Intermediate Macroeconomic Theory

Costas Azariadis

Lecture 6: Money, Stocks and Bonds

Money, Stocks and Bonds

1. ASSET MENUS

a) Payoffs
-interest bearing (stocks, bonds, money market instruments)
-no-interest (money & close substitutes)

b) Riskiness
-short maturity with low risk: money, T-bills, commercial paper, overnight loan
-long maturity with higher risk: stocks, T-notes and T-bonds, mortgages, private debt
-other high risk assets: junk bonds, some derivatives, hedge funds, leveraged portfolios

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c) Liquidity

-liquid (easy to sell at face value): T-bills, money market, currency

-illiquid (need to wait to sell at face value): houses, long bonds, thinly traded assets, non-performing loans

2. MONEY

a) Uses of Money

-medium of exchange: eliminates barter

-unit of account: prices expressed in money terms

-store of value: money is just like stocks & bonds, but…

- -safer (when inflation is low)
- -no dividends
- -more liquid

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Q: Is money safer than stocks & bonds? Safer than land? Than gold?

b) Measuring money supply

Two popular measures: M1 & M2

M1=currency (~50% of U.S. money supply or .85 trillion in 2009) plus demand deposits & checkable deposits (~50% of U.S. supply)

Total M1 equals 1.65 trillion in June 2009 (11.5% of GDP)

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Total M1 stock ≈ 11% of GDP

But nearly half of all currency circulates outside of the U.S →
Domestic M1 stock ≈ 7% of GDP

M2= M1 plus Saving deposits ≈ 60% of GDP (8.4 trillion in June 2009)

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c) How the FED changes M1

-print money to buy newly issued Fed debt (T-bills, notes, bonds) from the U.S. Treasury → $\Delta M > 0$

-Now called "quantitative easing"

-open market purchases of existing Federal debt from households, commercial banks, mutual funds → $\Delta M > 0$

-open market sales to the public of existing Federal debt held by the Federal Reserve System → $\Delta M < 0$

*open market purchases/sales conducted by FRB of NY following instructions by the FOMC (Fed Open Market Committee). FOMC consists of the Board of Governors plus regional Fed Bank presidents.

3. ASSET PRICES: STOCKS AND BONDS

a) Key Ideas:

Short run vs. Long run prices

-market psychology may drive asset prices in the short run

-waves of pessimism or exuberance → "bear" or "bull" markets

-people buy/sell as a herd because others are selling or buying

Long run prices driven by "fundamentals"

-asset prices reflect future dividends and earnings

-fundamental prices equal present value of all future dividends

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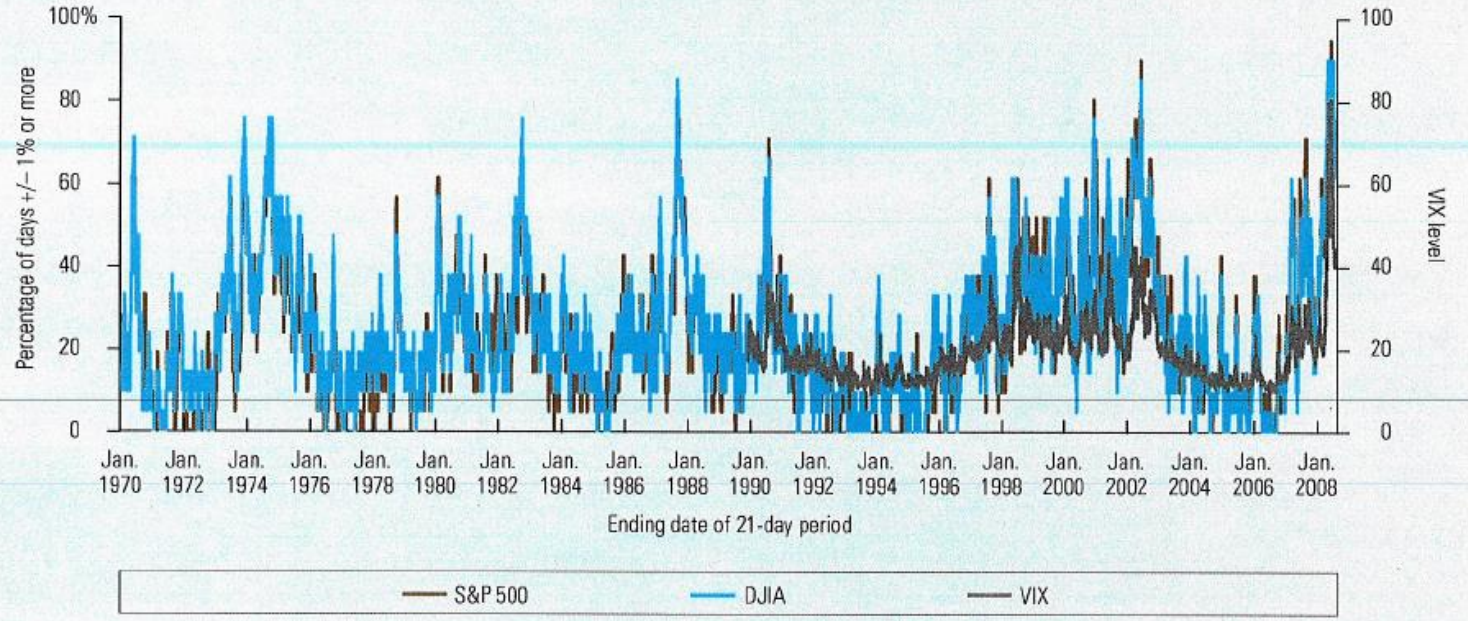
Figure 5. Percentage of days of up and down volatility in the S&P 500 Index and DJIA, daily data from January 1970 through December 2008, and VIX Index level, daily data from January 1990 through December 2008



