Lecture on Economic Stability under Alternative Banking Systems

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Give me your tired,
your poor,
Your under-water banks
yearning to be free
of deeds to empty houses
with light bills still past due.
Send these, the valueless,
the market-scorned to me.
I'll send back some checks,
backed by you and me.

Outline of the paper

- Introduction

- The Case For a Deposit-Taking and Lending Banking System

- Investment and Business Cycles under Alternative Banking Systems

- The Transition to a 100 Percent Reserve System: Some Suggestions

Summary & Conclusions

▸ The main conclusion of the paper is that fractional reserve banking results in excessively risky real investment where the marginal rate of transformation of expected returns for risk generated by the technology of firms is less than the marginal rate of substitution of expected returns for risk in the preferences of investors at the level of savings that financed the investment.

▸ Consequently the level of investment in an economy with a fractional reserve banking system is excessive and not Pareto Efficient

▸ This excessive real investment is shown to amplify business cycles when investors hold rational expectations and the production function is linear homogeneous with constant factor shares.

- We also suggest that full reserve banking take the form of Post Office banks and not private banks.

I. Introduction

1. The recent crisis has given all of us a license to propose regulatory changes to our financial system.

2. I wish to revive parts of the old Chicago Plan for banking reform which curiously have not surfaced in recent policy discussions of regulatory change.

3. The part I want to revive is their proposal for 100 percent reserve banking.
   - This would require banks to hold currency and deposits on the central bank in an amount equal to their demand deposit liabilities.

4. 100 percent reserve banking has had a long history: von Mises (1912), Hayek (1925), Simon (1934), Angell (1935), Fisher (1935), Hart (1935), Graham (1936), Mints (1950), Friedman (1959), Tobin (1985),Allais(1987), Kotlikoff (2010), and Benes and Kumhof (2012) among many others.

5. Presumed advantages of 100 percent reserve banking over fractional reserve banking from the above previous literature.
   i. A 100 percent reserve requirement would make banks absolutely safe eliminating the need for deposit insurance, regulation, and public bailouts.
   ii. A 100 percent reserve requirement would enable the central bank to have absolute control over the M1 money stock.
   iii. A 100 percent reserve requirement along with a k-percent money growth rule is presumed to help stabilize prices and real economic activity.

6. In my model fractional reserve banking leads to a Pareto inefficient level of investment and "excessive" volatility in real economic activity.

7. It is Pareto inefficient in the sense that the combinations of risk and expected returns that firms produce on their real investments (ie,MRT) are not equal to the combinations of risk and expected returns on securities held by household saver/investors as reflected in the MRS in their indifference curves at the savings that finances the Investment.

II. The arguments favoring deposit-taking and lending in present day banks

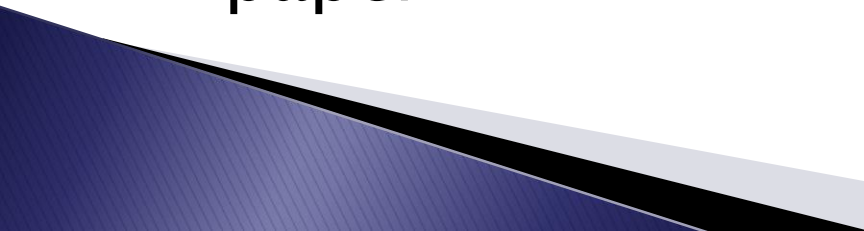   A. History and tradition across time and countries

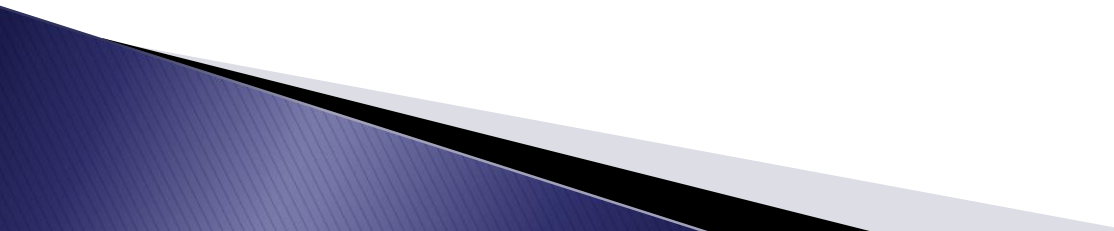   B. Optimal liquidity provision: Kashyap, Rajan, and Stein (2002)

        1) Kashyap et al. abstract from bank runs, fractional reserves and deposit insurance.

        2) They argue that deposit-taking and loan commitments represent two demands for liquidity.

3) To service these two demands the providers of liquidity (i.e., the banks) must hold a stock of liquid assets.

4) If these two demands for liquidity are not perfectly correlated then a smaller stock of liquid assets will be required to service these demands from depositors and borrowers when both deposit-taking and lending is carried out in the same financial institution, namely, present day banks.

- Query: What would happen to the correlations of the two demands for liquidity if the bank got into financial difficulties?
- It would seem that they would go to unity as depositors and borrowers would try and get their money from the bank before it failed.
- Kashyap et al. implicitly assume that banks can't fail and depositors and borrowers holding loan commitments would not run the bank.
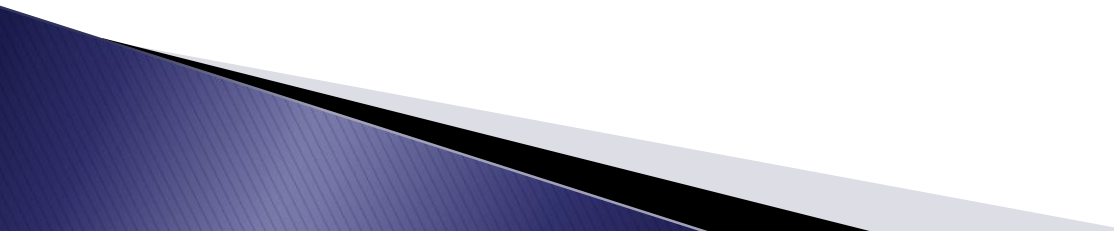
5. What are the assets that represent the stock of liquidity that must be held by banks to service their two customer demands?

    i. Cash in vault
    ii. Reserve accounts at the central banks
    iii. Short-term government securities
    iv. High grade commercial paper

6. Why must the stock of liquid assets be conserved? After all, they are just pieces of paper.

7. Liquid assets represent "costly" overhead.

    i.   Cash and formerly reserve accounts yield a zero rate of interest.

    ii.   Liquid assets that pay interest are subject to double taxation because banks are required to use the corporate form of business organization.

    iii.   Large stocks of liquid assets create agency costs in that they can be transformed into managerial perks and empire building.

