March 2016

CAIA® Level II Workbook

Chartered Alternative Investment Analyst Association®

March 2016
Level II Workbook

Preface

Congratulations on your successful completion of Level I and welcome to Level II of the Chartered Alternative Investment Analyst℠ (CAIA) program. The CAIA® program, organized by the CAIA Association® and co-founded by the Alternative Investment Management Association (AIMA) and the Center for International Securities and Derivatives Markets (CISDM), is the only globally recognized professional designation in the area of alternative investments, the fastest growing segment of the investment industry.

The following is a set of materials designed to help you prepare for the CAIA Level II exam.

Exercises

The exercises are provided to help candidates enhance their understanding of the reading materials. The questions that will appear on the actual Level II exam will not be of the same format as these exercises. In addition, the exercises presented here have various levels of difficulty and therefore, they should not be used to assess a candidate's level of preparedness for the actual examination.

March 2016 Level II Study Guide

It is critical that each candidate should carefully review the study guide. **It contains information about topics to be studied as well as a list of equations that the candidate MAY see on the exam.** The study guide can be found on the Curriculum and Study Materials page of the CAIA website: www.caia.org.

Errata Sheet

Correction notes appear in the study guide to address known errors existing in the assigned readings. Occasionally, additional errors in the readings and learning objectives are brought to our attention. In these cases, we will post the errata directly in the Workbook or into a separate errata sheet on the Curriculum and Study Materials page of the CAIA website.

It is the responsibility of the candidate to review these errata prior to taking the examination. Please report suspected errata to curriculum@caia.org.

The Level II Examination and Completion of the Program

All CAIA candidates must pass the Level I examination before sitting for the Level II examination. A separate study guide is available for the Level II curriculum. As with the Level I examination, the CAIA Association administers the Level II examination twice annually. Upon successful completion of the Level II examination, and assuming that the candidate has met all the Association's membership requirements, the CAIA Association will confer the CAIA Charter upon the candidate. Candidates should refer to the CAIA website, www.caia.org, for information about examination dates and membership requirements.

Topic 2: Private Equity

Readings

1. *CAIA Level II: Advanced Core Topics in Alternative Investments*, Wiley, 2012, ISBN: 978-1-118-36975-3. Part Two: Private Equity, Chapters 5 – 14.
2. *CAIA Level II: Core and Integrated Topics*, Institutional Investor, Inc., 2015, ISBN: 978-1-939942-02-9. Part I: Investment Products: Private Equity.
   A. Bengtsson, O. "Covenants in Venture Capital Contracts." *Management Science*, November 2011, Vol. 57, No. 11, pp. 1926-1943.
   B. Teten, D., A. AbdelFattah, K. Bremer, and G. Buslig. "The Lower-Risk Startup: How Venture Capitalists Increase the Odds of Startup Success." *The Journal of Private Equity*, Spring 2013, Vol. 16, No. 2, pp. 7-19.

Reading 1, Chapter 5
Private Equity Market Landscape

Exercises

1. What is mezzanine financing?

2. How do buyout and venture capital compare in terms of sector focus and business model (i.e., anticipated proportion of winners versus losers)?

3. What are the main functions served by private equity funds?

Problems 4 to 6

Consider the following three statements on private equity funds-of-funds.

4. "*Private equity funds-of-funds are often perceived as less efficient than direct fund investment because of the double layer of management fees*." Is this a perception often held by market participants? Explain.

5. "*Studies have shown that because of their diversification, funds-of-funds perform similarly to individual funds, but with more pronounced extremes.*" Is this assertion correct? Explain.

6. "*For larger institutions, intermediation through funds-of-funds allows them to focus on their core businesses. This advantage tends to outweigh most cost considerations*." Is this statement correct?

7. What are the cash flow J-curve and the net asset value (NAV) J-curve?

Problems 8 to 9

Alpha Partners, a private equity buyout fund, was founded in 1994 by three co-workers who left a major private equity firm. Until a few years ago, *Alpha Partners* has had stellar returns, sometimes 40% to 50% a year, and has become recognized as one of the top experts in the field. In spite of this, Mary Reinhart, a recently-hired manager of the fund, is worried about the recent performance of *Alpha Partners* and argues that the fund should aim for a more diversified portfolio by also including venture capital investments. Ms. Reinhart contends that "…*Investors seeking long-term stable returns would be prone to increase their exposure to venture capital, while those looking for higher returns would do so overweighting buyout."*

8. Is Ms. Reinhart's statement correct?

9. Ms. Reinhart also argues that "…*Traditional valuation methods can only be applied to venture capital after making many assumptions*." Is this assessment correct?

Solutions

1. Mezzanine financing is capital offered through the issuance of subordinated debt. This form of financing is halfway between common equity and secured debt. Mezzanine financing typically include warrants or conversion rights to back the expansion or transition capital for established companies.

   (Section 5.1)

2. Whereas buyouts typically focus in established industry sectors, venture capital concentrates on cutting-edge technology or rapidly growing sectors.

   In terms of business model, whereas buyouts are characterized by a high percentage of success with limited number of write-offs, venture capital is differentiated by a few winners with many write-offs.

   (Section 5.2)

3. Private equity funds primarily serve the following functions:

   - Collecting investors' capital to be invested in private companies
   - Screening, evaluating, and selecting potential companies possessing expected high-return opportunities
   - Controlling, coaching, and monitoring portfolio companies
   - Financing companies to develop new products and technologies, to make acquisitions, to promote their growth and development, or to allow for a buyout or a buy-in by experienced managers
   - Sourcing exit opportunities for portfolio companies

   (Section 5.3)

4. The answer is yes, this is often the perception of market participants. This additional layer of fees is supposed to be one of the main disadvantages of investing in private equity through funds-of-funds. This is because funds-of-funds would have to outperform direct fund investment to balance this double layer of fees. However, investing through fund-of-funds might be more cost-efficient when one takes into consideration the resources needed to run a portfolio of private equity funds internally.

   (Section 5.4.1)

5. Whereas the first part of the statement is correct, the second part is not correct. The correct statement would be as follows: While it is true that studies have shown that funds-of-funds perform similarly to individual funds, it has also been documented that funds-of-funds performance exhibits *less* pronounced extremes (presumably due to their diversification).

   (Section 5.5.1)

6. This statement is correct.

   (Section 5.5.4)

7. The cash flow J-curve illustrates the evolution of the net accumulated cash flows to and from the investors (limited partners) to a private equity fund. These accumulated cash flows are first increasingly negative during the early years of the fund's life before typically making an upward turn and becoming positive in the later years of the fund's existence.

   The net asset value (NAV) of a fund is computed by adding the value of all of the investments held in the fund and dividing by the number of outstanding shares of the fund. The NAV J-curve illustrates the evolution of the NAV versus the net paid-in (NPI), which first decreases during the early years of the fund's life and then typically improves in the later years of its existence.

   (Section 5.7)

8. No, the statement is incorrect, because investors seeking long-term stable returns would be inclined to overweight *buyout*, while those seeking higher returns would do so through increased exposure to *venture capital*.

   (Section 5.2)

9. Yes, this statement is correct. VC valuation is usually based on multiples rather than cash flows.

   (Section 5.2.4)

Reading 1, Chapter 6
Private Equity Fund Structure

Exercises

Problems 1 to 3

Consider the following simple example with no hurdle rate and in which limited partners contribute $200 million in the first year to fund investments A and B, at $100 million each, with an 80/20 carry split (see the following exhibit).

Year 1: Deal-by-deal

	Limited partners		General partner	Total
	Investment A	Investment B		
Original contributions	($100 million)	($100 million)		($200 million)
Acquisition of investments A and B				
Closing balance	($100 million)	($100 million)		($200 million)

1. Investment A is sold at the end of the second year for $160 million. Calculate the 80/20 carry split between limited partners and the general partner. Calculate the closing balance of limited partners and the general partner under the deal-by-deal approach.

2. Investment B is sold at the end of the third year for $70 million. Calculate the 80/20 carry split between limited partners and the general partner. Calculate the closing balance of limited partners and the general partner under the deal-by-deal approach. Calculate the total gain or loss for the fund.

3. How much would the limited partners and the general partner receive under the fund as a whole approach?

4. Suppose that one of a named key person departs a team. What does the key-person provision allow limited partners to do?

5. What is the rationale for the existence of the good-leaver termination clause?

6. Assume a $200 million contribution by the limited partners in the first year to fund an investment, a 6% hurdle rate, a 100% catch-up, an 80/20 carry split, and the sale of the investment by the fund in the second year for $300 million. Fill in the following waterfall table.

Original contributions	Limited partners ($200 million)	General partner	Total ($200 million)
Sale of investment for $300 million one year later			
Profit to be distributed:			
Return of capital			
Preferred return for limited partners			
Catch-up for general partner			
80/20 split of residual amount			
Closing balance			

7. In which situations is a clawback provision relevant?

8. What are Type 1 and Type 2 conflicts of interests?

Solutions

1. The profits of $60 million for Investment A are distributed to limited and general partners in line with the agreed-upon 80/20 split after the limited partners receive their return of capital.

Year 2: Deal-by-deal

	Limited partners		General partner	Total
	Investment A	Investment B		
Opening balance	($100 million)	($100 million)	$0 million	($200 million)
Sale of investment A for $160 million				
Return of capital	$100 million			$100 million
80/20 split of residual amount	$48 million		$12 million	$60 million
Closing balance	$48 million	($100 million)	$12 million	($40 million)

(Section 6.1.4)

2. In the third year the split of Investment B is as shown in the top half of the following exhibit with all $70 million going to the limited partners as return of capital. Under the deal-by-deal approach the limited partners would earn $18 million ($48 million - $30 million) and the general partners would earn $12 million for both projects combined.

Year 3

	Limited partners		General partner	Total
	Investment A	Investment B		
Opening balance	$48 million	($100 million)	$12 million	($40 million)
Sale of Investment B for $70 million				
Return of capital		$70 million		$70 million
80/20 split of residual amount				
Closing balance	$48 million	($30 million)	$12 million	$30 million
Subtotal	$18 million		$12 million	$30 million

(Section 6.1.4)

3. The fund as a whole had a gain of $30 million ($60 million - $30 million). Under the fund-as-a whole approach, the general partner would receive $6 million of carried interest (20%) and the limited partners would receive $24 million (80%).

   (Section 6.1.4)

4. In this case, the key-person provision allows limited partners to suspend investment/divestment activities until a replacement is found. The limited partners may even terminate the fund if they decide to do so and if this is allowed by the terms of the limited partnership agreement.

   (Section 6.1.7)

5. The good-leaver termination clause offers a clear framework for closing a partnership that is not functioning well, or when the confidence of the limited partners is lost. This without-cause clause allows limited partners to stop funding the partnership with a vote requiring a qualified majority (generally more than 75% of the limited partners).

   (Section 6.1.8)

6. Answer:

	Limited partners	General partner	Total
Original contributions	($200 million)		($200 million)
Sale of investment for $300 million one year later			
Return of capital	$200 million		$200 million
Profit to be distributed			$100 million
6% Preferred return for limited partners	$12 million		$12 million
Catch-up for general partner		$3 million	$3 million
80/20 split of residual amount	$68 million	$17 million	$85 million
Closing balance	$80 million	$20 million	$100 million

   Thus, limiter partners receive $280 million and general partners receive $20 million.

   (Section 6.1.9)

7. A clawback provision is relevant when early investments are successful (and repay more than the invested capital plus the preferred return), but later investments fail. A clawback is a provision activated when, at the end of a fund's life, the limited partners have recovered less than the sum of capital provided and a certain amount of the fund's profits. A clawback is designed to ensure that the general partners will not collect a greater portion of the fund's total distributions by collecting a share of early profits without adjustment being made for subsequent losses. Clawback liabilities can also exist for limited partners.

   (Section 6.1.9)

8. Walter (2003) differentiates between Type 1 and Type 2 conflicts of interest.

   Type 1 conflicts of interest are those "between a firm's own economic interests and the interests of its own clients, usually reflected in the extraction of rents or mispriced transfer of risk." These types of conflicts of interests are usually mitigated through an alignment of interests.

   Type 2 conflicts of interest are those "between a firm's clients, or between types of clients, which place the firm in a position of favoring one at the expense of another." These types of conflicts of interests are more problematic to address because fund managers may have multiple relationships with various clients.

   (Section 6.2)

Reading 1, Chapter 7
The Investment Process

Exercises

1. Why is it difficult to quantify the risks inherent to investing in private equity?

Problems 2 to 3

The endowment of XYZ University is considering allocating funds to private equity investments. Roger Gallagher, a research analyst working for the endowment's investment committee, has been assigned the task of determining the viability of using the Modern Portfolio Theory (MPT) framework to estimate the potential benefits of adding private equity to traditional investments. Mr. Gallagher has just handed in a report addressing these concerns. The following two statements appear in the report.

2. "*The standard IRR (internal rate of return) performance measure used for private equity funds is usually capital-weighted, and returns for public market assets are also usually capital-weighted.*" Is this affirmation correct? Explain.

3. "*The MPT usually assumes a normal return distribution, which clearly does not hold for private equity. In fact, the distribution of private equity returns departs significantly from the normal distribution.*" Is this statement correct? Explain.

4. Briefly explain the concept of the over-commitment strategy.

Problem 5

1991-2008	Annualized Return	Standard Deviation	Correlation with PE
Non-U.S. Stocks (MSCI EAFE)	4.50%	15.90%	0.71
U.S. Bonds (BarCap U.S. Government)	7.20%	4.30%	-0.19
Private Equity (PE) Index	7.60%	25.10%	1

Source: Edited from Schneeweis, Crowder, and Kazemi, The New Science of Asset Allocation, Wiley Finance, 2010

5. Using the information presented in the table, calculate the expected return and standard deviation of returns of a portfolio that is 75% invested in international stocks excluding the U.S. (MSCI EAFE) and 25% invested in U.S. private equity, with returns as represented by the PE index. Interpret the results obtained.

Problems 6 to 7

Peter Cracco is recommending that *Golden Capital*, an endowment that presently has allocations only to traditional investments, should set up an in-house private equity fund investment program. The current portfolio of *Golden Capital* consists of fixed-income securities, large company stocks, and an above average (when compared to other pension funds) allocation to small-cap stocks. With a belief that the benefits of investing in private equity are modest and aware of Markowitz's Modern Portfolio Theory (MPT), Mr. Cracco recommends the design of a highly diversified portfolio of private equity funds in an attempt to reduce the volatility of the returns generated by this asset class.

Mary Katz, a recently hired financial analyst at *Golden Capital*, offers support to Mr. Cracco's argument that portfolio allocation using a quantitative MPT-based model is not fully applicable to a portfolio of private equity funds, because private equity as an asset class lacks reliable statistical data (expected return, risk, and correlations). Katz mentions to Cracco that fund selection, tactical asset allocation, the management of diversification, and the management of liquidity are the main factors explaining private equity returns.

6. Is Ms. Katz's concern on the use of the MPT to measure the benefits of adding private equity investments to a portfolio composed by traditional investments correct?

7. Which of the factors mentioned by Ms. Katz is NOT one of the four main decisions to address in the private equity investment process?

Solutions

1. It is difficult to quantify the risks inherent to investing in private equity because of the idiosyncrasies of this asset class. The opaque nature of the private equity industry implies that:

   - Not all outcomes are known,
   - Information is difficult to collect, and
   - The quality of data is usually very poor.

   These difficulties are particularly prominent in the case of technology-focused venture capital funds.

   (Section 7.1)

2. The first part of this affirmation is correct because the standard IRR performance measure used for private equity funds is clearly capital-weighted (and can also be viewed as including a time- weighted component). However, returns for public market assets are usually only time-weighted.

   (Sections 7.1.1 and 7.1.2)

3. This statement is correct, although MPT can be developed using assumptions other than a normal distribution. Empirical evidence on private equity returns suggests the existence of significant skewness and excess kurtosis.

   (Sections 7.1.1 and 7.1.2)

4. The over-commitment strategy is followed by a private equity fund when more commitments to invest capital in the future are signed than can be met with existing capital resources. The goal is to be able to meet future capital calls with cash that becomes available such as through distributions from other investments. The objective of the over-commitment strategy is to keep a program permanently and fully invested in portfolio companies, so as to minimize the amount of capital that may remain uninvested at any point in time (i.e., in cash) with the resulting drag on total return.

   (Section 7.1.3)

5. The expected return of the portfolio $E(R_p)$ is equal to the weight of each asset in the portfolio multiplied by its expected return:

   $E(R_p) = (0.75 \times 4.5\%) + (0.25 \times 7.6\%) = 5.3\%$

   The formula for the standard deviation of returns of the portfolio (σ_p) is:

$$\sigma_p = \left[w_S^2 \times \sigma_S^2 + w_{PE}^2 \times \sigma_{PE}^2 + 2 \times w_S \times w_{PE} \times \sigma_S \times \sigma_{PE} \times \rho_{S,PE} \right]^{1/2}$$
$$= \left[\left(0.75^2 \times 0.159^2\right) + \left(0.25^2 \times 0.251^2\right) + \left(2 \times 0.75 \times 0.25 \times 0.159 \times 0.251 \times 0.71\right) \right]^{1/2}$$
$$= 17.0\%$$

   Where: w are the weights of each asset class in the portfolio and ρ is the correlation coefficient between the returns of non-U.S. stocks and private equity.

   In this case, the expected return of the portfolio increases from 4.5% to 5.3% when private equity (*PE*) is added to an all equity (non-U.S.) portfolio (*S*). However, the portfolio volatility increases relatively slightly when private equity is added to an all equity (non-U.S.) portfolio (from 15.9% to 17.0%).

The high risk experienced by private equity during the period of analysis combined with the relatively high correlation between non-U.S. stocks and private equity cannot render private equity as a particularly good diversifier to add to an all equity (non-U.S.) portfolio. Notice, however, that private equity could be a good addition to a multiple asset portfolio that includes other traditional and alternative assets, given the lower correlation that private equity exhibits in general with respect to those other assets.

(Sections 7.1.1 and 7.1.2)

6. Ms. Katz concern is correct. This is because for a quantitative application of an MPT-based portfolio model to work, one must be able to quantify each asset's expected return and risk, as well as the return correlations of each asset relative to the return of all other assets in the portfolio. Private equity and, in particular, venture capital managers lack such data. An accurate historical analysis of the correlations between private equity returns and the returns of other asset classes is likely not possible without making significant adjustments, such as computing private equity returns under an assumption that intervening cash flows are invested in public market indices.

