Today

Bank Expansion   M&B 9

Money Multiplier   M&B 10

Bank Expansion (M+B 9)

C = Currency in circ.

D = Checkable Deposits

R = Bank Reserves

Money Stock (M1)

$$M = C + D$$

Monetary Base   aka High-Powered Money

$$B = C + R$$

Simple Example

- Public starts with $100 in C.

$$D = 0 ;$$

Banks		Public	
A	L	A	L, NW
0	0	C 100	NW 100

Money Stock

$$M = C = 100$$

Monetary Base

$$R = C = 100$$

- Initially, Public has \$100 in C,
  Banks have 0 assets, 0 liabilities,
  $M = C = B = \$100$

- Suppose public wants to hold
  all M as D.

Public deposits \$100:

	Banks		
A		L	
R	100	D	100
		NW	0
	100		100

	Public		
A		L	
D	100	NW	100
	100		100

Now
$$M = D = \$100$$
(unchanged)

And
$$B = R = \$100$$
(unchanged)

Depositing C in Bank

- _changes composition of_ M: $C\downarrow$, $D\uparrow$

- _does not change_ $M = C + D$

  (_same for withdrawals of C from D_)

- doesn't change B

Spending Deposited Funds

- _only changes ownership of_ D

- _does not change M or B_

- <u>Suppose Banks only want to</u>

  <u>keep 10% reserves.</u>

<u>Banks lend $90 to public,</u>
who keep this on deposit.

Banks

A		L	
R 100		D 190	
Loans 90		NW = 0	
190		190	

Public

A		L, NW	
D 190		Loans 90	
		NW 100	
190		190	

Now,

$$M = D = \$190$$

- <u>M↑ as banks lend surplus</u>

  <u>reserves!</u>

But

$$\underline{B = R = 100}$$

- <u>Base unaffected by Bank actions.</u>

Now,
$$D = 190$$
$$R = 100$$

Banks only want to hold 10% of
$190 or $19 in R.

Lend out $100 - 19 = $81

But Public keeps this on deposit:

Banks

A	L
R 100	D 271
Loans 171	NW=0
271	271

Pub.

A	L, NW
D 271	Loans 171
	NW 100
271	271

Now
$$\underline{M = D = \$271} \quad \left(\underline{1!}\right)$$

But
$$\underline{B = R = \$100 \quad (\text{No change})}$$

Table 1

The Bank Expansion Process

$$\beta = 100$$

$$f = \frac{R}{D},$$

$$c = \frac{C}{D}$$

Money Supply ($)

Round #	Example 1 (f=0.1, c=0)	Example 2 (f=0.1, c=1.0)
Start	100.00	100.00
1	190.00	145.00
2	271.00	165.25
3	343.90	174.36
4	409.51	178.46
5	468.56	180.31
6	521.70	181.14
7	569.53	181.53
8	612.58	181.68
9	651.32	181.76
10	686.19	181.79
.	.	.
.	.	.
.	.	.
Equilibrium	1000.00	181.82

Currency Holdings

- Attenuate, but do not eliminate bank expansion

- Suppose $M_0 = C_0 = \$100$

  but public wants to hold equal C, D.

Round #1

Public Deposits $50,

Banks Lend $45 in currency

$$M = C + D = 95 + 50 = \$145$$

Round #2

Public redeposits $22.50

Banks Lend $.9(22.50) = \$20.25$

$$M = C + D = (95 - 22.50 + 20.25)$$
$$+ (50 + 22.25)$$
$$= \$165.25$$

Etc.

Bank Expansion Multiplier k (M+B10)

C = currency in circulation.

D = checkable deposits

R = bank reserves

$$M = C + D \quad (M1)$$

Monetary Base

$$B = C + R$$

With fractional reserve banking,
$R < D$, so
$B < M$.

Multiplier

$$k = \frac{M}{B}$$

or $\boxed{M = kB}$

$k > 1$ if $R < D$

Determination of k

Let

c = Public's desired ratio of $\frac{C}{D}$

f = Banks' desired ratio of $\frac{R}{D}$

(fractional reserve ratio)

$$0 \leq c \leq \infty$$

$$0 \leq f \leq 1$$

If public is happy,

$$C = cD$$

If banks are happy,

$$R = fD$$

So in equilibrium,

$$k = \frac{M}{B}$$

$$= \frac{C + D}{C + R}$$

$$= \frac{cD + D}{cD + fD}$$

$$\boxed{k = \frac{c + 1}{c + f}}$$

$$K = \frac{c+1}{c+f} \quad , \quad M = kB$$

Examples $\quad (B = \$100)$

① 10% reserves, no C

$$f = 0.1, \quad c = 0$$

$$k = \frac{(0)+1}{(0)+.1} = \frac{1}{.1} = 10$$

$$M \to (10)(\$100) = \$1000$$

② 10% reserves, $C = D$

$$f = 0.1, \quad c = \frac{C}{D} = 1.0$$

$$k = \frac{(1)+1}{(1)+(61)} = \frac{2}{1.1} = 1.8182\ldots$$

$$M \to (1.8182)(\$100) = \$181.82$$

Properties of $k = \frac{c+1}{c+f}$

- $f\uparrow \rightarrow k\downarrow$
  $f\downarrow \rightarrow k\uparrow$

- $f = 1 \rightarrow k = 1$ (100% reserve banking)
  $\Rightarrow M = B$, regardless of c

- If public uses only C, no D;

  $c = \infty,\ k = 1,\ M = B = C$

- $c\uparrow \rightarrow k\downarrow$
  $c\downarrow \rightarrow k\uparrow$ if $f < 1$

- $c = 0 \rightarrow k = \frac{1}{f}$

- $c = 0,\ f = 0 \rightarrow k = \infty$

  ($1 of B supports an
  indefinitely large M.)

Table 2

Illustrative Values of the Bank Expansion Multiplier

$$k = \frac{c + 1}{c + f}$$

Fractional Reserve Ratio (f)	Currency/Deposit ratio (c)					
	0.00	0.25	0.50	1.00	2.00	**
0	***	5.00	3.00	2.00	1.50	1.00
.10	10.00	3.57	2.50	1.82	1.56	1.00
.20	5.00	2.78	2.14	1.67	1.36	1.00
.50	2.00	1.67	1.50	1.33	1.20	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00

* If the public uses no checking deposits at all, c = C/D becomes infinitely large, hence $k = 1$.

** The multiplier becomes infinitely large as f and c both approach 0.

Excess vs Required Reserves

Let $f_R = {}_\wedge$ Avg. Legally required reserve ratio on D

R_R = Legally required reserves

so $R_R = f_R \cdot D.$

Let $R_x = R - R_R$

= eXcess Reserves

and f_x = Banks' desired ratio of $\dfrac{R_x}{D}$

so $R_x = f_x \cdot D$ if banks happy.