III. Investment and Business Cycles under Alternative Banking Systems

A. Introduction

1. Does minimizing the pieces of paper (ie, liquid assets) that banks must hold to service the demand for liquidity by borrowers and depositors result in a social optimum?

2. We argue that allocating saving to investment is a more important criterion in judging the social optimality of a banking system.

3. Under this criterion 100 percent reserve banking is superior to fractional reserve banking.

4. To show this we will develop a model of investment allocation based on the CAPM.

5. The CAPM will give us a risk and return trade-off and it is this trade-off that is important in allocating savings to investment.

6. I also assume consumption is predetermined and focus attention on savings flows into and out of the CAPM market portfolio.

Assumptions

- i) Underlying the market portfolio is one big operating firm with many divisions.
- ii) Capital is allocated to these divisions in the CAPM way that maximizes the Sharpe ratio of the expected market portfolio income, E(Y), to market portfolio risk measured as σ(Y).
- iii) The probability distribution describing the returns is assumed to be normal with mean E(Y) and standard deviation σ(Y).
- iv) Investors hold rational expectations.
- v)   Production functions are linear homogeneous.

Assumptions continued

- vi) The CAPM and the linear homogeneous production function form the micro economic foundation for this model.

- vii) To see this we derive the expected rate of return for division/firm j,ie, $E(R_j),$ when the market portfolio manager maximizes the ratio of $E(R_M)$ relative to $\sigma(R_M)$.

CAPM when Capital Stock is Fixed

$$\frac{E(R_M)}{S(R_M)} = \overset{\circ}{a}_j x_j E(R_j) \overset{\acute{e}}{\underset{\ddot{e}}{}} \overset{\circ}{a}_j x_j^2 s^2(R_j) + 2 \overset{\circ}{a}_j \overset{\circ}{a}_k x_j x_k s(R_j R_k) \overset{\grave{u}}{\underset{\hat{u}}{}}^{-\frac{1}{2}}$$

1.

Subject to:

$$\overset{\circ}{a}_j x_j = 1.0$$

where

x_j = the proportionate share of capital allocated to division j within the representative firm.

$E(R_j)$ = The expected rate of return on division j.

$s^2(R_j)$ = The variance of the rate of return on division j.

$s(R_j R_k)$ = the covariance of the rate of return between division j and division k.

$E(R_M)$ = the expected rate of return on all divisions j that make-up the firm.

$s(R_M)$ = the standard deviation of the rate of return on the representative firm.

CAPM when Capital Stock is Fixed

In maximizing (1) the market portfolio manager adjusts the proportionate allocations of capital, x_j, to each division j so that:

$$\partial \left[\frac{E(R_M)}{S(R_M)} \right] \Big/ \partial x_j = E(R_j) - \frac{E(R_M)}{S^2(R_M)} \left[x_j S^2(R_j) + \sum_k x_k S(R_j R_k) \right] = 0 \qquad \text{2.}$$

The second order conditions for a maximum are satisfied since:

$$\partial^2 \left[\frac{E(R_M)}{S(R_M)} \right] \Big/ \partial x_j^2 = -\frac{E(R_M)}{S^2(R_M)} S^2(R_j) < 0 \qquad \text{3.}$$

A CAPM model of Investment with 100 Percent Reserve Banking Sector

B.

1. The general form of the return generating process for the underlying representative firm/market portfolio is described by the two following equations.

    i. $E(Y) = f(K)$ $f'(K) > 0$ $f''(K) \leq 0$

    ii. $\sigma(Y) = g(K)$ $g'(K) > 0$ $g''(K) \geq 0$

Where:
K = Physical productive capital of the representative firm that underlies the market portfolio.
E(Y) = Expected income on the productive capital.
σ(Y) = Standard deviation of income generated on the productive capital.

Some Technical Details

- Note that as K varies, [σ(Y),E(Y)] describes a locus of points with (i) and (ii) describing the parametric representation of the locus.

- Eliminating K between (i) and (ii) defines E(Y) implicitly in terms of σ(Y).

- This is the relationship I want.
- First let me try and justify the derivatives in (ii) since economic theory is silent about them.
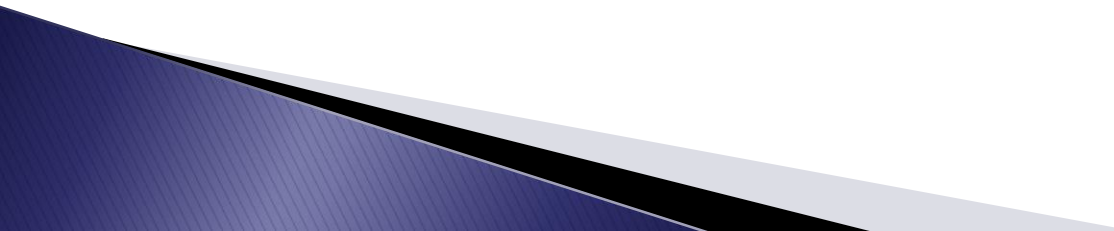
2. (i) just describes diminishing returns and is a standard assumption.

(ii) is a non-standard assumption.

ECONOMIC ARGUMENTS for (ii)

- Uneven capacity increasing real investments across the separate divisions in the firm/market portfolio can make relative prices more variable which in turn increases the operating risk within the firm.
- Variability of relative prices is a source of operating risk according to the New Classical theory (Lucas, 1973).
- Limited supply of experienced managerial talent forces the divisions within the firm to use inexperienced managers (or spread out experienced managers) and that contributes to operating risk.

Economic Arguments continued

- New investment typically involves implementing new technologies. Will the new technologies work as planned or will additional and unforeseen costs be required in their implementation?

- If new investment increases supply relative to demand, risk goes up for all firms since it is uncertain which firms will experience the demand.

2 continued

- Hoggarth et al. (2002) find that output losses associated with recessions that follow bank financed investment booms last longer and are greater in high income countries with developed financial markets compared to low income countries.

  Example:For the US prior to 2007 there was an expansionary build-up in real investment (eg., real estate) financed by banks that invariably was followed by a collapse in house prices and a deep and prolonged recession.

2ii (continued): Evidence from Financial Markets

- Countercyclical movement in the Sharpe ratio,
- $E(R_M)/\sigma(R_M)$ observed by many authors.
- Brandt and Kang (2003) find E(R) rises (falls) in and around NBER troughs (expansions) while σ(R) falls (rises).
- If financial asset prices mirror real asset returns this evidence is consistent with equations (i) and (ii).

