

**DERIVATIVE SECURITIES: OPTIONS AND FUTURES (GBUS 8426)**

**2017-2018, Quarter 3**

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**Course Overview:**

The Derivatives course is designed for students interested in a career in investment banking or corporate finance. The primary purpose of the course is to teach students how to interpret and value the wide variety of derivatives products available. As such, the course examines a broad array of derivative products that range from basic futures contracts to the more specialized products developed for interest rate markets. The valuation tools considered begin with basic arbitrage relationships and from there students will develop the Black-Scholes model. The course will also introduce the binomial approach and will use it as the primary valuation framework throughout the course. Students will also, through the use of assignments and problem sets, develop an intuitive understanding of why these products are used and the fundamental relationships that underlay all derivative products.

**Materials:**

Required: The class cases and other reading materials are posted on **CANVAS Portal 8426**.

Optional Textbook: Hull, John, *Options, Futures, and Other Derivative Securities*. Pearson-Prentice Hall (**HULL**). I will include chapter references for both 8<sup>th</sup> and 9<sup>th</sup> editions. I use the technical notes in the course pack for all of the sessions and it is not necessary to buy the textbook. However, if you plan a career in investment banking or corporate finance the Hull book is the most widely used reference on derivatives in the industry.

**Grading:**

The grading in the course has three components. They consist of class participation (30%), two problem sets (30%) and a final exam (40%).

Session	Date	Topic and Assignment
1	January 17 (Wednesday)	<b>Forward and Futures Prices</b> Case: F-1690 <i>Betting on Gold Using a Futures-Based Gold ETF</i> Reading: F-1427 <i>Forward and Futures</i>
2	January 18 (Thursday)	<b>Forward and Futures Prices II</b> Case: F-1641 <i>Johnson Family Farm – Hedging Decision</i>
3	January 24 (Wednesday)	<b>Hedging with Futures</b> Case: F-1697 <i>2012 Fuel Hedging at JetBlue Airways</i> Reading: F-1428 <i>Hedging with Forwards and Futures</i>
4	January 25 (Thursday)	<b>Trading Strategies Involving Options</b> Case: F-1698 <i>Hedge Fund Due Diligence at Lemn Alternative Asset Management Company</i> Reading: F-1429 <i>Trading Strategies with Options</i>
5	January 31 (Wednesday)	<b>Binomial and Black-Scholes Option Pricing Model</b> Reading 1: F-0943 <i>Binomial Option Pricing</i> Reading 2: F-1522 <i>The Black-Scholes Option Pricing Model</i>
<< <b>PROBLEM SET #1 DUE: February 1 (Thursday)</b> >>		
6	February 1 (Thursday)	<b>Equity Linked Notes</b> Case: F-DRAFT <i>Capped Buffered Return Enhanced Equity-Linked Note</i> Reading: F-1433 <i>Options on Stock Indices, Currencies and Futures</i>
7	February 7 (Wednesday)	<b>Warrants</b> Case: F-1642 <i>TARP Warrants: How Much to Bid?</i> Reading 1: F-1430 <i>The Pricing of Warrants</i> Reading 2: <i>Testimony on TARP Oversight</i>
8	February 8 (Thursday)	<b>Options on Stock Indices, Currencies and Futures</b> Reading 1: F-1433 <i>Options on Stock Indices, Currencies and Futures</i> Reading 2: F-1432 <i>Risk Management for Derivatives</i>
9	February 14 (Wednesday)	<b>Options in M&amp;As</b> Case: F-1715 <i>The Sanofi-Aventis Acquisition of Genzyme: Contingent Value Right</i> Reading: F-1322 <i>Technical Note on Structuring and Valuing Incentive Payments in M&amp;A Earnouts and Other Contingent Payments to the Seller</i>
10	February 15 (Thursday)	<b>Interest Rate Derivatives - Callable Bonds</b> Case: F-1063 <i>The Walt Disney Company: 100-Year Bonds - Sleeping Beauties?</i> Reading: F-1431 <i>Interest Rate Derivatives</i>
11	February 21 (Wednesday)	<b>Interest Rate Derivatives II - Caps, Floors and Swaptions</b> Case: F-1122 <i>G and P Greetings Inc.</i>
<< <b>PROBLEM SET #2 DUE: February 22 (Thursday)</b> >>		
12	February 22 (Thursday)	<b>Credit Derivatives</b> Case: F-1745 <i>Credit Default Swaps on AMR Corporation: Cash or Credit?</i> Reading: F-DRAFT <i>Credit Derivatives I – Single-Name Credit Default Swaps</i>
13	February 28 (Wednesday)	<b>Credit Derivatives II</b> Case: F-DRAFT <i>Credit Derivative Arbitrage: Single-name CDS vs. CDX Indices</i> Reading: F-DRAFT <i>Credit Derivatives II – CDS “Big Bang” and CDX Indices</i>
14	March 1 (Thursday)	<b>Total Return Swaps</b> Videos on Proshares Case 1: F-1729 <i>ProShares: The Alternative ETF Company</i> Case 2: F-1714 <i>ProShares Hedge Fund Replication ETF</i> Reading 1: ETF.com “SEC Rule Death Knell for Geared ETFs” (December, 2015) Reading 2: Wall Street Journal “SEC Moves to Curb Leveraged ETFs” (June, 2016) Reading 3: TheStreet.com “Trump Revives Triple-X-ETFs that Regulators Wanted to Kill” (March, 2017)