   (Section 7.1.2)

7. Tactical asset allocation. The other main decision in the private equity investment process involves strategic asset allocation.

   (Section 7.1)

Reading 1, Chapter 8
Private Equity Portfolio Design

Exercises

1. Name the three approaches to private equity portfolio design.

2. Why do investors generally follow the bottom-up approach when designing a private equity portfolio?

3. According to evidence presented in the book, how many funds are needed to diversify away most (e.g., 80%) of a portfolio's risk (standard deviation)? What is the strongest argument against a high level of diversification?

4. What are the advantages of the core-satellite approach?

5. State the reasons that explain why a diversification strategy that does not take into account the specificities of the private equity asset class can be quite inefficient.

6. How do U.S. and European venture capital (VC) funds compare to buyout funds in terms of historical risks and returns?

Problems 7 to 9

Catai Partners, a private equity fund of funds, was incorporated in 1996. Originally established as the 'in-house' private equity fund of a large endowment, *Catai* is a leader in the South-East Asian buyout market. The fund has established well-resourced local offices in Shanghai and Seoul, positioning the fund at the center of South-East Asian emerging large buyout deal flow. The portfolio construction methodology followed by *Catai Partners* starts by identifying suitable investments, followed by an intensive examination and due diligence in order to rank the fund managers by their attractiveness. Subsequently, the best funds are selected in order to invest the capital to be allocated to private equity. *Catai Partners* is concerned whether the fund managers are top-quartile. These concerns are addressed through the due diligence process and the structuring of the limited partnership agreements, with the addition of covenants and the post-commitment monitoring.

Francois Lefebvre, CAIA, is a consultant working for *Catai Partners.* Mr. Lefebvre has suggested to *Catai Partners* a strategy that will allow them to diversify most of their portfolio. but to manage a smaller portion of their holdings with the objective of generating especially high returns using highly selective active management strategies. In response, Angelica Ng, a research analyst at *Catai Partners*, comments to Mr. Lefebvre that naïve diversification allows private equity investors to avoid extreme concentrations by managing a number of dimensions.

7. What private equity portfolio construction approach is employed by *Catai Partners* to identify their fund managers?

8. What private equity portfolio construction approach is suggested by Mr. Lefebvre?

9. What are the dimensions suggested by Ms. Ng?

Solutions

1. The three approaches to private equity portfolio (PE) design are: the bottom-up, the top-down, and the mixed approaches.

   (Section 8.1)

2. Investors generally follow the bottom-up approach when designing a private equity portfolio, because it is usually thought that the quality of the fund management team is the most important factor when investing in private equity, an asset class that is characterized by a high differential between top-quartile and lower-quartile fund performance. Other factors such as sector or geographical diversification are commonly regarded as less important.

   The bottom-up approach also has the following advantages: It is simple, it depends solely on ranking, it is easy to understand, robust, and it can enhance the expected performance

by focusing the portfolio in the highest alpha funds, while controlling for risk by diversifying across multiple funds. Unfortunately, the bottom-up approach has the following two problems. First, it can lead to an unbalanced portfolio and thus it might carry substantially more risk than planned. And second, the proposed portfolio may ignore some important macroeconomic changes or opportunities.

(Section 8.1.1)

3. Empirical evidence in private equity suggests that 80% of the standard deviation is diversified away with a portfolio of 20 to 30 funds. The strongest argument against a high level of diversification is that fund quality may deteriorate rapidly as one continues to add funds to a portfolio. This is because there are too few excellent fund management teams within a vintage-year peer group and thus over-diversification not only causes a reduction in positive skewness and kurtosis, but also diminishes the portfolio's expected return. (This is more of an issue for venture capital funds than for buyouts). It is important to note that these notions only hold for the plain-vanilla limited partnership stakes in funds.

   (Section 8.2.2)

4. The core-satellite approach structures a portfolio in various sub-portfolios, which can then be assembled using one of the three construction techniques available (e.g., bottom-up, top-down, or mixed). The following are some of the advantages of the core-satellite approach:

   - This approach aims to increase risk control, reduce costs, and add value. This may be an effective strategy, particularly for institutions desiring to diversify their portfolios without giving up the potential for higher returns generated by selected active management strategies.
   - The flexibility it offers to customize a portfolio to meet specific investment objectives and preferences.
   - This approach also offers the structure for targeting and controlling those areas in which an investor considers he is better able to control risks, or is simply willing to take more risks. What constitutes core versus satellite depends on the investor's focus and expertise. Some see venture capital as satellite, while others view a balanced buyout and a venture capital funds portfolio as core.
   - It facilitates dedicating more time on the satellite portfolio, which is expected to generate excess performance, and less time on the lower-risk core portfolio.

   (Section 8.2.1)

5. The following are some of the reasons that diversification can be inefficient:

   - Over-diversification may lead to capping the upside
   - Investing in many teams without managing the diversification of each risk dimension (e.g., geography and industry sectors), can harm portfolio performance
   - The benefits of diversification set in more slowly when funds are highly correlated

- There exist diseconomies of scale
- The number of investments sets the cost base (e.g., legal expenses, due diligence, and monitoring effort) of a portfolio of funds
- It becomes increasingly difficult to identify and gain access to suitable funds, as the number of quality opportunities is limited.

(Section 8.2.3)

6. Empirical evidence presented in the book clearly indicates that U.S. venture capital funds have outperformed all other sub-asset classes, including buyout funds. This conclusion is reached considering only the average multiple as the return indicator.

   The out-performance of U.S. venture capital funds has been achieved bearing a much higher level of risk. For instance, the standard deviation of the multiples registered levels above 3.0 for U.S. VC funds, below 2.0 for European VC funds, below 1.0 for European buyout funds, and below 1.0 for U.S. buyout funds. Skewness and kurtosis, the other two measures of risks commented in the book, further indicate the higher risk level of venture capital funds, in both the U.S. and in Europe.

   (Section 8.3)

7. A bottom-up approach

   (Section 8.1.1)

8. A core-satellite approach

   (Section 8.2.1)

9. Number of fund managers, vintage years and calendar years, and industry sectors

   (Section 8.2.3)

Reading 1, Chapter 9
Fund Manager Selection Process

Exercises

1. Briefly describe the following four types of teams: Blue chip, established, emerging, and re-emerging.

Problems 2 to 4

Indicate whether each of the following quotes on private equity performance is correct or incorrect. Explain your answer.

2. "*A historical review of private equity performance indicates that average (but not median) private equity returns tend to underperform public equity indices.*"

3. "*A historical review of private equity performance suggests that there is a wider gap between top-quartile and bottom-quartile returns than there is for funds of quoted assets.*"

4. "*A historical review of private equity performance suggests that, similar to the world of mutual funds, there is strong evidence for serial persistence of higher returns in private equity (for funds with vintage years earlier than 2000).*"

5. Briefly explain the two main dimensions of a fund's value described in the book.

Problems 6 to 7

Indicate whether each of the following two statements regarding private equity funds is correct or incorrect.

6. "*Empirical evidence suggests that funds raised by teams that have performed well in the past tend to be undersubscribed.*"

7. "*Empirical evidence suggests that most top teams tend to give priority allocation to new investors.*"

Solutions

1. A blue-chip team is a team that has been able to generate a top-quartile performance for all of its funds through at least two business cycles (i.e., a sequence of more than three funds).

   An established team is a team that has been able to generate a top-quartile performance for most of its funds (more than three funds) through at least two business cycles.

   An emerging team is a team with a narrow joint history, but with all the characteristics to become an established team.

   A re-emerging team is a previously blue-chip or established team that has been through a restructuring (after experiencing recent poor performance or some significant operational issues) and has regained the potential to re-emerge as an established or blue-chip team.

   (Section 9.1)

2. The quote is incorrect. The correct quote should be: "*A historical review of private equity performance indicates that median (but not average) private equity returns tend to underperform public equity indices.*"

   (Section 9.2)

3. The quote is correct and is consistent with a positive skew to PE returns.

   (Section 9.2)

4. The quote is incorrect. It should be: "*A historical review of private equity performance suggests that, as opposed to the world of mutual funds, there is strong evidence for serial persistence of higher returns in private equity (for funds with vintage years earlier than 2000).*" Notice that the difference is that the evidence on PE persistence is *opposed* to the evidence on public mutual funds.

   (Section 9.2)

5. The first dimension is the quality of the proposal. The authors propose basing the assessment on a grading methodology supported by a qualitative scoring to benchmark a fund against best practices for the private equity market. Quality dimensions assessed are notably management team skills, management team motivation, conflicts of interest, management team stability, structuring/costs, and validation through other investors.

   The second dimension consists in the real option value associated with investment in the fund. For example, although investing in a first-time fund is usually perceived to be riskier than investing in an established fund, it normally allows access to the team's subsequent offerings, if the fund becomes a top performer and is oversubscribed in subsequent fundraisings. A problem with this dimension is that the value of a real option is difficult to assess.

   (Section 9.3.4.3)

6. The statement is incorrect. Past success leads to oversubscription.

   (Section 9.2)

7. The statement is incorrect. General partners typically reward loyal limited partners with access to future funds.

   (Section 9.2)

Exercises

Problems 1 to 3

Suppose that we have the following values for distributions, contributions, and net asset values (NAVs) for two German private equity funds (named PE Fund 1 and PE Fund 2) that belong to the vintage year 2002-stage focus buyout (amounts in Euro millions):

	2002	2003	2004	2005	2006	2007 (NAV)
PE Fund 1	(100)	(300)	(200)	(700)	400	1,400
PE Fund 2	(1,300)	(1,200)	(600)	900	1,400	1,800

Where: Positive numbers correspond to years in which investors received net distributions, negative numbers correspond to years in which investors made net contributions, and the figures for 2007 correspond to the NAVs of each of the two funds at the end of that year.

1. Calculate the IIRR (interim internal rate of return), the TVPI (total value to paid-in ratio), the DPI (distribution to paid-in ratio or realized return), and the RVPI (residual value to paid-in or unrealized return) for the two funds. Interpret the results obtained.

2. Perform a classical benchmark analysis based on the following hypothetical information collected for a sample of European private equity funds categorized as vintage year 2002-stage focus buyout, from inception to December 31, 2007:

   - The maximum return (measured using the IIRR) registered by a private equity fund was 34.70%
   - The highest quartile of PE funds had a return of 11.70% or more
   - The median return was 8.60%
   - The lowest quartile funds had returns of 0% or less
   - The minimum return was −8.40%

Problems 3 to 5

Mohamed Alasaaf is a research analyst working at *Krug Capital Group*, a mid-size U.S. endowment. Mr. Alasaaf has been evaluating the performance of a number of U.S. private equity funds to be considered to be added to *Krug's* portfolio of private equity funds. In this regard, he is in the process of evaluating the performance of *Parker Partners*, a U.S. private equity fund that belongs to the vintage year 2001-stage focus buyout. The following numbers correspond to distributions, contributions, and the net asset value (NAV) for *Parker* (amounts in US$ millions):

	2001	2002	2003	2004	2005	2006	2007
PE Fund Parker	(900)	(100)	200	(1,500)	(600)	2,300	?

Where: Positive numbers correspond to years in which investors received distributions, negative numbers correspond to years in which investors made net contributions, and the figure for 2007 corresponds to the NAV of the fund at the end of that year.

Mr. Alasaaf has already calculated that the total value to paid-in ratio (TVPI) for Parker is 1.77.

3. Calculate the distribution to paid-in ratio (DPI) of *Parker*.

4. Calculate the residual value to paid-in ratio (RVPI) of *Parker*.

5. Calculate the net asset value of *Parker* at the end of 2007.

Solutions

1. The interim IRR (IIRR) is defined as the discount rate that makes the net present value of the distributions, the contributions, and the NAV equal to zero. Therefore, in the case of PE Fund 1, the IIRR is found by solving the following equation:

$$\frac{(100)}{(1+IRR)}+\frac{(300)}{(1+IRR)^2}+\frac{(200)}{(1+IRR)^3}+\frac{(700)}{(1+IRR)^4}+\frac{400}{(1+IRR)^5}+\frac{1{,}400}{(1+IRR)^6}=0$$

Solving this equation using a financial calculator or Excel (function IRR), we obtain that the IIRR is equal to 12.92%. Following the same procedure for PE Fund 2, we find that its IIRR is lower: 8.46%.

Thus, subject to the limitations of internal rate of return analysis, PE Fund 1 has a 4% higher annual performance than PE Fund 2. Notice that we would need to compare these IIRRs to the discount rates or required rates of return applicable to each private equity fund to determine whether these returns were greater than the required minimum returns. (Further discussion on the discount rates applicable in private equity appears in Chapter 13).

TVPI: In the case of PE Fund 1, the TVPI is:

$$TVPI_T=\frac{400+1{,}400}{100+300+200+700}=1.38$$

In the case of PE Fund 2, the TVPI is 1.32. Thus, PE Fund 1 has a slightly higher ratio of total distributions and NAV to total contributions between 2002 and 2007 than does PE Fund 2. This measure does not take into account the time value of money. Also, note that even though the drawdowns or paid-in had a negative sign in the table (given that they represent a use of cash to private equity funds), we used their values expressed in positive

numbers in the denominator of the equation. This convention is followed, because it generates a more meaningful sign (i.e., a positive value) for the TVPI index, which is more easily interpreted in a manner similar to how benefit-to-cost ratios are usually expressed and interpreted. We followed the same procedure when calculating the total value of drawdowns in the case of the next two indices (DPI and RVPI).

DPI: In the case of PE Fund 1, the DPI is:

$$DPI_T = \frac{400}{100 + 300 + 200 + 700} = 0.31$$

In the case of PE Fund 2, the DPI is 0.74. Therefore, PE Fund 1 has a lower ratio of total distributions to total commitments between 2002 and 2007 than does PE Fund 2. This measure does not take into account the time value of money.

RVPI: For PE Fund 1, the RVPI is:

$$DPI_T = \frac{1{,}400}{100 + 300 + 200 + 700} = 1.08$$

In the case of PE Fund 2, the formula gives us an RVPI of 0.58. It can be seen that PE Fund 2 has a lower ratio of NAV to total contributions than does PE Fund 1. Again, note that this measure does not consider the time value of money.

(Sections 10.1.1 and 10.1.6)

2. It can be seen that PE Fund 1 had an excellent return, 12.92%, when compared to its peers, as its IIRR was located between the upper and the maximum return corresponding to hypothetical information collected for a sample of European private equity funds categorized as vintage year 2002-stage focus buyout, from inception to December 31, 2007. In the case of PE Fund 2, the observed return, 8.46%, was less impressive. Its IIRR was approximately equal to the median private equity fund return of the sample.

   (Sections 10.1.4 and 10.1.6)

3. DPI = 0.81 found as sum of distributions (25) over sum of capital drawn (31)

   (Sections 10.1.1 and 10.1.6)

4. RVPI = 0.97 found as TVPI (1.77) minus DPI (0.81) with rounding

   (Sections 10.1.1 and 10.1.6)

5. NAV = $3,000, rounded, found as RVPI (0.97) times sum of contributions (3,100).

   (Sections 10.1.1 and 10.1.6)

Reading 1, Chapter 11
Monitoring Private Equity Fund Investments

Exercises

1. What role might the design of the limited partnership agreement play in order to alleviate the risk of style drift?

Problems 2 to 4

Discuss whether the following three statements are accurate regarding the potential value created through monitoring activities at the portfolio of funds level.

2. *"Intensive contact with the fund managers is important when deciding whether to invest in a follow-on fund (i.e., re-ups)*."

3. "*Empirical evidence suggests that superior reinvestment skills are not important for investors in private equity*."

4. "*Networking and liaising with other limited partners is an important instrument for gathering information on the aggregate market and learning about other funds, and may help an investor gain access to deals that might otherwise not appear on the institution's radar screen*."

5. Have private equity fund managers in the U.S. historically relied on the exemption from registration under the Investment Advisers Act?

6. Why might limited partners prefer to limit the degree of transparency of a private equity fund?

Problems 7 to 8

Isabel Yale works at *Yellow Global*, an insurance company that is considering investing in *Lamont Private*, a private equity fund, as a limited partner. *Yellow Global* monitors its investments in private equity routinely and systematically, collecting information in an organized and planned way. *Yellow Global's* philosophy considers the monitoring process -where problems are identified and a plan to address them is worked out as an integral part of its control system within the investment process. In the past five years, *Yellow Global* has been very successful, with several investments made in private equity funds. In spite of this success, Xabier Etxeberria, a consultant to *Yellow Global*, is worried that the private equity portfolio of this insurance company is already too large to be managed efficiently and is considering proposing ways to adjust the portfolio structure to Ms. Yale.

Lamont Private, incorporated in 1993, has been a leader in the U.S. buyout market, their declared investment strategy. However, the projected sluggishness in the U.S. market in

the coming years has forced *Lamont* to look for investments in other more promising areas. In fact, *Lamont* is now considering becoming a leader in the buyout markets of South-East Asian emerging markets such as Vietnam, Malaysia, and the Philippines. These markets are considered to be riskier than the U.S.

7. Ms. Yale is concerned about the risk of "style drift" arising from the investments that *Lamont Private* is about to make in South-East Asian emerging countries. Ms. Yale states that "…*Style drift arises because adherence to a stated investment style may not always hold true in the world of private equity funds.*" Is Ms. Yale's statement correct?

8. What are the two main "exit routes" that Mr. Exteberria might suggest to Ms. Yale so that *Yellow Global* might be able to exit private equity fund investments before maturity in case they decide to do so?

Solutions

1. The upfront design of the limited partnership agreement is an important step to alleviate the risk of style drift. The covenants of the limited partnership agreement guide the behavior of the fund manager and may be used to set the risk profile of the investment at the time of commitment. However, there are risks associated with adhering too closely to a declared investment strategy, particularly when market conditions change considerably, creating new investment opportunities.

   (Section 11.2.2)

2. This statement is correct. Intensive contact with the fund managers improves the due diligence process and can lead to a faster finalization of contracts after incorporating enhancements based on the previous experience with the fund manager. Finally, a strong relationship can extend to junior team members ready to spin out and set up their own fund.

   (Section 11.2.3)

3. The opposite is true. Empirical evidence actually suggests that investors in private equity owe their success to superior reinvestment skills. For instance, Lerner, Schoar, and Wong (2007) refer to the case of endowment funds, where they found that these funds were relatively unlikely to reinvest in a partnership. However, in the cases in which endowments did reinvest, the subsequent performance of the follow-on fund was significantly better than those of funds they let pass.