2ii (continued): Micro Evidence

REGRESSION EVIDENCE

Kothari, Laguerre, and Leone (2002) present regression evidence that current investments in plant and equipment, R&D, and advertising are all positively related to the standard deviation (or variance in some experiments) of future earnings of Compustat industrial firms over the 1972–1997 sample time period.

2ii (continued): Macro Evidence for the U.S.

- For the nonfinancial corporate sector I run the following regression for the period 1977–2010.

- $Log(Stdev\ Profits, BT)_{t-t+4} = -4.86 + 1.38\ log(CapExpend)_t\ + 9.85\Delta(\frac{Liab}{A})$

- $\qquad\qquad\qquad (-2.17/.00)\ (4.07/.00) \qquad\qquad (1.74/.09)$

- A 1 percent change in capital expenditures results in a 1.38 percent change in the 5-year ahead standard deviation of before tax profits.

2ii continued: Macro Evidence for the U.S.

▸ Granger Causality test rejects the hypothesis that log(CapExpend) does not Granger cause Log (StdDevProf,BT), but we can reject the hypothesis that Log(StdDevProf,BT) Granger causes Log(CapExpend).

3. Taking the total differential of 1i and 1ii results in
    i. d[E(Y)] = f'(k)dK   and
    ii. d[σ(Y)] = g'(K)dK

4. Dividing 3i by 3ii yields the derivative of E(Y) wrt σ(Y)

    i. $\frac{dE(Y)}{d\sigma(Y)} = \frac{f'(K)}{g'(K)} > 0$ indicating E(Y) is a positive function of σ(Y)

5. For the second derivative we have:

    i. $\frac{d^2 E(Y)}{d\sigma(Y)^2} = \frac{d}{d\sigma(Y)} * \frac{dE(Y)}{d\sigma(Y)} = \frac{dE(Y)'}{d\sigma(Y)}$ where E(Y)' $= \frac{dE(Y)}{d\sigma(Y)}$

Next we take the total differential of E(Y)′ and σ(Y) and dividing as above to get:

ii. $$\frac{d}{d\sigma(Y)} * \frac{dE(Y)}{d\sigma(Y)} = \frac{d}{dK} * \frac{dE(Y)}{d\sigma(Y)} * \frac{dK}{d\sigma(Y)} \leq 0 \; since \; \frac{d}{dK} * \frac{dE(Y)}{d\sigma(Y)}$$
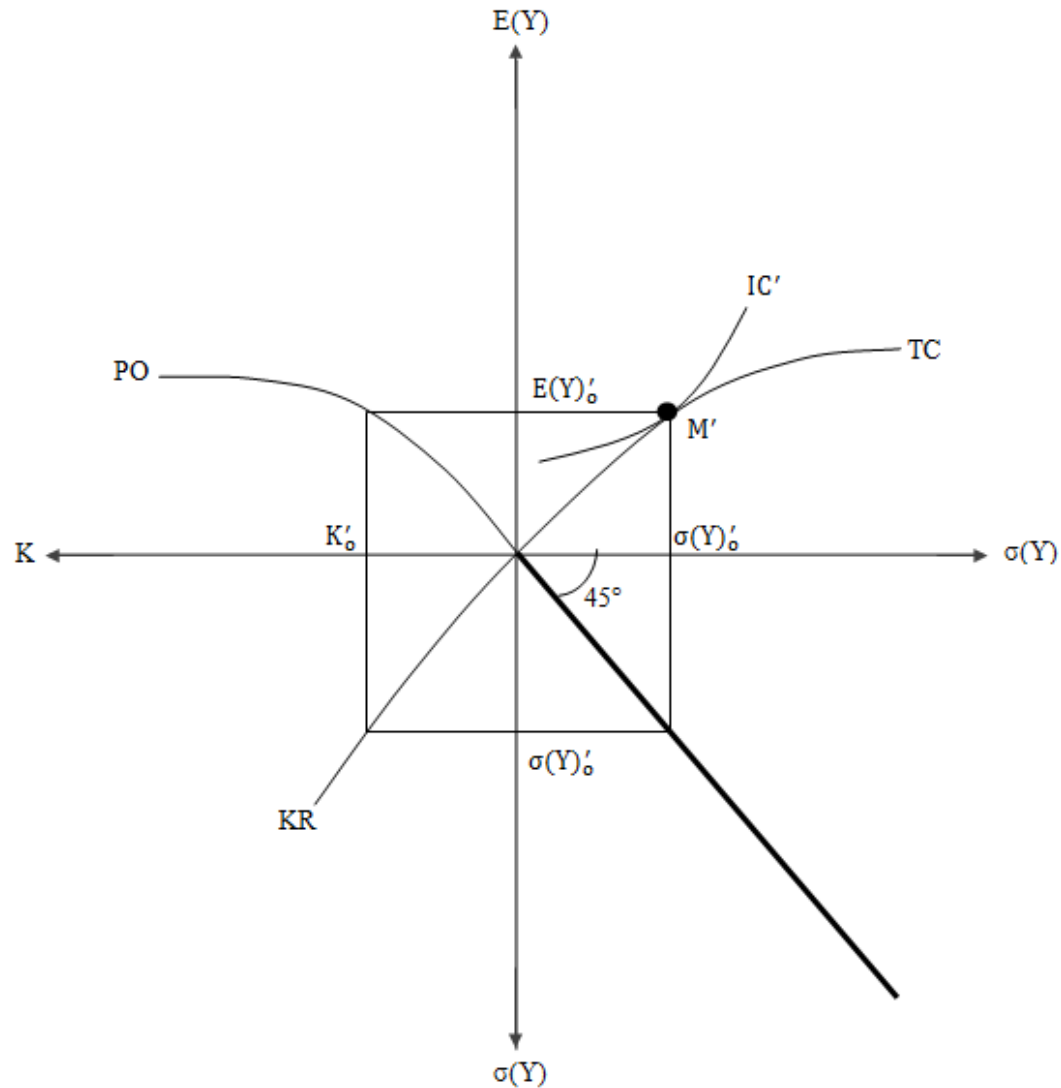
contains f'' which is negative according to 1i.

Thus E(Y) is a positive concave function of σ(Y). Firms produce more risk than expected income as capital investment goes up.

