Macro Micro Model with a Post-Keynesian Perspective in the Banking Industry

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Motivation: Price vector-General equilibrium-Partial equilibrium

Can **the equilibrium** be realized in the banking area?
Do we expect **the price vector** including prices on all markets
meeting the mathematical solution at the banking problem?

If so, we should assume this economy, where the price vector could
be solved, maintains the **macroeconomic balance** perfectly:
**equilibrium of the public budgets, the balance of payments,
full employment and no inflation**. It implies that if there are two
markets, the equilibrium in the one (net excess demand=zero)
means equilibrium in the other (net excess supply=zero). Walras
generalized this logic in n-markets. This is so-called the **general
equilibrium**.

Motivation: General equilibrium-Partial equilibrium

Two assumptions of partial equilibrium and the Banking area

- **The first assumption**, **Ceteris Paribus**, means all other things being equal. Real Economy Problem- **asset-liability mismatch**. If we consider an asset or liability, as a single variable started at the assumption, we close to ignore this case in the model. **deposit except for demand deposit**, we cannot explain the bank run

- The second assumption of partial equilibrium is that **other sectors are not affected due to change in one sector**. We know the **70 percent of liability on the bank balance sheet** is **deposit**.

General equilibrium: **multiple equilibria**. **economy as a whole**

Literature: From a price vector (Start of transactions) to the money value (Money supply)

Macroeconomic Methodology:
Old-Keynesian (Neoclassical synthesis)
Exogenous money supply vs. Endogenous money creation

- John Hicks, IS/LM model
  Three exogenous quantities: money in circulation, the government budget and the state of business expectations

- **Irving Fisher**, *value of currency* being *affected by* two movements-*expected growth* in the money supply reducing the real purchasing power of money and *expected increases in productivity* increasing the real purchasing power of money

Literature: Old-Keynesian (Neoclassical synthesis)

- Wilian Philips, Philips Curve: where credit is perceived quite as money
- Franco Modigliani, explained how changes in the exogenously defined money supply influence nominal income
- Robert Solow, presented the solow growth model, not mentioned of price P or inflation

Literature: Endogenous money creation

- **Knut Wicksell**, *two interest rates* -the natural rate is the return on capital and the money rate, in turn, is the loan rate
- **James tobin**, Commercial banks *as creators of money*
- **Chartalism (Modern Monetary Theory)** *Fiat money-governments with the power* to issue thier own currency are always solvent and can afford to buy anything for sale in their domestic unit of account even though they may face inflationary and political constraints
- **Horizontalism** *Credit money created by private banks, not managed by central banks*, can be seen to be leveraging of those reserves without the guidance of a particular leverage ratio.

Literature: Monetarism of Friedman and Post-keynesian

- Monetarism **Milton Friedman** believed that if the money supply was to be centrally controlled (as by the Federal Reserve) that the preferable way to do it would be with a mechanical system that would keep **the quantity of money** increasing **at a steady rate**. however, instead of government involvement at all, he was open to a real, **non-government, gold standard** where money is produced by **the private market**.

Literature: Monetarism of Friedman and Post-keynesian

- **Circuitism** - the economy creates money itself (endogenously), rather than money being provided by some outside agent (exogenously). Also, it models banks and other firms seperately, rather than combining them into a representative agent as in mainstream neoclassical models

- **Hard money**-money that is exchangeable at a given rate of some commodity such as gold. **Credit money** created by commercial banks as primary rather than derived from central bank money.

- The **money multiplier** based on capital adequacy ratio, i.e.the ratio of its capital to its risk-weighted assets not based on reserve requirement-cash reserve ratio.

Economy Policy and Individual Decision

- **Microeconomics** is the branch of economics that deals with the **behavior of the individual producer and consumer**, particularly as decisions are made with respect to the allocation of limited resources.
- Macroeconomics is the study of the total sum of economic activity, dealing with the issues of growth, inflation and unemployment and with national economic policies relating to these issues.
- **The M&M model (the Macro Micro Model)** is the model to explain from the Macro economic theory model to the Microeconomics. An individual want to make a decision micro-economically, also, the nation experiences actions of *cascaded individuals* after recognition of macro economy.

