

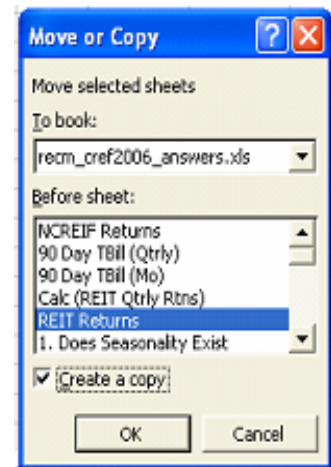
Real Estate Swaps and Derivatives

Objective: The objective of this assignment is to familiarize students with real estate swaps and real estate derivatives. A secondary objective is to expose students to some of the issues associated with commingled real estate funds (CREFs) which resemble private real estate investment trusts (REIT). Wall Street typically uses the return on CREFs as a proxy for the return on direct¹ real estate investment.

Assignment: Download the real estate data from my website (recm_red2007.xls) and use the downloaded spreadsheet to answer the following questions. Please highlight your answers in **yellow** and turn in a hard copy of your results. ***This is an individual assignment.***

1. Relationship between CREF and REIT Returns: (10 points) Using the template **1a. MvgAvg** in conjunction with **NCREIF Returns** and **REIT Returns** worksheets, calculate the quarterly equity REIT returns starting from March 1972 through March 2005.

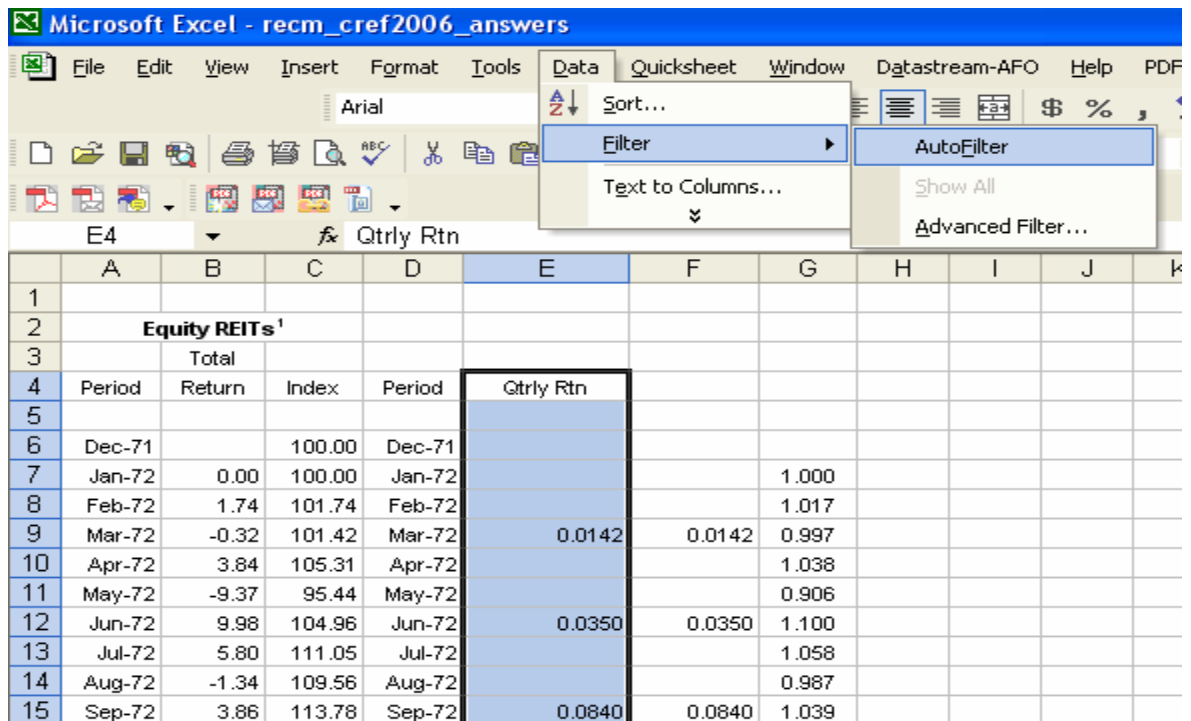
Hint: One way to accomplish this is to make a copy of the **REIT Returns** worksheet by right-clicking the mouse and selecting the **Move or Copy ...** option. Next, click on the REIT Returns sheet in the scroll down box, click on the **Create a copy** box located on the lower left hand side, and then click on the **OK** button. Label the new sheet that you copied **Calc (REIT Qtrly Rtns)** by double clicking on the tab. To calculate quarterly returns, you can either use the equity REIT index or alternatively calculate $1 + \text{Monthly Return}$ and then take the product of $(1 + R)$ for three months as shown in the following illustration:



¹Direct real estate investment means that the investor invests in the underlying real estate rather than investing in a share of stock which in turn owns real estate such as investing in a REIT.

	A	B	C	D	E	F	G
1							
2	Equity REITs¹						
3		Total					
4	Period	Return	Index	Perio	Qtrly Rtr		
5							
6	Dec-71		100.00	Dec-71			
7	Jan-72	0.00	100.00	Jan-72			=1+B7/100
8	Feb-72	1.74	101.74	Feb-72			=1+B8/100
9	Mar-72	-0.32	101.42	Mar-72	=C9/C6-1	=PRODUCT(G7:G9)-1	=1+B9/100
10	Apr-72	3.84	105.31	Apr-72			=1+B10/100
11	May-72	-9.37	95.44	May-72			=1+B11/100
12	Jun-72	9.98	104.96	Jun-72	=C12/C9-1	=PRODUCT(G10:G12)-1	=1+B12/100
13	Jul-72	5.80	111.05	Jul-72			=1+B13/100
14	Aug-72	-1.34	109.56	Aug-72			=1+B14/100
15	Sep-72	3.86	113.78	Sep-72	=C15/C12-1	=PRODUCT(G13:G15)-1	=1+B15/100
16	Oct-72	-2.32	111.15	Oct-72			=1+B16/100
17	Nov-72	-1.31	109.70	Nov-72			=1+B17/100
18	Dec-72	-1.54	108.01	Dec-72	=C18/C15-1	=PRODUCT(G16:G18)-1	=1+B18/100

Once you have finished your calculations, you will need to “collapse” your spreadsheet so that only rows containing the quarterly returns are showing. To accomplish this task, highlight the column that you wish to collapse → Select **Data** from the Excel menu → **Filter** → **AutoFilter** as follows:

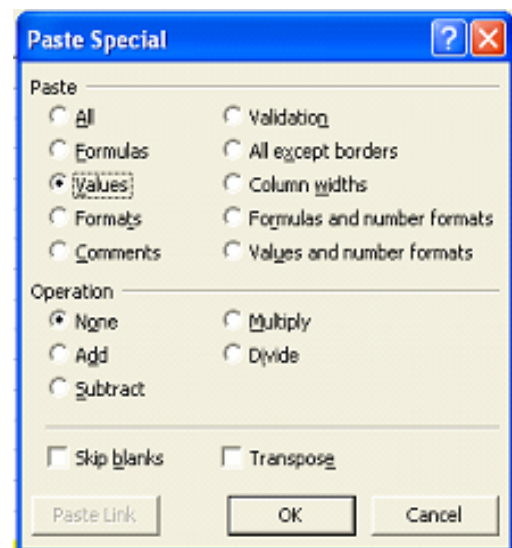


You will now notice a pull down button in the first row of the column that you highlighted. Click on the pull down button and select (Nonblanks) as illustrated below which results in a column of quarterly returns:

