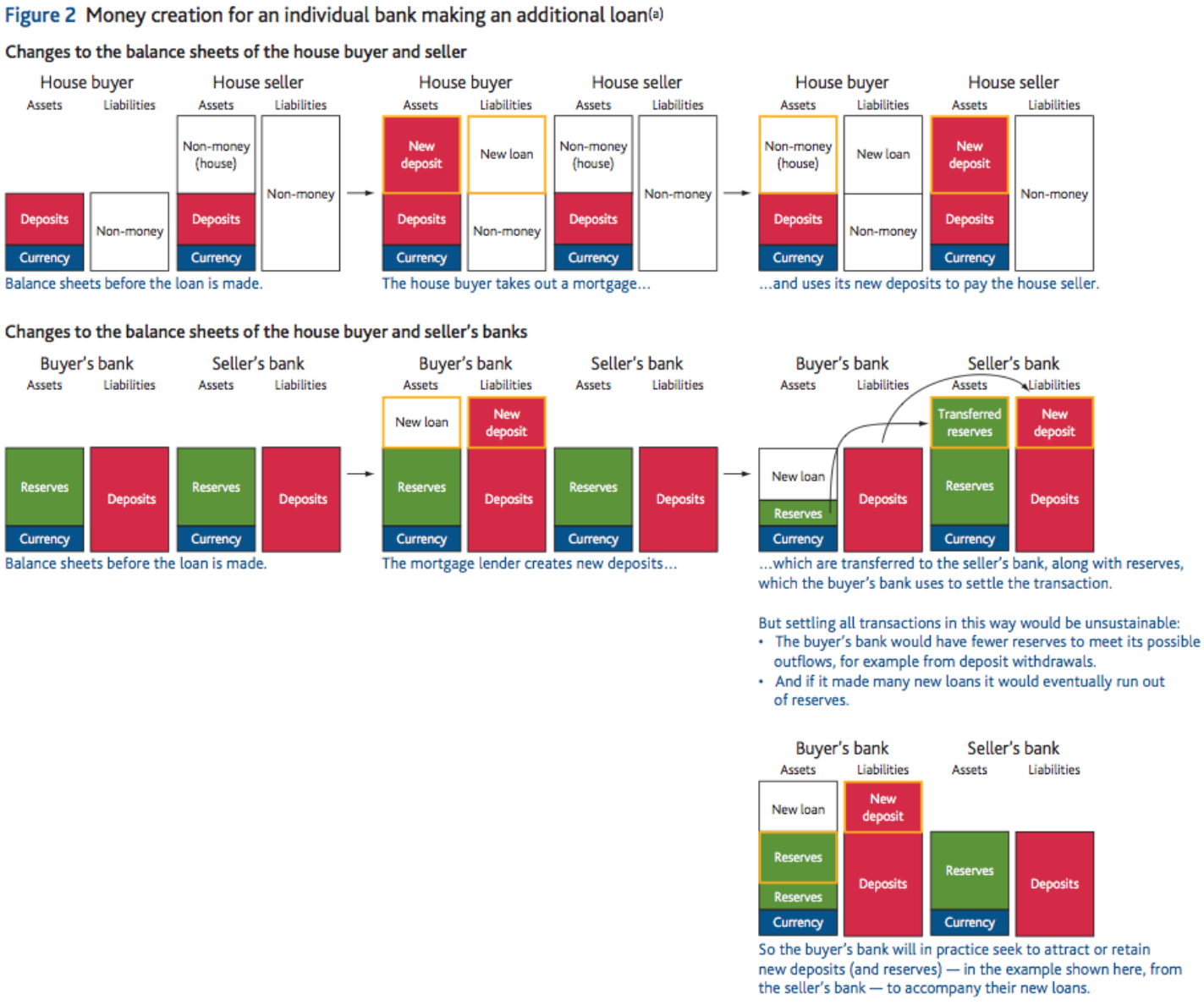


Figure 7: Whole story, source: McLeay et al. (2014b)