Then $f = \dfrac{R}{D} = \dfrac{R_R + R_x}{D} = \dfrac{f_R \cancel{D} + f_x \cancel{D}}{\cancel{D}}$

$f = f_R + f_x$

So $k = \dfrac{c + 1}{,c + f}$

$\boxed{k = \dfrac{c + 1}{c + f_R + f_x}}$

$f_R \uparrow \Rightarrow k \downarrow$

$f_x \uparrow \Rightarrow k \downarrow$

Reserve Requirements, 2010

Type of Deposit	Current setting Setting	Discretionary Range
Transactions (checking) deposits		
$0-10.7 million***	0%	
$10.7-55.2 million***	3%	
$55.2 million up***	10%*	8-14%
Savings and time deposits	0%**	0-9%
Eurocurrency liabilities	0%	

* Top rate on Transactions deposits reduced from 12% 4/92.
** Reserve requirements on savings and time deposits eliminated 12/90.
*** Reserve requirements for each bank increase progressively with size of bank. Brackets indexed annually by 80% of change in total reservable liabilities (0% bracket) or in total transactions deposits (3% bracket).

Graduated reserve requirement act as a progressive tax on banks, favors small banks.

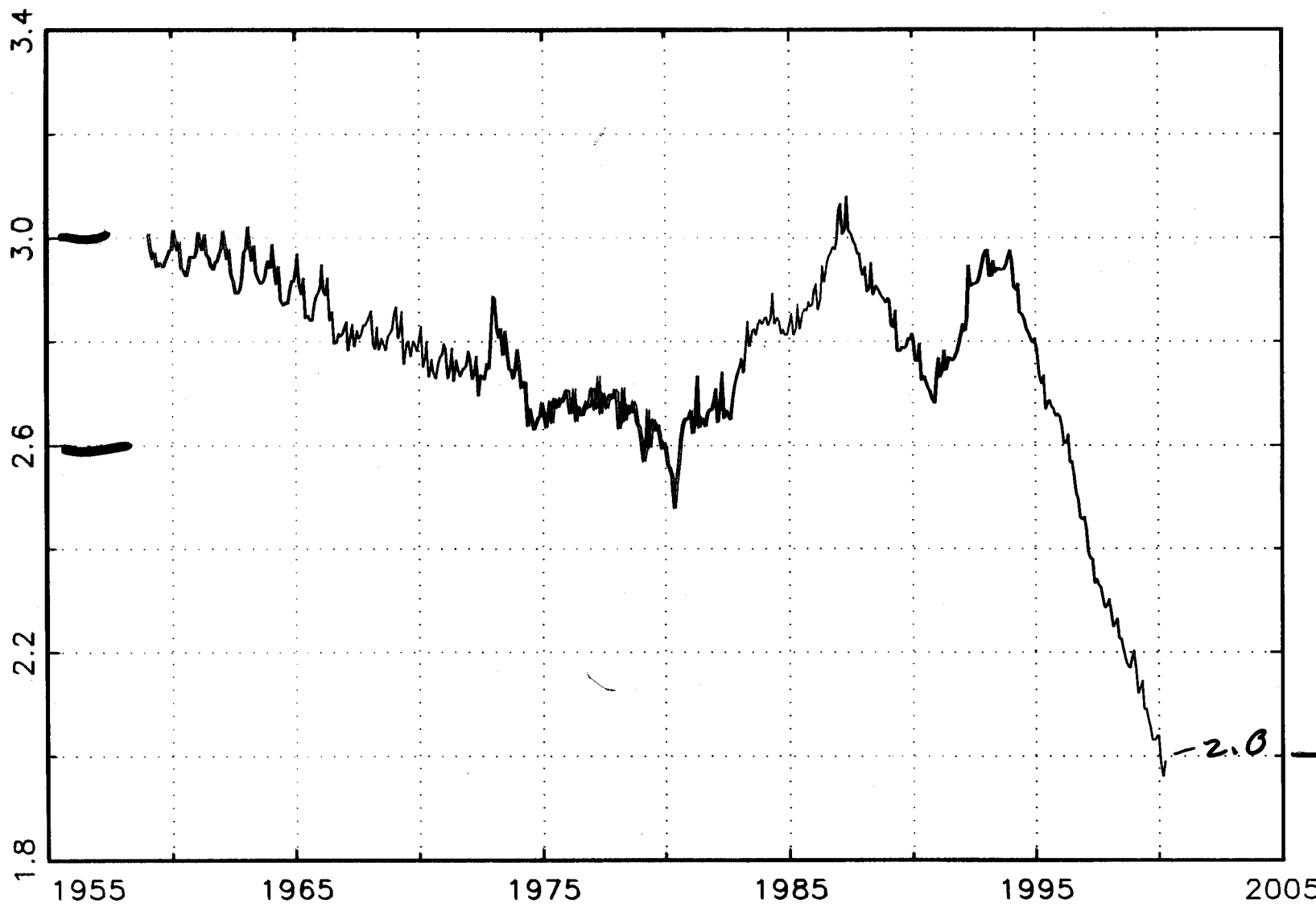Means average reserve requirement less than top (10%) reserve requirement.
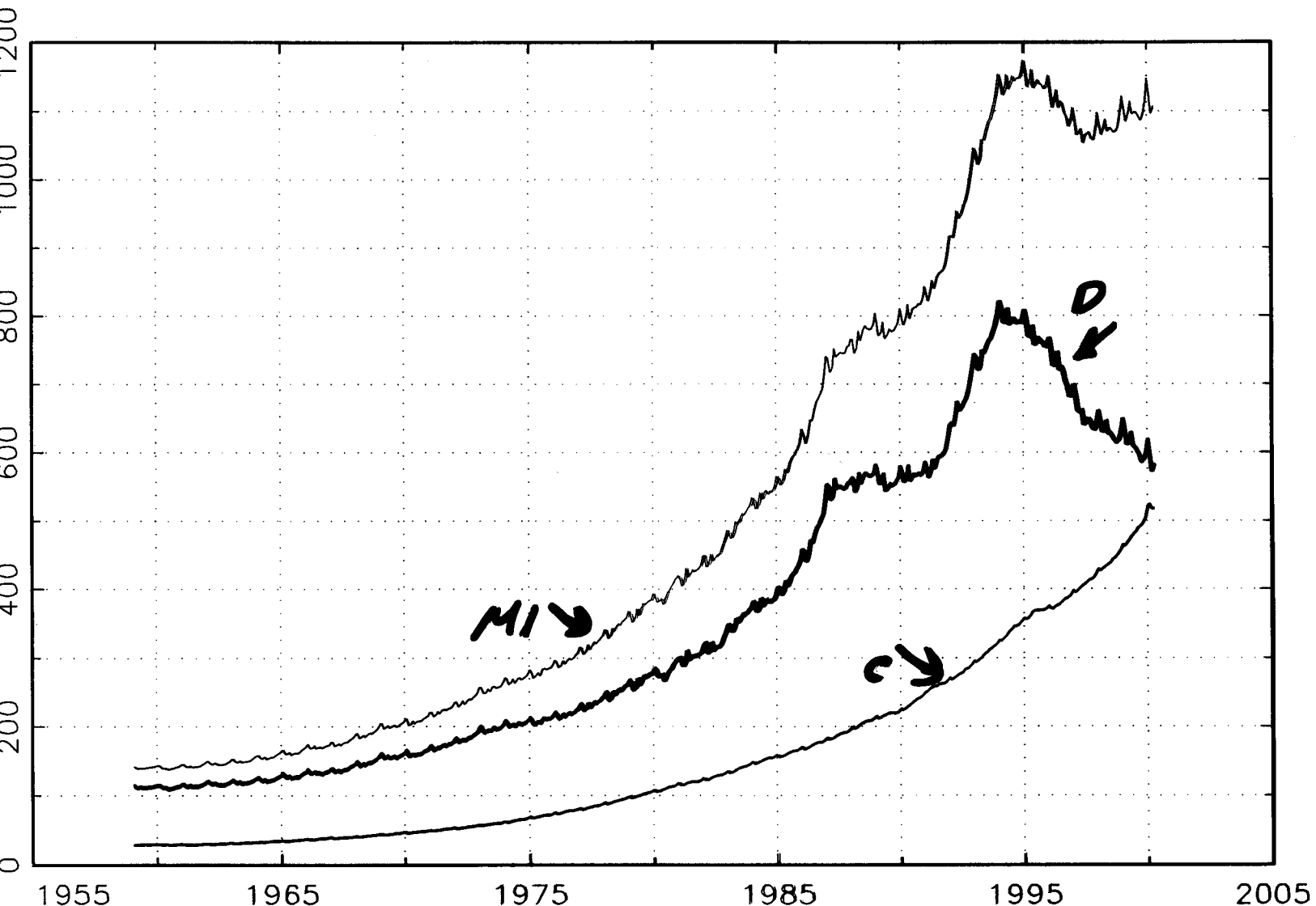
M1, Monetary Base B
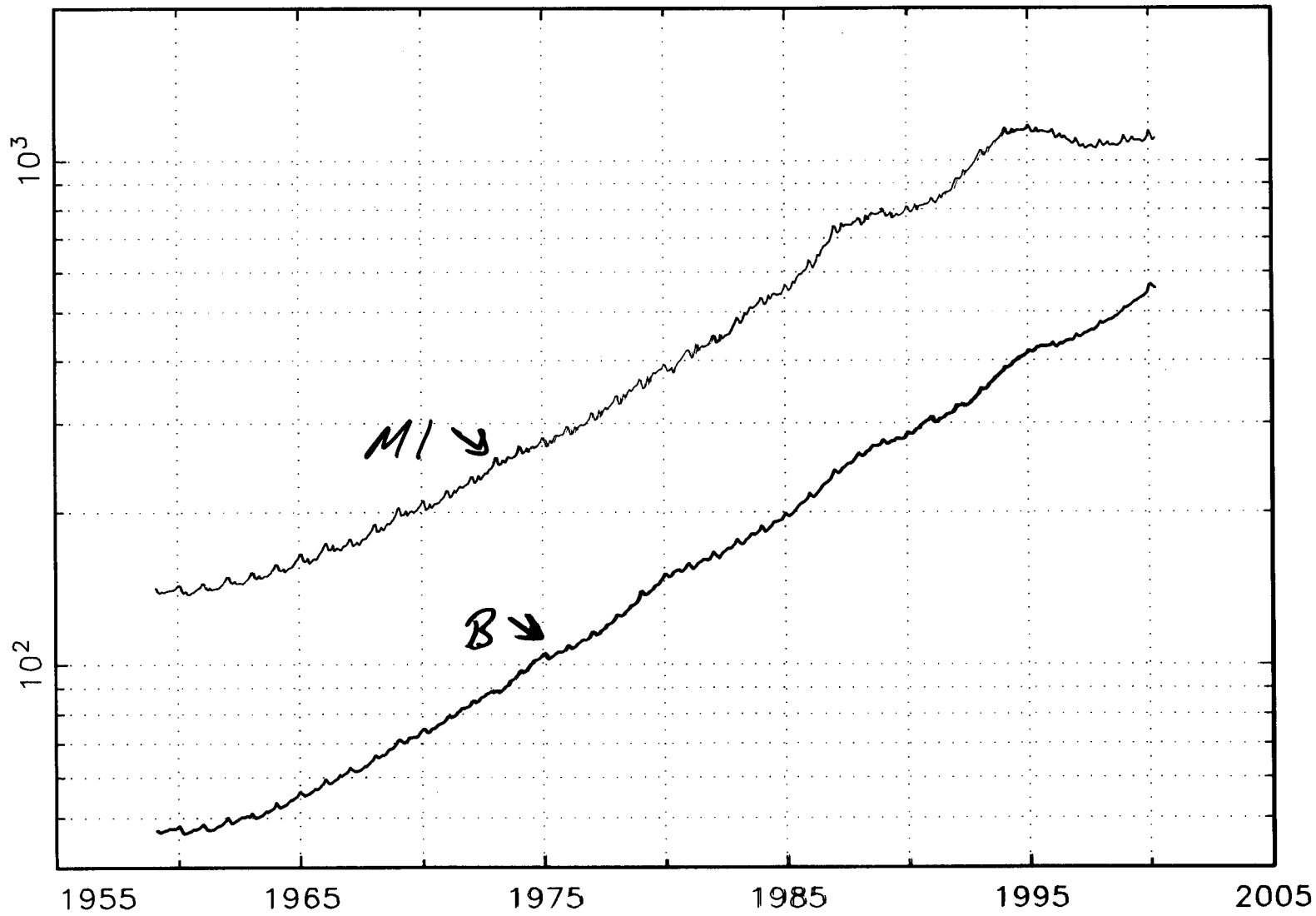
Bank Expansion Multiplier, k = M1/B