Amount of Money Supply: Money Creation

two money creation processes in the banking area.

- the central bank money creation that money can be created regardless of its form banknotes, coins and certificates of commodity. *The central bank chooses its form of money* and then, it is *denoted as money*.
- the commecial banks creat money by demand deposits. Whenever a bank gives out a loan ina fractioanl reserve banking system, a new sum of money is created. In this framework, *fiat money (paper currency and coins) makes up a small part of money supply*. A much greater part of demand deposits is near money such as checking accounts, transaction by a check or debit card, savings accounts, certificate of deposits (CDs) and money market mutual funds.

Amount of Money Supply: Money Creation

household	
Securities	savings
Deposits x	

commercial banks	
monetary base $\frac{1}{10}x$ **or** $10x$	**Deposits** x
Loans and Securities	Borrowings and Equity
monetary base=required reserves	

a cental banks	
Securities	**monetary base** $\frac{1}{10}x$
monetary base=required reserves	Federal reserve notes outstanding

Money Flow chart

Government (g)	Banks (i)	Households (j) and Firms (f)
		$\sum C_{j \cup f}$
	$\sum R_i$	
G_g		
$-B_g$	$-\sum B_i$	
$-T_g$	ϕT_i	$\sigma(T_j \& T_f)$
	$\sum A_i$	$-\sum A_{j \cup f}$
	$-\frac{1}{\phi}(\sum D_i)$	$\sum D_{j \cup f}$
	$\sum L_i$	$-\sum L_{j \cup f}$

Money Flow shows the economy operated by economic subjects of government (g), banks (i), households (j) and firms (f), where C Currency, R Reserve Deposit, G Government Deposits, B Loan, T Government Bond and investment, σ share parameter without money multiplier effect, ϕ share parameter with money multiplier

bank status at the equilibrium

the reserve bank status at the equilibrium

Assets	Liabilites
Claims to corporate L_{fr}	Securities B_{fr}
Claims to banks $B_{fr} - L_{fr}$	
Currency C_r	

the commercial bank status at the equilibrium

Assets	Liabilites
Claims to corporate $D_h + B_{fr} - L_{fr}$	Deposits D_h
	Borrowings $B_{fr} - L_{fr}$

General equilibrium

Each Market Clearing

I=S (Good Market)
D_b (Firm)-D_b (Firm)+D_b (Household)-D_b (Household)+D_b (Bank)-D_b (Bank)(Deposit market)
L_{fc} (Firm)-L_{fc} (Firm)-L_{fc} (Bank)+L_{fc} (Bank)+L_{fc} (FR)-L_{fc} (FR) (Credit Market)
B_s(Firm)-B_s(Firm)+B_h(Household)-B_h(Household)+B_{fs} (Bank)-B_{fs} (Bank) +B_{fs} (FB)-B_{fs} (FB) (Financial Market)

Firms

Assets	Liabilities
Real Asset D_b+B_h (=Investment I)	Liabilities to banks D_b+B_h -L_{fc} Liabilities to central bank L_{fc}

Banks: domestically chartered commercial banks, country branches and agencies of foreign banks, Edge Act corporation

Assets	Liabilities
Claims to corporate D_b+B_h -L_{fc}	Deposits D_b Borrowing B_{fc} −L_{fc}

Households

Assets	Liabilities
Securities B_h Deposits D_b Real Asset S_h-(B_h+D_b)	Savings S_h

Federal Reserve Banks

Assets	Liabilities
Claims to corporate L_{fc} Currency C_r Borrowing to banks B_{fc}-L_{fc}	Securities B_{fs}

General equilibrium

- Cho (The BCR (Bank capital regulation) model, 2014) If the some accumulated variables is not negative, for example, the components Investment I, Savings S_h, L_{fr} are not negative, there is the equilibrium in the economy and the existence of each factors like firms, Households, Banks, Federal Reserve Banks is fulfilled. The size of banks is affecting on each agent because equity capitals depend on previous deposits. Depending the change of bank size influencing on total deposit D_h, the liability of firms is affected by liabilities to banks $D_h + \sum_{s \in \Omega} P_s B_s^h - L_{fr}$, deposit of household D_h and real asset of household and firms.

