**Homework on discounting, asset valuation and monetary policy**

1. (Discount rate and housing price) Suppose a house is bought for 300,000 dollars. The required down payment is 25% of the house price. The rest of the money is borrowed through a 30-year mortgage with monthly payments. What is the amount of down payment and what is the amount of borrowing? The annual percentage rate on the mortgage loan is 7%. Calculate the monthly payment. Now suppose the government tries to making housing more affordable. It reduces the interest rate to 3%. What is the new monthly payment on the mortgage? Does the government policy improve the affordability of housing market over the short term? If the housing supply doesn’t increase, those who can afford the monthly payment of the original 300,000 dollar house will likely to buy the same kind of house. What will be the new price of the house which was originally sold for 300,000 dollars, if monthly payment is kept at the same level when interest rate was at 7% and down payment is 25% of the housing price? What is the new down payment? Over the long term, will lowering the interest rate alone improve or deteriorate the affordability of housing market?
2. (Mortgage duration and housing price) Suppose a house is bought for 400,000 dollars. The required down payment is 20% of the house price. The rest of the money is borrowed through a 30-year mortgage with monthly payments. What is the amount of down payment and what is the amount of borrowing? The annual rate on the mortgage loan is 5%. Calculate the monthly payment. Now suppose the government tries to making housing more affordable. It increases the mortgage duration from 30 years to 40 years. What is the new monthly payment on a forty year mortgage? Does the government policy improve the affordability of housing market over the short term? If the housing supply doesn’t increase, those who can afford the monthly payment of the original 400,000 dollar house will likely to buy the same kind of house. What will be the new price of the house which was originally sold for 400,000 dollars, if monthly payment is kept at the same level when mortgage duration was 30 years and down payment was 20% of the housing price? What is the new down payment? Over the long term, will increasing the mortgage duration alone improve or deteriorate the affordability of housing market? Why?
3. (Adjustable rates mortgage) A house is bought for 400,000 dollars. Suppose the mortgage rate is 4% per annum. The buyer chooses the adjustable rates mortgage, which lasts for 30 years. In the first 5 years, the buyer only needs to pay the interest part. In the next 25 years, the buyer will pay back interest and principal with an equal monthly payment. What is the monthly payment for the first 5 years? What is the monthly payment for the next 25 years? Why people often default on adjustable rate mortgages? Suppose the housing price appreciates 20% over one year. If the capital investment is measured as the first 12 month’s mortgage payment, what is the rate of return from this investment? Explain why real estate speculators love adjustable rates mortgages. If adjustable rates mortgages often result in mass default, why it can become popular in the first place?
4. There are two bonds. Each pays 4% annual interest. Bond A matures in five years and bond B matures in ten years. At the time of maturity, each bond will pay back annual coupon and the principle. The principle of each bond is 1,000,000 dollars. When the discount rate is 4% per year, what are the prices of bond A and B? When the discount rate is 2% per year, what are the prices of bond A and B? When the discount rate is 6% per year, what are the prices of bond A and B? How the change of bond prices is related to the maturity of bonds? When you expect interest rate to drop, which bond, A or B, you will buy? When you are unsure about future, will you invest in long term or short term?
5. There are two bonds. Both mature in ten years. Bond A pays 3% annual interest. Bond B pays 7% annual interest. At the time of maturity, each bond will pay back annual coupon and the principle. The principle of each bond is 1,000,000 dollars. When the discount rate is 4% per year, what are the prices of bond A and B? When the discount rate is 2% per year, what are the prices of bond A and B? When the discount rate is 6% per year, what are the prices of bond A and B? How the change of bond prices, percentage wise, is related to the coupon rate of bonds?
6. There are three stocks. Each stock will pay 2 dollars of dividend per share this year. Stock A’s dividend is expected to grow 2% per year to perpetuity. Stock B’s dividend is expected to stay the same to perpetuity. Stock C’s dividend is expected to decline 2% per year to perpetuity. When the discount rate is 4% per year, what are the prices of stock A, B and C? When the discount rate is 3% per year, what are the prices of stock A, B and C? When the discount rate is 5% per year, what are the prices of stock A, B and C? How the change of stock prices, percentage wise, is related to the growth rate of dividend payments?