M1, C, D = Total Checkable Deposits (excl. sweeps)

Sweep Accts

Important since 1995

Pairs

- Demand Deposit or NOW Acct.
  up to 10% Reserve Requirement

 unlimited checking

with
- MMDA
  0 reserve requirement (since 1991),

  only 6 checks or transfers/mo.

1. Deposits go in MMDA
2. Checks come out of checking acct.
3. 6 times/mo, bank transfers $
      from MMDA to checking, so checks
      clear, yet avg checking balance
      is minimized.
4. Customer may be unaware of arrangement.
5. Bank req'd R minimized.
6. Balance shows up in M2, not Official M1
      Included in "M1-S." (Unofficial)

Sweeps grew rapidly after 1995:
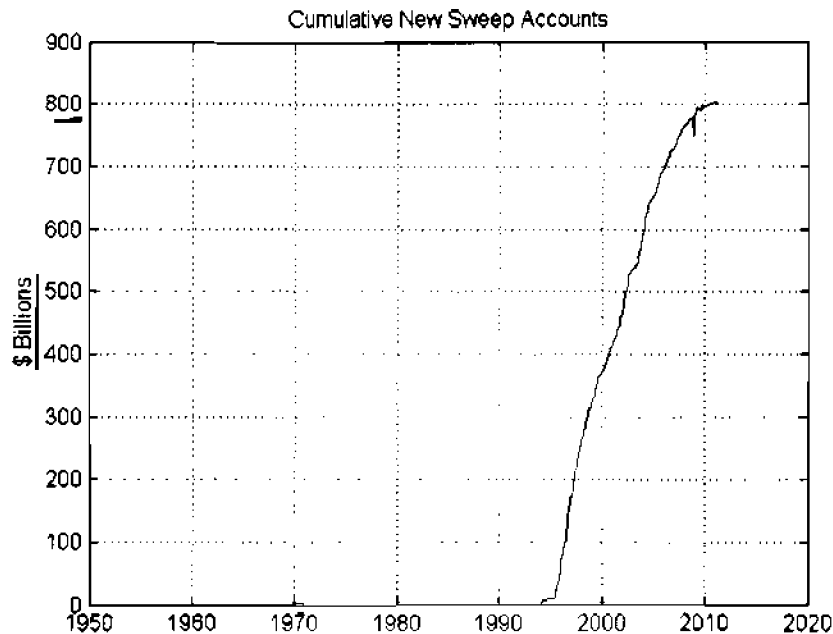
Cumulative New Sweep Accounts

But Fed does not require banks to report Sweep Accounts separately from MMDAs.

Best data are only for cumulative new conversions of conventional accounts to Sweep accounts, do not include growth since accounts were converted.

⇒ Slowdown after 2000 must understate actual growth in Sweeps,

Even M1-S may understate narrow Money Stock since 2000.

The Monetary Aggregates
(5/09, $ billions, s.a.)

Official M1:

Currency in circulation		849.8	(53.2%)
Checkable Deposits (excl Sweep Accts)		741.0	(46.4%)
Demand Deposits	406.6		
Other (NOW etc)	334.4		
Non-Bank traveler's checks		5.2	(0.3%)
Total M1		**1,596.0**	

M1-S (Unofficially computed for this course):

Currency in circulation		849.8	(35.5%)
Checkable Deposits (incl Sweep Accts)		1,536.2	(64.2%)
Official	741.0		
Sweep Accts (est.)	795.2		
Non-Bank traveler's checks		5.2	(0.2%)
Total M1-S		**2,391.2**	

M2:

M1		1,596.0
Savings Deposits (incl. MMDA)		4,445.0
Small time deposits		1,307.3
Retail Money Market Mutual Funds		979.2
Total M2		**8,326.6**

MZM (Zero-Maturity M, computed by St. Louis Fed per Wm. Poole):

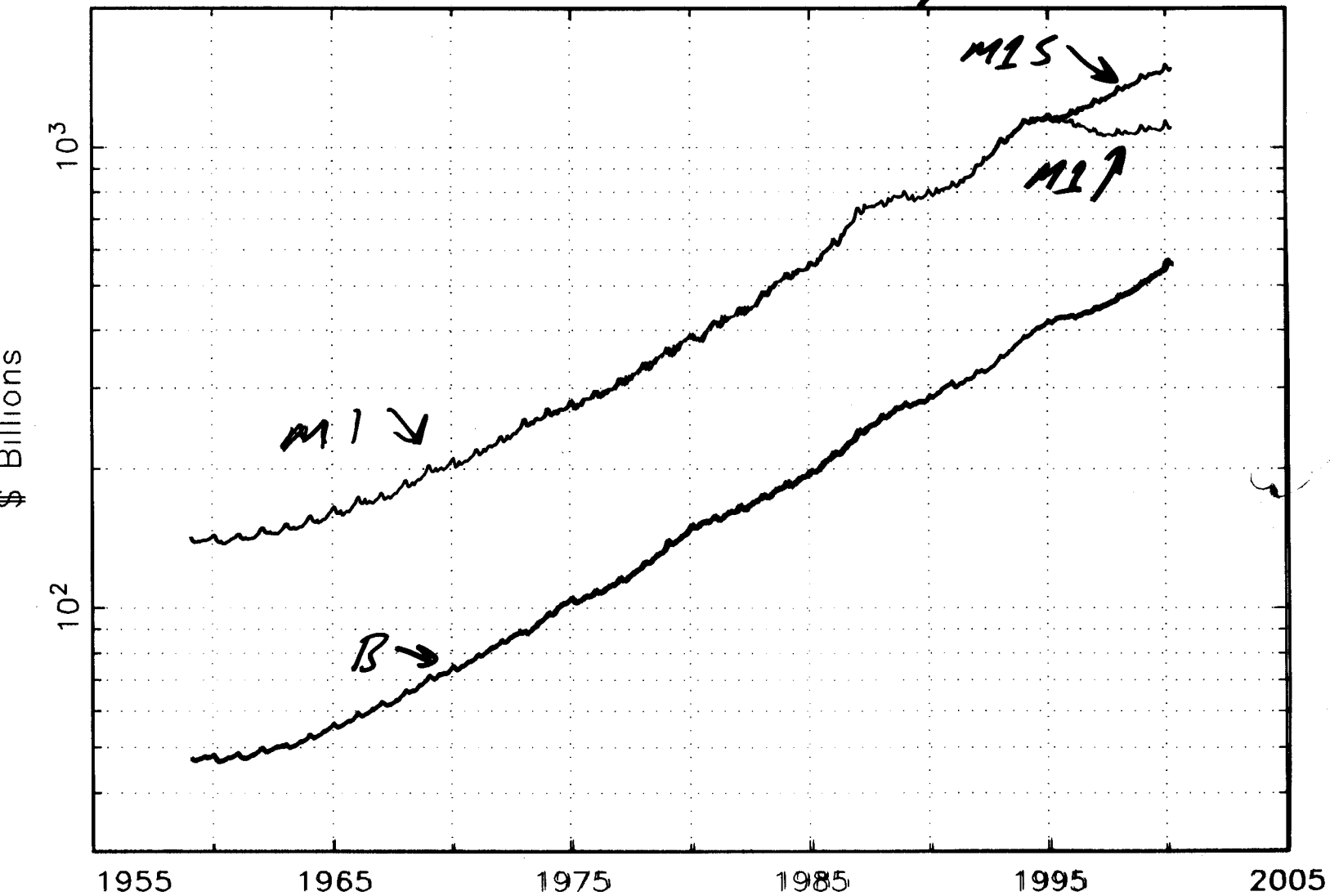|		
M1		1,596.0
Savings Deposits (incl MMDA)		4,445.0
All Money Market Mutual Funds		3,517.6
Retail	979.2	
Institution-only	2,538.4	
Total MZM		**9,558.6**