   (Section 11.2.3)

4. This statement is correct. Networking and liaising with other limited partners can also improve access to secondary opportunities in advance of the less favorable auction process.

   (Section 11.2.3)

5. The answer is yes. In the U.S., both hedge fund managers and private equity fund managers have historically relied on the same exemption from registration under the Investment Advisers Act.

   (Section 11.3.1)

6. Limited partners may prefer to limit the degree of transparency of a private equity fund because making information regarding star funds (very successful funds) public knowledge may draw the attention of competing investors. As private equity funds are not scalable, limited partners may be concerned about being locked out of follow-on funds because general partners have a preference for deep pocket investors. Limited partners need to protect their privileged access to follow-on funds or to new teams that set up their own vehicles outside the old fund.

   (Section 11.3.2)

7. Yes, Ms. Yale's statement is correct.

   (Section 11.2.2)

8. The first main exist route is the use of secondary transactions. A secondary market for limited partnership shares exists. However, this market offers limited liquidity and is expected to remain quite inefficient. Often shares in a private equity fund cannot be sold off without the consent of the general partners (and possibly that of other limited partners). Secondary transactions occur at a negotiated price, often at a considerable discount to net asset value.

   The second main exit route is securitization, a process that involves the transfer of limited partnership shares to a special purpose vehicle (SPV) for a collateralized fund obligation. The SPV is a distinct legal entity that issues senior and junior notes and uses the capital collected from the issuance to invest in a private equity fund-of-funds.

   (Section 11.4)

Reading 1, Chapter 12
Private Equity Fund Valuation

Exercises

1. Why is the net asset value (NAV) of a private equity fund often referred to as the fund's residual value?

2. How have limited partnership shares in a private equity (PE) fund (i.e., the value of the holdings of a particular limited partner) been traditionally valued?

3. Suppose that the fair value of the individual companies in a private equity fund could be established. What are the four reasons why their aggregation would often not provide the limited partners with the economic value of a private equity (PE) fund?

4. When may the modified bottom-up approach be used?

5. What is the main assumption behind the Grading-based Economic Model (GEM) approach for valuing a fund?

Problems 6 to 8

Indicate whether the following statements on the traditional use of the net asset value (NAV) to value a private equity fund are correct or incorrect.

6. "*The use of the NAV does not provide an institutional investor with the economic value of a private equity fund, because undrawn commitments are not considered when calculating the NAV.*"

7. "*The use of the NAV cannot provide an institutional investor with the economic value of a private equity fund, because its value cannot be equal to the net present value of the fund's expected cash flows.*"

8. "*The use of the NAV cannot provide an institutional investor with the economic value of a private equity fund, because the fund's management may be adding (or deducting) value to the private equity companies.*"

Solutions

1. The NAV of a private equity fund is often referred to as a private equity fund's residual value, because it represents the value of all investments remaining in the portfolio minus any liabilities (net of fees and carried interest) as of a specific date.

   (Section 12.1)

2. Limited partnership shares have traditionally been valued by multiplying the net asset value (NAV) of the fund by the percentage of shares owned in the fund. This is a bottom-up technique in which individual companies are valued (usually according to industry valuation guidelines and in compliance with accounting standards or valuation guidelines) and then aggregated to compute the PE fund value. However, in order to be truly fair, such value should equal the present value of the fund's expected cash flows (assuming efficient markets).

   (Section 12.1)

3. The following are the four reasons presented in the book:

i. Undrawn commitments: A private equity fund's expected future cash flows are generated not only by distributions out of the NAV, but also by capital draws for investments still to be made in the future.
ii. PE fund added (or deducted) value: The value-added that the management team of a PE fund is supposed to be adding to value the respective private equity companies should be reflected in the economic value of the fund.
iii. Future PE fund expenses: Additional management fees, expenses, catch-up, and carried interest will be charged over the remaining lifetime of the fund against its fair value and, thus, they will eventually reduce the cash flows to the investors and the value of the PE fund.
iv. Capital constraints for venture capital funds: Even if a portfolio company theoretically has a particular value during the early investment stages, success will depend on the fund's intentions going forward.

(Section 12.1)

4. The modified bottom-up approach may be used when it is difficult or too costly to determine specific exit scenarios for individual companies in a PE fund. The approach suggests the use of fund manager track record data or broad venture capital secondary market insight. Based on these inputs, global exit scenarios are determined and used for individual companies without specific scenarios, as well as for undrawn capital. Then, and similar to the bottom-up approach, these cash flow streams are combined, possibly adjusted depending on the partnership structure, and discounted to arrive at a present value for the fund.

   (Section 12.3.1)

5. The Grading-based Economic Model (GEM) approach is based on the assumptions that: (1) the historical performance or cash flows of comparable funds' is representative of the value of the fund being analyzed, and (2) that a grading system allows for reasonably accurate identification of the comparable funds.

   (Section 12.3.2)

6. The statement is correct.

   (Section 12.1)

7. The statement is incorrect. In theory, the value of an asset is the net present value of its future cash flows.

   (Section 12.1)

8. The statement is correct.

   (Section 12.1)

Exercises

1. Investor A invests in only one fund. In determining an appropriate discount rate for that investor to use in the valuation of private equity, is it necessary to incorporate an additional premium to compensate an investor for the risk of holding that single private equity (PE) position?

2. Based on estimated betas from publicly traded private equity (PTPE), are venture capital (VC) and buyouts more or less risky than public equity?

3. XYZ is a firm with $100 million in debt and $300 million in equity. The corporate tax rate paid by XYZ is 30%. If XYZ's beta with leverage is 1.4, calculate this company's unleveraged beta.

4. Does the use of appraisals as prices in private equity affect the estimation of beta?

Problems 5 to 6

Natalia Ramírez, CAIA, is a portfolio manager at *Northern*, a university endowment incorporated in 1997. Ms. Ramírez is planning to propose that *Northern* increase its holdings in the private equity asset class to 8% from 4% last year. She argues that this decision is motivated by the improved performance of the private equity asset class in the past few years and by the poor outlook for equities and bonds. As part of its plan to increase the private equity exposure of its portfolio, Ms. Ramírez is considering investing in *Privamerica Group*, a U.S. private equity fund that invests in U.S. companies. *Privamerica Group* actively seeks to make private equity co-investments in sponsor-led recapitalizations, buyouts, and growth opportunities, and also emphasizes building the value of its portfolio companies through the appreciation of its equity investments. *Northern* has already estimated future cash flows arising from *Privamerica Group* and is now in the task of estimating an appropriate discount rate for these cash flows in order to value *Privamerica Group*.

John Levine, a researcher at *Northern* working for Ms. Ramírez, is aware that the risk-free rate is the starting point needed to calculate the discount rate to be applied to *Privamerica Group's* cash flows. Mr. Levine knows that the risk-free asset is an asset for which the actual return is equal to the expected return. Given the fund's beta, Mr. Levine needs to estimate the equity risk premium for the U.S. market to be able to estimate the discount rate to be applied to *Privamerica Group's* cash flows. Mr. Levine notes that, in the US, the equity risk premium estimated with historical data from 1926–1998 is 6.10%. Although this approach of using historical data is commonly used, Mr. Levine notes that there are some limitations to it. For example, he mentions that there can be differences in the estimated market risk premium due to differences between arithmetic and geometric averages.

5. Is Mr. Levine's assessment on the risk-free asset correct?

6. Is Mr. Levine's assessment on the estimation of equity risk premiums using arithmetic and geometric returns reasonable?

Solutions

1. The answer is yes. Moskowitz and Vissing-Jørgensen (2002) estimated that the required additional premium to compensate an investor for the risk of holding a single PE position was at least 10% per year. Kerins, Smith, and Smith (2001) estimated that the required additional premium for an entrepreneur with 25% of her wealth tied to a single venture capital project is around 25%.

   (Section 13.1.1)

2. Empirical evidence based on PTPE betas suggests that venture capital is more risky and buyout is less risky than public equity. For instance, assuming a market risk premium of 5%, venture capital would demand a risk premium in excess of 400 basis points over public equity. The sample used in these studies was limited and most likely not fully representative of the VC market.

   (Section 13.2.1)

3. The formula to calculate a company's unleveraged beta is:

$$B_U = \frac{B_L}{\left[1 + (1 - T_C) \times \left({}^{D}/_{E}\right)\right]}$$

   Where: B_U is the firm's beta with no leverage, B_L is the firm's beta with leverage, T_C is the corporate tax rate, and *D/E* is the company's debt/equity ratio. Substituting the values into the equation renders:

$$B_U = \frac{1.4}{[1 + (1 - 30\%) \times (100 \,/\, 300)]} = 1.14$$

   This is slightly lower than the beta with leverage. This is because leverage adds risk. The tax factor reduces the pre-tax value of the debt to being an after-tax value.

   (Section 13.2.2.2)

4. The answer is yes. The use of appraisals as prices results from the absence of a market with continuous trading and continuously observable prices. The complexities of smoothing or stale pricing from appraisals complicate the measurement of true risks and correlations with other asset classes. In order to measure betas, data based on appraisals need to be corrected and adjusted.

   (Section 13.2.2.3)

5. The assessment is correct.

   (Section 13.1.1)

6. The answer is yes.

   (Section 13.1.1)

Reading 1, Chapter 14
The Management of Liquidity

Exercises

1. What is the meaning of the term "drawdown capital"?

2. What is the meaning of the term "harvesting period"?

3. May a limited partner default when he cannot meet a drawdown request? If so, is there any penalty involved?

4. An investor signs commitments for private equity investments in the size of 6% of her fund, while having resources available to allocate an additional investment of 8% to private equity. What is the over-commitment ratio? Are resources being used efficiently or inefficiently?

Problems 5 to 7

Amazonian Private Equity Fund (APEF) invests in late-stage Brazilian companies seeking to either enter the growing Brazilian market, or improve their current business operations in Brazil. The fund plans to generate medium-term capital appreciation and to offer investors a unique access to transactions in the largest emerging market of Latin America.

APEF is currently conducting a study on how to improve the management of its liquidity, a task that involves balancing between the benefits of putting money to work efficiently and the potential costs of having insufficient available resources to fund commitments and attractive opportunities. In this regard, the fund is reconsidering its over-commitment strategy, while it is also looking at possibilities of tapping into well-diversified and stable sources of financing. At the same time, APEF is also analyzing the pros and cons of using approaches to cash flow projections including estimates, forecasts, scenarios, and Monte Carlo simulations.

5. In an over-commitment strategy, is it typically appropriate for commitments to exceed the available resources in order to optimize the level of liquidity?

6. Could the secondary market sell-off of limited partnership shares be regarded as a well-diversified and stable source of financing for APEF?

7. Which of the cash flow alternatives considered by APEF is NOT one of the three cash flow projection approaches for a portfolio of private equity funds?

Solutions

1. Drawdown capital is cash that a general partner requests from a limited partner upon identification of suitable investment opportunities, or to cover management fees or expenses.

   (Section 14.1)

2. The harvesting period of a private equity fund consists of the later years of the fund, after the investments have matured and gained in value, when the fund seeks to exit its investments. The value of these investments is related to the growth of the company, the market environment at the time of the exit period, and the value added by the fund manager.

   (Section 14.1)

3. If a drawdown request cannot be met, a limited partner may default as a measure of last resort. However, in addition to the reputation damage suffered by the defaulting limited partner, there are onerous penalties associated with not meeting capital calls. These penalties may include:

   - The partial or total forfeiture of the partnership interest
   - The loss of entitlement to income or distributions
   - The termination of the limited partner's right to participate in future investments by the fund
   - The mandatory transfer or sale of its partnership interests
   - The continuing liability for interest in respect of the defaulted amount
   - The liability for any other rights and legal remedies the fund managers may have against the defaulting investor.

   Furthermore, defaulting limited partners may continue to be liable for losses or expenses incurred by the fund.

   (Section 14.2)

4. The over-commitment ratio is defined as:

$$Over-commitment\ ratio = \frac{Total\ commitments}{resources\ available\ \ for\ commitments}$$

Therefore, in this example, the over-commitment ratio is 75% (6%/8%). An over-commitment ratio of less than 100% suggests an inefficient use of resources.

(Section 14.5)

5. The answer is yes. Typically, a portion of the commitments can be met with distributions received from existing investments during the period prior to the capital being called.

   (Section 14.5)

6. The answer is no. Exiting private equity investments through the secondary market may take considerable time and may occur at discounts to NAV. The following may be three well-diversified and stable sources of financing for APEF: The possibility of having a mandatory stepping in as a provider of follow-on funding, the existence of short- and medium-term borrowing facilities, and the establishment of a reinvestment plan.

   (Section 14.2)

7. In private equity portfolio modeling, Monte Carlo simulations use projected cash flows as inputs to analyze future outcomes. The projections may be based on three approaches: estimates, forecasts, or scenarios.

   (Section 14.4.2)

Reading 2, Article A
Covenants in Venture Capital Contracts

The article studies why and how covenants are included in contracts between venture capitalists (VCs) and entrepreneurs. It begins with a brief review of academic literature on allocation rights among various stakeholders of a firm, and briefly examines the role of covenants in VC investments. The first section also provides a summary of the paper's findings. Using legal filings of VC-backed firms, the author is able to examine the role of covenants in VC investments.

Section 3 provides an overview of VC contracts, and examines the characteristics of the securities issued in a typical VC investment. The cash flow structures and rights of these securities are carefully explained. Section 4 examines various types of covenants that were present in the sample. The author finds that unlike bank loans and bonds, VC contracts exhibit considerable variation in their contractual design. This means certain covenants may not appear in all VC contracts. The paper claims that, in general, covenants are added to VC contracts to overcome a conflict of interest that arises between VC investors and entrepreneurs. The paper provides extended discussion of the nature of this conflict.
Section 6 provides the empirical evidence. It uses the available data to explain why certain covenants are included and what firm characteristics (e.g., location of the VC fund) affect the choice of the covenant.

Exercises

1. Do debt-like venture capital (VC) contracts with higher fixed payoffs include more or less covenants than do contracts with lower fixed payoffs? Explain the reasoning

2. Do covenants play an economic role in venture capital (VC) investments, (even though VCs are shareholders with access to other powerful governance mechanisms)?

3. Does the evidence presented by the author suggest that venture capital (VC) contracts include more or fewer covenants for less-mature start-ups? Briefly explain.

Solutions

1. The author of the paper finds that contracts with higher fixed payoffs include more covenants than do contracts with equity-like cash flow and control features (i.e. with lower fixed payoffs). The author only analyzes VC investments that offer preferred stock (and therefore the identification is based not on differences between type of security, but rather on contractual features pertaining to the preferred stock) and tests the theoretically motivated prediction that a financial contract will include a greater number of covenants when a financier is entitled to a higher fixed payoff (i.e., include a greater number of investor-friendly cash flow contingencies) and has no residual control rights. The paper finds that contracts that entitle VCs to higher fixed payoffs include 1.6 more covenants than do contracts that entitle VCs to lower fixed payoffs.

   (Pages 10-27)

2. The answer is yes. This outcome is explained by the finding that almost all VC contracts include covenants, such inclusion was found to be affected by conflicts of interests between entrepreneurs and VCs, and even VCs who hold board seat majorities obtain some covenant protection.

   (Pages 10-27)

3. The cross-sectional analysis of covenant determinants presented in the article suggests that VC contracts include fewer covenants for younger companies. This finding may be explained by the fact that younger companies have very few valuable assets and very low a salvage values to encourage an investor-friendly distribution of control rights.

   (Pages 10-27)

Reading 2, Article B
The Lower-Risk Startup: How Venture Capitalists Increase the Odds of Startup Success

The article uses in depth interviews with various participants in the VC industry and available academic and industry research to understand how VC investors can systematically help startups increase their odds of success. After introducing the paper, discussing its methodology and outlining the audience for which the paper is intended, the authors list the sources through which VC investors can add value to a startup. The seven elements of value added are given the acronym "TOPSCAN," which stands for (1) team building, (2) operations, (3) perspective, (4) skill building, (5) customer development, (6) analysis, and (7) network.

In the next section, the paper outlines the resources that are available to VC investors that can be used to help startups, and discusses in detail three different approaches that a VC investor can adopt: (1) being a banker, (2) being a mentor, and (3) being a portfolio operator.

The final section of the paper provides a set of guidelines to be used by VC investors to decide the type of VC investors that they want and can be. To begin, the VC investor must evaluate the available resources, namely: cash, brand, network, and in-house expertise.

Exercises

1. Name the seven elements through which venture capitalists can add more value to their portfolios (i.e. the "TOPSCAN" framework).

2. What is the most common service that portfolio operators offer to their portfolio companies?

3. What are the four elements that define the method suggested by the authors to be used as an objective measurement for a venture capital's assets and evaluating the VC's diverse resources?

4. Why was it difficult to analyze whether the portfolio operator strategy led to higher returns?

Solutions

1. The seven elements are: Team building, operations, perspective, skill building, customer development, analysis, and network.

   (Pages 28-40)

2. The most common service portfolio operators provide to their portfolio companies is recruiting assistance. Most of the venture capitalists in this category offer personal references to interesting candidates and also use their own websites as job boards for portfolio companies.

(Pages 28-40)

3. The four elements of the method suggested by the authors are: evaluating cash resources, evaluating brand resources, evaluating network resources, and evaluating in-house resources.

   (Pages 28-40)

4. The three caveats that did not allow the authors of the study to perform a rigorous analysis were: (i) The portfolio operator strategy is relatively new, and so there is not enough existing data for the small number of VC funds following this strategy, (ii) Returns data for venture capitalists (VCs) are hard to gather and difficult to contrast with one another across inconsistent fund sizes, strategies, and check sizes; and (iii) VCs with higher returns naturally have more money and therefore are more likely to invest the cash needed for the expensive portfolio operator strategy.

   (Pages 28-40)

Topic 3: Real Assets

Readings

1. *CAIA Level II: Advanced Core Topics in Alternative Investments*, Wiley, 2012, ISBN: 978-1-118-36975-3. Part Three: Real Assets, Chapters 15–22.
2. *CAIA Level II: Core and Integrated Topics*, Institutional Investor, Inc., 2015. ISBN: 978-1-939942-02-9. Part II: Investment Products: Real Assets.
   A. Inderst, G. "Infrastructure as an Asset Class." *EIB Papers,* 2010, Vol. 15, No. 1, pp. 70-105.
   B. Fu, C-H. "Timberland Investments: A Primer." Timberland Investment Resources, LLC. June 2012, updated April 2014.