6. Equations (1), (3), (4), and (5) can be described in terms of the geometry in Figure 1.
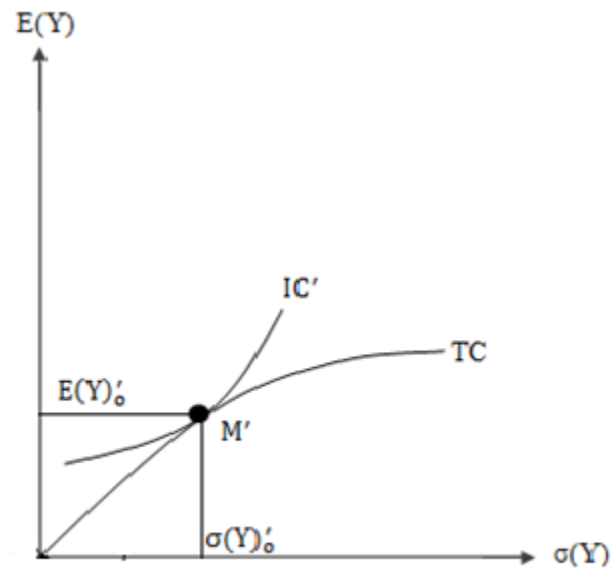
Figure 1
Pareto Efficient Investment in a CAPM Model

Figure 1
Pareto Efficient Investment in a CAPM Model

7. Definitions of curves in Figure 1

   i. **PO** = Productive opportunity curve for the firm/market portfolio.

   ii. **KR** = Generation of risk, $\sigma(Y)$, from capital investment by the firm/market portfolio.

   iii. **TC** = CAPM transformation curve describing the trade-off between risk and expected return generated on the real investments of the firm/market portfolio.

   iv. **IC** = Indifference curve of investors describing the preferred trade-off between risk and expected return that keeps investor expected utility constant.

8. Equilibrium in this CAPM model is described by the tangency between the CAPM Transformation curve TC and investor Indifference curve IC. At this point the firm/market portfolio is producing the combination of risk and expected return that maximizes the expected utility of investors for the level of savings that financed the investment.

9. Point M' defines a Pareto efficient level of real savings and investment in the real economy and the optimal combination of $\sigma(Y)$ and $E(Y)$.

- The model implies that σ(Y) grows faster than E(Y) with increases in capital investment.

- $\text{Log}(\frac{AveProfBT)}{StdProfBT}) = 6.65 - .753\text{Log(CapExpend)} + .001\Delta(\text{Liab})$
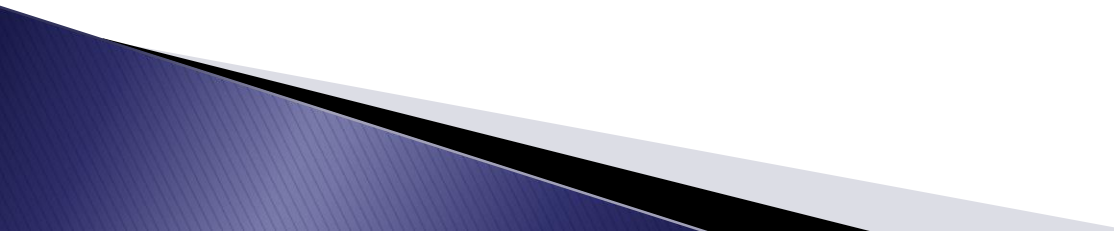
                 (3.8/.00) (-2.7/.01)   (2.2/.03)

$\overline{R^2} = .51$

$\text{Log}(\frac{AveProfBT}{StdProfBT)})$ computed over the period t+1 to t+5

(CapExpend) for period t

$\Delta(\text{Liab})$ for period t

Risk Aversion

▸ A clockwise (or counter-clockwise) movement of the indifference curve IC' reflects a reduction (or increase) in investor risk aversion.

▸ Changes in risk aversion will turn out to have an effect on future business cycles in this model.

Business cycles

- 10. What does this model have to say about business cycles?
- i. The investment in t=0 that produces the Pareto efficient combination of risk and expected return at point M' generates a probability distribution for Y from which future actual returns in t=1 will be drawn.
- ii. With Rational Expectations that probability distribution in t=0 is the one from which actual income Y and output Q in t=1 is drawn.
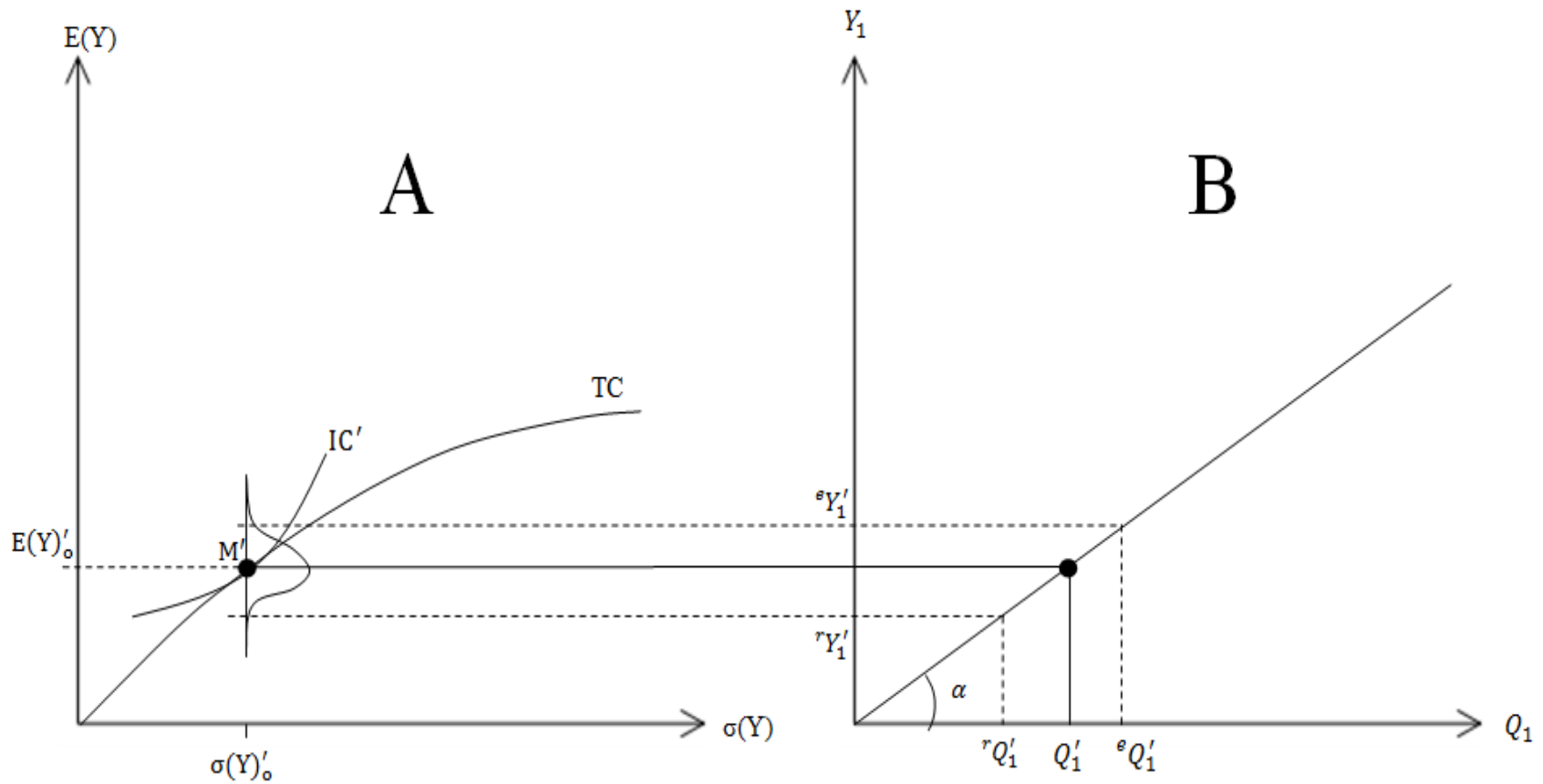
Where does Output come from in this Business Cycle Model?