Quantitative Easing at a glance

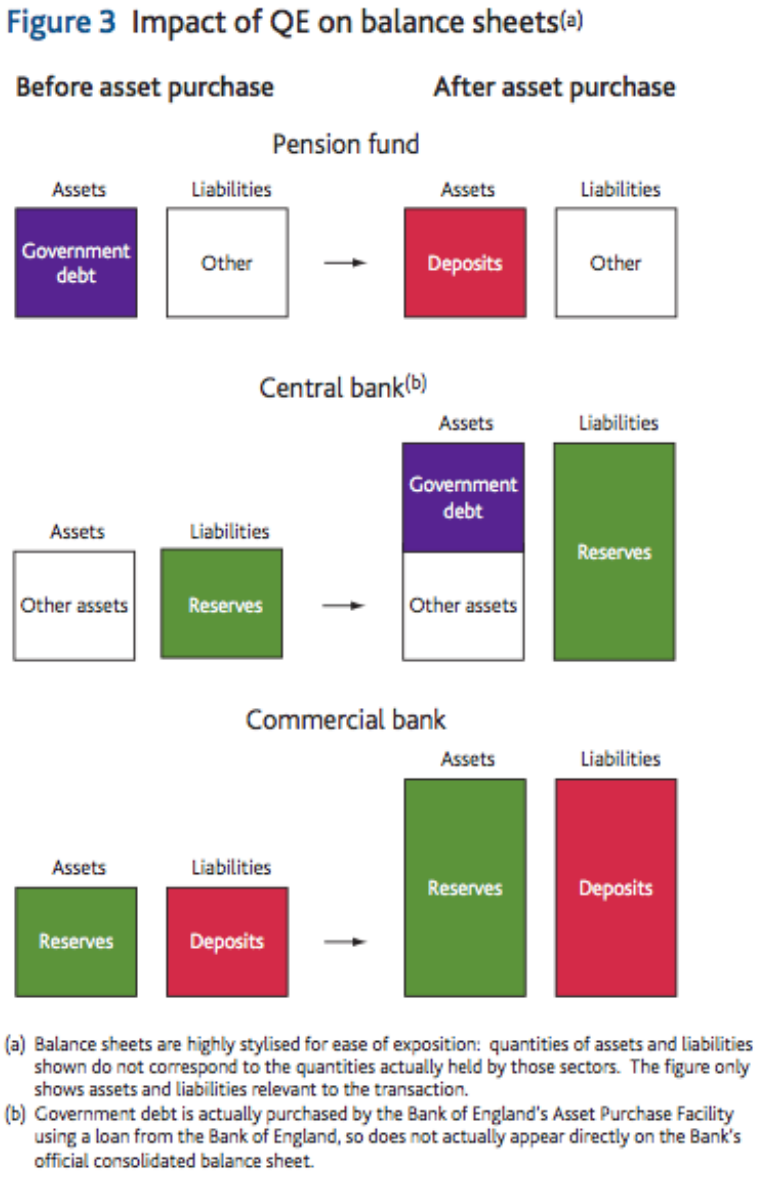


Figure 8: Quantitative Easing, source: McLeay et al. (2014b)

Two misconceptions about QE

- Extra reserves are not “free money”
- Extra reserves are not multiplied up into new loans

Richard Koo (2011) and Balance Sheet Recession

- Difference between balance sheet recession and ordinary recession
  - *Balance Sheet* recession when large share of private sector is minimising debt
  - They reconstruct their balance sheet or de-leverage.
- Impact on monetary policy
  - Decreasing interest rates will not create more demand for credit
  - Money supply contracts due to debt repayment
  - No risk of inflation because only asset prices falls
- Need for active fiscal policy