MMDA = Money Market Deposit Account, a Bank/Thrift liability.
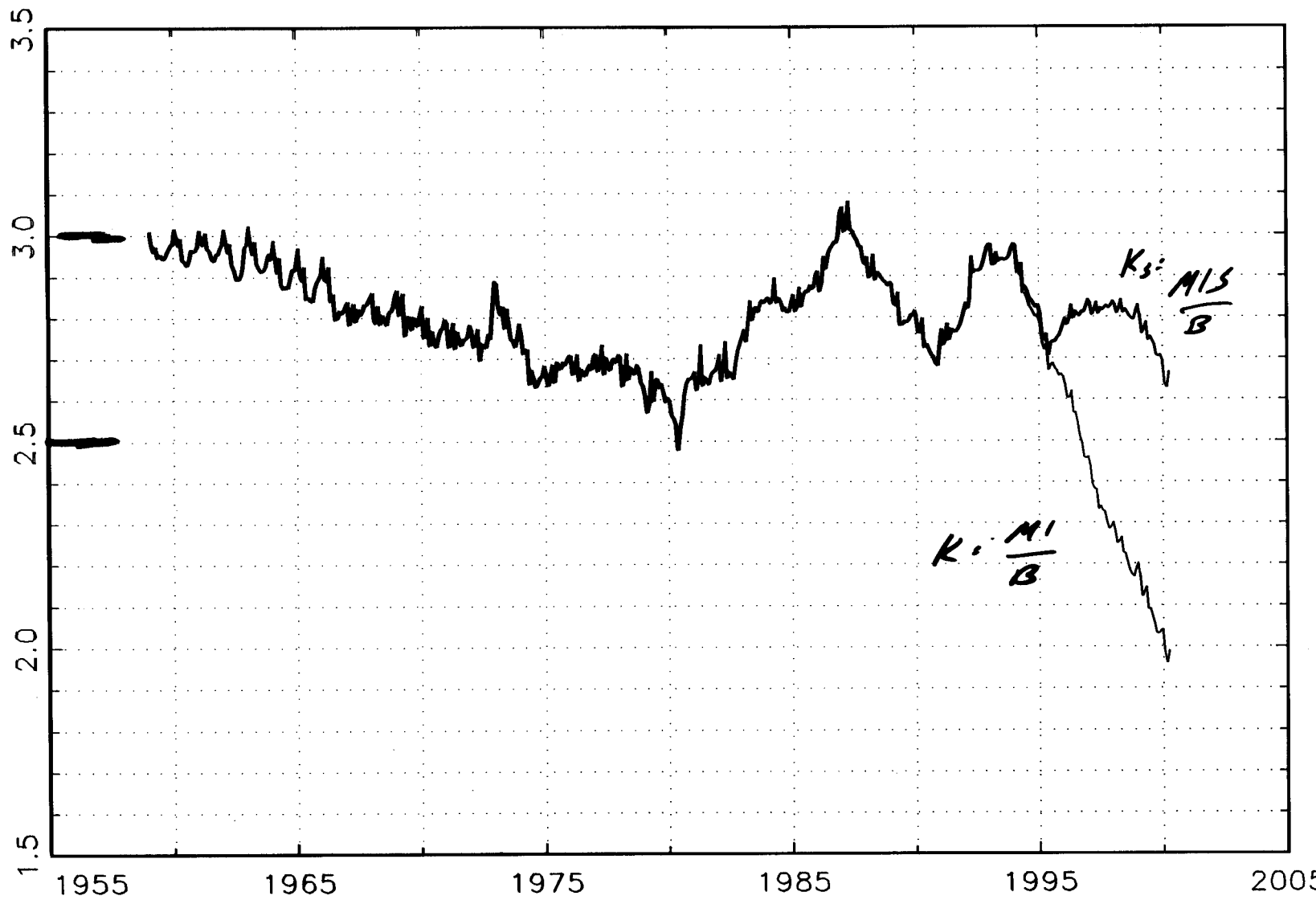MMMF = Money Market Mutual Fund, *not* a Bank/Thrift liability.

Data sources: *Federal Reserve Statistical Release H.4.1*; St. Louis Fed
(http://research.stlouisfed.org/aggreg/swdata.html) for estimated Sweep Accounts.

M1, M1S, Monetary Base B
"M1S" = M1 + Sweeps

10^3

10^2

\$ Billions

M1S

M1

M1

B

1955   1965   1975   1985   1995   2005

k = M1/B, kS = M1S/B

Currency/Deposit, Currency/(Deposit+Sweeps) Ratios

Currency/(Deposit+Sweeps) Ratio

Uptrend 1955-2000!

- "Underground Economy"
  - Tax Evasion
  - Illegal Activities
- "Currency Substitution"
  - Foreign use of US currency in high π countries.

C/(D+S)