Reading 1, Chapter 15
Real Estate as an Investment

Exercises

1. Does real estate offer the potential to hedge against unexpected inflation?

2. Real estate assets cannot be easily and inexpensively bought and sold in sizes or quantities that meet the preferences of buyers and sellers. What is the term used in real estate to describe this characteristic of real estate?

Problems 3 to 4

Consider an all-equity investment in an office building that has a 15-year, non-cancelable fixed-rate lease with a large and well-capitalized corporation.

3. Would the income from this property be similar to that of a corporate bond (issued by the tenant) or to that of a stock (also issued by the tenant)?

4. Would increasing and unanticipated inflation during the life of the lease affect positively or negatively the value of this investment? Explain.

5. Explain whether most commercial real estate investments are held publicly or privately and who typically owns the equity.

6. Why is it difficult to correctly and empirically measure the effect of unanticipated inflation on real estate prices?

Solutions

1. Yes, real estate has the potential to hedge against unexpected inflation.

(Section 15.1.1)

2. This characteristic of real estate is known as lumpiness.

   (Section 15.1.2)

3. The rental revenues provided by the property will be comparable to those offered by a corporate bond, because the lease locks in the income provided by the property for the next fifteen years. Furthermore, the value of the property to the investor will fluctuate in reaction to factors such as riskless interest rate changes, and changes in the credit spread on the debt of the tenant. These are the same factors that would affect the value of a corporate bond issued by the tenant.

   (Section 15.2.1)

4. In principle, increasing and unanticipated inflation during the life of the lease may harm the investor in this all-equity office building investment because this is a long-term, fixed-rate, lease. In theory, the investor would have been at least partially hedge against the risk of increasing and unanticipated inflation if the lease was an adjustable-rate lease, and assuming that adjustable-rates would reflect inflation rates.

   (Section 15.4)

5. Most commercial real estate is privately held and most of the equity of residential real estate is held by the occupier.

   (Section 15.3.7)

6. Unanticipated inflation is defined as the realized or observed rate of inflation minus the anticipated inflation. The difficulty to correctly measure empirically the effect of unanticipated inflation on real estate prices resides in developing an objective and accurate estimate of a variable that is unobservable: the market consensus-expected rate of inflation. The problem is further complicated because there are usually different time horizons over which market participants form their anticipated inflation rates.

   (Section 15.4)

Chapter 16
Unsmoothing of Appraisal Based Returns

Exercises

1. Suppose that overall equity market returns were 0%, 10%, 0%, and 0% in the first, second, third, and fourth quarter of a certain year, respectively. Two other return series having betas of 0.60 need to be calculated. The first return series is an unsmoothed return series that experiences its entire price response to the overall market in the same quarter

as the market. The second return series is a strongly smoothed return series that experiences half of its price response in the same quarter as the market, and the other half in the subsequent quarter. Calculate the returns of each of the series in each quarter and the arithmetic average and standard deviations of returns of each of the series during the year. Ignore compounding for simplicity. Comment on the results obtained.

2. Suppose that the value of the parameter alpha for the following equation (Equation 16.2 from the book) is 0.40.

$$P_t^{reported} = \alpha P_t^{true} + \alpha(1-\alpha)P_{t-1}^{true} + \alpha(1-\alpha)^2 P_{t-2}^{true} + \ldots \quad \text{(Equation 16.2)}$$

How much of the current reported price depends on the current true price, how much depends on the true price of the previous observation date, and how much depends on the true price of the observation date from two periods before?

3. Suppose that alpha has been estimated to be 0.50 for the following equation (Equation 16.3, Equation 16.4 can also be used):

$$P_t^{true} = (1/\alpha) \times P_t^{reported} - [(1-\alpha)/\alpha] \times P_{t-1}^{reported} \quad \text{(Equation 16.3)}$$

According to this, how much larger than the most recent reported price change should true price changes be?

Problems 4 to 9

The following Exhibit contains quarterly return data for two real estate series between the third quarter of 2007 and the second quarter of 2012. The first series (column 3) corresponds to the returns of a hypothetical U.S. real estate index (XYZ RE Index) that is unlevered and that is based on appraised prices of private real estate properties. The second series (column 4) corresponds to the returns of the all-equity FTSE NAREIT, which is based on closing market prices of publicly traded equity real estate investment trusts (REITs) in the U.S. The fifth and sixth columns contain the lagged returns of the XYZ RE Index and the all-equity FTSE NAREIT, respectively.

Year	Quarter	XYZ RE Index returns	NAREIT All Eq returns	XYZ RE Index lagged values	NAREIT All Eq lagged valued
2007	3	2.87%	2.59%		
2007	4	4.01%	-12.67%	2.87%	2.59%
2008	1	2.12%	1.40%	4.01%	-12.67%
2008	2	0.21%	-4.93%	2.12%	1.40%
2008	3	0.02%	5.55%	0.21%	-4.93%
2008	4	-7.28%	-38.80%	0.02%	5.55%
2009	1	-8.87%	-31.87%	-7.28%	-38.80%
2009	2	-6.61%	28.85%	-8.87%	-31.87%
2009	3	-4.21%	33.28%	-6.61%	28.85%
2009	4	-3.04%	9.39%	-4.21%	33.28%
2010	1	-0.36%	10.02%	-3.04%	9.39%
2010	2	2.98%	-4.06%	-0.36%	10.02%
2010	3	3.71%	12.83%	2.98%	-4.06%
2010	4	5.01%	7.43%	3.71%	12.83%
2011	1	4.97%	7.50%	5.01%	7.43%
2011	2	4.66%	2.90%	4.97%	7.50%
2011	3	4.17%	-15.07%	4.66%	2.90%
2011	4	3.45%	15.26%	4.17%	-15.07%
2012	1	3.43%	10.49%	3.45%	15.26%
2012	2	3.59%	3.97%	3.43%	10.49%
	Mean	0.74%	2.20%		
	Std. Dev.	4.40%	17.27%		
	Autocorrelation XYZ RE Index		86.45%		
	Autocorrelation NAREIT AllEq		23.04%		

4. Comment on the mean and standard deviations of XYZ RE Index and FTSE NAREIT returns. Furthermore, offer potential explanations for the finding that the standard deviation of returns for the XYZ RE Index is substantially lower to that of FTSE NAREIT.

5. Offer potential explanations for the finding that the autocorrelation of the all-equity FTSE NAREIT returns is substantially lower to that of XYZ RE Index returns.

6. Calculate the first unsmoothed return (i.e., fourth quarter of 2007) for XYZ RE Index.

7. Calculate the unsmoothed return in the fourth quarter of 2008 for XYZ RE Index. Comment on the result obtained.

8. In terms of asset allocation, what is the consequence of using the XYZ RE Index (original smoothed data) versus the unsmoothed version of this index?

9. In terms of correlations between real estate and other asset classes, what is the effect of using the XYZ RE Index returns (original smoothed data) versus the unsmoothed version of this index returns?

10. Why can't arbitrageurs prevent smoothed returns series from being unsmoothed?

11. What is the effect of data smoothing on estimated Sharpe ratios?

Solutions

1. The unsmoothed and strongly smoothed series have the same mean returns of 1.5% per quarter, which is lower than the equity market return of 2.5%. This is not surprising, as the unsmoothed and strongly smoothed return series have a low systematic risk (beta of only 0.6). Furthermore, the strongly smoothed series has almost half the standard deviation of returns of the unsmoothed series (and both volatilities are lower to that of the overall equity market). One of the main problems resulting from price smoothing is that it causes a substantial understatement of volatility.

   The following table shows the answers:

(1) Quarter	(2) Equity Market Returns	(3) Unsmoothed Returns	(4) Strongly Smoothed Returns
1	0%	0%	0%
2	10%	6%	3%
3	0%	0%	3%
4	0%	0%	0%
Mean Returns	2.5%	1.5%	1.5%
Standard dev.	5.0%	3.0%	1.7%

   (Section 16.1)

2. 40% (i.e., alpha = 0.40) of the current reported price depends on the current true price, 24% (i.e., 0.40 × 0.60) depends on the true price of the previous observation date, and 14.4% (i.e., 0.40 × 0.60 × 0.60) depends on the true price of the observation date from two periods before.

   (Section 16.2.1)

3. (1/0.50) = 2 ➔True price changes should be estimated based on a price change that is 2 times larger than the most recent reported price change.

   (Section 16.2.1)

4. The mean quarterly return of the all-equity FTSE NAREIT is somewhat higher than the corresponding mean quarterly returns of the XYZ RE Index (2.20% vs. 0.74%). The difference in standard deviations is striking (17.27% for the all-equity FTSE NAREIT versus only 4.40% for the XYZ RE Index).

The difference in the standard deviations of returns can be partially explained by the fact that, as mentioned in the problem, the XYZ RE Index has no leverage, whereas the all-equity FTSE NAREIT reflects the returns of the levered real estate positions that are generally included in REITs. The other explanation arises from the fact that the XYZ RE Index is based on appraisals, and thus is subject to price smoothing.

(Section 16.4)

5. The autocorrelation of the all-equity FTSE NAREIT returns is fairly low and its positive although small value may even have a spurious component arising from the extraordinary events that affected the real estate market since 2007. This low value suggests that the market for REIT is informationally efficient. This REIT index can be considered a proxy of a true return series. On the other hand, the high value for the autocorrelation of XYZ RE Index returns is consistent with XYZ RE Index being based on appraisals, and thus subject to price smoothing.

   (Section 16.4)

6. Using Equation 16.9:

   $R_{t,true} = (R_{t,reported} - \rho R_{t-1,reported}) / (1 - \rho)$

   $R_{t,true} = [4.01\% - 0.8645 \times 2.87\%] / (1 - 0.8645) = 11.28\%$

   (Section 16.4)

7. Using Equation 16.9:

   $R_{t,true} = (R_{t,reported} - \rho R_{t-1,reported}) / (1 - \rho)$

   $R_{t,true} = [-7.28\% - 0.8645 \times 0.02\%] / (1 - 0.8645) = -53.85\%$

   The -7.28% (smoothed) XYZ RE Index return in the fourth quarter of 2008 produces a striking -53.85% return in the unsmoothed return, which is closer to the true return during that quarter (proxy by the all-equity FTSE NAREIT), which fell by -38.80% during that quarter.

   (Section 16.4)

8. The XYZ RE Index (original smoothed data) wrongly and dangerously suggests a very low standard deviation of returns for real estate and thus, asset allocations based on these falsely low volatilities would substantially overweight real estate in a mean-variance optimization framework.

   (Section 16.4.4)

9. The use of XYZ RE Index returns (original smoothed data) understates the correlation of the (smoothed) returns to the returns of other asset classes. In a mean-variance framework, the combination of low volatility (already discussed in the previous problem) with the low correlation of smoothed returns would assign weights to real estate that can be substantially higher than those corresponding to unsmoothed data.

   (Section 16.4.4)

10. There are two main reasons that prevent smoothed return series from being unsmoothed by arbitrageurs. First, the return series may suggest arbitrage opportunities that are only apparent. For example, in the case of appraisals, they represent estimated values (and not market prices) that do not correspond to either bids to buy or offers to sell. Second, significant transaction costs or other barriers to arbitrage may prevent smoothed returns series from being unsmoothed by arbitrageurs.

    (Section 16.1.1)

11. Smoothed prices understate true volatility and, therefore, the denominator of the Sharpe ratio is artificially low when using smoothed data. Given that mean returns (which go in the numerator of the Sharpe ratio) are usually only slightly affected by smoothing, the final effect will be an artificial increase in the estimated Sharpe ratio.

    (Section 16.1.3)

Chapter 17
Core, Value-Added, and Opportunistic Real Estate

Exercises

Problems 1 to 4

Suppose that a U.S. real estate fund is considering incorporating the following four properties in its portfolio:

A. An unleveraged purchase of a well-recognized and fully operating office complex located in downtown Atlanta, Georgia. The complex is currently experiencing a high occupancy rate. The fund plans to hold this property for the long-term.
B. A highly leveraged purchase of an unoccupied and undeveloped lot of land located in a rural area in Alberta, Canada. The fund predicts that this lot of land will appreciate in the near-term as the economy in the area improves, and plans to hold it for only one to two years.
C. Leasing of a hotel located in Panama City, Panama. This hotel will be held for an intermediate-term sale and roll over into new properties.
D. A limited partnership investment in a highly leveraged development for sale of housing units for low income families in Atlanta, Georgia.

1. According to NCREIF's (National Council of Real Estate Investment Fiduciaries) style category, how would the office complex depicted as investment A be categorized?

2. According to NCREIF's (National Council of Real Estate Investment Fiduciaries) style category, how would the lot of land (investment B) be categorized?

3. According to NCREIF's (National Council of Real Estate Investment Fiduciaries) style category, how would the hotel (investment C) be categorized?

4. According to NCREIF's (National Council of Real Estate Investment Fiduciaries) style category, how would the development (investment D) be categorized?

5. In terms of investment structure/control, and using NCREIF's style category, how would core attributes, value-added attributes, and opportunistic attributes properties be categorized?

6. Compare expected returns and risks of core, value-added, and opportunistic real estate portfolios.

7. A real estate project has a current market value of $180 million and expected annual cash flows from rent, net of operating expenses, of $12 million. Calculate the cap rate.

8. Suppose that in the previous problem the $12 million annual net operating income is expected to grow at a constant rate of 3% per year forever and that the discount rate for this real estate project is 9%. Calculate the market value of the real estate project.

Problems 9 to 10

Suppose that Real Estate Fund ABC is considering purchasing a well-recognized and fully operating office building located in downtown Philadelphia, Pennsylvania. It is the first of January. Last year, the net operating income (NOI) provided by this property was $10 million. NOI is expected to grow 10% this year, 9% during the second year, and 5% per year from the third year and until eternity. The risk-free rate, measured using the U.S. Treasury Bond yield to maturity, is 3%.

9. Analysts at Real Estate Fund ABC have estimated that the added risk of this property suggests the inclusion of a 5% risk premium above the risk-free rate. Calculate the market value of this property.

10. The current owner of the office building agrees with the estimates of future NOI growth used by analysts at Real Estate Fund ABC for this property, but considers that the risk premium used by ABC is too high and cannot be warranted by the relative stability of the rents that she argues this building provides and will continue to offer. The current owner argues that it would be more reasonable to consider adding a risk premium of 4% to this property. Calculate the market value of this office building from the point of view of the current owner.

11. What is rollover risk in real estate?

Solutions

1. The office complex would typically be classified as a "core" investment.

   (Section 17.2)

2. The lot of land would typically be considered an "opportunistic" investment.

   (Section 17.2)

3. The hotel would typically be categorized as a "value-added" investment.

   (Section 17.2)

4. The development would typically be considered an "opportunistic" investment.

   (Section 17.2)

5. In the case of core-attributes, this type of properties tends to have substantial direct control. Value-added attributes often have moderate control and offer security or a preferred liquidation position. Opportunistic attributes are characterized by insignificant control, as these investment structures generally come in the form of limited partnerships and with unsecured positions.

   (Section 17.2)

6. Core portfolios should achieve relatively high income returns and display relatively low volatility. Valued-added portfolios should derive a considerable part of their return from real estate property appreciation and should exhibit moderate volatility. Opportunistic portfolios are expected to achieve most of their return from the appreciation of real estate property values and may exhibit substantial total return volatility.

   (Section 17.2)

7. The cap rate is simply \$12 million/\$180 million = 6.67%

   (Section 17.5)

8. Using the formula for the present value of a perpetuity that grows at a constant rate, we have:

   Market value = \$12 million / (0.09 – 0.03) = \$200 million

   (Section 17.5)

9. In this case, the CAP rate to be used is equal to (equation 17.5): 3% + 5% = 8%
   The market value is calculated as follows ($ amounts in millions):

$$MV_0 = \frac{\$10(1.10)}{(1.08)} + \frac{\$10(1.10)(1.09)}{(1.08)^2} + \frac{\$10(1.10)(1.09)(1.05)}{(0.08-.05)}\frac{1}{(1.08)^2} = \$380.25$$

   According to these estimates, the market value of the property is $380.25 million.

   (Sections 17.5 and 17.6.3)

10. In this case, the CAP rate to be used is equal to (equation 17.5): 3% + 4% = 7%

    The market value is calculated as follows ($ amounts in millions):

$$MV_0 = \frac{\$10(1.10)}{(1.07)} + \frac{\$10(1.10)(1.09)}{(1.07)^2} + \frac{\$10(1.10)(1.09)(1.05)}{(0.07-.05)}\frac{1}{(1.07)^2} = \$570.56$$

    According to these estimates, the market value of the property is $570.56 million. Notice how using a CAP rate that is just 1% lower increases the market value of the property by around 50%. Remember that these discount rates are used for cash flows that are projected until infinity and, therefore, the present value of these cash flows can be very sensitive to changes in the discount rate.

    Note: Review the book Investments by Bodie, Kane, and Marcus if you need to refresh concepts related to valuation calculations (Chapter 18).

    (Sections 17.5 and 17.6.3)

11. Rollover risk in real estate generally refers to:

    - Changes in financing (e.g., converting a construction loan to a permanent mortgage loan),
    - Changes in the nature of a real estate project (e.g., completion and full leasing of a certain project),
    - Changes in ownership (e.g., this risk is particularly high for opportunistic investments, given the importance of capital appreciation for this style of real estate).

    (Section 17.1)

Chapter 18
Real Estate Indices

Exercises

Problems 1 to 3

The Fullertown City Employees' Pension Fund is considering allocating funds to real estate investments. As a first step, the fund's investment committee has asked researchers John Troconis, Virginia Peterman, and Jay Ahn, to write a report on alternative investment vehicles available to institutional investors for gaining access to real estate investments. The three researchers are examining the characteristics of real estate indices as a first step to understand the idiosyncrasies of reported real estate returns and return standard deviations.

Mr. Troconis finds that properties that are transacted during a particular period and that are used to calculate these indices may not be representative of the underlying real estate market. Ms. Peterman finds that a technique used when designing real estate indices uses observed transactions of some properties to estimate the prices of all properties, including those that did not transact, by directly modeling the heterogeneity of real estate properties. Finally, Mr. Ahn finds that a technique used when constructing real estate indices has been criticized because only a few data points can be found to create an index when following this methodology.

1. Which bias does Mr. Troconis discover?

2. To which technique is Ms. Peterman referring to?

3. What is the technique that Mr. Ahn finds to be problematic?

4. Is the NCREIF NPI (National Council of Real Estate Investment Fiduciaries Property Index) calculated on a leveraged or on an unleveraged basis? Is it calculated on a before or on an after-tax basis?

