

Solutions to Midterm Exam #2
Economics 252 Financial Markets
Prof. Robert Shiller
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PART I: 6 points each

1. ACCORDING TO SHILLER (“IRRATIONAL EXUBERANCE”, 2005), WHAT HAS BEEN THE LONG-TERM TREND IN REAL HOME PRICES IN US AND HOW DOES IT RELATE TO TRENDS IN POPULATION, BUILDING COSTS, AND INTEREST RATES?

- There is no obvious pattern in the long term trend of real home price. The long term real home prices were generally declining from 1890 to 1940 with a sharp fall after the World War I. We saw no boom during the 1920s despite the sharply rising stock market during that period. Nor did we see a drop in home prices after the stock market crashed in 1929. The housing market rose sharply after the World War II and was steadier from 1950s to 1970s. There were two regional booms before the recent housing boom, one in the late 1970s and one in the late 1980s. Starting from 1997, there has been a “rocket-taking off in real home prices and the ascent of home prices has been robust and steady. (3 points)

3 points: Correctly describe the general price trends both historically and recently, with a detailed break down of different periods.

2 points: Correctly describe the general price trends both historically and recently, but with some details missing.

1 point: Mention some price trends but incomplete. Or mention that the long term trend is upwards (It is not).

- None of growth patterns in population, building costs or interest rate seem to be able to explain the recent sharp increase in the real home prices. Building costs have been mostly level or declining all the way back to 1980; population growth has been very steady; interest rates have been declining steadily since the early 1980s. (3 points)

3 points: Precisely describe the trends in population, building costs interest rates and state the inability to explain the recent housing market trend.

2 points: State the inability but with some trends missing or merely describe the trends.

1 point: Only mention the trends but do not state their inability.

2. BRIEFLY STATE AND DESCRIBE THE FOUR TYPES OF RISKS THAT INVESTORS IN MORTGAGE LOANS FACE.

Credit Risk: The risk that the homeowner/borrower will default. For conventional mortgages, the credit risk depends on the borrower. Credit risk can be reduced if the mortgage is insured by a government agency or a private insurance company.

Liquidity Risk: Mortgage loans are illiquid and the bid-ask spreads are large.

Price Risk: The price of a fixed-income instrument, including mortgages, moves with market interest rates. A rise in interest rates will decrease the price of a mortgage loan.

Prepayment Risk: Prepayments refer to the payments made in excess of the scheduled principle repayments. The effect of the prepayment right is that the cash flow from a mortgage is uncertain to the investors.

(6 points, 1.5 each)

1.5 points: Specify all four risks with a brief description.

0.5 points: Only write down the risks without giving descriptions or imprecise descriptions.

3. WHAT RELATIONSHIP DOES SIEGEL FIND BETWEEN REAL GDP GROWTH AND STOCK MARKET RETURN AND WHAT IS HIS EXPLANATION FOR THIS RELATIONSHIP?

- The long-term stock market returns are **negatively** correlated with real GDP growth from 1900 through 2006, meaning that the higher the GDP growth rate, the lower the stock market return. This relationship holds both for major markets around the world and developing markets during recent years. (3 points)

3 points: Precisely describe the relationship.

1-2 points: Draw a graph without specifying axis or any explanation.

- The determinants of stock prices are earnings and dividends on a per share basis. Although GDP growth affects aggregate earnings and dividends, it does not necessarily increase the growth of per share earnings or dividends because economic growth requires increased capital expenditures. Implementing and upgrading technology requires substantial investment which must be funded either by borrowing or issuing new shares. The added interest costs and the dilution of earnings reduce the growth of per share earnings. (3 points)

3: Distinguish the aggregate and per share earnings and dividends. Explain why per share earnings and dividends may decrease despite the increase of aggregate earnings.

2: Distinguish the aggregate and per share earnings and mention costly investment but explanations are not precise.

1: Either distinguish the aggregate and per share earnings and dividends or mention that economic growth is costly to maintain.