Representative agents (Neoclassical model) vs Cascaded individuals (Post-keynesian model)

- Recognization about oscillation of economy : short term-sudden shock, long run-an equilibrium price
- Neoclassical works are based on a '*Representative agent.*' An agent represents a whole category of individuals.
- An idea to model banks and others firms seperately is started by Circuitism of Post-Keynesian. The economy creates money itself (endogenously), rather than money being provided by some outside agent (exogenously).
- money is distinguishable as hard money-money that is exchangeable at a given rate for some commodity such as gold and credit money-created by commercial banks as primary rather than derived from central bank money.

Comparison of a social planner and a regulator

	a Social Planner	a Regulator in the Banking industry
Goal of Decision	Maximization of a Social Welfare Function	Rational Behaviour
Method	Pareto Optimality	Path-dependency
Uniqueness of Optimal Solution	NO 2nd Fundamental Theorem of Welfare Economics	YES Endogenous Money Supply
Macro & Micro	Macro= $\sum$Micro	Macro$\neq \sum$Micro
Income Distribution	Main Factors of Production Land, Labor, Capital	Non-Neutrality of Money
Cause of Redistribution	Policy ineffectiveness	Uncertainty
Decision Timing	Adaptive Expectation Real Business Cycle	Dynamic Method Effective Demand
Remedy about Exogenous Change	Maximizing Expected Utility	Solving Constaints in a different market

Aggregate deposits (stock) or pyroclastic deposits (flow) - Moral hazard problem

Considering the aggregate of deposits, related to the moral hazard, we can simply start with the static model with only two period $t = 0$ and $t = 1$.

The bank want to take a risk because the fundamental money source is secured by a government. At $t = 1$, the deposit insurance premium is paid by the bank. At $t = 1$, the bank is liquidated, and depositors are compensated whenever the bank's assets are insufficient.

For simplicity, the riskless rate (and the deposit rate) is normalized to zero.

Aggregate deposits (stock) or pyroclastic deposits (flow) - Moral hazard problem

The balance sheets of the banks are as below:

Assets ($t = 0$)	Liabilities ($t = 0$)
Loans L	Deposits D
Insurance premium P	Equity F

Assets ($t = 1$)	Liabilities ($t = 1$)
Loan Repayments $\tilde{L}$	Deposits D
Insurance Payment $\tilde{S}$	Liquidation Value $\tilde{V}$

Aggregate deposits (stock) or pyroclastic deposits (flow) - why the bank needs to borrow much more money if regulated?

At date 1, the stockholders receive the liquidation value of the bank:

$\tilde{V} = BankAsset - Deposits + RecoveredDeposits = \tilde{L} - D + \tilde{S}$

where $\tilde{S}$ is the payment received from deposit insurance:

$\tilde{S} = max(0, D - \tilde{L})$ using the balance sheet at date 0 to replace D,

$\tilde{V}$ can also been written as $\tilde{V} = F + (\tilde{L} - L) + [max(0, D - \tilde{L}) - P]$

thus the value of equity will be the sum of its initial value, the increase in the value of loans, and the net subsidy (positive or negative) from the deposit insurance.

Aggregate deposits (stock) or pyroclastic deposits (flow) - Moral hazard problem: why the bank needs to borrow much more money if regulated?

Suppose, for instance, that $\tilde{L}$ can take only two values: X with probability θ (success) and 0 with probability $(1 - \theta)$ (failure).