5. Is the NCREIF NPI (National Council of Real Estate Investment Fiduciaries Property Index) based on appraised values or on market transactions?

Problems 6 to 7

The value of NCREIF NPI at the end of the fourth quarter of 2010 was 1,665.4. In 2011, the return for the first quarter was 3.36%, the return for the second quarter was 3.94%, the return for the third quarter was 3.30%, and the return for the fourth quarter was 2.96%.

6. Calculate the Index level at the end of the first quarter of 2011 and at the end of the second quarter of 2011.

7. Calculate the annual return for 2011.

8. What are the two main criticisms of repeat-sales indices?

9. Suppose that a hedonic pricing model has been estimated for land prices during a hypothetical period of time and for a hypothetical county in England using the following equation:

   $P = B_0 + B_1B + B_2S + B_3L + B_4U$

   Where:

   P = Price of an acre of land (in British Pounds or GBP)

   B = Depreciated cost of buildings on the land (in British Pounds)

   S = Soil productivity index

   L = Land productivity index

   U = Distance (in miles) to the city center

   Using Ordinary Least Squares, suppose that we get the following estimated equation:

   $P = 43.72 + 1.120B + 0.183S + 0.802L – 2.321U$; $R^2 = 0.63$

   Interpret the values of the coefficients obtained in the regression.

10. Which technique is most often used in the world when designing real estate indices?

11. Which method is used to construct the Case-Shiller Home Price Indices, an index group that tracks the value of U.S. residential real estate properties?

Solutions

1. Sample selection bias

   (Section 18.2.4)

2. Hedonic-price indices

   (Section 18.2.2)

3. Repeat-sales method

   (Section 18.2.1)

4. The NCREIF NPI is calculated on an unleveraged basis. This means that the properties being included in the index are assumed to have been purchased with 100% equity. The returns to the NPI are calculated on a before-tax basis.

   (Section 18.1.1)

5. The NCREIF NPI is based primarily on appraised values reported every quarter, rather than market transactions.

   (Section 18.1)

6. The index level after the first quarter of 2011 would be 1,665.4 × 1.0336 = 1,721.36. Similarly, the index after the second quarter of 2011 would be 1,721.36 × 1.0394 = 1,789.18. Note that the index value the second quarter can also be calculated as 1,665.4 × 1.0336 × 1.0394 = 1,789.18.

   (Section 18.3)

7. The annual return for 2011 would be: (1.0336 × 1.0394 × 1.0330 × 1.0296) – 1 = 14.26%. Notice that it would be incorrect to sum the four returns: 3.36% + 3.94% + 3.30% + 2.96% = 13.56%.

   (Section 18.3)

8. The two main criticisms of repeat-sales indices are: First, a bias may be present in the indices because the properties that are most highly represented in the construction of the index are those properties that are transacted most frequently. The problem is that these properties may be unrepresentative of all of the properties that compose the index. Second, the properties that turned over at a certain point in time may have had major improvements (and, thus, are of a different quality) that were made to smooth the progress of the transaction.

   (Section 18.2.1)

9. Every GBP increase in the depreciated cost of building in the land increases the price of one acre by GBP 1.120, every unit increase in the soil productivity index increases the price of one acre by GBP 0.183, every unit increase in the land productivity index increases the price of one acre by GBP 0.802, and every mile further distant form the city center that a lot of land is located lowers the price of one acre by GBP 2.321

   (Section 18.2.2)

10. Most of the major real estate indices in the world use real estate market prices (see Exhibit 18.1).

    (Section 18.3)

11. Repeated-sales pricing

    (Section 18.3)

Chapter 19
Public vs. Private Real Estate Risks

Exercises

1. The book documents a much wider dispersion of real estate market-based returns relative to appraisal-based returns. Is the lower accuracy of market prices relative to smoothed appraisals a reason for this?

2. State the steps that an arbitrageur would follow when an exchange-traded fund (ETF) becomes overpriced relative to its net asset value (NAV).

3. Pension Fund ABC is a U.S. pension fund that has only invested in traditional investments up to now. ABC is considering allocating funds to real estate, given the perceived low volatility of this asset class. To this end, ABC hires a consultant to determine the potential diversification benefits of being exposed to real estate by investing in real estate investment trusts (REITs). ABC is concerned about the high volatility levels experienced by REITs during the recent financial crisis. More specifically, ABC's analysts are perplexed when they learn that the NAREIT index shoot up almost 100% in 2009 after having plummeted in 2008, and wonder whether these numbers reflect the true evolution of real estate prices. They ask the consultant for an explanation. The consultant replies that "*this price increase represents the true changes in the values of real estate properties adjusted for the effects of leverage*." Is the consultant's assessment on the behavior of real estate prices during the financial crisis correct?

4. List the three major potential benefits offered by the emergence of derivatives on housing prices.

5. This real estate investment vehicle has, among others, the following characteristics: it trades in stock exchanges and has a fixed number of shares outstanding. These shares are issued to the general public in an initial public offering and cannot be obtained or redeemed by the investment company. What is the name of this investment vehicle?

Problems 6 to 9

ETF XYZ is a hypothetical ETF constituted by five stocks. Each stock trades at $2 and the ETF trades at $10. ETF XYZ tracks an index (Index XYZ) consisting of the same five stocks, but ten shares of each stock are in the index. The index is currently at 100. For simplicity, ignore interest rates, margin requirements, commission,s and transaction costs. Consider the three hypothetical scenarios for the next trading day (t=1) depicted in problems 6 to 8.

6. Suppose that on the next trading day (t=1), Index XYZ declines 10%, each of the stocks that make up ETF XYZ decline to $1.80, and ETF XYZ declines to $8. Is there an arbitrage opportunity? If so, what steps would an arbitrageur follow? What would be the arbitrage profit?

7. Suppose that on the next trading day (t=1), Index XYZ declines 10% (i.e., from 100 to 90), each of the stocks that make up ETF XYZ decline to $1.80, and ETF XYZ declines to $9. Is there an arbitrage opportunity? If so, what steps would an arbitrageur follow? What would be the arbitrage profit?

8. Suppose that on the next trading day (t=1), Index XYZ increases 10% (i.e., from 100 to 110), each of the stocks that make up ETF XYZ rises to $2.20, and ETF XYZ rises to $11.50. Is there an arbitrage opportunity? If so, what steps would an arbitrageur follow? What would be the arbitrage profit?

9. For the previous problem (Problem 8), explain how the actions of arbitrageurs would eliminate any potential arbitrage profits.

10. Why would institutions with long-term horizons (e.g., endowments) view Real Estate Investment Trusts (REITs) as risky investments compared to private real estate investments?

Solutions

1. The answer is no. The correct answer would be: Lower accuracy of smoothed appraisals relative to market prices.

   (Section 19.1.2)

2. When an ETF becomes overprice relative to its NAV, an arbitrageur would (1) short-sell the ETF in the market, (2) buy eligible and representative shares for the ETF's underlying portfolio, (3) convey the shares to the corresponding fund in exchange for the acquisition of new shares in the ETF, and (4) use the new ETF shares to cover the original short position in the ETF.

   (Section 19.2.2)

3. The consultant's assessment is not necessarily correct. His assessment, which would imply that REIT prices are informationally efficient, is only one of the two primary interpretations of the return divergence that has been amply documented between real estate property prices and REITs. The other potential explanation to this return divergence, which is not mentioned by the consultant, is that the REIT's returns and their high volatility may emanate from a risk source that is uncorrelated with the underlying economic fundamental factors affecting real estate property prices, such as volatility in the U.S. stock market driven by illiquidity and market stress. As commented on the book, there is considerable disagreement on which of these two explanations is more accurate.

A third explanation that has also been proposed argues that the real estate market is segmented (defined as differences in pricing of similar assets trading in separate markets, attributable to the differences in the markets themselves).

(Section 19.2.4)

4. In theory, the introduction of derivatives on housing prices during the past few years offer the following three major potential benefits: (1) price revelation, (2) better risk management, and (3) the capacity to short-sell residential real estate.

   (Section 19.3.1)

5. Closed-end real estate mutual funds.

   (Section 19.3.3)

6. In t=0, there were no arbitrage opportunities. In t=1, Index XYZ declined 10% (from 100 to 90), each of the stocks that make up ETF XYZ also declined 10% to \$1.80, but shares of the ETF declined more (20%, from \$10 to \$8). ETF XYZ is therefore trading at a discount to its NAV and an arbitrageur would:

   - Buy shares of ETF XYZ in the market. Let us suppose that the arbitrageur buys 1 ETF share for \$8.
   - Tender the shares of ETF XYZ in exchange for shares in the ETF's underlying portfolio of stocks.
   - Sell the shares received from the tender into the market. Since each of the stocks in the portfolio is trading at \$1.80, the arbitrageur would receive \$9 (i.e., \$1.80 × 5). This generates an arbitrage profit of \$1 for each ETF.

   (Section 19.2.2)

7. We were originally at an equilibrium situation, and now the index, the ETF and the stocks that constitute the ETF, all declined 10%. Therefore, there are no arbitrage opportunities in this case. The ETF is trading at the value that corresponds to its net asset value (NAV).

   (Section 19.2.2)

8. In t=0, there were no arbitrage opportunities. In t=1, Index XYZ increased 10% (from 100 to 110), each of the stocks that make up ETF XYZ rose to \$2.20, but shares of ETF XYZ rose proportionally more (15%, from \$10 to \$11.50). ETF XYZ is trading at a premium to its NAV and an arbitrageur would:

   - Short-sell the ETF in the market. Let us suppose that the arbitrageur short-sells 1 ETF share for \$11.50.

- Buy the shares of the five stocks that make up the ETF's underlying portfolio. At $2.20 each, this amounts to $11.
- Convey the shares to the ETF in exchange for the acquisition of new shares in ETF XYZ.
- Use the new ETF shares to cover the original short position in the ETF. This generates an arbitrage profit of $0.50 for each ETF.

(Section 19.2.2)

9. By short selling ETF shares, arbitrageurs will drive down the price of ETF XYZ until any overvaluation of this ETF with respect to its NAV disappears.

(Section 19.2.2)

10. Institutions such as endowments, which have long-term horizons, may perceive private real estate investments as having relatively low risk given their steady cash flow and low volatility in values in the long-term, when these investments might need to be liquidated. REITs, on the other hand, may be perceived as riskier due to the ample fluctuations exhibited by their market prices. Note that this is a question that deals with the important concepts of market segmentation and market clientele.

(Section 19.2.5)

Chapter 20
Portfolio Allocation within Real Estate

Exercises

Problems 1 to 2

A building has a $15,000,000 depreciable base that will be evenly depreciated over 15 years (using straight-line depreciation). The marginal tax rate is 35% and the discount rate is 7%.

1. Calculate the present value of the 15-year tax shield.

2. Assuming that the building is sold after 15 years for a value above its original cost, what would be the net gain to the taxpayer from being able to deduct depreciation? Note: Assume that both the tax rate and the discount rate remain at 35% and 7%, respectively.

Problems 3 to 8

An investment grows at 8% per year (pre-tax) during 10 years. Gains are taxed at 30% per year.

3. Calculate the future value of this investment if taxes are paid yearly.

4. Calculate the future value of the investment if taxes can be deferred.

5. Calculate how much more profit is allowed by the tax deferral.

6. Calculate the after-tax rate with deferral.

7. How much does the after-tax deferral of gains help increase after-tax gains?

8. What is the pre-tax equivalent to the after-tax gains with tax deferral?

9. Why an investor's relationship with real estate managers may be particularly important in the case of direct property ownership through partnerships with a small number of investors?

10. A U.S. real estate investor purchases a lot of land in Canada for 50,000,000 Canadian dollars ($C). The spot exchange rate is $C 1 = USD 1. If the price of this lot of land is expected to increase 8% per year (in $C) and the Canadian dollar is expected to lose 5% per year with respect to the U.S. dollar, calculate the expected value of the property two years from now from the U.S. investor point of view. Ignore any transaction costs.

Solutions

1. This building will allow deduction of an annual depreciation of $1,000,000 per year. At a marginal tax rate of 35%, the annual depreciation tax shield is $350,000 per year. At a discount rate of 7%, the present value of the 15-year tax shield is $3,187,770.

   (Section 20.1.1)

2. In this case, the taxpayer will owe taxes on the recaptured depreciation of $15,000,000. Given a tax rate of 35% and a discount rate of 7%, this tax liability of $5,250,000 (i.e., $15,000,000 × 0.35) in 15 years has a present value of $5,250,000 / $(1.07)^{15}$, or $1,902,842. Thus, the net gain to the taxpayer from being able to deduct depreciation is $3,187,770 – $1,902,842 = $1,284,928.

   (Section 20.1.1)

3. In this case, the investment would grow at:

   After-tax rate without tax deferral = $r \times (1 - TAX) = 8\% \times (1 - 0.30) = 5.6\%$

   A dollar invested for 10 years earning 5.6% per year would grow to $\$1 \times (1.056)^{10} = \$1.7244$ (or $1 + $0.7244) in 10 years.

   (Section 20.1.2)

4. $1 growing for 10 years at 8%, with gains taxed at 30% at the end of 10 years, would grow as follows:
   After-tax rate with tax deferral = $\{1 \times [(1 + r)^T - 1](1 - TAX) + 1\}$

   After-tax future value of \$1 = $\{[\$1 \times (1.08^{10} - 1)(1 - 0.30)] + 1\}$= \$1 + \$0.8113 = \$1.8113

   (Section 20.1.2)

5. In this example, the tax deferral allows accumulation of 12% more profit compared to the previous problem [(\$0.8113 – \$0.7244) / \$0.7244].

   (Section 20.1.2)

6. The general formula for the after-tax rate using an annual taxation of gains that is equivalent to earning *r*% for T years with tax deferral is:

   After-tax rate with tax deferral = $\{1 + [(1 + r)^T - 1](1 - TAX)\}^{1/T} - 1$

   After-tax rate with tax deferral = $\{1 + [(1 + 0.08)^{10} - 1](1 - 0.30)\}^{1/10} - 1 = 6.12\%$

   (Section 20.1.2)

7. Tax deferral of gains has the effect of increasing the after-tax gains from 5.6% to 6.12%.

   (Section 20.1.2)

8. The pre-tax rate equivalent to 6.12% after-tax is found by dividing by (1 – TAX):

   6.12% / (1 – 0.30) = 8.74%. Thus, tax deferral of gains relative to annual taxation of gains is equivalent to being able to earn 8.74% pre-tax rather than 8%.

   (Section 20.1.2)

9. Investor's relationship with real estate managers may be particularly important in this case, because the real estate investor cannot rely on other investors to control and monitor the real estate manager. Compare this situation to the case of public equity investing, where an investor can remain passive in most cases.

   (Section 20.3)

10. A U.S. investor would consider the value of the land in U.S. dollars. Therefore, from the U.S. investor point of view, two years from now the property is expected to be worth:

    $\$C\ 50{,}000{,}000 \times (1 + r)^2 \times (1 + fx)^2 =$
    $\$C\ 50{,}000{,}000 \times (1 + 0.08)^2 \times (1 - 0.05)^2 = USD\ 52{,}633{,}800$

(Section 20.6)

Chapter 21
Farmland and Timber Investments

Exercises

Problems 1 to 6

Pension Fund XYZ is a U.S. pension fund that has only invested in traditional investments up to now. XYZ is considering allocating funds to real estate assets, including farmland and timberland investments. To this end, XYZ hires a consultant to determine the potential diversification benefits of being exposed to farmland and timberland investments. The Pension Fund is also interested in knowing the following specific aspects related to these investments: how their returns are measured, whether these returns are correlated or uncorrelated to changes in inflation and currency fluctuations, the potential effects that on these investments may have world population and diet consumption dynamics, and whether there are benefits to accessing farmland and timberland investments by investing in agriculture-related equities. The consultant has just handed in a report to Pension Fund XYZ addressing these questions.

1. At the beginning of the report, the consultant comments that in NCREIF's farmland index … "*Investment returns are reported on a non-leveraged basis; while there may be properties in the index that have leverage, returns are reported as if there is no leverage*." Is this comment true or false?

2. The consultant states that… "*Empirical evidence suggests that investments in farmland are a good inflation hedge*." Is this statement true or false? Explain.

3. The consultant comments that… "*Empirical evidence suggests that a stronger dollar is associated with decreases in land prices in the U.S.*" Is this statement true or false? Explain.

4. The consultant predicts that… "*It is expected that diets around the world will continue to be shifting towards lower per capita meat consumption, thus causing a decreased demand for feed grains.*" Is this prediction consistent with the literature discussed in the book? Explain.

5. The consultant suggests that… "*It is also possible to access commodity-oriented returns via investment in agricultural companies with listed equities. Agriculture-related equity investments are active at all points in the value chain and have a very low market beta.*" Is the consultant's assertion on the market beta of agricultural equities true or false? Explain.

6. The consultant suggests that… "*Coastal farmland returns have significantly different macroeconomic sensitivities than core farmland in primarily agricultural states.*" Is this comment true or false?

7. Why could currency hedging be particularly costly when a U.S. institution invests in timberland in emerging markets?

Solutions

1. This comment is correct.

   (Section 21.3.1)

2. This statement is true. Farmland is expected to be a hedge against inflation because it is a real asset that is related to food and energy production. Farmland should be a good inflation hedge because its supply is largely inelastic and increasing valuations will lead to relatively marginal increases in supply.

   (Section 21.3.1)

3. This statement is false because empirical evidence shows that a stronger dollar is associated with *increases* in land prices in the U.S. This may be due to a stronger dollar being a proxy for monetary policy, or may be a reflection on both land values and the price of the dollar of the impact of increased external demand for U.S. farm products.

   (Section 21.3.1)

4. This prediction is inconsistent with the literature discussed in the book. The evidence suggests that diets have actually experienced a shift towards *higher* per capita meat consumption. This higher per capita meat consumption throughout the world will increase demand for feed grains. The degree to which this increased demand might not be fulfilled by superior crop yields will create pressure for the expansion of farmland.

   (Section 21.1)

5. This assertion is false. Empirical evidence actually suggests that a significant component of returns to agricultural equity investments is equity market beta. Market risk either needs to be hedged out, or accepted as a significant dilution to the expected benefits of investing in agriculture-related assets.

   (Section 21.2)

6. This comment is true. According to Geman and Martin (2010), one major factor that tends to be present in coastal farmland, and which can partially explain this difference, is urbanization and residential or commercial real estate use value.