	A	B	C	D	E	F	G
1							
2	Equity REITs¹						
3		Total					
4	Period	Return	Index	Period	Qtrly Rtn		
9	Mar-72	-0.32	101.42	Mar-72	0.1101	0.0142	0.997
12	Jun-72	9.98	104.96	Jun-72	0.1147	0.0350	1.100
15	Sep-72	3.86	113.78	Sep-72	0.1182	0.0840	1.039
18	Dec-72	-1.54	108.01	Dec-72	0.1202	-0.0507	0.985
21	Mar-73	2.38	106.05	Mar-73	0.1209	-0.0182	1.024
24	Jun-73	2.12	100.30	Jun-73	0.1307	-0.0542	1.021
27	Sep-73	6.48	105.39	Sep-73	0.1311	0.0508	1.065
30	Dec-73	-0.23	91.25	Dec-73	0.1368	-0.1342	0.998
33	Mar-74	-2.18	97.36	Mar-74	0.1477	0.0670	0.978
36	Jun-74	1.56	86.89	Jun-74	0.1523	-0.1075	1.016
39	Sep-74	-0.48	73.84	Sep-74	0.1720	-0.1502	0.995
42	Dec-74	-1.61	71.72	Dec-74	0.1885	-0.0287	0.984
45	Mar-75	2.82	86.17	Mar-75	0.1978	0.2015	1.028
48	Jun-75	6.25	92.78	Jun-75	0.2164	0.0767	1.062
51	Sep-75	-6.31	84.30	Sep-75	0.2274	-0.0915	0.937
54	Dec-75	2.32	85.56	Dec-75	(Blanks)	0.0150	1.023
					(NonBlanks)		

You will have to copy this column to the **1a. MvgAvg** worksheet template by


- highlighting the column in the **Calc (REIT Qtrly Rtns)** worksheet with your mouse,
- selecting **Edit** → **Copy** from the Excel toolbar,
- clicking on the **1a. MvgAvg** tab,
- highlighting the EREIT Quarterly Return column starting with cell B5 through cell B137, and
- selecting **Edit** → **Paste Special ...** from the Excel toolbar. In the Paste Special box that appear, click on **Values** then click the **OK** button.

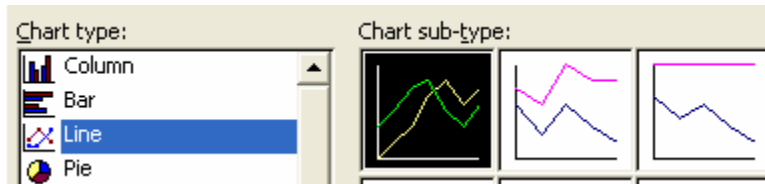


In the next column, labeled MA(4Q) for 4 quarter moving average or one year moving average in the **1a. MvgAvg** worksheet, calculate the 4 quarter moving average by using the average command for four quarters. The formula for cell C8 is thus =AVERAGE(B5:B8) . Copy and paste this formula in cells C9 through C137. Using a similar logic process, calculate the 8 quarter (2 years), 12 quarter (3 years), 16 quarter

(4 years), and 20 quarter (5 years) moving average of equity REIT returns. Next, link the quarterly NCREIF returns to the **1a. MvgAvg** worksheet. To link one worksheet to another worksheet, input an = sign into cell H29 in the **1a. MvgAvg** worksheet, click on the **NCREIF Returns** tab and then click on cell D3 in the **NCREIF Returns** worksheet. Your sheets are now linked. Copy and paste cell H29 in the **1a. MvgAvg** worksheet into cell H30 through cell H137 of the **1a. MvgAvg** worksheet.

b. Graph the co-movement of returns between the contemporaneous equity REIT returns and the NCREIF returns. In addition to this, calculate the correlation coefficient using the = CORREL function in Excel and put it as a comment in your graph. To generate this graph using the data in the **1a. MvgAvg** worksheet,