4. WHAT IS MEANT BY A SPOT RATE? HOW CAN YOU VALUE A BOND USING SPOT RATE?

- Spot rate (as in Fabozzi): The yield on a zero-coupon instrument, also known as the zero-coupon rate. (2 points)
- First break the payment of a bond into different cash flows based on the time periods when these cash flows are received. (Zero coupon bonds only have one payment at maturity). The value of the bond is equal to the sum of discounted cash flows, with each discount rate being the corresponding spot rate for that period. If cash flows are received more frequently than annually, a proportion of the spot rate should be used as the discount rate: e.g if spot rate = r and the bond pays coupon semiannually, then the semiannual spot rate = $2/r$ should be used to discount the cash flow in that period. (4 points)

4: Completely explain the method of calculating the value. Correctly specify the discount rate for each time period, including more frequent than annual time periods.

Mathematical formula is acceptable with reasonable amount of explanations.

3: Completely explain the method of calculating the value. Correctly specify the correct discount rate for each time period, but do not specify the rates when payment frequency is higher than annual or other minor mistakes that do not affect understanding.

1: Only write down the mathematical formula with very few or without explanations.

5. CONSIDER A 3-YEAR BOND WITH A COUPON RATE OF 6% AND A PAR VALUE OF \$1000. SUPPOSE THE BOND PAYS INTEREST SEMIANNUALLY AND IS SELLING FOR \$700. EXPLAIN HOW YOU WOULD CALCULATE THE YIELD TO MATURITY OF THIS BOND (YOU DON'T HAVE TO COMPUTE THE EXACT FIGURE).

Solve for y and yield to maturity = $2y$:

$$700 = \sum_{i=1}^6 \frac{3}{(1+y)^i} + \frac{1000}{(1+y)^6}$$

(6 points)

6: Use the correct formula and correctly specify coupon payment, principal, semiannual rate, as well as yield to maturity.

2-4: Use the correct formula but forget to semi-annualize the annual rate before using and/or other minor mistakes.

0: wrong formula.

6. WHAT ARE MORTGAGE PASS-THROUGH SECURITIES? WHAT IS THE DIFFERENCE BETWEEN AGENCY MORTGAGE PASS-THROUGH SECURITIES AND NON-AGENCY MORTGAGE PASS-THROUGH SECURITIES?

- Securities consist of a pool of residential mortgage loans. All payments of interest and principal are “passed through” to the investors that hold these securities in each period. (3 points)
- Agency mortgage pass-throughs refer to the mortgage securities that are associated with Government National Mortgage Association (Ginnie Mae), Federal National Mortgage Association (Fannie Mae), and Federal Home Loan Mortgage Corporation (Freddie Mac). These mortgages must meet the agencies underwriting standards related to the maximum size of the loan and the maximum ratio of the loan to the market value of the mortgaged property.

Nonagency mortgage pass-throughs refer to the mortgage pass-through securities that are privately issued. They do not have to meet the agencies underwriting requirements. (3 points)

3 points: Precisely describe agency/nonagency mortgage pass-throughs and their different underwriting requirements. Correctly state the agencies.

2 points: Correctly state the agencies. Merely mention the difference in issuing institutions.

7. WHY WOULD A CORPORATION ISSUE AN ASSET-BACKED SECURITY TO RAISE FUNDS RATHER THAN ISSUING A STRAIGHT CORPORATE BOND?

The motivation for issuing an asset-backed security rather than a straight corporate bond is the opportunity to reduce funding costs by separating the credit rating of the issuer from the credit quality of the pool of loans or receivables. In particular, the corporation seeking financing may sell their assets to SPV (special purpose vehicle or special purpose corporation). SPV can then sell securities backed by these assets at any rating desired with required credit enhancement if necessary. This way a corporation with a lower credit rating can reduce their funding cost by issuing a security with a higher credit rating. (6 points)

6: Precisely explain how the funding cost can be reduced through SPV.