Balance sheet of member banks of the FED

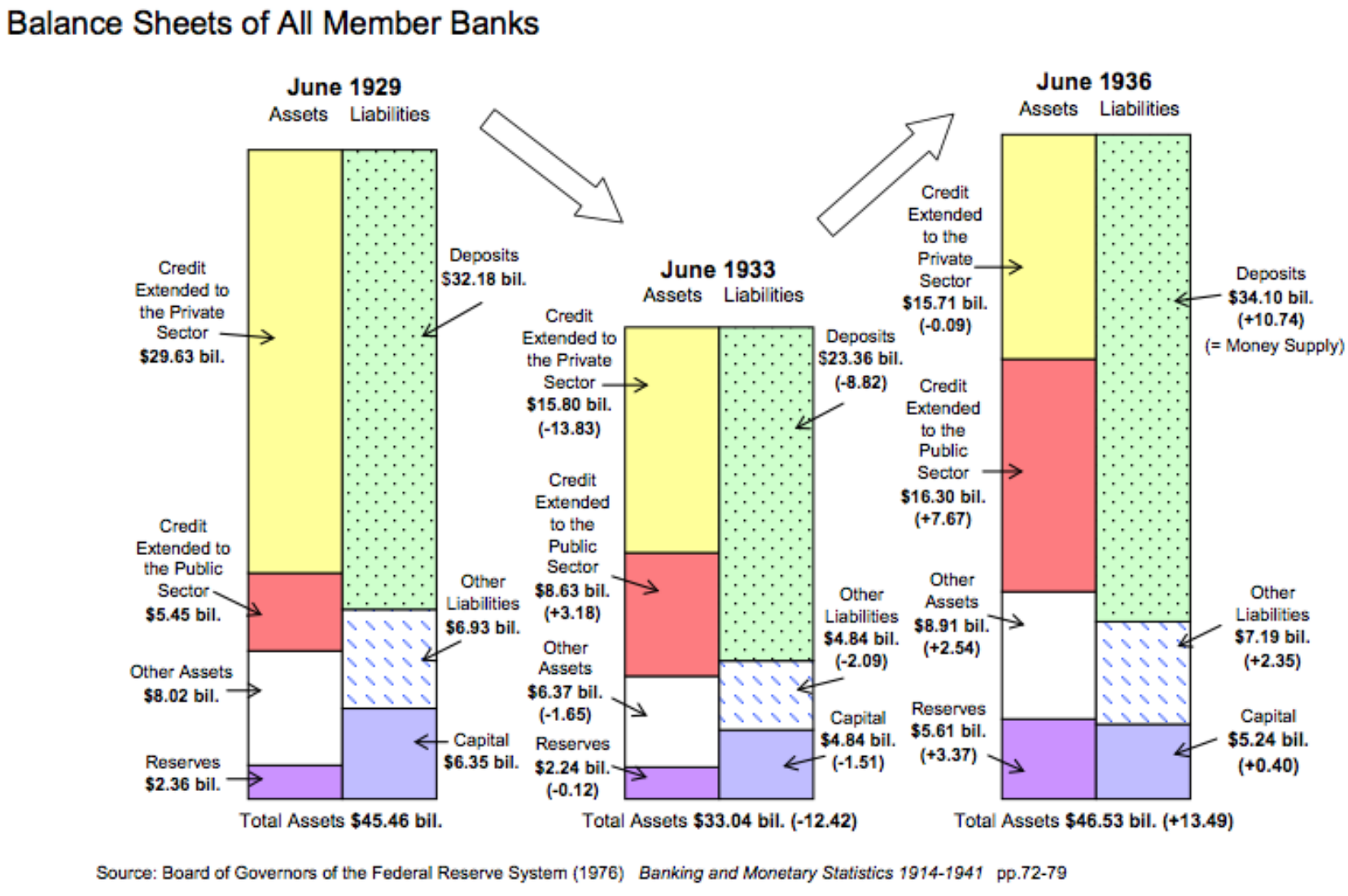


Figure 9: Balance Sheet of Member Banks, source: Koo (2011)

Austerity Tales: the Netherlands an Italy, Mazzolini and Mody (2014)

- Debt and Deflation dynamics analysis
  - European countries implemented significantly larger austerity measures
  - Similar austerity measures, even among heterogeneous countries
  - Public debt ratios are higher than in 2010
  - Public debt ratios have exceeded forecasts and are hand in hand with lower inflation
- The solvency equation

$$PB_{i,t} = \beta_0 + \beta_1 D_{i,t-1} + \beta_2 \ddot{Y}_{i,t} + c_i + \epsilon_{i,t}$$

Results of the regression, Mazzolini and Mody (2014)