87-91
S&L & FDIC
Crisis.
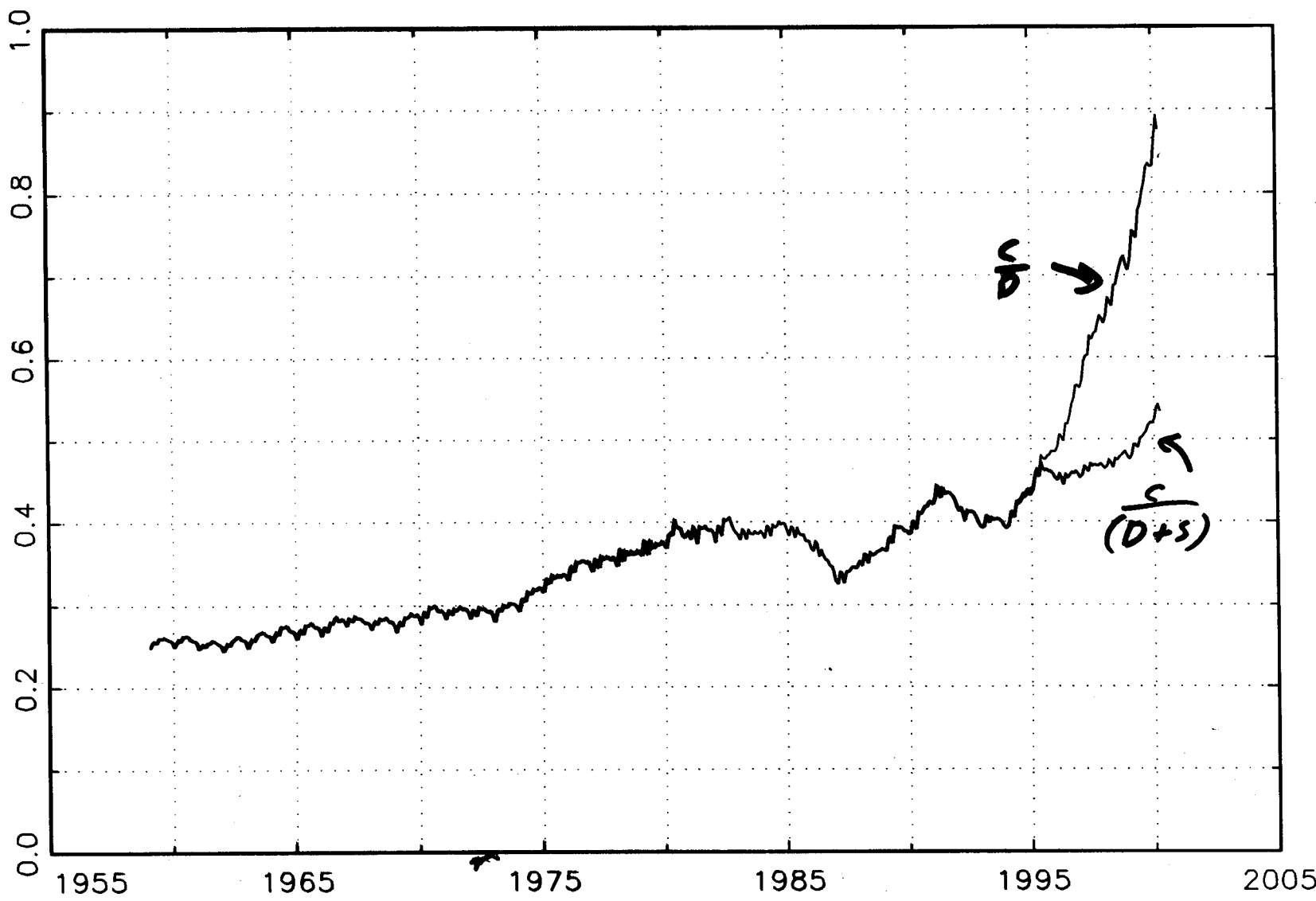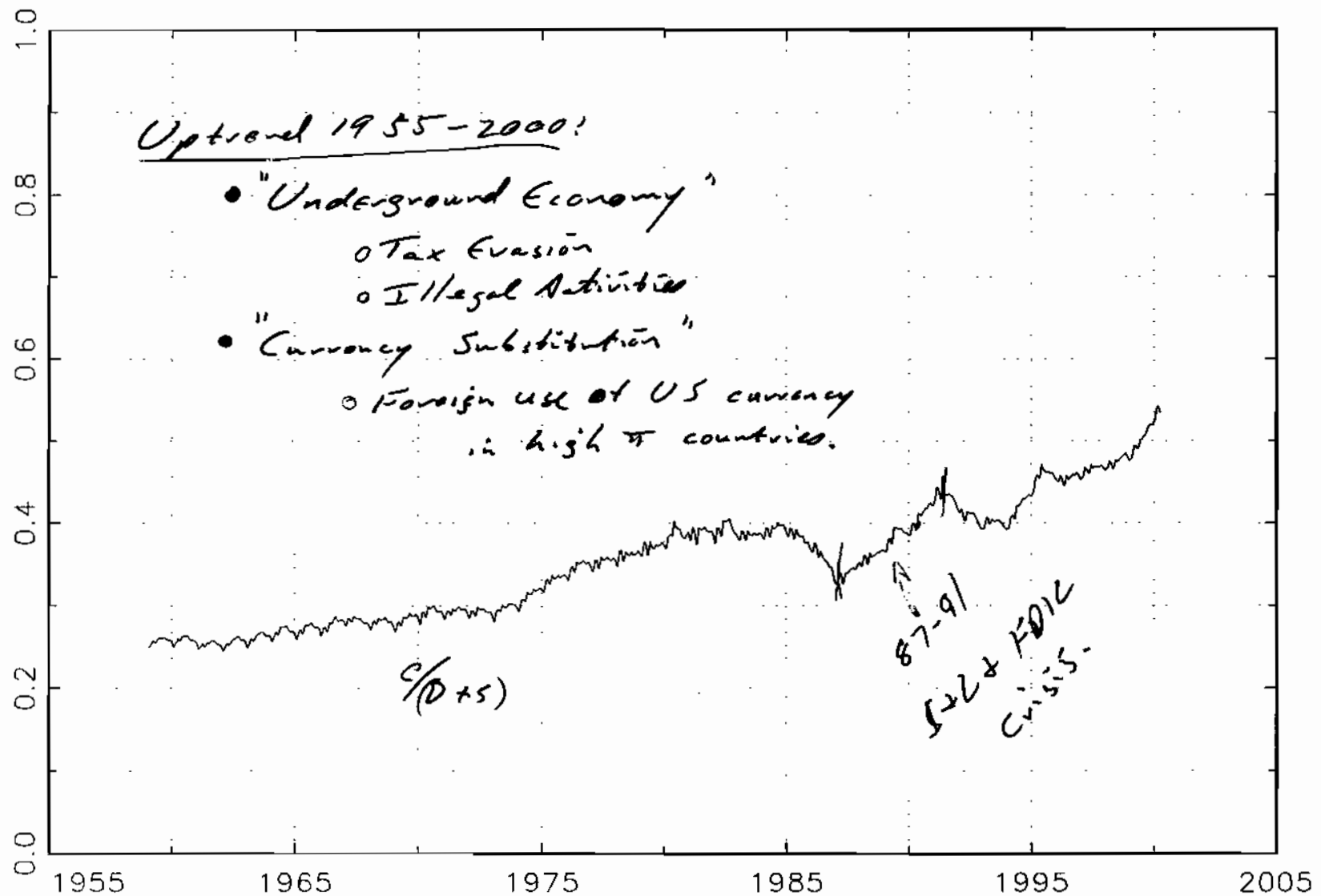
$$R = \frac{c+1}{c+f_R+f_x} \qquad f = f_R + f_x$$