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #1: January 17, 2017 (Wednesday)

Topic: **Forward and Futures Prices**

Case: ***F-1690 Betting on Gold Using a Futures-Based Gold ETF***

Read: ***F-1427 Forward and Futures***

(\*optional\*) HULL Chapters 1, 2 and 5 (8<sup>th</sup> ed. & 9<sup>th</sup> ed.)

Spreadsheet: ***F-1690X.xlsx***

Assignment:

1. Review the information on gold futures contracts of the CME group (ex-COMEX) based on contract specification available in Exhibit 4 or at the [CME website](#). How do gold futures work?
2. Suppose that Michelson took a long position (as a speculator) on the December 2012 gold futures contract on 9/20/2012 and closed it on 10/19/2012. Use Exhibit 7 to compute the daily gains using the daily futures prices over that month. Would Michelson have lost or made a profit over the period? Would he have received a margin call?
3. Exhibit 6 shows the prevailing futures prices (settle) for gold on 10/19/2012. Assume that the Oct-12 futures settle price of 1,722.8 is effectively the gold spot price. What storage costs do you need to assume in terms of carry costs such that the arbitrage-free futures prices match the observed quoted futures prices? What about other maturities in Exhibit 6?
4. Looking at Exhibit 3, why does the futures-based gold ETF (DGL) have a “slippage” in return compared to the physical-based gold ETF (GLD) or gold spot prices?
5. What ETF would you recommend Michelson invest in order to get exposure to gold: a futures-based ETF like DGL or a physical ETF like GLD?

Extra question (if you have time): Examine the period from 6/2/2008 to 10/19/2012. Assume that DGL follows exactly the roll schedule in Exhibit 12 and GC futures contract prices in Exhibit 13 of DBLCI-OY Gold Index. How much did the roll yield contribute for the DGL return?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #2: January 18, 2017 (Thursday)

Topic: **Forward and Futures Prices II**

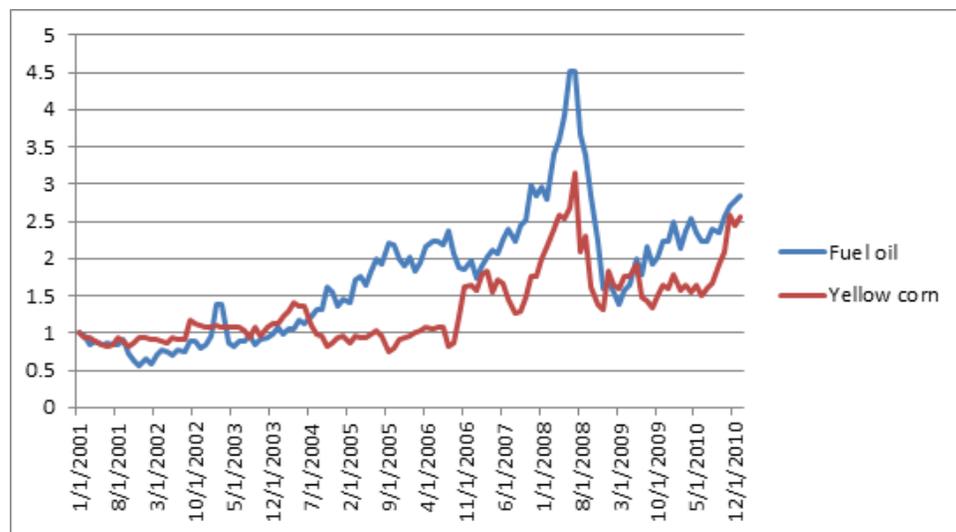
Case: ***F-1641 Johnson Family Farm – Hedging Decision***