Sources: Vanguard, Standard and Poor's, Dow Jones, and CBOE.

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Figure 7. Percentage of days of volatility data for S&P 500 Index and DJIA, from January 1970 through December 2008

Percentage of days of volatility measures	S&P 500 Index	DJIA
Percentage of days up 3% or more	0.76%	0.84%
Percentage of days up 2% or more	2.65	2.92
Percentage of days up 1% or more	12.24	12.97
Percentage of days up	52.49	51.87
Percentage of days down	47.51%	48.13%
Percentage of days down 1% or more	11.46	11.67
Percentage of days down 2% or more	2.45	2.46
Percentage of days down 3% or more	0.66	0.66
Percentage of days up or down 3% or more	1.42%	1.50%
Percentage of days up or down 2% or more	5.10	5.37
Percentage of days up or down 1% or more	23.70	24.64

Sources: Vanguard, Standard and Poor's, and Dow Jones.

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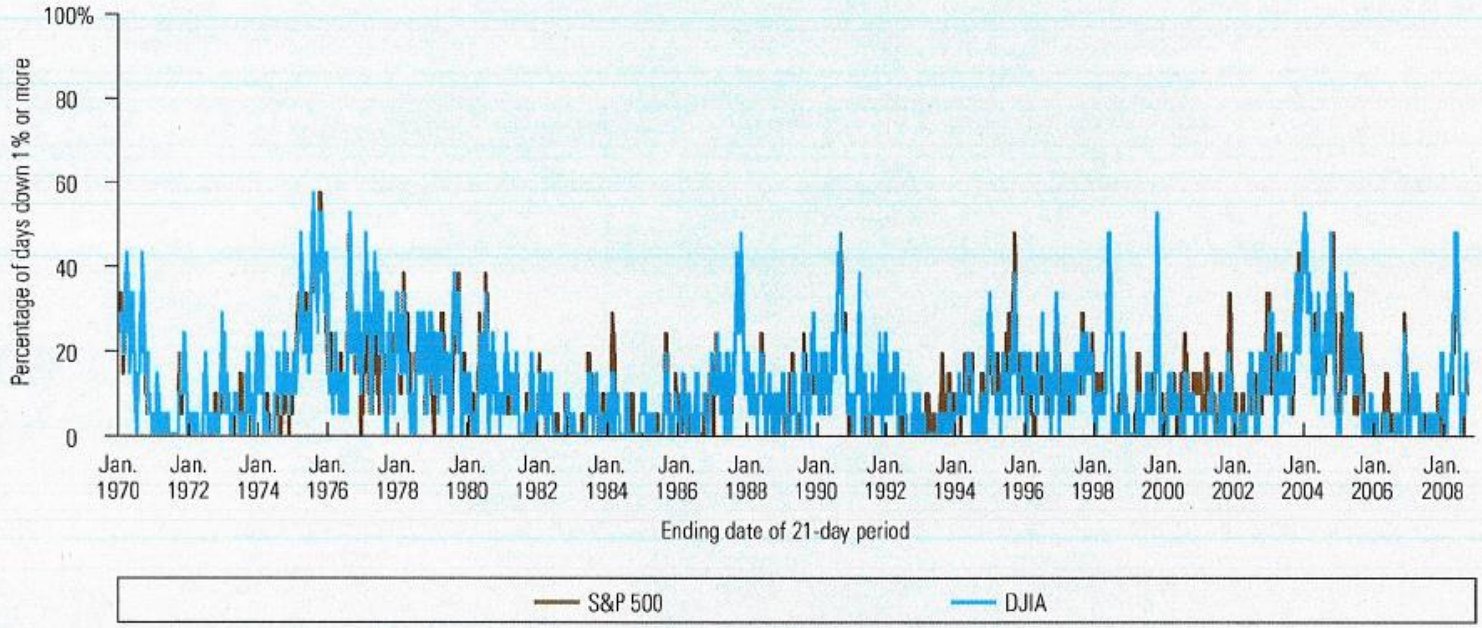
Figure 8. Percentage of down volatility, daily data from January 1970 through December 2008



Sources: Vanguard, Standard and Poor's, and Dow Jones.