(Section 21.3.1)

7. Currency hedging can be costly for two main reasons in the case of timberland investments in emerging markets. First, there is the long-term nature of timberland investments. This first reason also applies to developed markets. And second, investors have the problem that arises from the difficulty of hedging currency risk in a number of emerging markets (e.g.., lack of enough currency derivatives, illiquidity, and transaction costs).

   (Section 21.5)

Chapter 22
Investing in Intellectual Property

Exercises

1. Describe the post-production film stage.

Problems 2 to 5

Four Cats Production, LLC is currently in the pre-production phase of its fifth feature film, a horror movie that is expected to appeal to a wide range of audiences, both in the U.S. and internationally. The company is seeking investors who are interested in investing in the movie, which is scheduled to begin production in May 2013. The company estimates a budget of U.S. $1,000,000 for producing the film. The investment proposal offered by *Four Cats Production, LLC* includes, among others, the assertions commented in the following questions.

2. "*Investors may be aware that the majority of movie productions in the U.S. film industry are profitable*." Is it this assertion true or false? Explain.

3. "*This is a horror movie, and evidence suggests that this is among the least risky of the film genres.*" Is it this assertion true or false? Why?

4. "*We expect that the theatrical exhibition of our production in the U.S. will last for a year."* Is it this prediction reasonable? Why?

5. "*We plan to produce a sequel if the film is successful. Evidence in the film industry suggests that sequels tend to generate greater revenues and have lower risk*?" Is it this assertion true or false? Why?

Problems 6 to 7

6. Suppose that a hedonic pricing model has been estimated for the oil painting prices of a hypothetical artist during a certain period of time using the following equation:
   $P = B_0 + B_1A + B_2Y + B_3DNY + B_4DD$

Where:

P = Price of the painting in US$
A = Total area of the painting (in square inches)

Y = Year in which the auction of the painting took place (e.g., 1990 =1, 1991 = 2, etc.)

DNY = A Dummy variable that takes the value of 1 if the painting was auctioned in New York City and 0 if it was auctioned in London.

DD = A Dummy variable that takes the value of 1 if the painting was executed before 1995 or 0 if it was executed after 1995.

Using Ordinary Least Squares, we get the following estimated equation (p-values in parenthesis):

$$P = 32{,}456 + 17.5A + 84.3Y + 6.1DNY + 133.9DD; \; R^2 = 0.61$$
$$\qquad\qquad (0.043) \quad (0.079) \quad (0.563) \quad\quad (0.098)$$

Interpret the values of the coefficients obtained in the regression.

7. Are the regression coefficients of the variables obtained in the regression statistically significant at 5%?

8. What are the regulatory risks to investing in patents?

9. Describe the available empirical evidence regarding returns on R&D?

Solutions

1. This is the final stage of film production. In this stage, the video/film is assembled by the video/film editor (film editing, scoring, titles and credits, dubbing, special effects, soundtrack music rights or composition) and the film is released to cinemas.

   (Section 22.2.2)

2. It is false. In the case of the film industry, and similar to venture capital, profitability is highly skewed to the right. This means that a small percentage of films have a very high profitability, while the remaining large percentage has little or no profitability.

   (Section 22.5)

3. It is true. Evidence presented in the book suggests that horror movies are the least risky of all genres.
   (Section 22.2.5)

4. This prediction is unreasonable. Evidence suggests that the window of theatrical exhibitions is around six months. One year is too optimistic.

(Section 22.2.1)

5. This assertion is true. According to empirical evidence, sequels are associated with higher revenues and less risk.

   (Section 22.2.4)

6. For every square inch increase in the total area of a painting, the price of the painting increases by $17.5

   For every year increase in the auction date, the price of the painting increases $84.3

   If the auction takes place in New York City, the painting is worth $6.1 more

   If the work of art was executed before 1995, the painting is worth $133.9 more

   (Section 22.3)

7. The only regression coefficient that is significant at 5% is the coefficient that corresponds to the area of the painting (i.e., 0.043 < 0.05 or 5%).

   Neither the coefficient for the year in which the auction of the painting took place nor the coefficient for the Dummy variable that takes the value of 1 if the painting was executed after 1995 are statistically significant at 5%. However, they are both statistically significant at 10% (i.e., 0.10 > 0.079 > 0.05%, and 0.10 > 0.098 > 0.05%).

   The coefficient for the Dummy variable that takes the value of 1 if the painting was auctioned in New York is not statistically significant at 5% (i.e., 0.563 > 0.05).

   (Section 22.3)

8. Patents are government-issued rights, and as such, there always exists the risk that a government either changes the corresponding intellectual property (IP) authority or imposes new regulation on licensing/sales activities.

   (Section 22.4.7)

9. Empirical evidence suggests that the private returns to R&D are positive and greater to those of other forms of capital investment.

   (Section 22.4.1)

Reading 2, Article A
Infrastructure as an Asset Class

The article discusses how investors can now allocate assets to infrastructure investments, which include transportation, utility, communications, energy, and educational assets, among others. There are questions, however, such as whether infrastructure investments comprise a distinct asset class, and whether investments should be made in private equity-like vehicles or in publicly traded stocks. Investors may allocate to infrastructure as a separate asset class, or embed infrastructure within other categories, such as real assets, private equity, or real estate.

Some investors have very specific goals for their infrastructure investments, which require those assets to exhibit five stylized economic characteristics. Those characteristics, when present, may allow infrastructure to offer attractive risk-adjusted returns as well as a hedge against inflation.

This article includes an overview of infrastructure investment vehicles, and the types of investors that have historically included infrastructure in their asset allocation. The risk-return profiles of public and private infrastructure investments are presented. Benchmarking and historical returns are discussed, and infrastructure returns and risk are compared to other investments in the real estate and private equity sectors. Evidence on inflation protection and portfolio diversification is explored.

Exercises

1. Indicate the key risks that are present at the level of infrastructure projects and companies.

Solutions

1. The following are the key risks that are present at the level of infrastructure projects and companies:

    - Construction risk;
    - Business risk (demand, supply factors);
    - Operational and management risk;
    - Leverage, interest rate risk;
    - Legal and ownership risk;
    - Refinancing risk;
    - Regulatory risk (fees, concessions);
    - Environmental risks;
    - Political and taxation risks; and
    - Social risks (e.g., opposition from pressure groups, corruption)

    (Pages 42-76)

Reading 2, Article B
Timberland Investments: A Primer (Updated)

This article discusses timberland investment, and how investors seek to profit from investing in forests. In addition to earning competitive risk-adjusted returns, timberland investors also seek to hedge inflation and reduce portfolio volatility. Biological fundamentals and global demographics can explain the optionality and low correlation of timber investments to other alternative and even traditional assets. Some investors may also have environmental or social goals for their timberland investments.

While there are many advantages to timber investments, some investors are concerned about the size of the market and the long-term and illiquid nature of these investments. Of course, investment vehicles differ along these dimensions depending on if they are publicly traded, direct investments, commingled funds, or separate accounts.

The biology and geography of timber is also explored, as different species of trees have different growth rates depending on their location within North or South America, Central and Eastern Europe, Asia, Africa or Oceania. The value of logs is based on their geography, size and final use. Similar to real estate properties, timberland investments can be valued using comparable sales, cost, and net present value approaches.

Exercises

1. From an investment attribute (or portfolio fit) standpoint, what are the key features of timberland that attract investors?

Solutions

1. Investors are attracted to timberland for the following four motivations: (1) portfolio fit, (2) intrinsic attributes, (3) positive market fundamentals, and (4) soft values. This question asks about the first of these motivations. From an investment attribute or portfolio fit standpoint, timberland offers three attractive features:

    i. Competitive risk-adjusted returns. Timberland has historically offered attractive average returns relative to its volatility, and its performance compares favorably with those of equities, fixed income and several other leading asset classes.
    ii. Inflation hedging. Real assets, including timberland, are known to be potential inflation hedges. In the case of timberland, wood-based products are used in many sectors within the global economy. The study demonstrates that five-year returns of the NCREIF Timberland Index are closely related with U.S. inflation over corresponding periods.
    iii. Diversification through low return correlations. Timberland investment returns have low correlations with many other asset classes. Consequently, timberland can help provide portfolio-level diversification.

    (Pages 77-105)

Topic 4: Commodities

Readings

1. *CAIA Level II: Advanced Core Topics in Alternative Investments*, Wiley, 2012, ISBN: 978-1-118-36975-3. Part Four: Commodities, Chapters 23–28.
2. *CAIA Level II: Core and Integrated Topics*. Institutional Investor, Inc., 2015. ISBN: 978-1-939942-02-9. Part III: Investment Products: Commodities
   A. Gorton, G. and K.G. Rouwenhorst. "Facts and Fantasies about Commodity Futures." *Financial Analysts Journal*, March/April 2006, Vol. 62, No. 2, pp. 47-68.
   B. Erb, C. and C. Harvey. "The Strategic and Tactical Value of Commodity Futures." *Financial Analysts Journal*, March/April 2006, Vol. 62, No. 2, pp. 69-97.
   C. Irwin, S.H. and D.R. Sanders. "Financialization and Structural Change in Commodity Futures Markets." *Journal of Agricultural and Applied Economics*, August 2012, Vol. 44, No. 3, pp. 371–396

Reading 1, Chapter 23
Key Concepts in Commodity Market Analysis

Exercises

1. Why does the primary focus on commodity investments tend to be on commodity futures markets?

2. What are the differences between real assets and financial assets?

3. What effect do speculators in commodity markets have on liquidity?

4. What is convenience yield?

5. Suppose the following example of a commodity. The spot price per bushel is $10.50. The total storage cost per bushel per month is as follows:

   Storage costs/Month: $0.08
   Insurance/Month: $0.03
   Spoilage rate/Month: 0.50%
   Financing rate/Month: 0.50%

   The transport costs to and from storage are $0.05 each. What would be the total cost of carry for four months, assuming round trip transportation costs and ignoring commissions and transactions costs? What would be the corresponding break-even futures price?

6. Suppose that the spot price of gold is $1,500 per ounce; the futures price of gold for delivery in six months is $1,600 per ounce, and interest rates are 0.50% per month. Assume that the only carrying costs are the financing costs. There are no transactions costs. Describe in detail how to structure a successful arbitrage.

7. Suppose that the spot price of gold is $1,500 per ounce; the futures price of gold for delivery in six months is $1,500 per ounce, and interest rates are 0.50% per month. Assume that the only carrying costs are the financing costs. There are no transactions costs. Describe in detail how to structure a successful arbitrage.

8. Briefly explain the three main theories about the shape of commodity forward curves.

Solutions

1. The primary focus on commodity investments tends to be on commodity futures markets for two equally important reasons. First, the majority of commodity investments are directly or indirectly conducted through futures and forwards. Second, futures markets are the primary venue for price discovery in most commodity markets.

   (Section 23.1)

2. Real assets, also called economic assets, can be used or consumed. They are tangible assets with intrinsic value that offer a reasonable expectation of inflation protection. Commodities, real estate, factories, patents, certain types of real options, and human capital are examples of real assets. There are two types of real assets: durable and non-durable. Durable assets are employed in the production of wealth, but are not consumed in the process. Materials are used during production and can be either durable or non-durable.

   Financial assets are claims on the income that is derived from the use of certain real assets. A financial asset may also have an ownership claim on the real assets themselves. For example, the stockholders of an airline company are entitled to share in the income generated by using real assets such as airplanes, jet fuel, and peanuts. If the airline company owns the airplanes, the stockholders will also share in the profits or losses when airplanes are sold.

   (Section 23.2)

3. Speculators in commodity markets play an important economic function because their investment adds liquidity to the market, which makes it easier for other participants to manage risk.

   (Section 23.3)

4. Convenience yield is the benefit that comes from physical possession of an asset. It is an economic benefit, not a monetary benefit. It is a measure of the *convenience* of having an asset available to use. It can also be regarded as a measure of how much a buyer would pay to avoid the inconvenience of constantly ordering new quantities of an asset and worrying that the supply of the asset will not arrive when needed. Convenience yields vary with the level of inventories. As inventories decline, the convenience yield rises, as consumers will pay more to ensure adequate supplies to operate their businesses.

   (Section 23.4)

5. The total monthly cost/Bushel is equal to: \$0.08 + \$0.03 + (\$10.50 × 0.50%) + (\$10.50 × 0.50%) = \$0.215. The total storage costs for 4 months would be: \$0.86 (\$0.215 × 4). Adding the round trip transportation costs, the total costs of carry are: \$0.96 (\$0.86 + \$0.10). Therefore, the break-even futures price (spot + carry) is equal to \$11.46 (\$10.50 + \$0.96).

   (Section 23.5)

6. In this case Futures price > Spot price × (1 + Cost of carry). This is an example of a cash-and-carry arbitrage.

   In t = 0: Borrow \$1,500 for six months at 0.50% per month and purchase an ounce of gold in the spot market for \$1,500. Simultaneously, sell a futures contract for the delivery of gold in six months for \$1,600. The total cash flow is \$0.

   In t = six months: Deliver the ounce of gold purchased in t = 0 against the futures contract. The arbitrageur would receive \$1,600 and repay the loan (\$1,500) and interest (\$1,500 × 0.5% × 6 months = \$45), for a profit of \$55.

   (Section 23.5)

7. In this case Futures price < Spot price × (1 + Cost of carry). This is an example of a reverse cash-and-carry arbitrage.

   In t = 0: Short sell an ounce of gold in the spot market for \$1,500 and deposit the proceeds for six months at 0.50% per month. Simultaneously, buy a futures contract for the delivery of gold in six months for \$1,500. The total cash flow is \$0.

   In t = six months: The deposit would have grown to \$1,545 [initial deposit of \$1,500 plus interest (\$1,500 × 0.5% × 6 months = \$45)]. The arbitrageur would pay \$1,500 for the delivery of an ounce of gold by the party having the short futures contract position and then use that ounce of gold to repay the short sale, for a profit of \$45.

   (Section 23.5)

8. The theories for why commodity forward curves slope up or down are similar to theories proposed to explain why yield curves slope up or down.

   The Rational Expectations Hypothesis holds that the price of an asset for delivery in the future must be the same as the market's current forecast of the spot price of the asset on the future delivery date.

   Normal backwardation is the tendency of commodity futures contracts to trade at prices below the rational expectations price. Keynes argued in 1930 that commodity futures prices should typically be lower than the rational expectations prices defined in the Rational Expectations Hypothesis.

The Preferred Habitat Hypothesis holds that producers of bonds (borrowers) prefer long maturities, while consumers of bonds (lenders) prefer short maturities. Producers offer attractive yields, which would mean low bond prices, to entice borrowers to extend their maturity, or to induce speculators to borrow at short maturities and lend at long maturities.

(Section 23.6)

Chapter 24
Role of Commodities in Asset Allocation

Exercises

1. What does empirical research suggest regarding the portfolio benefits of commodity investments?

2. What are the factors that affect spot returns in the cases of energy, agricultural commodities, and base metals? Do spot commodity prices tend to mean-revert?

3. Is the following statement correct? "*Roll return is a profit or loss occurring at the time of the contract roll.*" Explain.

4. Is the following statement correct? "*There is ample evidence suggesting that the long-run real return to spot commodity investments has been positive*." Explain.

5. Is the following statement correct? "*Even if spot returns are zero, an investor might generate positive returns if a futures contract market is in backwardation*." Explain.

6. Comment on the following statement. "*All things being equal, an increase in commodity price volatility will cause the magnitude of the (positive or negative) risk premium to increase.*"

7. Do empirical studies suggest that commodity markets are weak-form efficient?

8. What do empirical studies suggest regarding the correlation of commodity sectors with each other (e.g., the correlation between energy sector and non-energy sector commodities)?

9. Are commodity investments good hedges against event risk?

10. Do the correlations of commodity futures with stocks and bonds tend to become more positive, more negative, or remain the same as holding periods increase?

Problems 11 to 12

Raymond Marceau is in charge of recommending commodity investments to *Athens Fund*, an endowment that, at present, has allocations only to traditional asset classes. The current portfolio of *Athens Fund* consists of diversified investments in fixed-income securities and stocks. Mr. Marceau has collected the following information on commodities, U.S. stocks, U.S. bonds, and U.S. inflation for the period 2001-2007:

(2001-2007)	Commodities Composite Commodity Index*	Stocks S&P 500 Total Return Index	Bonds Lehman U.S. Aggregate
Average Return	10.50%	3.30%	5.80%
St. Deviation	15.70%	13.30%	3.60%

CORRELATION MATRIX	
	Commodities
Stocks	0.03
Bonds	-0.05

CORRELATION MATRIX	
	Monthly Inflation (CPI) Changes
Stocks	0.02
Bonds	0.02
Commodities	0.31

* It was calculated as the average of the performances of BCI, GSCI and DJ-AIG indexes

Mr. Marceau noticed that commodities provided the highest return of the three asset classes, but he is concerned that the standard deviation of the commodities' return is higher than the standard deviation of the return of either stocks or bonds. This led him to question whether to add commodities to the traditional portfolio of stocks and bonds at all. Mr. Marceau would also like to assess whether commodities provide a better inflation hedge than stocks or bonds and would like to examine the long-term performance of commodities investments.

11. Discuss Mr. Marceau's fear on the benefits of adding commodities to a traditional portfolio in the context of asset allocation.

12. Based on the information provided, discuss the inflation-hedging capabilities of commodities.

Solutions

1. Since the 1970s, a steady evolution of academic research has shown that commodity investment is a good inflation hedge, and at the same time can also provide a profitable source of returns on its own. Furthermore, literature suggests that adding commodities to a portfolio can help reduce portfolio volatility.

   (Section 24.1)

2. Spot returns are influenced by factors that can be the result of seasonal issues like weather or driving patterns for energy; weather patterns or crop sizes for agricultural commodities; and growth in real demand for base metals.
   Empirical evidence suggests that spot commodity prices tend to mean-revert over longer time horizons.

(Section 24.3.1)

3. The above statement is incorrect. Roll return, which is defined as the portion of the return of a futures contract that is due to the change in the basis, accrues over time (i.e., from the time the investor goes long the futures contract to the time of the roll). This is very similar to the case of a bond coupon.

   (Section 24.3.1)

4. The above statement is incorrect, the long-term performance of real spot prices remain inconclusive. While spot commodity returns have been positive in nominal terms over the past century, the inflation-adjusted spot returns offered by many commodities have actually been negative. Over the past century, there have been extended periods of rising commodity prices (such as the period confined by the past two decades), as well as long periods of declines.