▸ Iii. Once period t=1 occurs actual investor income and total output become known when A in the production function

$Q_1 = \tilde{A}[K^\alpha N^{1-\alpha}]$ takes on a given value.

▸ iv. The business cycle in this model is measured by the spread of the probability distribution in Figure 2 and it is an expected utility maximizing business cycle.

Figure 2
Business Cycles in a CAPM Model

$$Q_1 = \tilde{A} \left[K_0^\alpha N_0^{1-\alpha} \right]$$

The Model with Fractional Reserve Banking

 A thought experiment in the sense of Gilboa et al. (2014) and Maki (2005,2009).

1. Suppose now bankers successfully lobby for fractional reserve requirements along with a government subsidized deposit insurance scheme.

2. With the excess reserves the banks now have they will invest in the firm/market portfolio (since the return on reserves is zero) with real investment expanding from K_0' to $(K_0' + \Delta K) = K_0^*$ in quadrant 2 of Figure 3.

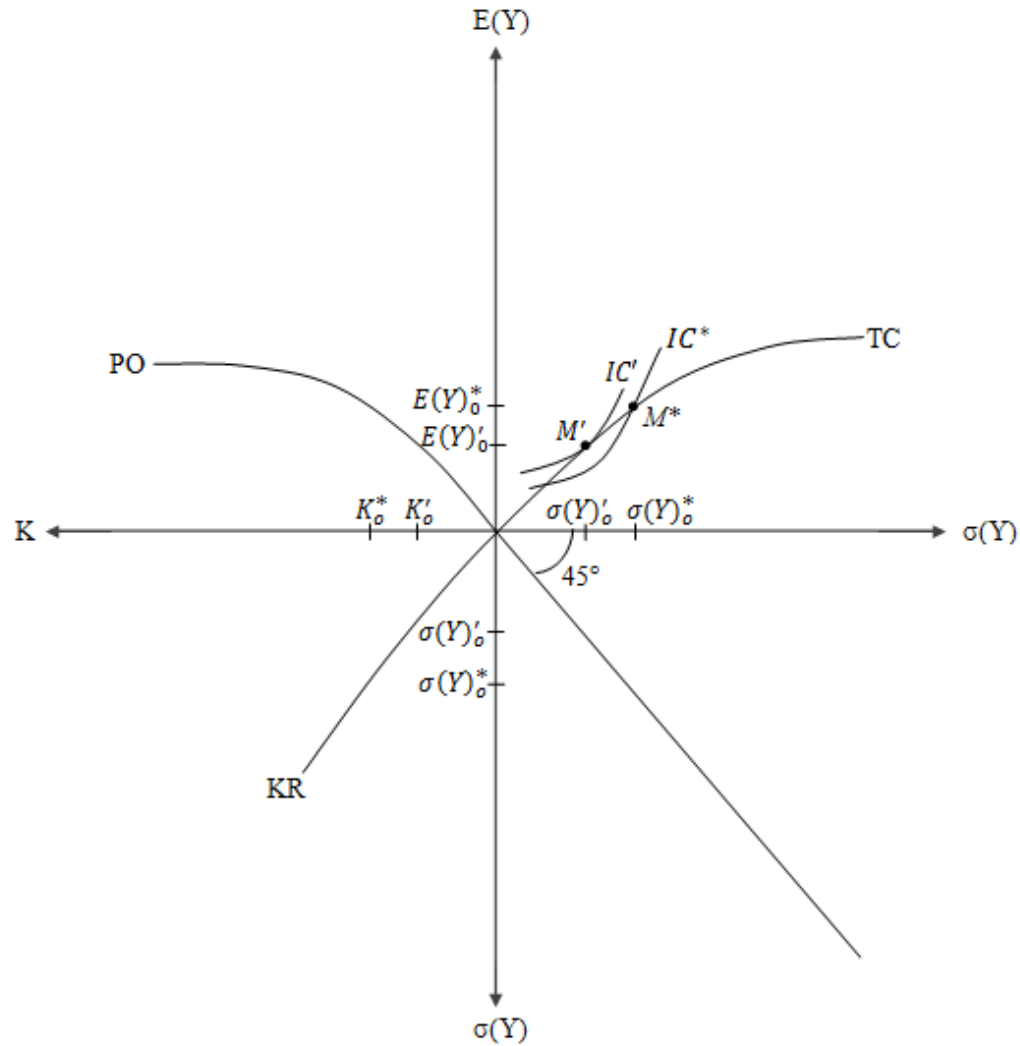# Thought experiment (continued)

a) I further assume that there is available capacity in the investment goods industry so that the additional finance provided by the banks will **not** result in inflation.

b) If there were no excess capacity, the newly created money would cause inflation in the capital goods industry that in turn would cause a redistribution of the claims on the market portfolio away from household savers towards banks.

c) Obviously this would reduce the expected utility of household savers even more.

Thought Experiment (continued)

▸ To sum up I want to show is that even in the absence of inflation considerations, real investment financed by money creation of fractional reserve banks will result in a suboptimal level of investment and excessive volatility in real economic activity.

