Public Affairs 974
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Problem Set 2 Answers (rev 12/2)

Due ***in lecture*** on Thursday, November 29. Be sure to put your name on your problem set. Put "boxes" around your answers to the algebraic questions.

1. Suppose the price change of a stock is given by:

$$P_{t+1} - P_t = (E_t P_{t+1} - P_t) + \left[\frac{D_{t+2} - E_t D_{t+2}}{(1 + rp + rf)} + \frac{E_{t+1} P_{t+2} - E_t P_{t+2}}{(1 + rp + rf)} \right]$$

Assume no news regarding dividends is coming out between t and t+1.

1.1 Why how might changes in expectations from t to t+1 regarding events at t+4 have an impact on the price change from t to t+1? Be explicit about the channel.

Answer: Note that under the assumptions:

$$P_{t+1} - P_t = (E_t P_{t+1} - P_t) + \left[\frac{E_{t+1} P_{t+2} - E_t P_{t+2}}{(1 + rp + rf)} \right]$$

Going from t to t+1, expectations of the stock price at t+2 are revised in response to events in t+4, and this feeds back to the present price.

1.2 Should the change in the stock price be a completely uncorrelated random error? Show why or why not.

Answer: Consider a sufficiently short time horizon so dividends are not relevant. Then the standard stock price equation becomes:

$$P_t = \frac{E_t P_{t+1}}{1 + (rf + rp)}$$

Assume log-normality of the error term:

$$p_t = E_t p_{t+1} - \ln(1 + rf + rp) \rightarrow p_t + \ln(1 + rf + rp) = E_t p_{t+1}$$

Use the assumption of rational expectations:

$$p_{t+1} = E_t p_{t+1} + \tilde{u}_{t+1}$$

Substitute in the expression for log price:

$$p_{t+1} = p_t + (rf + rp) + \tilde{u}_{t+1}$$

Re-express in terms of growth rate of the stock price:

$$\boxed{p_{t+1} - p_t = (rf + rp) + \tilde{u}_{t+1}}$$

Then the change in the stock price equals an uncorrelated random error and a constant.

2. Consider a Bank that has the following balance sheet:

2.1 Suppose the bank has the following structure:

Assets		**Liabilities**	
Reserves	$50M	Checkable Deposits	$230M
Securities	$25M		
Govt Securities	$25M		
Loans	$150M	Bank Capital	$20M

Bank capital is the equity of the owners (shareholders) of the bank. ABS stands for asset backed securities.

Under the Basel II guidelines, government securities would have zero weight in assets; recalculate the capital ratio for this bank. Show your work. (Note also reserves carry zero weight in the calculation of risk weighted assets.)

Answer: The capital ratio is 20/(0×25+1×25+1×150) = 20/175 = **11.43%**

2.2 Suppose the government securities are actually as risky as non-government securities. Calculate the true capital ratio.

Answer: The capital ratio is 20/(1×25+1×25+1×150) = 20/200 = **10.00%**

3. Leverage, liquidity, and bank balance sheets

3.1 Consider two banks, H (high bank capital) and L (low bank capital).

High Bank Capital				**Low Bank Capital**			
Assets		Liabilities		Assets		Liabilities	
Reserves	$9M	Deposits	$90M	Reserves	$10M	Deposits	$96M
Loans	$71M	Bank Capital	$10M	Loans	$70M	Bank Capital	$4M
ABS	$20M			ABS	$20M		

Bank capital is the equity of the owners (shareholders) of the bank. ABS stands for asset backed securities.

Calculate the return on equity (ROE) for each bank, if the rate of return on loans is 5%, and 10% on ABS, and the interest rate on deposits is 2%.

Answer: For H bank:
((0.05×71+0.10×20) – (0.02×90))/10 = 3.75/10 = 0.375 = **37.5%**

For L bank:
((0.05×71+0.10×20) – (0.02×96))/10 = 3.63/4 = 0.9075 = **90.75%**

3.2 Show what happens to each of the bank balance sheets when the asset backed securities lose 25% of their value.

Answer: the balance sheets now look like the following:

High Bank Capital				**Low Bank Capital**			
Assets		Liabilities		Assets		Liabilities	
Reserves	$9M	Deposits	$90M	Reserves	$10M	Deposits	$95M
Loans	$71M	Bank Capital	$5M	Loans	$70M	Bank Capital	$0M
ABS	$15M			ABS	$15M		

Bank capital is the equity of the owners (shareholders) of the bank. ABS stands for asset backed securities.

The H bank remains solvent, while the L bank become insolvent, and depositors lose $1M.

3.3Now consider two banks, one which borrows a nothing short term, and one that borrows a lot on short term money markets.

Bank Deposit Based				**Money Market Based**			
Assets		Liabilities		Assets		Liabilities	
Reserves	$6M	Deposits	$60M	Reserves	$3M	Deposits	$30M
Loans	$74M	Short term	$30M	Loans	$77M	Short term borrowing	$60M
				borrowing			
ABS	$20M	Bank Capital	$10M	ABS	$20M	Bank Capital	$10M

Calculate the return on equity (ROE) for each bank, if the rate of return on loans is 5%, and 10% on ABS, and the interest rate on deposits is 2%, and the interest rate on short term borrowing is 1%.

Answer: For Deposit-based bank:
((0.05×74+0.10×20) – (0.02×60+0.01×30))/10 = 4.2/10 = 0.42 = **42%**

For Money market based bank:
((0.05×77+0.10×20) – (0.02×30+0.01×60))/10 = 46.5/10 = 0.465 = **46.5%**

3.4 Show what each bank must do when short term money markets freeze, so that the banks cannot continue to borrow short term.

Answer: For Deposit-based bank, either deposits must be increased by $30M (and reserves raised by $3M), or Loans and ABS fall by $30M. For the Money market-based bank, deposits must be increased by $60M (and reserves increased by $6M), or Loans and ABS fall by $60M.

4. Consider a Taylor rule of the following form:

$$i_t^{FedFunds} = \pi_t + 0.5 \times (y_t - y_t^*) + 0.5 \times (\pi_t - \pi_t^*) + r_t^*$$

4.1 Calculate the implied Fed funds rate, assuming the equilibrium real rate is 2.5%, and target inflation rate is 2%. You will need to obtain information on the output gap and inflation rate. Show your work.

Answer:
The 2012Q3 output gap calculated in log terms is **-5.98%** (as of 2012Q3) The CPI-all inflation rate (12 month as of Sept.) is **1.98%**.

$$i_t^{FedFunds} = 0.0198 + 0.5 \times (-0.0598) + 0.5 \times (0.0198 - 0.02) + 0.025$$

$$i_t^{FedFunds} = 0.0148$$

4.2 Suppose there is uncertainty surrounding the estimates of y-y^* and π-π^*. Suppose further the standard deviation of each series is 0.026 and 0.012 respectively. What is the range of changes consistent with the Taylor rule, and this degree of uncertainty, using 95% confidence intervals? Show your work. What assumptions do you need to make in order to obtain your answer?

$$i_t^{FedFunds} = 0.0198 + 0.5 \times (-0.0598 - 2 \times 0.026) + 0.5 \times (0.0198 - 0.02 - 2 \times 0.012) + 0.025$$

$$i_t^{FedFunds} = 0.0198 + 0.5 \times (-0.0598 + 2 \times 0.026) + 0.5 \times (0.0198 - 0.02 + 2 \times 0.012) + 0.025$$

The range is therefore (-0.0232, 0.0528)

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