   (Section 24.4)

5. The above statement is correct. Collateralized commodity futures returns can be decomposed into the spot return, the collateral return, and the roll return. Therefore, an investor might generate positive returns if a futures contract market is in backwardation, even if spot returns are zero, by rolling from high-priced to low-priced contracts and riding the term structure.

   (Section 24.4)

6. The above statement is correct. During periods of positive risk premium, a volatility shock will cause the risk premium to rise. In periods of negative risk premium, the risk premium would be expected to decline in response to a volatility shock.

   (Section 24.4)

7. Commodity markets do not seem to be weak-form efficient. Researchers have found that simple trading rules based on storage or momentum are able to deliver excess returns after adjusting for transactions costs.

   (Section 24.4)

8. Empirical evidence suggests that commodities have a low, and oftentimes even negative, correlation with each other. Therefore, commodities can offer uncorrelated investment opportunities across various commodity markets. This finding can be explained as follows. Energy sector commodities are often negatively correlated to non-energy sector commodities, because higher energy prices can weigh on economic growth and therefore slow down demand for other commodities.

(Section 24.4)

9. The evidence suggests that commodity investments are good hedges for event risk. The reason for this is that, whereas equity prices tend to be impacted negatively by political or economic distress and by natural disasters, commodity prices usually react positively to such incidents. This characteristic of commodity returns is advantageous for investors because it results in further reduced correlations between stocks and commodities in periods of market stress or crisis, which is precisely when diversification benefits are most desired.

   (Section 24.5.1)

10. The empirical evidence suggests that the correlation of commodity futures with stocks and bonds, which tends to be negative, also tends to become more negative as the holding period increases. This pattern suggests that the potential benefits of diversification provided by commodity futures may only be realized at longer horizons.

    (Section 24.5.2)

11. One must take into consideration the correlation between commodities and the existing portfolio allocation and not just the stand-alone standard deviation of the returns of an asset when making assessments regarding new allocations.

    (Section 24.5)

12. The evidence presented suggests that commodities offer a better inflation hedge than stocks or bonds.

    (Section 24.5)

Chapter 25
Methods of Delivering Commodity Alpha

Exercises

1. What is the difference between directional strategies and relative value strategies? Explain briefly.

2. What is the difference between fundamental directional strategies and quantitative directional strategies?

Problems 3 to 5

Assume the following scenario. In April, a spreader observes contango in the crude oil forward curve. July and December light sweet crude oil futures on the NYMEX are trading at $55.45 and $62.27, respectively. The size of the NYMEX light sweet crude oil

contract is 1,000 barrels. The spreader anticipates a flattening of the curve and narrowing of the spread between the two maturities.

3. What positions (long or short) should she take in July and December light sweet crude oil futures?

4. Assuming that the spreader takes a position of long 5 July contracts and short 5 December contracts, and that in July an oversupply of crude in the world markets causes the price of the August contract to decline to $45.33, while the December contract declines to $49.03. Calculate the total gain (loss) of the spread.

5. Assuming that the spreader takes 5 long July positions and 5 short December positions, and that in May political turmoil in oil producing countries causes the price of the July contract to increase to $63.08 and the December contract to increase to $69.63, calculate the total gain of the spread.

Problems 6 to 9

These problems have been partially adapted from NYMEX's publication Crack Spread Handbook (2001). Suppose that an independent refiner is worried about the possibility of increasing oil costs (input) and falling refined product (heating oil and gasoline) prices (output). The refiner will use a crack spread to hedge this risk.

On June 17, the refiner enters an obligation in the cash market to buy 60,000 barrels of crude oil on July 15 at prevailing market prices. The refiner has also entered an obligation to sell 840,000 gallons (20,000 barrels) of heating oil and 1,680,000 gallons (40,000 barrels) of gasoline on August 28 at prevailing market prices. August crude oil futures contracts are trading at $87.54/bbl., September heating oil contracts are trading at $110.05/bbl. and September gasoline futures contracts are trading at $108.31/bbl. Each one of these contracts is for the equivalent to 1,000 barrels. In the cash market, crude oil is trading at $88.10/bbl., gasoline at $2.6181 per gallon, and heating oil at $108.94/bbl. 42 gallons of gasoline are equivalent to one barrel of gasoline.

6. Which positions in crude oil futures, heating oil futures and gasoline futures contracts should the refiner take on June 15 through a 3:2:1 crack spread?

Note: Remember that a 3:2:1 crack spread means that 3 barrels of oil are used to produce 2 barrels of gasoline and 1 barrel of heating oil.

7. Calculate the futures crack spread.

8. Calculate the cash market margin.

9. On July 16, crude oil futures prices fall to $87.05, distillates increase (heating oil to $113.43/bbl. and gasoline futures to $112.87/bbl.), the basis remains stable, and the refiner puts on the spread. In the cash market, crude oil prices are $87.05/bbl., gasoline is

trading at $2.6755 per gallon, and heating oil is trading at $113.02/bbl. 42 gallons of gasoline are equivalent to one barrel of gasoline. Calculate the futures crack spread, the futures profit, the NY Harbor cash market margin, and the realized margin.

Solutions

1. Directional strategies convey a view on market direction, and thus consist in either long or short positions. Relative value strategies try to identify overpriced and underpriced securities, while hedging away some or all of the market exposure.

   (Section 25.1)

2. Fundamental directional strategies are supported by an examination of supply and demand factors for commodities or commodity sectors. They can be based on macroeconomic factors (e.g., economic growth, interest rate forecasts, and currency forecasts) or on industry-specific factors (e.g., number of cattle in feed lots). Quantitative directional strategies use technical analysis or quantitative models to attempt to identify mispriced commodities.

   (Section 25.2)

3. The spreader should go long July and short December light sweet crude oil futures.

   (Section 25.3.1.1)

4. The loss on the long August contract is: -$55.45 + $45.33 = ($10.12)
   The gain on the short December contract is: $62.27 - $49.03 = $13.24
   Total gain on the spread: $3.12

   The total gain of the spread is:

   Position P&L = P&L barrel × Contract size × Position size

   = $3.12 × 1,000 × 5 = $15,600

   (Section 25.3.1.1)

5. The gain on the August contract is: -$55.45 + $63.08 = $7.63
   The loss on the December contract is: $62.27 - $69.63 = ($7.36)
   Total gain on the spread: $0.27

   The total gain of the spread is:

   Position P&L = P&L barrel × Contract size × Position size

   = $0.27 × 1,000 × 5 = $1,350

(Section 25.3.1.1)

6. On June 17, the refiner should initiate a long position in crude oil and short positions in heating oil and gasoline to fix a substantial portion of his refining margin through a 3:2:1 crack spread. He does this by going long 60 August crude oil futures contracts at $87.54/bbl., while selling 20 September heating oil contracts at $110.05/bbl. and 40 September gasoline futures contracts at $108.31/bbl.

   (Section 25.3.1.2)

7. The futures crack spread is calculated as:

   [(Number of gasoline futures contracts sold short × Gasoline futures price) + (Number of heating oil contracts sold short × Heating oil futures price) – (Number of long crude oil contracts × Crude oil futures price)] / Total number of crude oil contracts. Thus, the futures crack spread on June 17 is:

   [(40 × $108.31) + (20 × $110.05) − (60 × $87.54)]/60 = $21.35/bbl.

   (Section 25.3.1.2)

8. The cash market margin is calculated as:

   [(Number of gasoline contracts sold short × Gasoline cash market price) + (Number of heating oil contracts sold short × Heating oil cash market price) – (Number of long crude oil contracts × Crude oil cash market price)] / Total number of crude oil contracts. Thus, the NY Harbor cash market margin is:

   [(40 × $109.96) + (20 × $108.94) − (60 × $88.10)]/60 = $21.52/bbl.

   Note: The gasoline contract price per barrel of $109.96 was found multiplying the gasoline price of $2.6181 per gallon by 42 gallons of gasoline per barrel.

   (Section 25.3.1.2)

9. Futures crack spread: [(40 × $112.87) + (20 × $113.43) − (60 × $87.05)]/60 = $26.01/bbl.

   Futures loss = Initial crack spread − Closing crack spread = $21.35 − $26.01 = -$4.66/bbl.

   NY Harbor cash market margin: [(40 × $112.37) + (20 × $113.02) − (60 × $87.05)]/60 = $25.54/bbl.
   Realized margin: Cash margin + Futures loss = $25.54 - $4.66 = $20.88/bbl.

In this scenario, the refiner would be over hedged, and the hedge would have eliminated the potential gain.

(Section 25.3.1.2)

Chapter 26
Methods of Delivering Commodity Beta: Indices, Swaps, Notes, and Hedge Funds

Exercises

1. Define the return to commodity beta.

2. What is the primary benefit of obtaining commodity exposure through derivatives contracts, rather than direct physical ownership?

3. What is the primary vehicle used by institutional investors to obtain indirect commodity exposure?

4. In the context of obtaining commodity exposure, what are three major drawbacks of over-the-counter commodity index swaps?

5. Explain why equity of firms that derive a significant part of their revenue from the sale of physical commodities might offer weak exposure to the underlying commodities?

6. Explain why high grade bonds of commodity producing firms offer weaker exposure to commodities than high yield bonds of commodity producing firms?

7. What is the principal advantage of master limited partnership (MLP) structures in obtaining commodity exposure?

8. State four ways how commodity-based exchange traded notes (ETNs) are different from commodity-based exchange traded funds (ETFs).

9. Many index-linked notes offer leveraged exposure to commodity indices (i.e., three-times-leverage products). Describe the implicit option that an investor into such notes enjoys and contrast this to the bond positions issuers of such notes typically take.

10. Why are principal-guaranteed commodity-linked notes unpopular with institutional investors?

11. Relative to the first generation commodity indices, what are the main distinguishing characteristics of second and third generation commodity indices?
12. Define roll return in the context of commodity futures investments.

13. In the context of commodity index methodology, why is futures curve positioning important?

14. What part of commodity index methodology tends to have the largest impact on index returns?

Solutions

1. The return to commodity beta is defined as the fundamental risk-based return from holding a passive long position in a commodity.

   (Section 26.1)

2. The primary benefit of obtaining commodity exposure through derivatives contracts is the ability to benefit from price changes in the commodity without the need to store it.

   (Section 26.2)

3. The primary vehicle used by institutional investors for obtaining exposure to commodity indices is commodity index swaps.

   (Section 26.3)

4. The main drawbacks of commodity index swaps are:

   - Limited access: commodity index swaps are available only to large, highly credit-worthy investors
   - Limited exit: the secondary market for commodity index swaps is not liquid
   - Additional risks: swaps experience greater counterparty risk than commodity futures markets

   (Section 26.3.1)

5. Many of such firms hedge their principal commodity exposures, which can significantly affect the degree of commodity exposure the firm provides to investors. Furthermore, there is evidence that commodity producers engage in selective hedging, in which they actively alter their hedge ratios based on their view of future commodity prices.

   (Section 26.3.2)

6. High grade bonds of commodity producing firms have low sensitivity to the underlying commodity markets. High yield bonds, where the default or political risk is high, are more correlated with the commodities produces by the issuing firms.

   (Section 26.3.3)

7. The principal advantage of master limited partnership (MLP) structures is in avoiding corporate taxation. Income from qualifying MLPs is distributed directly to investors.

(Section 26.3.5)

8. The four ways are:

   i. ETNs are zero coupon instruments
   ii. The return to the ETN is subject to the credit-worthiness of the issuer
   iii. The price of the ETN is based on a contractually designated relationship with the underlying index
   iv. ETNs may qualify for capital gains tax treatment if held for a sufficiently long period of time

   (Section 26.3.6)

9. The investor enjoys an implicit protective put through the limited liability of the notes, since the price of the note cannot become negative. However, the issuer typically purchases option protection against declines in commodity price that can force the issuer lose more than 100% of the note value.

   (Section 26.4)

10. Steep declines in commodity prices will cause the issuers of principal-guaranteed commodity-linked notes to shift 100% out of commodities into bonds. This feature of principal-protected notes ensures that the investor will not lose principal, but if the notes are shifted into bonds, the investor won't be able to benefit from the diversification properties of commodities. For example, investors holding notes that were shifted into bonds during 2006 would have missed out on the commodity bull market in 2007 and 2008.

    (Section 26.4)

11. Second- and third- generation enhanced indices have been developed in an attempt to provide a number of developments such as:

    - Unique roll methodologies
    - Unique weighting methodologies
    - Enhanced rebalancing methodologies
    - Rules-based trading strategies

    (Section 26.5)

12. Roll return, or roll yield, is the portion of the return to a futures contract that is due to the change in basis.

    (Section 26.6)

13. Since forward curves of commodities are generally non-linear, the impact of contango or backwardation on returns can vary significantly due to the choice of curve positioning strategy. In other words, sensitivity of the return of a futures contract to the shape of the

forward curve can vary depending on whether we are closer to the short-end or the long-end of the curve.

(Section 26.7)

14. Perhaps the largest impact on commodity index returns comes from weighting methodology. A weighting methodology determines the degree of diversification or concentration on particular commodities or sectors. Weighting methodologies can also incorporate active weights, as well as short positions for long/short or short-biased indices.

(Section 26.7)

Chapter 27
Macroeconomic Determinants of Commodity Futures Returns

Exercises

1. Why do higher interest rates cause commodity prices to decline? (Hint: Argue in terms of the effects of interest rates on economic conditions and storage costs)

Problems 2 to 4

Exhibit 27.4, which is reproduced below, shows the results of regressing commodity returns on the two components of inflation (expected and unexpected) according to the following equation:

$$R_t = \beta_0 + \beta_1 E(\pi_t) + B_2\big(\pi - E(\pi_t)\big) + e_t \qquad (27.1)$$

Where: R_t is the return of the respective S&P GSCI commodity excess return index, β_0 is a constant, $\beta_1 E(\pi_t)$ is the expected inflation, $B_2\big(\pi - E(\pi_t)\big)$ is the remaining unexpected inflation, and e_t is an error term.

Exhibit 27.4 Regression Results for the Inflation Hedging Property

Index	U.S. Inflation			EU Inflation			Asian Inflation		
	β_0	β_1	β_2	β_0	β_1	β_2	β_0	β_1	β_2
Composite	-0.439	2.859[a]	5.532[a]	0.295	-0.021	2.335[c]	0.353	-0.137	-0.321
	(-1.307)	-2.833	(6.329)	(0.569)	(-0.022)	(2.805)	(1.183)	(-0.373)	(0.257)
Agriculture	-0.063	-1.103	0.198	-0.785	0.903	-0.718	-0.601[c]	0.479	0.095
	(-0.156)	(-0.901)	(0.186)	(-1.310)	(0.816)	(-0.688)	(-1.770)	(1.151)	(0.296)
Energy	-1.393[c]	7.601[a]	12.699[a]	-0.977	3.114	9.249[a]	1.105c	-1.141	-1.303[c]
	(-1.909)	(3.469)	(6.691)	(-0.881)	(1.520)	(4.879)	(1.701)	(-1.431)	(-2.119)
Industrial Metals	0.490	0.236	2.274[c]	1.469[c]	-1.896	-0.641	0.122	0.852	0.556
	(0.945)	(0.151)	(1.686)	(1.918)	(-1.341)	(-0.481)	(0.281)	(1.604)	(1.356)
Livestock	-0.311	1.637	0.104	0.133	-0.057	-0.365	0.198	-0.164	-0.075
	(-0.832)	(1.460)	(0.107)	(0.810)	(0.955)	(-0.380)	(0.633)	(-0.426)	(-0.254)
Precious Metals	-0.248	-0.276	2.033[c]	0.783	-2.271[b]	-0.679	-0.294	-0.096	-0.143
	(-0.615)	(-0.228)	(1.933)	(1.312)	(-2.060)	(-0.654)	(0.339)	(-0.230)	(-0.446)

Note: a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively.

2. What is the relationship between expected and unexpected U.S. inflation and the composite commodity index? Between expected and unexpected U.S. inflation and the livestock index?

3. What is the relationship between expected and unexpected European inflation and the commodity composite index? Between expected and unexpected European inflation and the agriculture index?

4. What is the relationship between expected and unexpected Asian inflation and the commodity composite index? Between expected and unexpected Asian inflation and precious metals?

5. Commodity prices tend to be dollar-denominated. What is the typical effect of a general depreciation of the U.S. dollar on commodity prices?

6. Why is the supply of non-storable commodities fixed in the short run?

7. Briefly explain the behavior that commodity prices usually exhibit during the different phases of the business cycle.

8. Why do many commodities such as agriculture, industrial metals, and livestock, show less negative returns during strong recessions than during weak recessions?

Solutions

1. First, higher interest rates can directly lower commodity prices because of the negative effect that they have on economic conditions in general, and on the demand for commodities in particular. Second, commodity prices can also decline because higher interest rates cause an increase in storage costs.

   (Section 27.3)

2. A positive and statistically significant relationship between expected and unexpected U.S. inflation and the composite commodity exists. On the other hand, the relationship between expected and unexpected U.S. inflation and the livestock index is not statistically significant.

   Also, it can be noted that for the composite commodity index, the effect of unexpected inflation is much larger than for expected inflation. Therefore, the hedging property of commodities is much higher when inflation is unexpected. It is the hedge against unexpected inflation that makes commodities particularly valuable.

   (Section 27.1)

3. In the case of European inflation, a positive and statistically significant relationship exists between unexpected European inflation and the composite commodity index. The inflation hedging property holds for unexpected inflation, but not for expected inflation. The relationship between expected and unexpected European inflation and the agriculture index is not statistically significant.

   (Section 27.1)

4. In the case of Asian inflation, the relationship between expected and unexpected Asian inflation and the commodity index composite and between expected and unexpected Asian inflation and precious metals is not statistically significant.

   (Section 27.1)

5. A general depreciation of the dollar typically causes an increase in commodity prices, which are dollar-denominated. In theory, this is because commodity exporters from countries for which the national currency is not the U.S. dollar demand a higher price in return for the exchange rate loss, and vice versa. However, not all commodities are affected in the same magnitude.

   (Section 27.2)

6. The supply of non-storable commodities is fixed in the short-run because investment in commodity production can take years. Only in the long-run do further investments in commodity infrastructure lead to an increase in their supply.

   (Section 27.2)

7. At the beginning of a recession, unemployment increases, consumer demand falls, and wages increase less than under normal circumstances, or even decline. Demand for commodities is low, which reduces commodity prices. Once the central banks realize the economy is in a recession, they would typically reduce real interest rates, and commodity

prices are expected to increase again, as long as the market perceives that the economy will begin to improve in the near future.