$E(\tilde{V} - F) = E(\tilde{L} - L + \tilde{S} - P)$
$= E(\tilde{L} + \tilde{S}) - (L + P)$
$= E(\tilde{L}) + E(max(0, D - \tilde{L})) - (L + P)$
$= \theta X + [P(\tilde{L} = X)max(0, D - X) + P(\tilde{L} = 0)max(0, D)] - (L + P)$
$= \theta X + \theta max(0, D - X) + (1 - \theta)D - (L + P)$

Aggregate deposits (stock) or pyroclastic deposits (flow) - Moral hazard problem: why the bank needs to borrow much more money if regulated?

The expected profit for the bank's stockholders will be
$$\pi := E(\tilde{V} - F) = (\theta X - L) + ((1 - \theta)D - P) + \theta max(0, D - X)$$

where the first term represents the Net Present Value (NPV) of the loans and the second term is the net subsidy from the deposit insurance system. If deposit insurance is fairly priced, this term is nil ($P = (1 - \theta)D$), and the strong form of the Modigliani-Miller result obtains: the market value of firm, $E(\tilde{V}) + D$, is independent of its liability structure.

Aggregate deposits (stock) or pyroclastic deposits (flow) - Moral hazard problem: why the bank needs to borrow much more money if regulated?

Suppose that P is fixed and that banks are free to determine the characteristic (θ, X) of the projects they finance in a given feasible set. Then, within a class of projects with the same NPV ($\theta X - L$ = constant),the banks will choose those with the lowest probability of success θ (or the highest risk). This comes from the fact that the premium rate $\dfrac{P}{D}$ is given, and does not depend on the risk taken by the bank.

Aggregate deposits (stock) or pyroclastic deposits (flow) - Moral hazard problem: why the bank needs to borrow much more money if regulated?

If the regulation body push a commercial bank to raise F, at the expected profit for the bank's stockholders, it can be negative effect on profit. At the formula of
$\pi := E(\tilde{V} - F) = (\theta X - L) + ((1-\theta)D - P) + \theta max(0, D - X)$,
the bank should consider the strategy to raise its NPV ($= \theta X - L$).
$\dfrac{P}{D}$ is given and F is restricted over the regulated level. In the first term, to meet the balance of asset-liability, the bank is required to raise L. However, the goal of profit is to raise its NPV ($= \theta X - L$). Hence, the bank consider to rearrange the loan plan $\tilde{L}$ considering θX.

The object, should be regulated: Banks, households and firms

In case of the required reserves of a bank is 10% of deposits as below

Assets ($t = 0$)	Liabilities ($t = 0$)
Cash and Deposit with the central bank $\frac{1}{10}x$	Deposits x
Loans and Securities $A - \frac{1}{10}x$	Borrowings and Equity $A - x$
Total A	Total A

Money Circulation with the money multiplier effect

Assets ($t = 0$)	Liabilities ($t = 0$)
Cash and Deposit with the central bank $10x$	Deposits x
Loans and Securities $A - \frac{1}{10}x$	Borrowings and Equity $A - x$
Total $10x + A - \frac{1}{10}x$	Total A

The object, should be regulated: Banks, households and firms

- How we can explain about the money circulation of $10x$, not $\frac{1}{10}$? From the micro viewpoint to the macro viewpoint, by defining money of commercial banks, central banks, household or firms, "aggregate deposits" (stock) is designing to "pyroclastic deposits" (flow) by segmentation of factors.

- In detail, if we consider money within the micro viewpoint or aggregate deposits, money or individuals do not have characteristics. It implies that a three-factor-model of firms, households and banks is enough to present the idea with classical production factors like capital and labor.