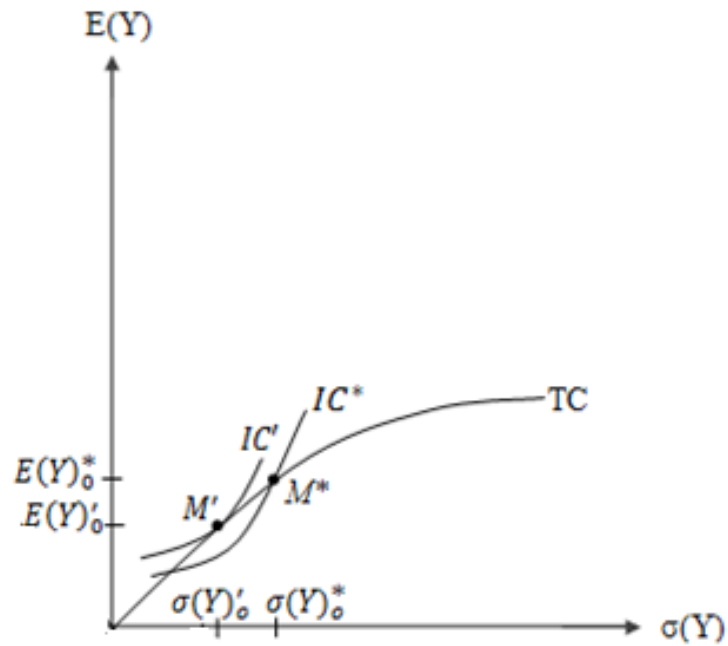▸ This is shown geometrically in Figure 3.

Figure 3
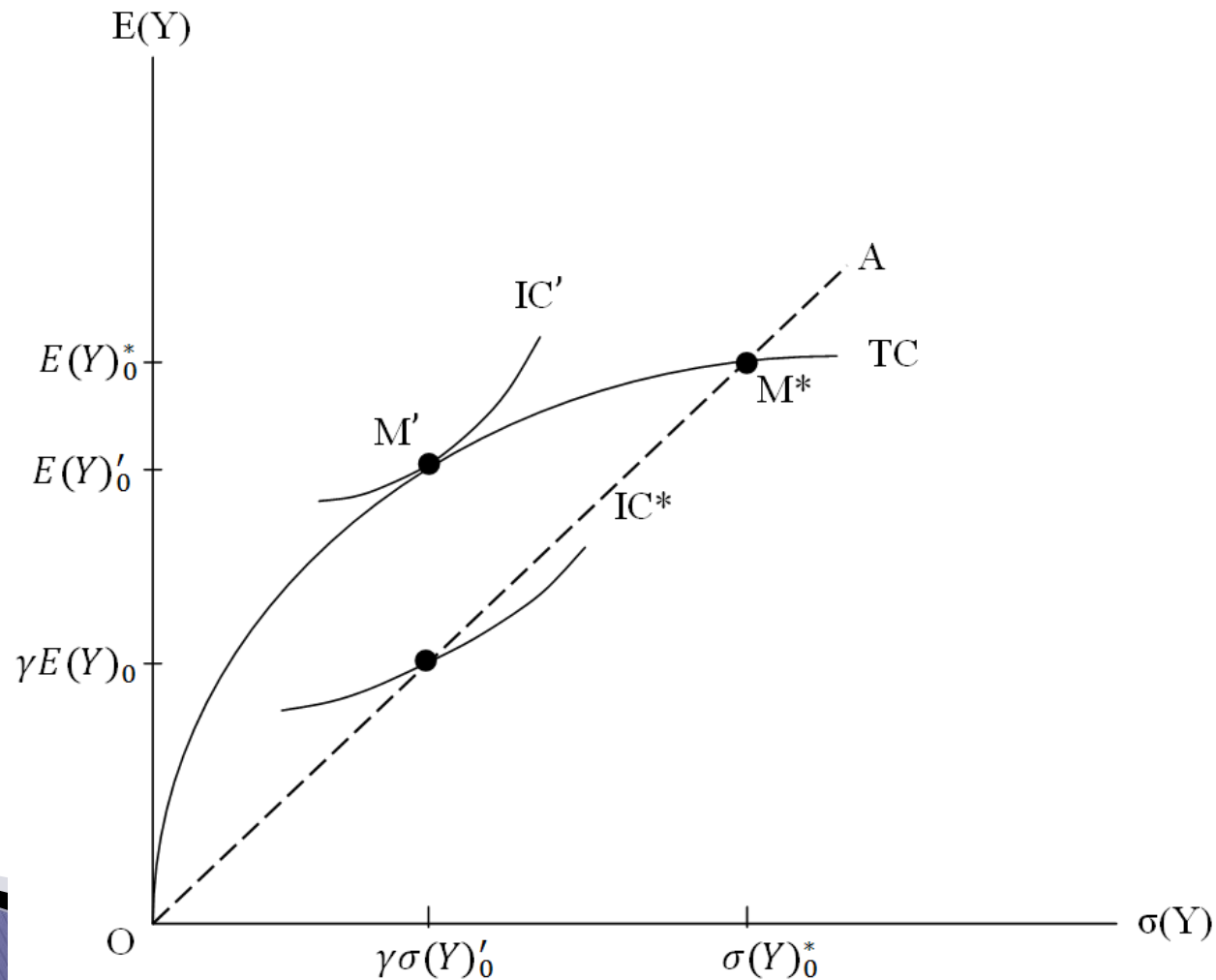## Pareto Efficiency under Alternative Banking Systems in a CAPM Model

Figure 3
Pareto Efficiency under Alternative Banking Systems in a CAPM Model

Figure 3A
Pareto Efficiency under a Fractional Reserve Banking System

3. The new level of investment of K_0^* financed with the utility maximizing savings of households **and** the money creation of banks results in the following in Figure 3:

i) Higher expected income, $E(Y)_0^*$

ii) Higher risk, $\sigma(Y)_0^*$

iii) A movement up the TC curve to M_0^* where the tradeoff between expected returns $E(Y)$ and risk $\sigma(Y)$ is lower.

iv) At M_0^* The saver/investor's indifference curve IC^* intersects TC and is everywhere below IC'.

v) IC* passes through M* when household saver/investors obtain all of the E(Y) and σ(Y) generated on the market portfolio from the investment by banks.