Read: ***F-1427 Futures and Forwards***

Spreadsheet: n/a

Assignment:

1. How are futures prices for commodities like corn determined? In the case, the current spot price is \$5.835 per bushel, the July '11 futures price is \$6.08. Assuming that the cost of storage is \$0.015 bushel per month and the spoilage rate is 0.5% per month, does the July '11 futures price make sense?
2. Which of the alternatives in the case should Johnson choose? What factors are going to influence the decision?
3. If Johnson takes the Pacer contract, how will Cargill hedge their risk?
4. The figure below shows the cumulative price indices for fuel oil and corn with January 1, 2001 equal to 1.00. What issues does this raise with regard to the price for corn?



## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #3: January 24, 2017 (Wednesday)

Topic: **Hedging with Futures**

Case: *F-1697 2012 Fuel Hedging at JetBlue Airways*

Read: *F-1428 Hedging with Forwards and Futures*

(\*optional\*) HULL Chapter 3 (8<sup>th</sup> ed. & 9<sup>th</sup> ed.)

Spreadsheet: *F-1697X.xlsx*

Assignment:

1. Given the high price of jet fuel at the end of 2011, should JetBlue hedge its fuel costs? And if so, should it increase or decrease the percentage hedged for 2012?
2. Focusing on the 2007-2011 period, which commodity (WTI crude oil, Brent crude oil or heating oil) moved more closely to the price of jet fuel?
3. Should JetBlue continue using WTI as an oil benchmark for its crude oil hedges or switch to Brent? Quantify your answer using the 2007-2011 historical data provided in Exhibit 6.

Extra questions (if you have time):

1. Morales wants to backtest a WTI hedge versus a Brent hedge. She takes a monthly hedge position of 20 million gallons for 2012 (total hedge of 240 mil. gal., about 45.7% hedge ratio if the annual gallons consumed stays flat at 525 mil. gal.). Assume (unrealistically) that JetBlue would use a simple futures hedge (note: the WTI and Brent exchange-traded futures contract are for 1,000 barrels = 42,000 gallons). Now use the 60 months of the 2007-2011 historical prices on jet fuel, WTI and Brent to simulate what would have been the monthly jet fuel costs under three scenarios: i) without a hedge; ii) with a WTI hedge; and iii) with a Brent hedge. Would any hedge have helped reduce fuel cost volatility?
2. What risks are being hedged and what risks are left unhedged?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #4: January 25, 2017 (Thursday)

Topic: **Trading Strategies Involving Options**

Case: ***F-1698 Hedge Fund Due Diligence at Leman Alternative Asset Management Company***

Read: ***F-1429 Trading Strategies with Options***

(\*optional\*) HULL Chapters 9, 10 and 11 (8<sup>th</sup> ed.) or 10, 11 and 12 (9<sup>th</sup> ed.)

If you want to practice option strategies with “paper money” (but real prices) set up an account at [CBOE Virtual Options Trading](#)

Spreadsheet: ***F-1698X (Calculator).xlsx***

Assignment:

1. Sheet “Calculator” of the spreadsheet ***F-1698 (Calculator).xls*** presents the value of \$1 invested in a collar strategy with at-the-money calls and at-the-money puts using the historical data. Reconcile the analysis with Exhibit 2 on the collar option strategy. How does the performance of the collar strategy compare with the return from HFRI EH index, the S&P 500 index and in 1-month T-bills? Further plot the monthly growth in the collar strategy against the monthly growth in value of \$1 in the HFRI EH index, the S&P 500 index and in 1-month T-bills. What do you conclude?
2. Now use the calculator to do the same but with a collar strategy with out-of-the-money calls (with strikes equal to 105% of the current value of the S&P500 index) and out-of-the-money puts (with strikes equal to 95% of the current value of the S&P500 index). What would have been the growth in the value of \$1 following this strategy? What do you conclude?
3. Can you get any level of moneyness (based on a fixed strike rule) of the calls and puts on the collar strategy so you can match the growth in the value of \$1 experienced by the Squarefield Guard hedge fund? A fixed strike rule means that the percentage that call and put options are out of the money should be held constant over time.