R/D, Rr/D, Rx/D Ratios

f

f_R

~17%

1980-85 DIDMCA
reduced f_R

1/91 f_R on Savings
→ 0 %

4/92 — Top f_R to 10%
from 12%

$f_x < \frac{1}{2}$%, negligible*
(due to FF market)
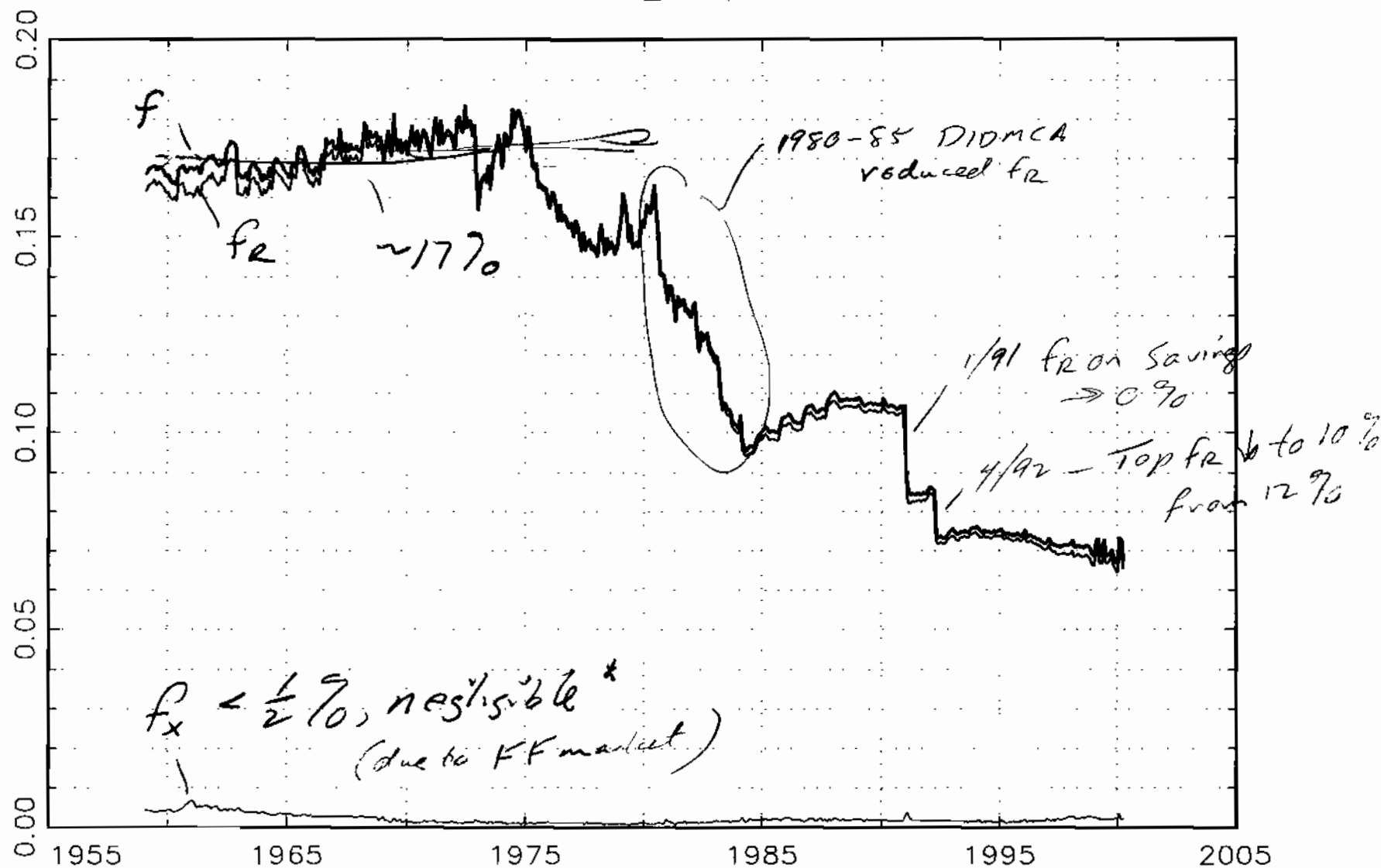
* Prior to 2008!

R/DS, Rr/DS, Rx/DS Ratios
"DS" = D + Sweeps

R/DS

Rr/DS

R/D

R/(D+S)