vi) If bankers get a share of the returns from the bank's claim on the returns of their investment in the market portfolio (say 50%), then saver/investors IC* will intersect or touch the line 0A in Fig.3A but lie everywhere below IC'.
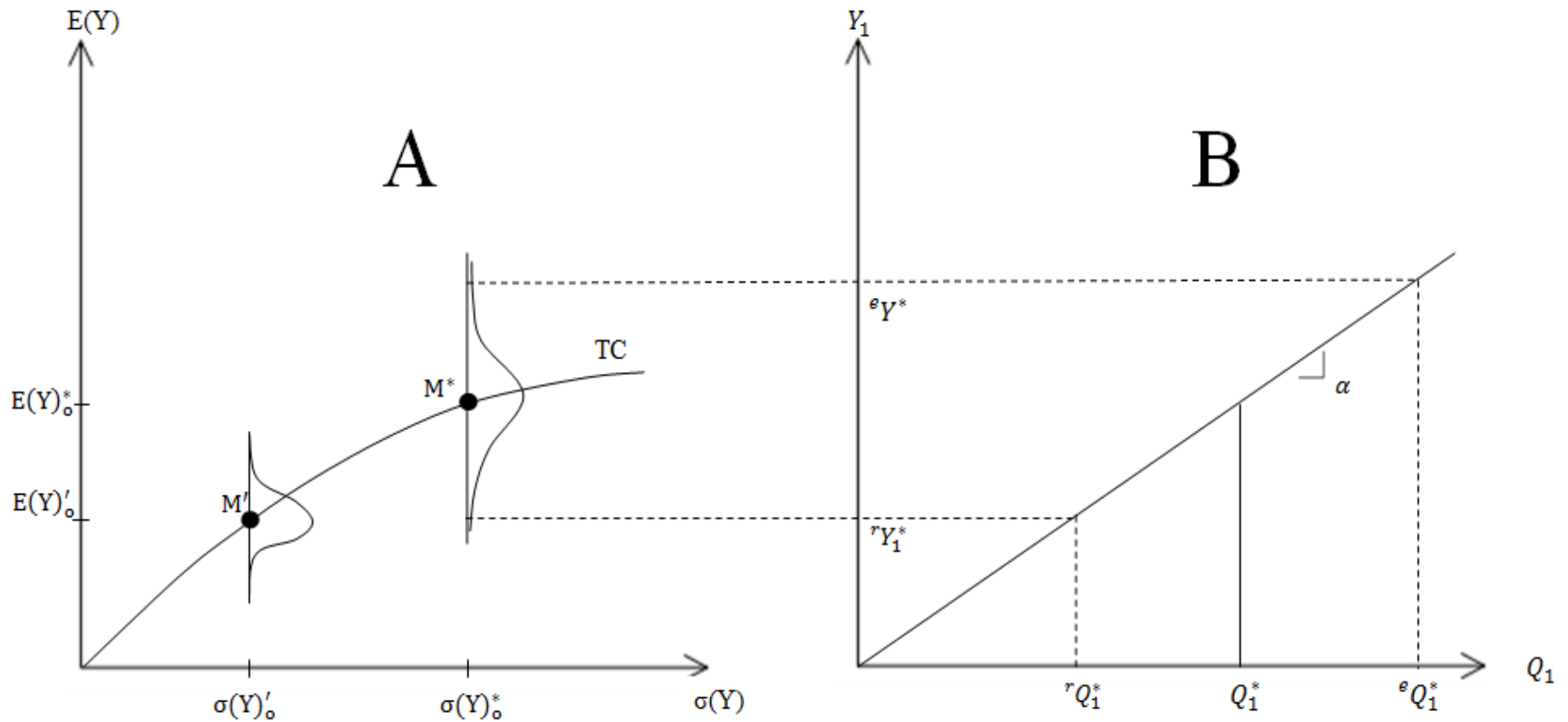
Fractional Ownership in the Market Portfolio

vii) The line OA in Figure 3A plots the various proportions, $(1-\gamma)$ and γ, of ownership on the market portfolio M between bankers and savers. Points closer to the origin indicate small ownership shares for saver/investors and larger ownership shares for banks.

Eg., Saver/investors put up 50% of K_0 and banks put up 50%. Managers take 50% of the bank's share of $E(Y)$ as a bonus. In the end savers get a 75% claim on the returns of the market portfolio with bankers getting the remaining 25%.

Figure 4
Business Cycles under Alternative Banking Systems in a CAPM Model

$$Q_1 = \tilde{A}\left[K_0^{\alpha} N_0^{1-\alpha} \right]$$

4. The effect on the probability distribution describing business cycles is given in Figure 4 Parts A and B.

    i. There it can be seen that the probability distribution associated with M* is more spread out than the distribution associated with M'.

5. In this way money creation amplifies business cycles.
6. Trade deficits in an open economy that lead to inward foreign direct investment would produce this same result for domestic savers.

Possible Disadvantages of 100 Percent Reserve Banking

1. Would every country have to adopt this plan in order for it to be effective?
   i. It would be more effective if they did.
   ii. Domestic firms might borrow abroad.

2. Would overall risk-free liquidity decline?
   i. Yes. Liquidity would become more expensive and in shorter supply as checking account banking would decline.

Possible Disadvantages of Full Reserve Banking (Continued)

ii   Since liquidity is a scarce resource, it should be priced to reflect its scarcity just like we price every thing else that is in short supply in a market economy.

3. Claim: Growth would decline.

i. Yes but for risk averse household savers the growth that would emerge would be utility maximizing growth.

Possible Disadvantages (Continued)

4. Claim: Loss of evaluation and monitoring skills now provided by fractional reserve banks.

   i. Those skills would re-emerge in shadow banks.

   ii. Remember shadow banks like finance companies and insurance companies presently compete with fractional reserve banks protected with deposit insurance.

   iii. They would surely continue to compete in the absence of fractional reserve banks protected by deposit insurance.

5. Claim: Shadow banks that would emerge from a transition from fractional reserve to full reserve banking would be more vulnerable to financial and economic crises.

   i. The Great Financial and Economic Crisis that started in 2007 didn't need full reserve banking to occur.

   ii. Going over to a full reserve banking system doesn't mean shadow banks can't be regulated with capital and liquidity requirements.

Disadvantages (Continued)

6. Claim: Difficult transition from fractional reserve to full reserve banking?

    i. Yes but more difficult than transition to the Euro, Brexit, or metrication for the UK starting in the 1970"s?

7. Mathew 25: 14–30. "Parable of the Talents."

Disadvantages (Continued)

- 8.   Claim: Would private fractional reserve banking with enhanced regulation work better than full reserve Post Office banking?
- i. U.S. banks have historically been successful in getting Congress to eliminate regulations that reduce their profits, risk notwithstanding. Eg., Glass-Steagall to Gramm-Leach-Bliley Act of 1999.
- ii. Will it be any different for Dodd-Frank?