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #5: January 31, 2017 (Wednesday)

Topic: **Binomial and Black-Scholes Option Pricing Models**

Case: n/a

Read: **F-0943 Binomial Option Pricing**  
**F-1522 The Black-Scholes Option Pricing Model**

(\*optional\*) HULL Chapters 12, 13 and 14 (8<sup>th</sup> ed.) **or** 13, 14 and 15 (9<sup>th</sup> ed.)

Software: Install the HULL Derivagem toolkit for options valuation **DG201.xls** (see also Readme201.txt, DG201functions.xls)

Spreadsheet: **Black-Scholes data.xls**

Assignment:

1. Binomial Model:
  - 1.1. What would a three-month European call option with a strike price of \$50 be worth on a stock with a current stock price of \$52.75? Assume a risk free rate of eight percent and that the stock price can only go up or down by seven percent (1.07 or .9345) during the next three months.
  - 1.2. What would a European put option with the same strike price sell for?
  - 1.3. What would be the price of the call option in question one, if the price could change every six weeks by either +1.0489 or .953? What would the price of the stock be if the stock price changed every month by  $\pm 2.28\%$ ?
  - 1.4. Assume that you have an option which will mature in three months (90 days), the volatility of the underlying stock (non-dividend paying) is .25, the exercise price is \$47, the risk free rate is 6%, and the current stock price is \$49. Do a comparison of the binomial model and the Black-Scholes Model. You can do this comparison by using the same inputs in each model and comparing the calculated value of the call option. What happens as you vary the number of periods used in your binomial model?
2. Black-Scholes Model:
  - 2.1. Choose one of the stocks in the price file **Black-Scholes data.xls**.
  - 2.2. Calculate the volatility using daily, weekly and monthly prices. Do this using the log of the price relatives.
  - 2.3. Does the time period over which you measure the volatility matter?
  - 2.4. Calculate the volatility using daily, weekly and monthly prices and the price relatives themselves. Is there a difference in value from using the log of the price relatives?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #6: February 1, 2017 (Thursday)

Topic: **Equity Linked Notes**

Case: ***F-Draft Capped Buffered Return Enhanced Equity-Linked Note***

Read: ***F-1433 Options on Stock Indices, Currencies and Futures***

Spreadsheet: n.a.

Assignment:

1. How should JPMorgan Chase bank allocate the \$1,000 to deliver this Capped BREN to the client?
2. Was this Capped BREN a “fair” deal to the client?
3. Can the investor do it “at home” using Russell 2000 Index CBOE listed options?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #7: February 7, 2017 (Wednesday)

Topic: **Warrants**

Case: **F-1642 TARP Warrants: How Much to Bid?**

Read: **F-1430 The Pricing of Warrants**

**Testimony on "TARP Oversight: An Update on Warrant Repurchases and Benefits to Taxpayers" - Robert A. Jarrow (May 11, 2010)**

Spreadsheet: **F-1642X JP Morgan data.xlsx**

Assignment:

1. How much would you bid for the JP Morgan warrants? For your calculations, use these number of shares and warrants:

	Nr of Common Shares	Nr of Warrant Shares
JPMorgan Chase	4,000 mln	88.4 mln

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #8: February 8, 2017 (Thursday)

Topic: **Options on Stock Indices, Currencies and Futures**

Case: n/a

Read: **F-1433 Options on Stock Indices, Currencies and Futures**

**F-1432 Risk Management for Derivatives**

(\*optional\*) HULL Chapters 16 and 17 (8<sup>th</sup> ed.) **or** 17 and 18 (9<sup>th</sup> ed.)

Spreadsheet: **Exchange rate data.xlsx**

Assignment: For purposes of the assignment, assume the current date is January 2011 and that the June options mature exactly in 6 months. Note also that call premiums and strikes are quoted in cents, so 125 means \$1.25.

1. Using the data in the excel spreadsheet on exchange rate options, estimate the implied volatility based on the average of the bid and ask prices. Also using the historic exchange rates, estimate volatility.
2. Use a two period (price changes every 3 months) binomial option pricing model to estimate the value of a June 2011 call with a 133 strike.
3. How would we have to alter the inputs (risk-free rate, underlying asset value etc.) on the regular Black-Scholes model to price options on futures?