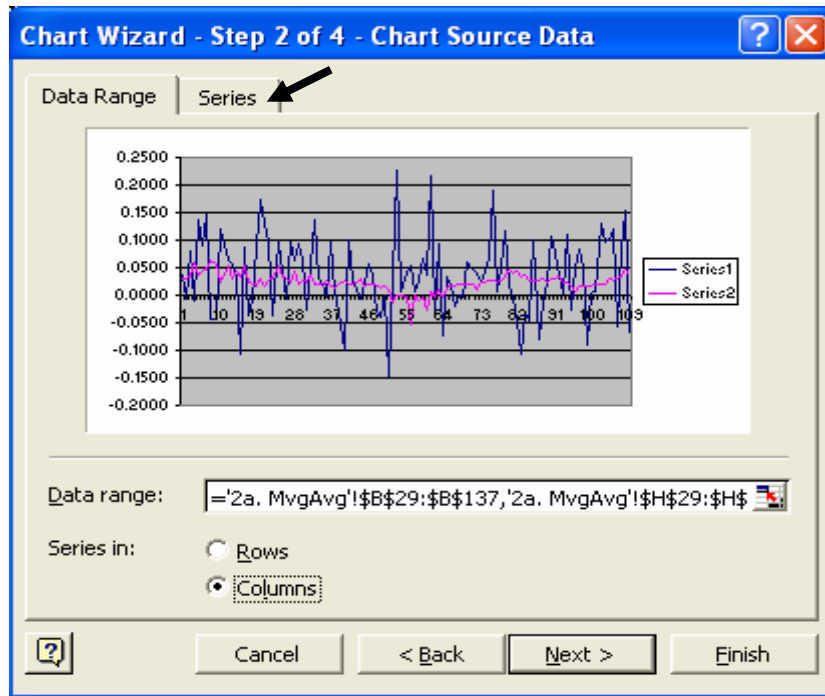
- click on the Chart Wizard icon 
- Select **Line** as the Chart Type and the first chart in the upper left hand corner as the Chart Sub-type



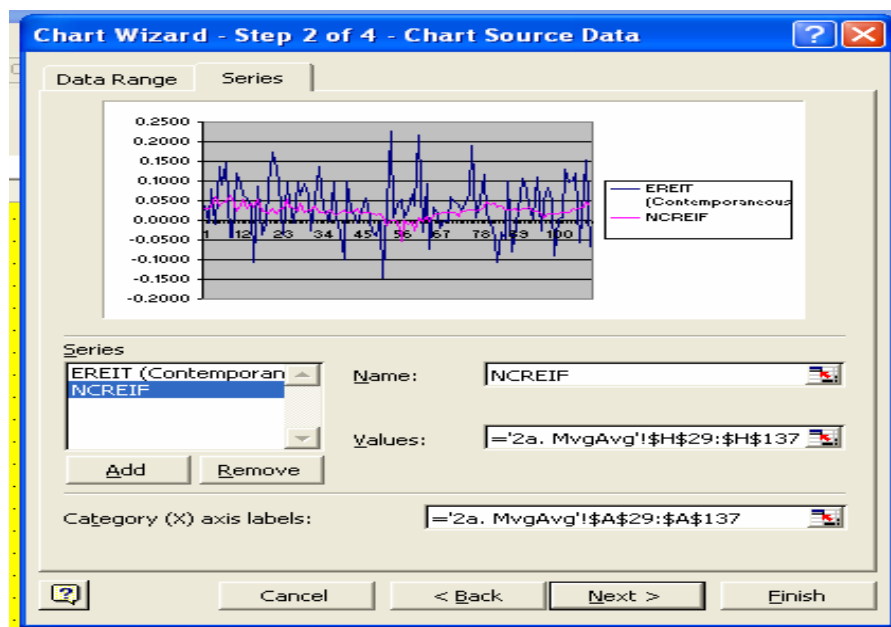
- In **Data range:** box, select the columns that you wish to graph together. For our first graph, we will use column B (cell B29 through cell B137) and column H (cell H29 through cell H137). Click on cell B29. Notice that **= '1a. MvgAvg!'\$B\$29** appears in the **Data range:** box. Highlight the rest of the cells in column B through cell B137. **= '1a. MvgAvg!'\$B\$29:\$B\$137** now appears in the **Data range:** box. Type a comma (,) then click on cell H29 and highlight the rest of the cells in column H through cell H137. The following is now appears in the **Data range:** box