4%
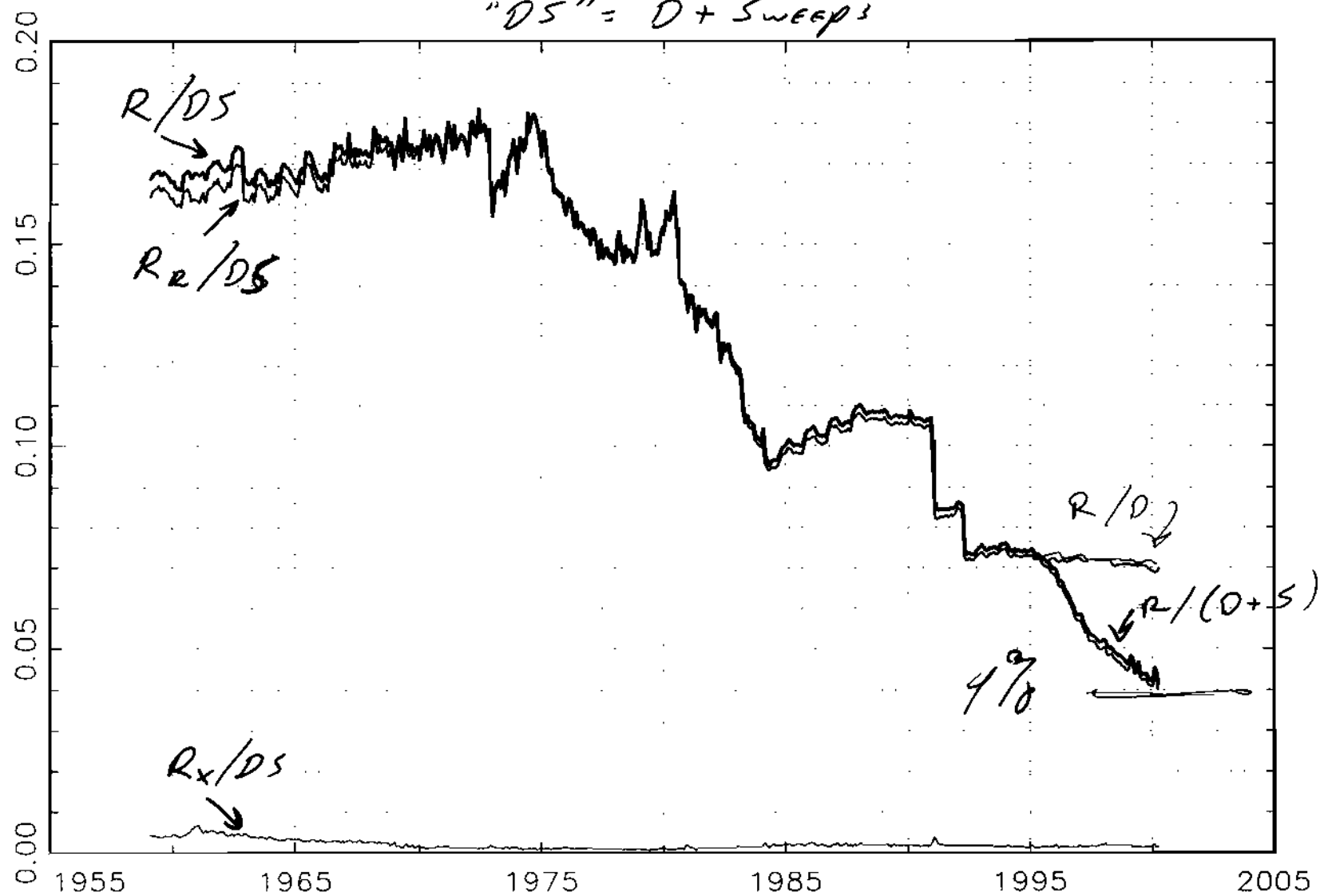
Rx/DS

M1S Bank Expansion Multiplier, kS = M1S/B
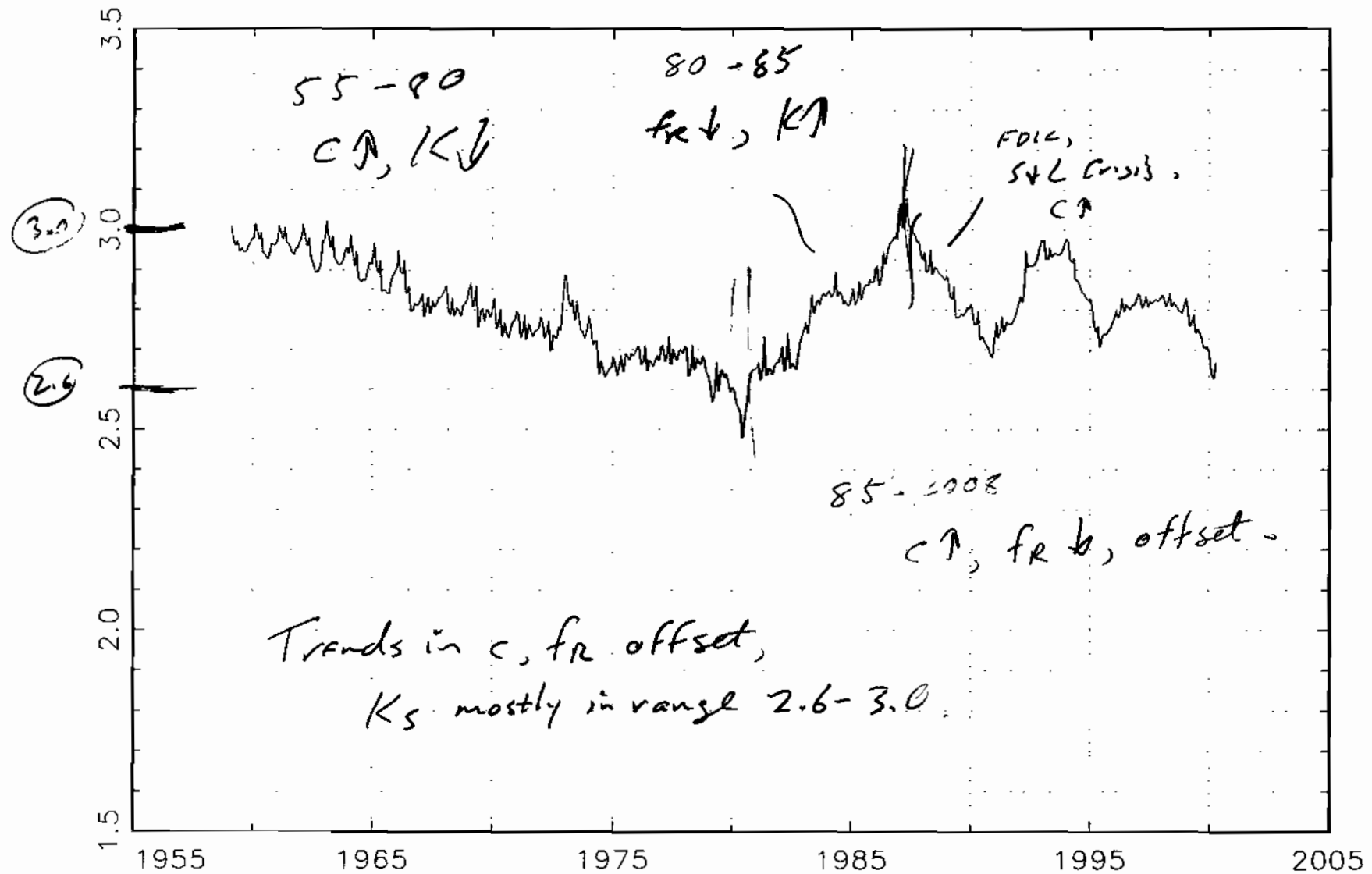
Interest on Bank Reserves

Pre-2008:

Fed pays no interest on Reserve Deposits

$\Rightarrow$ Banks keep R_X to minimum via Fed Funds Mkt,

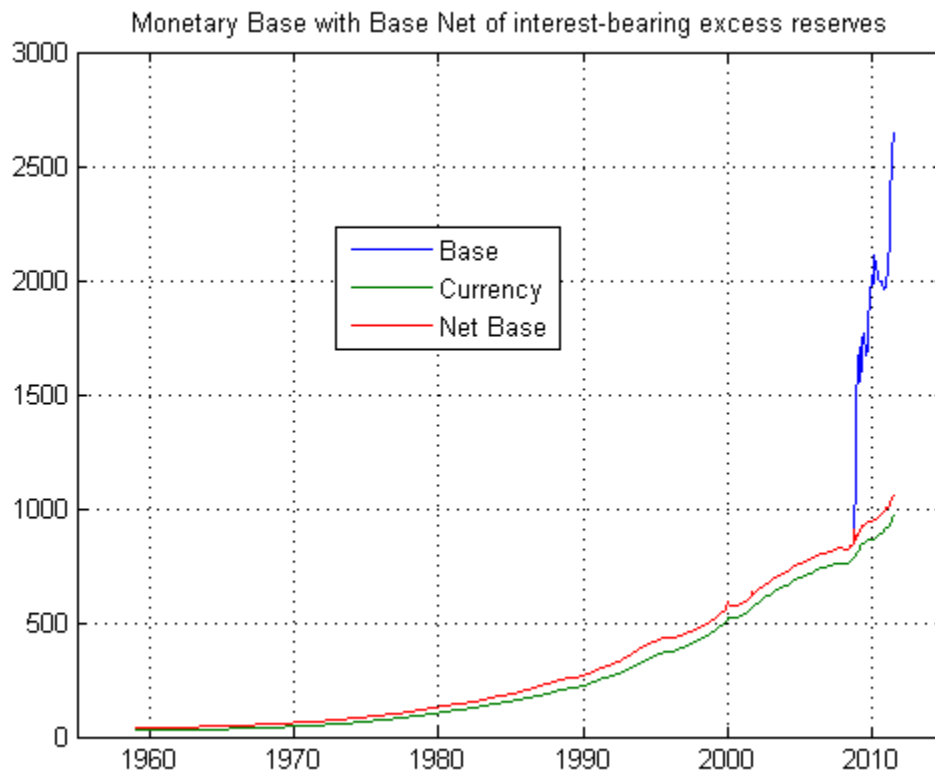$\Rightarrow f_R$ acts as a small tax on D, increases seigniorage

$\Rightarrow k = \dfrac{c+1}{c+f_R+f_X}$ fairly stable, M predictable

Since 10/08 (authorized by TARP Bill)

Fed pays i on Reserve deposits at rate slightly above
Fed Funds rate.

$\Rightarrow R_X$ has exploded, base has tripled!

Implications ???

Monetary Base with Base Net of interest-bearing excess reserves

Most of Base Explosion since 2008 has been Excess Reserves, which now pay interest at slightly more than the Fed Funds Rate.

"Net Base" = Base B – Required Reserves R_R

$$= \text{Currency C} + \text{Excess Reserves } R_X$$

Net Base has grown rapidly since 2008 (+25% 2008 to 2011), which should be of great concern for inflation.

Optimistically, however, these Excess Reserves represent Financial Intermediation on the part of the Fed rather than direct Inflationary Finance, and hence may not have the direct inflationary implications that Currency does.