2-4: Merely state that the funding cost can be reduced without explaining how or state that credit rating can be separated without linking it to the funding cost.

8. WHAT ARE SAVINGS AND LOAN ASSOCIATIONS (S&Ls)? BRIEFLY DESCRIBE THE S&L CRISIS.

- A Savings and Loan Association is a financial institution that specializes in accepting saving loans and investing in mortgages and mortgage-backed securities. They are often mutually owned meaning that the depositors and the borrowers have the ability to direct the financial and managerial goals of the organization. Like banks, S&Ls may be chartered under state or federal statutes and are subject to reserve requirements. They may obtain funding from both deposits and the money market. (3 points)

3: Specialization (1 point) + any 2 points from the following:

ownership structure (1 point), chartered under state or federal authorities (1 point), funding source (1 point)

2: Specialization (1 point) + any 1 point

1: Specialization

- Until the early 1980s, S&Ls financed housing through traditional mortgages at interest rates fixed for the life of the loan, which was typically long. Funding for these loans however, came from deposits having a maturity considerably shorter

than the loans. The problem of lending long and borrowing short is extremely risky because of the interest rate risk. The interest rates during the 1970s were highly volatile and were followed by the historically high level of interest rates in the early 1980s. This made the mortgage loans owned by S&Ls worth far less than the face values. With the regulation imposed on the ceiling on the interest rate that S&L could pay, S&L started to lose a significant outflow of deposits to the money market funds. As the crisis progressed, many S&Ls facing financial difficulties pursued strategies that exposed the institution to greater risk, hoping that good fortune would prevent their mistakes from causing a banking crisis. (3 points)

3: State the fundamental cause for the crisis and explain why the mismatch of maturities is a problem. Link the explanation with the interest rate movement from 1970s to 1980s and link. Explain the drawback of regulation and the worsening of the situation.

1-2: State the fundamental cause but with incomplete explanations.

9. WHAT IS AN OPEN MARKET PURCHASE BY THE FED AND WHAT EFFECT DOES IT HAVE ON THE MONEY SUPPLY? WHAT OTHER INSTRUMENTS CAN THE FED USE TO INFLUENCE THE MONEY SUPPLY?

- An open market purchase refers to a transaction conducted by the Fed. The Fed buys a particular amount of securities from a seller which temporarily changes the level of reserves in the system and will increase the money supply. (3 point)
- The other instruments used by the Fed to influence the money supply are reserve requirements, discount rate, repo and reverse repo. (3 points)

10. IN CLASS, WE DISCUSSED THREE FUNDAMENTAL REASONS FOR HAVING BANKS: MORAL HAZARD, ADVERSE SELECTION, AND LIQUIDITY. BRIEFLY DESCRIBE THESE AND DISCUSS THEIR IMPORTANCE.

Moral Hazard: Managers or stockholders in a firm have an incentive to take big risks unseen by the individual investors who lend to the firm. If investors are dispersed, none of them is willing to spend the time to monitor the firm and none has ability to control management. Banks often exist within local communities where bankers live. The socializing activities among the bankers (or relationship banking) help them get insider knowledge about local corporations. Investors trust banks for their superior knowledge in lending business.

Adverse Selection: Issuers of securities have trouble getting a good price for them, since the market as a whole cannot distinguish good from bad companies. This is because information is public good and no one will take trouble to collect information about companies and give it away. So only the bad companies are willing to issue securities for the market price and this may break down the market. Banking relationship helps solve this problem in the similar way as in the moral hazard problem.

Liquidity: Borrowers often need a relatively long term loan but lenders do not want to commit to such long term investments. The loans therefore are inherently illiquid. Banks create liquidity by accepting short-term deposits and making effectively long term business loans. They can do that with fractional reserves, meaning that they keep a certain part of the deposits as reserves and trust depositors will not claim their deposits all at the same time.

(2 points each)

2: Clearly explain why banks will help solve these problems.

1: Merely describe what the terms mean.