Disadvantages (Continued)

- iii. U.S. policies towards the supply and demand of financial products are too conflicted.
  a.   Wall Street Reform part of Dodd-Frank Act versus the Consumer Protection part of the Act.
  b.   Federal Home Loan Banks (1932), FHA (1934), and Community Reinvestment Act (1977) are all designed to provide access to a variety of financial products to low income groups.
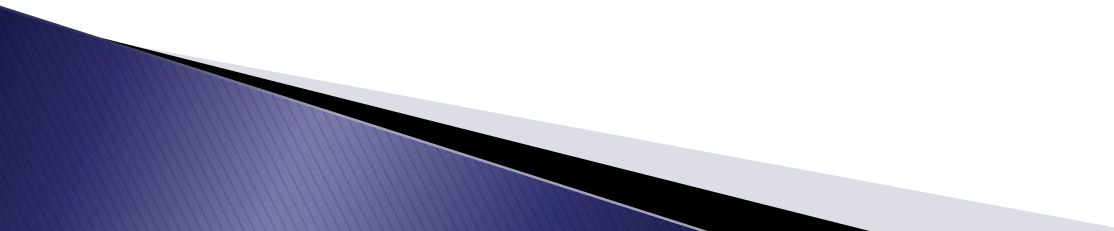
Disadvantages (Continued)

c. These financial products are contained within and pose risks to the private financial system.

d. It is these risks that regulation like Dodd-Frank are designed to mitigate.

Monetary Policy in a Full Reserve Banking System

1. Open market operations would remain the same.
2. Discounts and Advances and the Term Auction Facility (TAF) would be different.

i. Instead of lending to banks at their initiative the Central Bank would buy and sell shares in shadow banks at prevailing market prices.

ii. The shadow banks in turn would invest in firms and lend to individual.

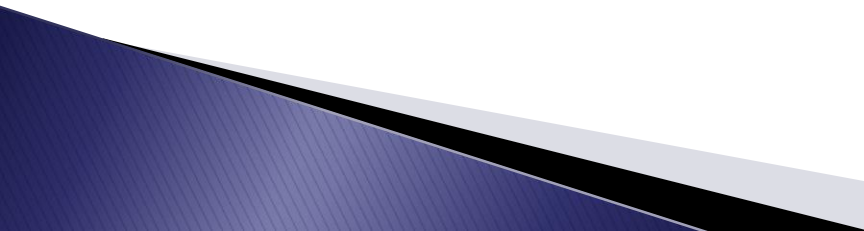iii. This buying and selling by the Central bank could be general or targeted at specific sectors.
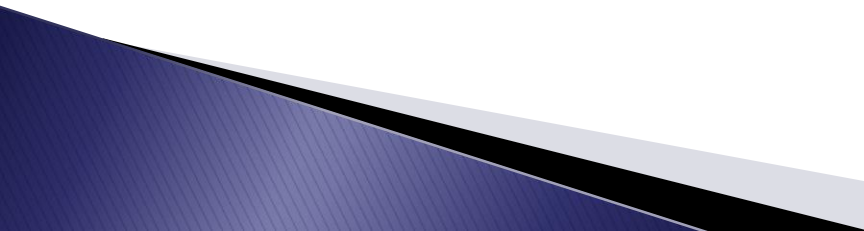
Monetary Policy (continued)

iv. Under Discounts and Advance banks initiate the transaction and the volume of reserves that result from the transaction.

v. Investing in the market portfolio or shadow banks the Central bank initiates the transaction and the volume of reserves that result from that transaction.
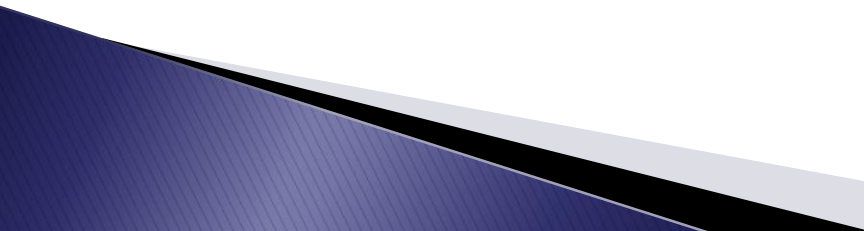
IV. Transition from Fractional Reserves to 100 Percent Reserves

A. **Post Office Banking**

1. One way to transition from fractional reserve banking to 100 percent reserve banking is to set up a postal banking system.

2. Is this feasible from a facilities availability point of view?

   i. In 2003 there were 7,842 banks in the U.S. (and falling) with roughly 68,000 branches (and rising).

   ii. At the same time there were roughly 187,000 post offices.

   iii. In addition post office kiosks could be set up in office buildings and various stores.

3. At some announced date (e.g.,1/1/20) declare postal checks to be legal tender and remove deposit insurance from present day bank deposits

4. What would become of banks?

   i. Today's banks would become non-bank financial institutions of their own choosing.
   ii. If they were systemically important they would be subject to suitable regulations as present day shadow banks.

5. How would these post offices earn an income to cover their costs including profit?

   i. They would earn interest on their reserves at the central bank if the central bank wanted to subsidize check writing.
   ii. They would charge their customers fees for their deposit accounts.

6. Since the post office would have a monopoly over checking account money, deposit account fees would have to be set by some public service commission.

- B. **Using the Existing Banking System**
- 1. Thanks to the Federal Reserve paying interest (in excess of the T-bill rate) on bank reserves, banks in the U.S. could now easily move to a 100 percent reserve system without selling other assets on their balance sheets.
- 2. U.S. banks have excess reserves more than twice the level of reservable deposits.

- 3. Banks would then split into a narrow 100 percent reserve bank and a non-bank financial intermediary.
- 4. Disadvantages in having 100 percent reserve banking carried out by present day commercial banks.
- i) Banks have a history of overturning regulation that reduces their profits.

V. Summary and Conclusions

1. In this paper I develop a CAPM model that enables us to:

   i. Evaluate the optimality of the coordination of savings and investment.
   ii. Link current investment decisions to future volatility of real output.

2. In my thought experiment I find a fractional reserve banking system results in excessive real investment and volatility of real output compared to the utility maximizing Pareto efficient level of real investment and business cycle volatility in a 100 percent reserve banking system.

3. The main policy implication that follows from this model is to require banks to hold 100 percent reserves (in the form of currency and accounts at the central bank) against their demand deposit liabilities.

4. How countries could achieve 100% reserve banking should be the subject of future research.

5. Advantages of 100 Percent Reserve Post Office Banking vs 100 Percent Reserve Banking by Existing Private Banks

◦ Existing private banks have been successful in the past in undoing restrictive regulations. In time private banks would lobby to reduce reserve requirements to get them back in the business of financial intermediation and trading.

• With no deposit insurance, there will be less of a precedent for public rescues of shadow banks.