- This is defferent approach from the heterogenous agent model.

the Federal Reserve System Open Market Account (SOMA): Heterogenous agent model can not explain so cascaded individual model will do

- At the liability of federal banks, the Federal Reserve System Open Market Account (SOMA) is one of the monetary policy tools used by the Federal Reserve System.
- It consists of the Federal Reserve's domestic and foreign portfolios. We consider the economy at the country level.
- Because of foreign portfolios of the SOMA, to reduce uncertainty of investment as we can, we suppose that the SOMA of assets offsets deposits and the SOMA of liabilities and capital. Hence, currency and loans to depository institutions as assets and capital securities.

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New Concept of PKGE: A Cascaded Individual j

Consider, fistly, a deterministic Walrasian exchange economy with two kind of goods. Assume that a representative agent i has an initial endowment $e_i = (e_{i1}, e_{i2}) \gg 0$, and a cascaded individual j has an initial endowment $e_j = (e_{j1}, e_{j2}) \gg 0$ and a Cobb-Douglas utility function is as below.

$$u(x_{i1}, x_{i2}) = (x_{i1}^{\gamma}, x_{i2}^{1-\gamma}), \ u(x_{j1}, x_{j2}) = (x_{j1}^{\gamma}, x_{j2}^{1-\gamma})$$

where $0 < \gamma < 1$ and the pair (x_{i1}, x_{i2}) denotes the quantities of goods 1 and 2 consumed by agent i. Thus a representative agent i is described by a pair $\alpha_i = (\gamma, e_i)$. In addition, the pair (x_{j1}, x_{j2}) denotes the quantities of goods 1 and 2 consumed by a cascaded individual j.

Thus a cascaded individual j is described by a pair $\alpha_j = (\gamma, e_j)$

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The Maximization Problem of Typical Agent

Let $p > 0$ be the price of the first good. We normalize prices so that $(p, 1 - p)$ is the vector of prices accepted by an agent and a cascaded individual.

The typical agent solves the following maximization problem (P):

maximize $u(x_{i1}, x_{i2})$,
subject to the "budget constraint" defined as
$px_{i1} + (1 - p)x_{i2} = w_i(p)$

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The Maximization Problem of A Cascaded Individual

In case of a cascaded individual, assume that there are $m + n$ securities available to the intermediary and not defined either Securities B_h or Deposits D_h, where the first m are assets and the last n are liabilities. The *dollar* value of the sth security operated by a cascaded individual at the beginning of the period to maintain the good 1 is denoted by x_{j1s}.

maximize $u(x_{j1s}, x_{j2s})$,
subject to the "budget constraint" defined as
$p \sum_{s=1}^{m+n} x_{j1s} R_{j1s} + (1-p) \sum_{s=1}^{m+n} x_{j2s} R_{j2s} = w_j(p)$,
$Y = \sum_{s=1}^{m+n} x_{j1s} R_{j1s} + \sum_{s=1}^{m+n} x_{j2s} R_{j2s}$

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The Maximization Problem of A Cascaded Individual

where elements of the vector x fulfill:

[Three Condition of elements of the vector x]

$x_{j1s} \geq 0$, for $s = 1, ..., m$,
$x_{J1s} \leq 0$, for $s = m + 1, ..., m + n$,
$\sum_{s=1}^{m+n} x_{j1s} + \sum_{s=1}^{m+n} x_{j2s} = K$

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The Problem of An Intermediary: Avoidance of deviation

K is abstracted by the Securities B_h + Deposits D_h + Real Asset $S_h - (B_h + D_h)$ at the equlibrium of good, deposit, credit and financial markets.

In addition, denoted by R_{j1s}, the increment in real terminal value of one dollar worth of security s purchased at the beginning of the period by a cascaded individual.

The random variable R_{j1s} includes all related increments to either Securities B_h or Deposits D_h like interest payments, dividents and changes in capital value, deposit interest, changes in deposit value, tax expense of deposit.