11. WHAT IS THE TEMPORARY AUCTION FACILITY (TAF), WHO USES IT AND WHO MANAGES IT AND WHAT IS ITS PURPOSE?

The TAF was created and managed by Fed in collaboration with Bank of Canada, Bank of England, The European Central Bank and Swiss National. Under the TAF, the Fed will auction term funds to depository institutions against the wide variety of collateral that can be used to secure loans at the discount window. By allowing the Fed to inject term funds through a broader range of counterparties and against a broader range of collateral than open market operations, this facility could help promote the efficient dissemination of liquidity when the unsecured interbank markets are under stress. (6 points)

Precisely describe the function of TAF (2 points) and its purpose (2 points). Specify the beneficiary and the managing agent. (1 point each)

12. WHAT HAVE BEEN THE MOST IMPORTANT GOALS OF US MONETARY POLICY?

The goals are: stability in the price level, high employment (or low unemployment) of civilian labor force, economic growth in output of goods and services, stabilizing interest rates, and the stability of dollar in foreign currencies. (6 points)

6 points: Precisely specify the five goals.

4-5 points: Specify the five goals but some may not be precise.
1-3 points: Missing goals.

PART II 8 points each

13:

- A) Suppose that last year Company X paid a dividend of \$10 per share. This year Company X pays a dividend of \$20 per share. If the company uses the Lintner Model of Dividends to decide how much dividend to pay, what is the company's earnings per share (EPS) this year? Assume that the adjustment rate is equal to 0.5 and the target ratio is equal to 0.5.

$$\text{DIV}(t) - \text{DIV}(t-1) = 0.5 * [0.5 * \text{EPS} - \text{DIV}(t-1)] \rightarrow \text{EPS} = 60$$

- B) Now assume that next year's EPS is equal to this year's EPS. What will be the dividend per share next year?

$$\text{DIV}(t+1) = \text{DIV}(t) + 0.5 * [0.5 * \text{EPS} - \text{DIV}(t)] = 25$$

(4 points each)

4 points: Write down formula for the Lintner model and calculate answers correctly.

2-3 points: Model is right with algebraic mistakes.

1 point: Only give answers.

14. The Jones family is looking to buy a house, and has asked a real estate agent to take them around showing them houses for sale. The agent, in planning their tour of local houses for sale, asks them what their price range is. They have decided that the most they can pay, in terms of a monthly mortgage payment, is 20% of their monthly income. Their annual income is \$60,000 a year, they expect to put down on the house, they expect to get a 30-year mortgage, and the interest rate is 6% a year. What should they tell the agent is the most they can afford to pay for a house?

Their monthly income is \$5000. 20% of that is \$1000, which must be their mortgage payment. Call P the house price, so $.8 * P$ is mortgage balance, the pdv of 360 monthly payments has to equal $.8 * P$, so the annuity value of

$$.8 * P = 1000 * (1 / .005) * (1 - (1 / 1.005)^{360})$$

Solve this for P, upper bound is \$208,489.52 for the house.

8 points: Use proper discount and formula. Obtain answer correctly.

5-7 points: Show good understanding of the concept but miscalculate the result or other minor mistakes.

1-4 points: Show certain understanding of the formula but with misunderstanding about some concepts.

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- A) A company pays a dividend of \$2 per share a year, and earnings (and dividends) have been growing at 2% a year. If the cost of capital for the company is 20% a year, what is the price of a share (ex dividend)?

$$P=2/(0.2-0.02)=11.11 \quad (4 \text{ points})$$

- B) Now suppose that the company announces it has a new investment plan that requires that they cut their dividend in half, to \$1 per year, but they hope that the growth rate of dividends will be at a higher level from now on. What must the new growth rate of dividends be to result in unchanged share price?

$$1/(0.2-g)=11.11 \text{ and solve for } g=11\% \quad (4 \text{ points})$$

4 points: correctly use the Gordon model and calculate results.

3 points: correctly use the Gordon model but mis-calculate results or other minor errors.

1-2 points: mis-use rates or merely report a number.