= '1a. MvgAvg!'\$B\$29:\$B\$137, '1a. MvgAvg!'\$H\$29:\$H\$137

Choose the **Columns** option for Series in: and then click on the Series tab located at the top of the Chart Wizard screen.



For the first series (Series1: '1a. MvgAvg!\$B\$29:\$B\$137), highlight **Series1** in the **Series:** box and in the **Name:** box type in **ERET (Contemporaneous)** as the label. Next, highlight **Series2** in the **Series:** box² and in the **Name:** box type in **NCREIF** as the label. Finally, click on the **Category (X) axis labels:** box, click on cell A29 and then holding down the left button on your mouse, highlight the remaining cells in column A through cell A137. Then click on the **Next>** button. Your Chart Wizard screen should resemble the following illustration:



²Series2: '1a. MvgAvg!\$H\$29:\$H\$137

You can now finish up your graph. When you reach Chart Wizard Step 4 of 4 – Chart Location, select the **As new sheet:** option for **Place chart:**, then click on the adjacent box and type **1b. REIT vs NCREIF** as the tab for your graph.

- c. Graph the co-movement of returns between the one year (four quarters) moving average (MA(4Q)) of equity REIT returns and the NCREIF returns. In addition to this, calculate the correlation coefficient using the = CORREL function in Excel and put it as a comment in your graph.
- d. Graph the co-movement of returns between the two year (eight quarters) moving average (MA(8Q)) of equity REIT returns and the NCREIF returns. In addition to this, calculate the correlation coefficient using the = CORREL function in Excel and put it as a comment in your graph.
- e. Graph the co-movement of returns between the three year (twelve quarters) moving average (MA(12Q)) of equity REIT returns and the NCREIF returns. In addition to this, calculate the correlation coefficient using the = CORREL function in Excel and put it as a comment in your graph.
- f. Graph the co-movement of returns between the four year (sixteen quarters) moving average (MA(16Q)) of equity REIT returns and the NCREIF returns. In addition to this, calculate the correlation coefficient using the = CORREL function in Excel and put it as a comment in your graph.
- g. Graph the co-movement of returns between the five year (twenty quarters) moving average (MA(20Q)) of equity REIT returns and the NCREIF returns. In addition to this, calculate the correlation coefficient using the = CORREL function in Excel and put it as a comment in your graph.
- h. For more than a decade, financial academics and market professionals have debated whether the return behavior of equity REITs is more like that of direct ownership in real estate or more like stocks. The debate stemmed largely from the apparently much stronger correlations between REITs and the stock market (and particularly small cap stocks) than between REITs and actual commercial real estate properties. Using the graphs that you have constructed in the preceding questions (1a - 1g), discuss whether the return behavior of equity REITs is linked to the direct ownership in real estate as proxied by NCREIF returns. Do you feel that analysts should look at the contemporaneous relationship between returns on REITs and CREFs which is the source of this debate or is it better to look at a moving average of REIT returns relative to CREFs. Why or why not? What is the relationship between REITs and CREFs e.g., does one return series lead or lag the other? In



other words, is one return series a leading indicator of the other return series? What is the economic intuition for why this is the case?