Table 1: The Solvency Equation

	(1) Euro Nations: Greenspan Put	(2) Euro Nations: Great Recession		(3) Non-Euro Nations: Greenspan Put	(4) Non-Euro Nations: Great Recession	
VARIABLES	(2002-7)	(2008-13)	(2011-15)	(2002-7)	(2008-13)	(2011-15)
Gross debt/GDP	0.06***	0.08**	0.15***	0.04*	-0.00	0.04
	[4.78]	[3.48]	[7.15]	[2.06]	[-0.04]	[1.51]
Output gap	0.17*	0.28	0.30*	0.23***	0.27***	1.20**
	[2.25]	[1.53]	[2.44]	[10.78]	[5.78]	[3.62]
Constant	-3.04**	-7.40**	-12.87***	-1.61*	-2.59	-4.48
	[-2.93]	[-3.64]	[-9.09]	[-2.02]	[-0.78]	[-1.77]
Observations	72	85	75	66	58	45
R-squared	0.11	0.15	0.41	0.25	0.11	0.52
Number of countries	13	15	15	12	11	9

Figure 10: The Solvency equation

Public deficit and public debt matter

- Impacts are controversial and no clear answer
- Need a model to try to analyse more formally impacts
- Under *Ricardian equivalence*, i.e. if future generations consumption enters in present utility function, there are no macroeconomic consequence of current deficit or surplus

Government Budget Constraints

- Fiscal surplus (deficit), Primary fiscal surplus (deficit), Balance of Payment surplus (deficit)
- Dynamic equation of public debt: $B_{t+1} = B_t + r_t \cdot B_t - E_t$
- $B_0 = \frac{B_T}{R_T} + \sum_{t=0}^{T-1} \frac{E_t}{R_t}$
- If not on a *Ponzi scheme* ($\lim_{T \to \infty} \frac{B_T}{R_T} = 0$), then we have the *conventional government budget constraint*

$$B_0 = \sum_{t=0}^{\infty} \frac{E_t}{R_t}$$

Private Budget Constraints

- Adding a capitalist whose budget constraint is $J_{t+1} = (1 + r_t)J_t - C_t$
- As for the government:

$$J_0 = \sum_{t=0}^{\infty} \frac{C_t}{R_t}$$

- If starting from $B_0 = 0$, any fiscal surplus or deficit has to satisfy the conventional budget constraint and will imply a modification in the capitalist budget constraint: $J_{t+1} = (1 + r_t)J_t - C_t - E_t$
- Over infinite horizon: $J_0 = \sum_{t=0}^{\infty} \frac{C_t + E_t}{R_t}$ which is equivalent to the previous version for the capitalist

Overlapping Generation Models

- Each generation lives for a finite number of periods (usually 2) and make decision without regard to the future
- Modigliani's *Life-cycle theory of saving* where people save while they work in order to consume when they retire, no planned bequest
- Other assumptions: unique interest rate, households can freely borrow or lend, no cheating the system, all saved funds are borrowed by firms implying equality between interest rate and profit rate

Two period-households

- For two period households: $c^w + s^w = w$ and $c^r = (1 + r_{+1})s^w$ leading to

$$c^w + \frac{c^r}{1 + r_{+1}} = w$$

- Where c^w and c^r are defined by *time preferences* over lifetime, leading to *indifference curves* between present and future consumption. Maximising agent, choses the level of saving allowing to reach the highest indifference curve.
- For example, in the case of a Cobb-Douglas utility function: $U(c^w, c^r) = (1 - \beta)ln(c^w) + \beta ln(c^r)$, we have that the best allocation between saving and consumption is such that $c^w(r, w) = (1 - \beta)w$, $s^w(r, w) = \beta w$ and $c^e(r, w) = (1 + r_{+1})w$

Classical Overlapping Generation Growth Model

- Workers save for their retirement, retired workers own all capital stock and save nothing
- Life cycle theory and demographics define social savings, coming out of wages and not of capitalist wealth as in the classical model
- Leontief technology and thus growth-distribution schedule $w = x - v \cdot k$ and $c = x - (g_K + \delta)k$
- Wage rate is fixed $w = \overline{w}$ and labor markets clears at full employment
- The number of young households in time $t + 1$ will be determined by the savings of working households in t, because of the fixed labor to capital ratio. The growth rate of population n is thus equal to growth rate of capital g_K and thus the growth rate of output $g_X = g_K$
- Capital stock of next generation is financed by savings of current generation and we thus have

$$(1 - \delta)k + (g_K + \delta)k = \beta \cdot w = s^w$$

Neoclassical Overlapping Generation Growth Model

- Growth rate of labor force is given $n = \overline{n}$ and wage adjust so that full employment prevails, thus need $g_K = \overline{n}$
- Growth-distribution schedule and saving decision as in the classical model but wages are endogenous and is determined by $\beta \cdot w = (1 + \overline{n})k$