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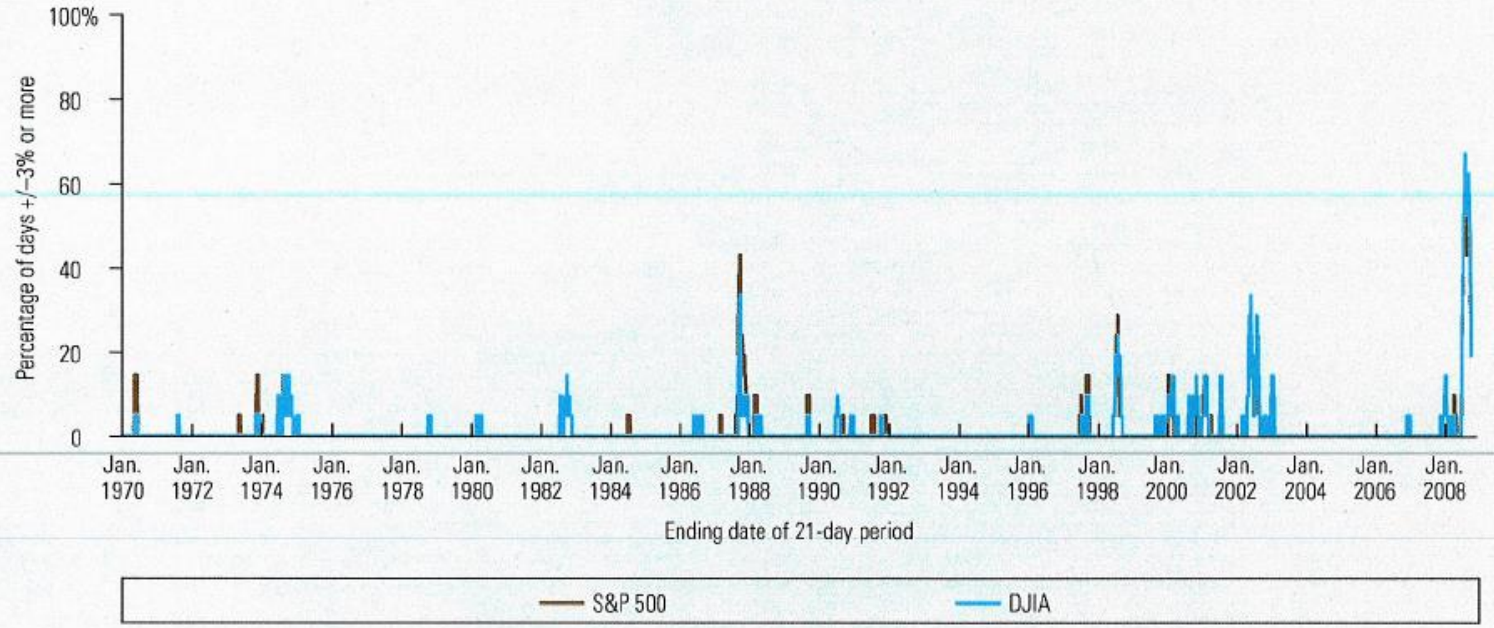
Figure 9. Percentage of days of up and down extreme volatility, daily data from January 1970 through December 2008



Sources: Vanguard, Standard and Poor's, and Dow Jones.

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b) Long-run asset prices: The Gordon Pricing Formula (1959)

-Named after Myron J. Gordon (1920-); professor at MIT, Rochester, U of Toronto, now emeritus.

$$\frac{P_t}{d^e_{t+1}} = \frac{1}{r_A - g}$$

P_t = current asset price

d^e_{t+1} = expected dividend next period

r_A = risk-adjusted yield for entire class of similar assets

g = growth rate of dividends or earnings

S&P averages over the last 100 years

price/earnings ≈ 15 - 20

price/dividends ≈ 25 - 30

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e) No-arbitrage asset pricing

Key: Equality of returns for assets in same risk class
Investing \$1 in any asset of this class returns $\$1+r_A$ tomorrow

For a particular asset with constant growth in expected dividend

$$d^e_{t+1} = (1+g)d_t$$
$$d^e_{t+2} = (1+g)^2 d_t$$
$$d^e_{t+n} = (1+g)^n d_t$$

\$1 invested today brings in $\frac{d^e_{t+1} + P^e_{t+1}}{P_t}$ tomorrow

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Because:

1) \$1 buys $\frac{1}{P_t}$ shares

2) each share, if sold tomorrow, brings in

-dividend d^e_{t+1} (expected)

-resale price, P^e_{t+1} (expected)

No-arbitrage means

$$1 + r_A = \frac{d^e{}_{t+1} + P^e{}_{t+1}}{P_t}$$

$$= \frac{1 + \dfrac{P^e{}_{t+1}}{d^e{}_{t+1}}}{\dfrac{P_t}{d^e{}_{t+1}}}$$

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Or

$$1+r_A=\frac{1+\dfrac{P^e_{t+1}}{d^e_{t+2}}\dfrac{d^e_{t+2}}{d^e_{t+1}}}{\dfrac{P_t}{d^e_{t+1}}}$$

Assume rational expectations

→Investors do not make big mistakes in predicting prices

→$P^e_{t+1}=P_t$ (expected=actual price)

Let

$\Pi_t=P_t/d^e_{t+1}$ = price to (expected) dividend ratio

Then $$1+r_A=\frac{1+(1+g)\Pi_{t+1}}{\Pi_t} \qquad (*)$$

Where $1+g=d^e_{t+2}/d^e_{t+1}$

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Solving for the steady state of (*)

Let $\prod_t = \prod$ for all time

Then

$$1 + r_A = \frac{1}{\Pi} + 1 + g \Rightarrow$$

$$r_A - g = \frac{1}{\Pi} \Rightarrow$$

$$\Pi = \frac{1}{r_A - g}$$

(Gordon Formula)

f) Example: Pricing the S&P 500

Long-term stock yields ≈ .07 per year

Stock risk premium ≈ .01

Risk-adjusted yield $r_A \approx .06$

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Dividend growth rate ≈ GDP growth rate ≈ .027 = g

Then $r_A - g = .060 - .027 \approx .033$

$\Pi = P_t / d_{t+1} = 1/.033 \approx 30$

Earnings ≈ 2 (dividends)

$$\frac{P}{E} ratio = \Pi \frac{d_{t+1}}{e_{t+1}} = \frac{\Pi}{2} \approx 15$$

(historically accurate)

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4. UNDERSTANDING INFLATION:

a) Transactions volume

T → proportional to Py

P= price level (CPI)

y=real income

i=nominal return on T-bills

=opportunity cost of money

$i = r + \pi^e$

r= real return

π^e = expected inflation

b) Money Demand

$M^d = P * L(y,i)$

L: liquidity schedule $\frac{\Delta L}{\Delta y} > 0$

$$\frac{\Delta L}{\Delta i} < 0$$

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c) The velocity of Money

$$v = \frac{P \cdot y}{M} = \frac{\text{nominal GDP}}{\text{money supply}}$$

U.S. velocity (with M=M1) =7 in 1970's

≈ 10 now

v: measures how many times on average $ changes hands in one year

-depends a lot on technology (ATM's, online banking, etc)

→ M^d and L depend on banking technology

5. MONEY AND INFLATION

a) Is inflation a monetary phenomenon or one that depends on supply-side shocks (oil & commodity prices)?

b) Equilibrium in the Money market

$M = M^d = PL(y, r + \pi^e)$

M: supply; M^d : demand, then $\Delta M = P(\Delta L) + L(\Delta P) \Rightarrow$

$$\frac{\Delta M}{M} = \frac{P(\Delta L)}{M} + \frac{L(\Delta P)}{M}$$

$$= \frac{P(\Delta L)}{P \cdot L} + \frac{L(\Delta P)}{P \cdot L}$$

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$$\frac{\Delta M}{M} = \frac{\Delta L}{L} + \frac{\Delta P}{P}$$

$$\frac{\Delta P}{P} = \frac{\Delta M}{M} - \frac{\Delta L}{L}$$

$$\frac{\Delta P}{P} = \frac{\Delta M}{M} - \left[\varepsilon_Y \frac{\Delta Y}{Y} + \varepsilon_I \frac{\Delta \Pi^e}{\Pi^e}\right]$$

$\frac{\Delta P}{P}$ Inflation

$\frac{\Delta M}{M}$ Money Growth

ε_Y Income elasticity of L

ε_I Interest elasticity of L

Assume: r is fixed, not influenced by policy →

$$\varepsilon_Y = \frac{2}{3}$$

$$\varepsilon_I = 0$$

$$\frac{\Delta Y}{Y} = .03$$

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Then the long run inflation is:

Inflation=rate of money growth – .02

However, in the short run the growth rage of GDP, $\Delta Y/Y$, can be less than .03 and even negative due to shocks.

Then the short run inflation rate can be as big as $\Delta M/M$ or bigger.