Skim also the F-1432 reading for an overview on "Greeks". I will say a few words on it in class.

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #9: February 14, 2017 (Wednesday)

Topic: **Options in M&As**

Case: ***F-1715 The Sanofi-Aventis Acquisition of Genzyme: Contingent Value Rights***

Read: ***F-1322 Technical Note on Structuring and Valuing Incentive Payments in M&A Earnouts and Other Contingent Payments to the Seller***

Spreadsheet: ***F-1715X.xlsx***

Assignment:

1. Why are the views of the Genzyme and Sanofi management teams so divergent on the value of the alemtuzumab MS drug?
2. What are the differences between CVRs and typical financial options such as calls? What are the advantages and disadvantages of using CVRs in this acquisition? In what other M&A situations are CVRs useful?
3. How much is the CVR worth if you take the projected launch dates and revenues for the alemtuzumab MS drug from scenarios 2 through 8 from Wall Street analysts in case Exhibit 10? Use the student spreadsheet, UVA-F-1715X, supplied with the case.
4. What level of projected alemtuzumab MS drug revenues would you need to make the total offer value of \$74 cash + CVR = \$80-per-share? In order to do this, use the student spreadsheet and create your own scenario 9 in the calculator in the case Exhibit 10 worksheet.

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #10: February 15, 2017 (Thursday)

Topic: **Interest Rate Derivatives – Callable Bonds**

Case: **F-1063 The Walt Disney Company: 100-Year Bonds Sleeping Beauties?**

Read: **F-1431 Interest Rate Derivatives**

This is a fairly intense reading and we will discuss valuing bond options (pages 1-11), interest rate caps and floors, and swap options in class. The best way to prepare for class is to review the examples presented in the technical note. For further reading, you may find helpful HULL Chapter 28 (8<sup>th</sup> ed.) or 29 (9<sup>th</sup> ed.).

Spreadsheet: **F-1063X Exhibits1&2.xlsx**

Assignment:

1. Using the data in Exhibits 1 and 2 of the technical note (F-1431), what would be the value of a call option on a 7-year 5% coupon bond (Face Value = \$100)? Assume that today is December 31, 2003, and it is exactly 6 months to the next coupon payment. For the option, the exercise price is \$98 (quoted price), and the time to maturity is 24 months.
2. Skim through the Walt Disney 100-year bond which is callable in 2023 (UVA-F-1063). Assume that today is February, 2015, the 10-year is 4.28% and the price of the bond is 125. How much is the callable option worth to Disney (try using Derivagem **DG201.xls**)? Can you make sense of the value of these bonds?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #11: February 21, 2017 (Wednesday)

Topic: **Interest Rate Derivatives II - Caps, Floors and Swaptions**

Case: **F-1122 G and P Greetings Inc.**

Read: **F-1431 Interest Rate Derivatives**

Read pages 11-14 of the F-1431 technical note. For further reading, you may find helpful Chapter 28 of HULL (8<sup>th</sup> ed.).

Spreadsheet: **F-1122XLS.xls**

Assignment:

1. What is the value of the interest rate cap described under alternative #2 in the case?

Optional questions:

2. Given the information in the case, what will be the fixed rate for a plain vanilla 2-year swap (quarterly payments) that will clear the market?
3. What would be the one year forward 2-year swap rate? This is the rate that you would quote today for a swap that began September 1, 1996.
4. What is the value of the swaption discussed in the case? Why does the combination of issuing non-callable bond and buying a swaption approximate the value of a callable bond?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #12: February 22, 2017 (Thursday)

Topic: **Credit Derivatives - Single-Name CDS**

Case: **F-1745 Credit Default Swaps on AMR Corporation: Cash or Credit**

Read: **F-Draft Credit Derivatives I – Single-Name Credit Default Swaps**

(\*optional\*) For further reading, HULL Chapter 24 (8<sup>th</sup> ed.) or 25 (9<sup>th</sup> ed.)

Spreadsheet: n/a

Assignment:

1. What is a credit default swap (CDS) and how does it work? What are its uses?
2. How much should be the spread of a 5 year CDS on AMR using the structural approach?
3. Does Thomas have a trading opportunity as of Feb. 24, 2011? What position do you recommend Thomas to take on CDS contracts on AMR?