Pareto-efficiency

- *Allocation of resources* from a dictator instead of private property:
  - *feasible* if plan can be achieved
  - *Pareto-superior* the plan is every household is at least as well off and at least one household is better off
  - *Pareto-efficient* if no other plan is Pareto-superior
- Pareto efficient is not ▪optimal*, no value judgement between two plans that are not superior to the other
- Pareto-efficiency doesn't address distribution or relative levels

Pareto-efficiency in the OLG

- *First welfare theorem*: an allocation emerging as a market clearing equilibrium, in an economy where
  - agents have full information
  - no external effects on agents
  - there is vigorous competition
- then the economy is Pareto-Efficient.
- Not true for the following OLG (we are the dictator trying to make the retirees of the first period better off):
  - net profit rate $r = v - \delta$
  - savings per employee for full employment $= (\delta + n)k$
  - total consumption per worker is given by $c = x - (\delta + n)k$ on the equilibrium path
  - How to make better off the retirees without impacting the future generations?

Analysing Social Security and Budget Deficits

- Public deficits are burden for future generations - the OLG model is the natural approach to answer this claim
- A few notes
  - No distributional or insurance impact of social security and taxes
  - No impact on decision to work or consume
  - No inflation
  - Only considering steady-state growth paths

Social Security

- Taxes workers t an pays a benefit b to retired:

$$c^w + s^w = w - t$$

$$c^r = b + (1 + r_{+1})s^w$$

- In a Cobb-Douglas utility function:

$$c^w = (1 - \beta)(w - (t - \frac{b}{1 + r_{+1}}))$$

$$s^w = \beta w - t + (1 - \beta)(t - \frac{b}{1 + r_{+1}})$$

$$c^r = (1 + r)s^w + b$$

Adding social security

- The *reserve fund* is the sum of all fiscal surpluses and deficits
- In per worker level,

$$f = \frac{(1+r)f_{-1} - b_{-1}}{1+g_{K-1}} + t$$

- The saving-investment condition needs to be updated for this new stock

$$(1+g_K)k = s^w + f$$

- Two different types of social security
  - *Fully funded*: $f = t$ and taxes are invested to pay benefit afterwards $b = (1+r_{+1})t$
  - *Unfunded*: $f = 0$ and taxes are used to pay benefit to current retired $b_{-1} = (1+g_{K-1})t$
- Two sorts of closure: classical ($\overline{w}$) and neoclassical ($\overline{n}$)

Exercise: work out the impacts of social security on savings, investment, wages and profit rates

Budget constraint for households

$$c^w + \frac{c^r}{1+r_{+1}} = w - (t - \frac{b}{1+r_{+1}})$$

In the case of a Cobb-Douglas utility function

$$c^w = (1-\beta)(w - (t - \frac{b}{1+r_{+1}}))$$

$$s^w = \beta w - t + (1-\beta)(t - \frac{b}{1+r_{+1}})$$

$$c^r = (1+r)s^w + b$$

Conclusion

- Fully funded has no impact on any closure
- Unfunded has
  - Lower growth impact on Classical model
  - Higher wage and lower profit rate for Neoclassical model

Public debt

- What if instead of taxes, the government borrows to finance social security?
- $t = 0$, $B = -f$ is outstanding debt
- Debt evolves as $f = \frac{(1+r)f_{-1} - b_{-1}}{1+g_{K-1}}$
- Savings condition becomes in the case of a CD utility function: $s^w = \beta w - (1-\beta)(\frac{b}{1+r_{+1}})$
- We thus have $(1+g_K)k = \beta w - (1-\beta)(\frac{b}{1+r_{+1}}) + f$ and the new growth-wage relation is

$$w = \frac{1 = \delta + (g_K + \delta)k}{\beta} + b\frac{1-\beta}{\beta(1+r_{+1})} - f$$

- Existence of a steady state? Only if $g_K^\star > r$ because of $f^\star = -\frac{b}{g_K^\star - r}$

Conclusions

- In the classical and neo-classical models under Ricardian equivalence, no room for public policy
- But the OLG, in certain cases (i.e. the unfunded social security), impacts social saving and investment
- In the real world?

Next Time

- New Keynesian/RBC/DSGE Approach, Romer Chts 5-7