2. Illiquidity of Real Estate and the Swapping of CREF Cash Flows: (50 points) One strategy that some investment banks such as Morgan Stanley have proposed to CREF investors who wish to lessen their exposure in real estate but do not want to pay large transaction costs and do not want to turn a “paper” loss into a real loss through a sale of CREF units is to swap CREF returns for risk-free returns on either LIBOR or Treasury bills. Suppose that your firm, who holds units in a CREF, executes a real estate swap for a 3 month (90 day) Treasury bill. The swap is initiated in the second quarter of 2000; the real estate swap will last for 20 quarters ending in the first quarter of 2005.³ The terms associated with the swap agreement are as follows:



Initial Appraised Value: \$250,000,000
Discount (of Appraised Value): 15%
Length of Swap (in quarters): 20 quarters (from 2000 Quarter 2 until 2005 Quarter 1)
Spread over 3-month Treasury bill: .125%

where

Initial Notional Amount = Initial App Value * (100% - Discount of Appraised Value)

Discount Accretion Amount (per period) = (Initial Appraised Value * Discount of Appraised value)/Length of Swap

Discounted Initial Russell-NCREIF Capital Index Value =(Capital Index Val *(100%-Discount of Appraised value))

Number of Index Units = Notional Amount ÷ Discounted Capital Index Value

Discount Accretion (Percent %) = Discount ÷ Length of the Swap

Fill in the **yellow** highlighted areas in the Receiver⁴ Template (the **2a. Swap05 (Recv Ppty CF** worksheet) and the Payer⁵ Template (the **2b. Swap05 (Pays Ppty CF** worksheet)”. The highlighted areas: 1) Show the net cash flows to Party A including all intermediate calculations on a spreadsheet, 2) Show the net cash flows to Party B including all intermediate calculations on a spreadsheet, and 3) Show the cash flows to the financial intermediary who set up the swap agreement including all intermediate calculations on a spreadsheet. Is the swap a good deal for your firm? Was the swap, in

³The question to consider here is how would the party who wants to participate in real estate (receiver of real estate cash flows) have fared over this time period.

⁴Receives Property Cash Flows

⁵Pays Property Cash Flows

hindsight, a good deal for the other party? Why or why not? If it is not a good deal, explain why it isn't. Plot out the NCREIF returns vs. 3-month Treasury bill.

3. Buy and Hold Strategy: Investing in CREFs relative to Equity REITs: (10 points) In general, institutional investors typically will not engage in real estate swaps. The choice therefore frequently involves choosing between CREFs and REITs. Suppose that an institutional investor purchased 1 unit of NCREIF for \$100,000 in the first quarter of 1991. Assume that:



- The NCREIF unit appreciates or declines each quarter at the capital return portion of the NCREIF index. The income (dividend) paid on the NCREIF unit each quarter is equal to the income return on the NCREIF index.
- The income that the investor receives from his/her one unit is put in a bank account. Interest paid on that account is equal to the 90 day Treasury bill yield and is paid quarterly. Interest is compounded on a quarterly basis. Assume that income is paid at the end of each quarter on the value of the CREF unit at the beginning of each quarter.
- The investor can only sell his/her unit when the total quarterly NCREIF return (capital appreciation + income) is greater than the quarterly return on the 90 day Treasury bill
- A new institutional buyer of the investor's unit will only purchase a unit of NCREIF if the total quarterly NCREIF return (capital appreciation + income) is greater than the quarterly return on the 90 day Treasury bill **and** the total quarterly NCREIF return (capital appreciation + income) is greater than the quarterly return on the NAREIT index.