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #13: February 28, 2017 (Tuesday)

Topic: **Credit Derivatives II - CDX Indices**

Case: **F-DRAFT Credit Derivative Arbitrage: Single-name CDS vs. CDX**

Read: **F-DRAFT Credit Derivatives II – CDS “Big Bang” and CDX Indices**

Spreadsheet: **F-DRAFT CREDIT DERIVATIVE INDEX ARBITRAGE 2017 02 25.XLSX**

Assignment: Use the spreadsheet to complete Diego’s to-do list:

1. Bootstrap the survival probabilities of Company #100 using the par spread curve and value the CDS contract mentioned in Appendix 1 (Exhibit 1 and Exhibit 2)
2. Bootstrap the survival probabilities of Company #100 using its conventional spread and value the CDS contract mentioned in Appendix 1 (Exhibit 3 and Exhibit 4)
3. Understand how and why the differences between #1 and #2 exist
4. Price an on Company #100 Asset Swap using the details on Appendix #3 (Exhibit 5)
5. Bootstrap the survival probabilities of the HY Index using its composite spread and value the HY CDX contract mentioned in Appendix 2 (Exhibit 6 and Exhibit 7)
6. Bootstrap the survival probabilities of Company #100 using its theoretical spread and value the CDX contract mentioned in Appendix 2 (Exhibit 8 and Exhibit 9)
7. Understand how and why the differences between #6 and #7 exist
8. Review #1 - #7 and determine if any arbitrage opportunities exist and whether or not trading them is advisable

## DERIVATIVE SECURITIES: OPTIONS AND FUTURES

Class #14: March 1, 2017 (Thursdat)

Topic: **Total Return Swaps**

Case: ***F-1729 ProShares: The Alternative ETF Company***

***F-1714 Proshares Hedge Replication ETF***

Read: ***ETF.com “SEC Rule Death Knell for Geared ETFs” (December, 2015)***

***Wall Street Journal “SEC Moves to Curb Leveraged ETFs” (June, 2016)***

***TheStreet.com “Trump Revives Triple-X-ETFs that Regulators Wanted to Kill” (March, 2017)***

Assignment: F-1729: This case is background reading on ProShares.



ProShares - The Alternative ETF Company  
DardenPublishing • 9 videos • 128 views • Last updated on Apr 28, 2015  
Supplemental videos to the Darden case study "ProShares - The Alternative ETF Company."  
▶ Play all ◀ Share + Save

Watch videos at

[https://www.youtube.com/playlist?list=PLfSs4GfD5hMGJm7twdxUz\\_VKY4Hqk\\_NPI](https://www.youtube.com/playlist?list=PLfSs4GfD5hMGJm7twdxUz_VKY4Hqk_NPI) and be prepared to answer the following questions:

1. Besides geared ETFs, what are common ways for investors to get leverage and inverse exposures?
2. Why was the “compounding effect” detrimental to geared ETFs during volatile markets of 2008-09? Why do most geared funds aim to track the index returns for just one day, and how can you deal with this issue if you are an investor with a multi-day horizon?
3. What are the challenges and opportunities of alternative ETF products? What do you recommend that ProShares pursues for its growth?

Update: read the WSJ article (June 6, 2016) – Do you think 2x or 3x leveraged /inverse ETFs should be banned as the SEC recently proposed?

F-1714: Watch ProShares’s video presentation



<http://youtu.be/XEUa45fjOD4>

and be prepared to answer the following questions:

1. Are hedge funds an appropriate asset class for retail investors? What are the advantages/disadvantages of hedge fund replication ETFs?
2. Do you think that the factor-based approach employed by MLFM-ES index worked\*? Look at slide 20 of case Exhibit 1. Why do you think the weight on

three-month T-bills features so prominently and can you explain the variation in the weights of the other factors?

3. To understand how HDG invests to replicate the Merrill Lynch Factor Model—Exchange Series (MLFM-ES) index, map HDG’s May 31, 2013, schedule of investments in case Exhibit 4 into the long/short positions in each MLFM-ES factors in slide 19 of case Exhibit 1. Why do you think that HDG gets some factor exposures by directly investing in securities while others are using swaps or futures?

For more background on style analysis, read William F. Sharpe’s article at <http://www.stanford.edu/~wfs Sharpe/art/sa/sa.htm>

I will also discuss final exam format and we can review questions from problem sets.