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The Problem of An Intermediary: Avoidance of deviation

The intermediary try to avoid the deviation at the framework, thus
the vector x is selected to minimize the standard deviation of Y for
any given level , K_{fr}, of expected value,

$Min_x\ \sigma^2(Y) - \lambda[E(Y) - K_{fr}]$,
s.t constraints of Three Condition of elements of the vector x

[Three Condition of elements of the vector x]
$x_{j1s} \geq 0$, for $s = 1, ..., m$,
$x_{J1s} \leq 0$, for $s = m + 1, ..., m + n$,
$\sum_{s=1}^{m+n} x_{j1s} + \sum_{s=1}^{m+n} x_{j2s} = K$

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The Problem of An Cascaded Individual: Acceptance of deviation

The distribution of the random variable R_{j1s} or R_{j2s} can be exogenously given and indepedent from the value of the vector x under the hypothesis of a perfectly competitve market.

However, a cascaded individaul has different efficient portfolios from deviation avoidance portfolios of federal reserve banks. A cascaded individual also pursue the stable efficient portfolios and capture profits above the minimized deviation level than the previous expectation.

Indeed, if a cascaded individual react to the economy of nation, the reaction is occured when he/she recognizes higher or lower value than expectation.

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The Movement of An Cascaded Individual: Raoult's Law

Raoult's law, which is a law of thermodynamics that the partial vapor pressure of each component of an ideal mixture of liquids is equal to the vapor pressure of the pure component multiplied by its mole fraction in the mixture, can be applied at the action to fulfill the expectation of desire about pyroclastic deposit.

Goal
Indeed, for stable economic growth, the overall framework to the long run should be detected as the macro level, but for viewpoints of investment at the financial perspective, the individual decision reacting to sudden shocks can be prolonged to the group action like a bankrun.

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The dynamics of An Cascaded Individual: Raoult's Law

Once the portfolio composition in the solution have reached equilibrium, the total vapor pressure ρ of the solution (changed from liquid) is:

$\rho = \rho_A^* x_A + \rho_B^* x_B + ...$

the individual cascaded vapor pressure for each portfolio composition is $\rho_i = \rho_i^* x_i$

where x_A, x_B, x_i are quantities of good A , B and i. ρ_i is the partial vapor pressure of the portfolio composition i in the gaseous mixture, ρ_i^* is the vapor pressure of the pure portfolio composition to fulfill a cascaded individual and x_j is the mole fraction of the portfolio quantity composition i in the mixture.

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Potential Project Decision of An Cascaded Individual: At the equilbrium

If the system is at equilibrium, then the *potential project Pj* of the quantity composition i must be the same in the liquid solution and in the vapor above it. That is, $Pj_{liq} = Pj_{vap}$

Assuming the liquid is an ideal status for a cascaded individual, and using the formula for potential portfolios, that is:

$Pj^*_{liq} + \sigma^2(Y) = Pj^{\ominus}_{vap} + \frac{f_s}{\rho^{\ominus}}$

where f_s is the fugacity - effective pressure of the vapor about the portfolio of securities s and $\ominus$ indicates the negative status in the investment affected by economy of a nation

$Pj^*_{liq} + \sigma^2(Y) = Pj^{\oplus}_{vap} + \frac{\rho^{\oplus}}{f_s}$

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A Cascaded Individual model at the perspective of PKGE: Optimal Allocation

Both of them, a cascaded individual wants to take risk of portfolio deviation, even though the economy wants to go from Vapor (flow) - moving status with tendancy at the business cycle to Liquid (stock) - original optimal status.

a vector x^* which maximizes that ratio $\frac{E(Y)}{\sigma(Y)}$ and the leverage ratio when assets $\sum_{s=1}^{m} x_{j1s} + \sum_{s=1}^{m} x_{j2s}$ and liabilities $|\sum_{s=m+1}^{m+n} x_{j1s} + \sum_{s=m+1}^{m+n} x_{j2s}|$ are under the effective fugacity f_s.

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the Future Research on M&M model, a Cascaded Individual Model

- Real banking problem solving
- Financial Contagion
- Macro to Micro