Based on the preceding assumptions,

a. Using the **3a. When Buy CREF** worksheet, what percentage of the time since the first quarter of 1991 through the first quarter of 2005 did Commingled Real Estate Funds outperform both REITs and Treasury Bills? Please discuss which investment vehicle you would have preferred to hold over this period given perfect hindsight if you wanted to maximize returns? Hint: You will need to use a series of IF and AND statements in column E. For example, in column E4 you should have a statement that resembles the following

=IF(AND(B4>D4,B4>C4),"Buy XXX",IF(AND(C4>D4,B4<C4),"Buy YYY","Buy ZZZ"))

b. Using the **3b. MIRR (NCREIF)** and **3b. MIRR (NAREIT)** worksheets, what is the modified IRR for the NCREIF unit. If the investor had in lieu of purchasing a NCREIF unit, bought \$100,000 worth of the NAREIT's equity REIT composite index what

would his/her Modified IRR be assuming the same holding period as the NCREIF investment and assuming quarterly payouts? In hindsight, would the investor have been better off buying NCREIF or NAREIT based solely on the MIRR?

How to Calculate the Modified Internal Rate of Return (MIRR):

To calculate the MIRR, the future value of a lump sum formula is used as follows:

$$FV = PV (1 + \text{MIRR})^T$$

where FV = future value of all cash flows. All cash flows are compounded forward at the rate on passbook savings or some safe rate (we use the 90-day return).

PV = present value of cash outlays. If the investment is staged in, say, investing \$1,000 in Period 0 and another \$1,000 in Period 1, these cash outlays are discounted back to present at the opportunity cost of funds. The opportunity cost of funds is defined as the rate of return on the next best opportunity.

T = Holding period; time to sale of your investment

Example: Suppose that an investor invests \$2000 in the current period (t_0) and another \$2000 at the beginning of the next period (t_1). Cash flows on the 5 year project are \$700 (t_1), \$750 (t_2), \$775 (t_3), \$800 (t_4) and \$850 (t_5). The terminal value of the project is \$2500 (t_5). If the investor did not invest in this project, the rate of return associated with his next best opportunity is 9%. Assume that the risk free rate is 3% and the risk free rate remains stationary over the five year period. Cash outlays (investments in the project) are assumed to be made at the *beginning* of each period. Cash inflows are assumed to be received at the *end* of each period. What is the modified IRR?

r_f	0.03							
OppCost	0.09							
	Cash			Discounted	Cash			Compounded
Time	Outlay	1+OpCost	PV Factor	Outflows	Inflows	1 + r_f	FV Factor	Inflows
0	2000			2000				
1	2000	1.09	0.917431	1834.86	700			940.74
2					750	1.03	1.03000	978.58
3					775	1.03	1.06090	953.15
4					800	1.03	1.092727	900.41
5					3350	1.03	1.1255088	3350
5	T	Totals	PV	\$3,834.86			FV	\$7,122.88
			MIRR	0.131829936				

4. S&P/Case Shiller Housing Futures and Price Discovery (10 points): One of the benefits of housing futures according to the Chicago Mercantile Exchange (CME) is that it will stabilize the market in the long term. Like any futures contract, really the goal is price discovery in the marketplace. The CME housing futures market is a tool to tell you where the market believes prices are going, to give the broader market a sense of price discovery. Using the worksheet “4. CME Housing Fut (Feb 2-07)” together with the following files

Section46_Housing_Futures_And_Options_2007002.pdf

Section46_Housing_Futures_And_Options_2007023.pdf

obtained from <http://www.cme.com/trading/dta/hist/dbindex.html>, calculate the percentage price decline/advance forecasts for the various futures contracts available for the 10 cities and the composite of those 10 cities. What can we infer about the "predicted" forward looking change in prices in various markets and the U.S. as a whole when we compare the first table - Change from CSI Index Oct-06 (1/3/07) with the second table - Change from CSI Index Nov-06 (2/2/2007)?

5. Relationship Between Homebuilding Stocks and Housing Futures (10 points). One point on each part a – g, 3 points for part h): According to the efficient market hypothesis (EMH), financial markets are "efficient", or that prices on traded assets already reflect all known information and therefore they reflect the collective beliefs of all investors about future prospects. If this is the case, the question which arises is to what extent do the price movements of homebuilding stocks already incorporate information in the forward looking futures prices?

a. Construct a Homebuilders Stock Index: Given the information on stock prices and shares outstanding for various large homebuilders in the “Homebuilder Stocks” worksheet, construct a Homebuilders Stock Index using the worksheet template “5a. Homebuilder Stock Index”. The market value for each home builder stock per period is the price per share multiplied by the number of shares outstanding. I have provided an example of how to calculate the market value for Beazer Homes USA (BZH)). The total market value per period is the sum of the market value of all home builder stocks per period while total shares outstanding per period is the sum of the shares outstanding of all home builder stocks.

b. Price of Homebuilder Stock Index Compared to Price of Housing Futures: Fill in the “5b. Homebldrs vs Housing Future” worksheet template using information in the “5a. Homebuilder Stock Index” and “CME Housing Futures (Composite)” worksheets.

c. Correlation Between Homebuilder Stocks and Housing Futures: Calculate the correlations between the homebuilder stocks and the various housing futures contracts for the composite 10 city index given your answer in part b above. To generate a correlation matrix in Excel, click on **Tools** → **Data Analysis** ... → **Correlation** → click **OK** button → highlight the input range with your cursor including the label at the top of the data → check the box “Labels in First Row” → Type in

the box **New Worksheet Ply 5c. Corr(Housing Futures)**. If you do not see the **Data Analysis** option in **Tools**, pull down the **Tools** menu → select **Add-Ins** ... check the box **Analysis ToolPak** → click **OK** button. You should now see the **Data Analysis** option in **Tools**.

- d. Chart Builders versus Feb 27 CSI: Using the data in the “5b. Homebldrs vs Housing Future” worksheet, use a **Lines on 2 Axes** chart to show the relationship between the price movement of home builders and the price movement of the February 27 futures contract on the composite 10 city Case Shiller index (CSI). Please label the tab on this chart “5d. Chart (Bldrs vs Feb27 CSI)”.
 - e. Chart Builders versus May 29 CSI: Using the data in the “5b. Homebldrs vs Housing Future” worksheet, use a **Lines on 2 Axes** chart to show the relationship between the price movement of home builders and the price movement of the May 29 futures contract on the composite 10 city Case Shiller index (CSI). Please label the tab on this chart “5d. Chart (Bldrs vs May29 CSI)”.
 - f. Chart Builders versus Aug 28 CSI: Using the data in the “5b. Homebldrs vs Housing Future” worksheet, use a **Lines on 2 Axes** chart to show the relationship between the price movement of home builders and the price movement of the August 28 futures contract on the composite 10 city Case Shiller index (CSI). Please label the tab on this chart “5d. Chart (Bldrs vs Aug28 CSI)”.
 - g. Chart Builders versus Nov 27 CSI: Using the data in the “5b. Homebldrs vs Housing Future” worksheet, use a **Lines on 2 Axes** chart to show the relationship between the price movement of home builders and the price movement of the November 27 futures contract on the composite 10 city Case Shiller index (CSI). Please label the tab on this chart “5d. Chart (Bldrs vs Nov27 CSI)”.
 - h. Comparison of Charts: From the charts that you generated, please discuss to what extent do the price movements of homebuilding stocks already incorporate information in the forward looking futures prices?
6. Profit/Loss on Feb27 CSI Contract (10 points): Using the worksheet template “6. Profit Loss on Feb27 CSI”, calculate the profit or loss on the February 27 CSI Composite 10 cities contract. What is the dollar profit if the contract is purchased on December 26, 2006 and held through February 2, 2007? Does the investor receive any margin calls over this holding period? Remember that the contracts are marked to market at the end of each day. Unlike the stock market in which price fluctuations represent a paper profit or loss at the end of each day assuming that the stock is held, in the futures market, the end of each day represents an actual profit or loss. Assume that the investor purchased 10 CSI Composite Feb07 contracts at a price of \$221 per contract. Initial and maintenance margin requirements for housing future contracts are reported in the “Margins (CME Housing)” worksheet.