In a period of strong expansion, consumer demand is high; unemployment is low, and wages increase more than under normal circumstances. This causes an increase in inflation, which, in turn, raises commodity prices (as long as commodities exhibit the inflation hedging property). As the demand for commodities increases during the economic expansion (most commodities are required as inputs to firms' production), an increase in inflation is observed and the central bank is induced to raise real interest rates so as to prevent the economy from overheating. With a lag of several months, the higher real interest rate lessens the demand for commodities, leading to a decline in commodity prices.

(Section 27.3)

8. It is argued that this empirical finding, which is documented in Exhibit 27.10, could be due to the effect of lower real interest rates during periods of recession. During periods of strong recession, lower real interest rates might induce some investors to shift part of their capital into commodities. In this case, the lower demand for commodities during those periods is partly compensated for by the gain in the relative attractiveness of commodities.

   (Section 27.3)

Chapter 28
Effective Risk Management Strategies for Commodity Portfolios

Exercises

1. Consider the example of front-month equivalents (FME) of NYMEX heating oil (HO) and NYMEX unleaded gasoline (UNL), shown in Exhibit 28.5 in the book, which is reproduced here:

   Exhibit 28.5 FME of NYMEX Heating Oil and NYMEX Unleaded Gasoline

Month	NYMEX WTI		NYMEXHO		NYMEXUNL		Total	Total
	delta (bbl.)	position (bbl.)	delta (bbl.)	position (bbl.)	delta (bbl.)	position (bbl.)	delta (bbl.)	position (bbl.)
Total	366,507	500,000	11,813	11,905	-11,813	-11,905	366,507	500,000
FME	366,507	-	11,813	-	-11,882	-	366,438	-
Jan-06	366,507	500,000	11,813	11,905	-	-11,905	378,320	500,000
Feb-06	0	-	0	-	-11,813	-	-11,813	-

Source*:* Data from Kiodex Risk Workbench

Assuming FME of 11,813 heating oil barrel equivalents and FME of 11,882 short unleaded gasoline barrel equivalents, and considering a $2.00 per gallon change in price for both heating oil and unleaded gasoline, calculate the resulting change in the net asset value assuming that the correlation between the price of heating oil and unleaded gasoline is +1.

2. Repeat the previous problem, but now assume that the correlation between the price of heating oil and unleaded gasoline is -1.

Problems 3 to 4

ABC Fund is a hedge fund dedicated to the energy sector. The fund invests in three strategies: directional speculation, speculation on spreads, and speculation on implied volatility. Hypothetical positions in each of the strategies for January 2006 contracts are shown in the following Exhibit. For each of the strategies, the change in mark-to-market (MTM) for different days is calculated. For the volatility strategy, the change in MTM is further broken down between changes in the forward curves and changes in implied volatilities. The returns are calculated on capital invested (i.e., the margin required) to open these positions on NYMEX. The capital invested was $810,000; $145,238; and $847,500 for the outright forwards position, the speculation on spreads and the speculation on options forwards, respectively. The standard deviations were 37.62%, 9.71%, and 39.61% for the outright forwards position, the speculation on spreads, and the speculation on options forwards, respectively.

Exhibit *ABC Fund*'s Forward and Volatility Strategies

	Changes Due to Directional and Spread Speculation		Changes Due to Implied Volatility Speculation	
	Directional	Spread	Option Forward	Option Volatilities
11/30/2005	203,543	1,439	-34,276	1,294
12/1/2005	-145,459	-4,563	300,002	-8,321
12/2/2005	321,765	-3,001	350,564	-20,349
12/5/2005	198,529	10,432	201,561	-15,826
12/6/2005	-101,346	-5,49	102,543	-1,982
12/7/2005	723,481	-9,872	-456,542	-16,762
12/8/2005	234,543	1,234	450,093	2,907
12/9/2005	287,443	-5,543	-432,568	5,782
12/12/2005	-542,901	10,342	765,911	16,532
12/13/2005	201,432	18,453	129,996	2,569
12/14/2005	121,965	14,349	-248,954	6,836
12/15/2005	-652,119	-2,584	-321,347	—

3. Calculate the total profit and loss for each investment, the return on capital and the return on standard deviation.

4. Interpret the results obtained in the previous problem. Were the profits in the volatility strategy due mainly to changes in the forwards curve or to volatility? Comment on the spread and directional strategies dynamics.

Solutions

1. The FME of 11,813 long heating oil barrel equivalents and FME of 11,882 short unleaded gasoline barrel equivalents can be shocked in a matrix, as illustrated in the following Exhibit, which is similar to Exhibit 28.6 in the book. This process allows a firm to examine the associated changes in net asset value.

   Exhibit: Price Changes Affecting Net Asset Value

		$2.00
Price Change Scenario	FME	Correlation 1
NYMEX Heating Oil	11,813	23,626
NYMEX Unleaded Gasoline	(11,882)	(23,764)
Change in the Net Asset Value		($138)

   The resulting change in the net asset value is ($138).

   (Section 28.3)

2. Once again, the FME of 11,813 long heating oil barrel equivalents and FME of 11,882 short unleaded gasoline barrel equivalents can be shocked in a matrix, as illustrated in the following Exhibit, which is similar to Exhibit 28.6 in the book. This process allows a firm to examine the associated changes in net asset value.

   Exhibit: Price Changes Affecting Net Asset Value

		$2.00
Price Change Scenario	FME	Correlation -1
NYMEX Heating Oil	11,813	(23,626)
NYMEX Unleaded Gasoline	(11,882)	(23,764)
Change in the Net Asset		$(47,390)

   The resulting change in the net asset value is $(47,390). A correlation of -1 is highly unlikely because it assumes that the price of heating oil and unleaded gas will move in opposite directions.

   (Section 28.3)

3. The following table shows the respective computations

	Changes due to directional and		Changes due to implied volatility	
	Directional	Spread	Option Forward	Option Volatilities
11/30/2005	203.543	1.439	-34.276	18.294
1/12/2005	-145.459	-4.563	300.002	-8.321
2/12/2005	321.765	-3.001	350.564	-20.349
5/12/2005	198.529	10.432	201.561	-15.826
6/12/2005	-101.346	-5.490	102.543	-1.982
7/12/2005	723.481	-9.872	-456.542	-16.762
8/12/2005	234.543	1.234	450.093	2.907
9/12/2005	287.443	-5.543	-432.568	5.782
12/12/2005	-542.901	10.342	765.911	16.532
12/13/2005	201.432	18.453	129.996	2.569
12/14/2005	121.965	14.349	-248.954	6.836
12/15/2005	-652.119	-2.584	-321.347	-
Invested capital ($)	810.000	145.238	847.500	
Standard deviation	37.62%	9.71%	39.61%	
Total P&L ($)	850.876	25.196	806.983	-10.320
Return on capital	105.05%	17.35%	95.22%	
Return on Standard deviation	279.23%	178.68%	2.40%	

(Section 28.5)

4. The returns on invested capital and returns relative to standard deviation for the volatility strategy are excellent. However, a concern should be raised because profits and losses based on the volatility changes are, in fact, showing that most of its profits are related to the changes in the forward curves, rather than volatility.

   The spread strategy made money in the period and its standard deviation was very low. The resulting high return relative to standard deviation shows the strategy's efficiency post facto. If the investor intended to allocate a portion of the fund to a less volatile strategy, this objective was achieved.

   (Section 28.5)

Reading 2, Article A
Facts and Fantasies about Commodity Futures

This article and the following article by Erb and Harvey were published in the same issue of the Financial Analysts Journal in 2006. These seminal articles changed the way that institutional investors considered commodity futures in their asset allocation. Since these articles were

published, institutional assets allocated to commodity futures and swaps increased by over 500%. Using data from 1959 to 2004, Gorton and Rouwenhorst build a custom commodity futures index and compare the returns and inflation hedging performance to that of equity markets. The key to changing the institutional view of commodity market investments was to contrast investing in commodity futures to investments in spot or physical commodity markets which do not earn the collateral yield or the roll yield of futures-based investments.

Investors need to understand the mechanics of the commodity futures markets, and how they compare to spot market investments. Returns on commodity market investments can be partially explained by the motivations of commodity market participants that can drive the term structure of the futures market using concepts such as backwardation, contango, and normal backwardation.

Over the long-term course of their study, the authors examine the correlations between the returns on commodity investments with inflation as well as the returns to stocks and bonds. Commodities and stocks show different return patterns at different stages of the business cycle. Investment characteristics of commodity futures and investments in common stocks of commodity-producing firms are studied as well.

Exercises

1. What are the main conclusions regarding the historical performance of spot commodity prices and collateralized futures returns? How do they compare to inflation?

2. How does the historical performance of a collateralized investment in commodity futures compare to U.S. stocks and corporate bonds?

Solutions

1. The historical performance of spot commodity prices and collateralized commodity futures returns show large differences. The historical return to an investment in commodity futures has far exceeded the return to an investment in spot commodities, and both have outpaced inflation.

   (Pages 108-129)

2. Over a 45-year period, the average annualized return to a collateralized investment in commodity futures has been similar to the return on the S&P 500. Both outperformed corporate bonds. Stocks and commodity futures have exhibited higher volatility than bonds. Commodity futures outperformed stocks during the 1970s, but this performance reversed during the 1990s.

   (Pages 108-129)

Reading 2, Article B
The Strategic and Tactical Value of Commodity Futures

Erb and Harvey use returns of the GSCI from 1969 to 2004 to compare commodity futures investments to those in stocks and bonds. While reaching conclusions similar to those of Gorton and Rouwenhorst, this article delves more deeply into the implications of the assumption of equal weighting of individual commodities in the portfolio construction process. Returns across commodity indices can vary dramatically over time, based on differences in the weights of the individual commodities in each index basket.

An important component of the long-term returns to any commodity index is the diversification return that is earned when commodity holdings are rebalanced back to the required index weights. Expected returns to commodity investments can be explained or justified using a number of perspectives, including the CAPM, the insurance perspective, the hedging pressure hypothesis, and the theory of storage.

The article examines roll returns and the ability of commodity futures to hedge various types of inflation. It concludes with an examination of the role of commodity futures in strategic and tactical asset allocation. The size of an investor's commodity allocation should consider the investor's risk tolerance as well as the composition of their liabilities. In a tactical context, the value of momentum and term structure strategies is explored.

Exercises

1. According to evidence presented in the paper, what is the payoff to a momentum strategy consisting of going long the GSCI for one month when the previous one-year excess return was positive and going short the GSCI when the previous one-year excess return was negative?

Solutions

1. The authors find that the momentum effect is strongest in the first 13 years of the sample period, and that the effect is still evident in the more recent period. As usual when conducting these experiments, the historical stability of this result cannot be immediately extrapolated into the future.

   (Pages 130-158)

Reading 2, Article C
Financialization and Structural Change in Commodity Futures Markets

Irwin and Sanders analyze the financialization and structural changes in commodity futures markets, their potential implications, and the assertion that passive commodity index positions played an important role in the large run-up in commodity prices during the first decade of the 21st century. The authors provide a summary of the significant trends in specific commodity trading that have taken place over the last ten years.

The authors provide detailed examples of a wide variety of commodity contracts and their recent trading histories. The details presented in the study's 18 figures and 7 tables provide a rich background for the most important parts of the paper, namely the impacts of commodity futures trading volume on volatility, hedging, and the run-up in prices that some have called a massive bubble. The article extensively discusses various examples and details to support the main arguments of the paper. For example, Table 2 establishes an important relationship between the size of ETPs and the broadness of their focus.

Exercises

1. What are rational market impacts and irrational market impacts?

2. Did the replacement in 2006-08 of the open out-cry pit trading mechanism by an electronic order routing and matching engine affect trading activity?

3. Mention the three large structural changes experienced by the commodities markets during the first decade of the 21st century that contributed to the increase in market activity.

Solutions

1. Rational market impacts result from broader market participation and more active trade. Potentially reduced risk premiums and improved market liquidity are two examples of rational market impacts. Irrational market impacts arise from the markets' inability to react to these impacts. A commodity price bubble is an example of an irrational market impact.

   There is evidence of rational (and beneficial) impacts of the structural changes in commodity futures markets over the last decade. The literature indicates that the irrational (and harmful) impacts of financialization and structural change in commodity futures markets over the last decade have been minimal.

   (Pages 159-184)

2. The answer is a resounding yes. The commodity futures markets experienced a dramatic change in 2006–2008 when the open outcry pit trading system (which was a 150-year old trading mechanism) was mainly replaced by an electronic order routing and matching engine. This historic change could very well have contributed to the subsequent dramatic increased observed in trading activity, and may have had a significant impact on market performance (because the costs of trading most likely fell and information transmission was enhanced).

   (Pages 159-184)

3. The first structural change is the shift in 2006–2008 from a primarily telephone/open outcry trading platform to a computer/electronic order matching platform. This move helped to reduce trading costs and to improve information transmission. The second

structural change is that the entrance to futures markets improved dramatically as the trade shifted to an electronic platform. The third structural change is the entry of new financial participants in the commodity futures markets.

(Pages 159-184)

Topic 5: Hedge Funds and Managed Futures

Readings

1. *CAIA Level II: Advanced Core Topics in Alternative Investments*, Wiley, 2012, ISBN: 978-1-118-36975-3. Part Five: Hedge Funds and Managed Futures, Chapters 29–40.
2. *CAIA Level II: Core and Integrated Topics*. Institutional Investor, Inc., 2015. ISBN: 978-1-939942-02-9. Part IV: Investment Products: Hedge Funds, Fund of Funds and Managed Futures.
   A. Reddy, G., P. Brady, and K. Patel. "Are Funds of Funds Simply Multi-Strategy Managers with Extra Fees?" *The Journal of Alternative Investment*, Winter 2007, Vol. 10, No. 3, pp. 49-61.
   B. Jain, S. "Investing in Credit Series Distressed Debt." *UBS Alternative Investments*, June 15, 2011, published in *AIAR*, Q2 2012, Vol. 1, Issue 2.

Chapter 29
Structure of Managed Futures Industry

Exercises

Problems 1 to 2

An investor takes a long position in 5 December oil futures contracts towards the close of the trading day on July 6. Futures oil prices are U.S. $50. The contract size is 1,000 barrels; the futures contract requires an initial margin of $9,500 and has a maintenance margin level set at $7,500.

Ignore commissions and interest rates for the following two problems.

1. Calculate the total daily gain (loss), the cumulative gain (loss), the margin account balance, and any potential margin call that the investor may receive assuming the following futures prices during the next few days:

Day	Futures price (US$)	Daily gain (loss) (US$)	Cumulative gain (loss) (US$)	Margin balance (US$)	Margin call (US$)
July-6	50	-	-	?	-
July-7	47.8	?	?	?	?
July-8	47.8	?	?	?	?
July-9	45	?	?	?	?
July-10	46.5	?	?	?	?

2. If the investor had closed out the long oil futures position at the end of July 10th, what would have been his/her cumulative gain or loss?

3. *CTA Fund ABC* has a margin-to-equity ratio of 24%. Calculate the margin that *CTA Fund ABC* would be required to maintain if the fund had $120 million in assets under management. Is the margin-to-equity of *CTA Fund ABC* considered to be conservative or aggressive?

4. Comment on the empirical evidence on the benefits of managed futures (CTAs) regarding diversification and performance.

5. Briefly explain how single currency margining works.

6. Must trading on behalf of U.S. investors in futures contracts listed on an exchange outside the U.S. be approved by the CFTC?

7. For CTAs, what are the potential sources of foreign exchange risk associated with using futures to trade?

Problem 8

Mary Graham, CAIA, is a high net-worth U.S. investor with two decades of experience in successfully managing her own investments. Aware of the benefits of diversification into managed futures, Ms. Graham has decided to allocate a portion of her portfolio to this asset class by setting up a managed account.

Arnaud Giraud is the founder and principal of *Green Capital, Inc.*, a Commodity Trading Advisor (CTA), which was founded in 1998. Mr. Giraud has a limited power of attorney granting him authority to place and execute trades on behalf of Ms. Graham´s managed account.

8. Describe the main disadvantage of a managed account as it relates to the liability of Ms. Graham.

Solutions

1. The following table shows the respective calculations.

Day	Futures price (US$)	Daily gain (loss) (US$)	Cumulative gain (loss) (US$)	Margin balance (US$)	Margin call (US$)
July-6	50	-	-	47.500	-
July-7	47.8	-11,000	-11,000	36.500 = 47,500	36,500 + 11,000 = 47,500 ←
July-8	47.8	0	-11,000	47.500	
July-9	45	-14,000	-25,000	33.500 = 47,500	33,500 + 14,000 = 47,500 ←
July-10	46.5	7.500	-17,500	55.000	

The initial margin balance is equal to $47,500 (i.e., $9,500 × 5). On July 7th, oil futures prices to be delivered in December declined to $47.80. This meant that the investor lost $11,000 on that day [i.e., (47.80-50.00) × 5 contracts × 1,000 barrels per contract]. The investor's margin balance account would have been debited by $11,000. The investor received a margin call on that date, because the margin balance declined to $36,500 (i.e., $47,500 – $11,000), which is below the maintenance margin of $37,500 (i.e., $7,500 × 5 contracts). The investor would have needed to deposit $11,000 in the margin account so that the balance would return to the initial margin of $47,500.

On July 8th, futures price closed at the same level as in the previous day and therefore no daily gain or loss was recorded on that day. On July 9th, oil futures prices to be delivered in December declined to $45.00. This meant that the investor lost $14,000 on that day [i.e., (45.00-47.80) × 5 contracts × 1,000 barrels per contract]. The investor's margin balance account would have been debited by $14,000. As in July 7th, the investor received a margin call on that date, because the margin balance declined to $33,500 (i.e., $47,500 – $14,000), which is below the maintenance margin of $37,500 (i.e., $7,500 × 5 contracts).

On July 10th, oil futures prices to be delivered in December rose to $46.50. This meant that the investor gained $7,500 on that day (i.e., (46.50-45.00) × 5 contracts × 1,000 barrels per contract). The investor's margin balance account would have been credited by $7,500. The new balance on the margin account would have been 55,000. The investor is allowed to withdraw any amount in excess of the initial margin (in this case, $7,500) from the margin account.

(Section 29.4)

2. To close-out the long position on 5 December futures oil contracts, the investor would have taken a short position on 5 December futures oil contracts. The cumulative loss on July 10th was $17,500, ignoring commissions paid and interests received on the margin account.

   (Section 29.4)

3. The margin that *CTA Fund ABC* would be required to maintain is equal to: $120 million × 0.24 = $28,800,000. The margin-to-equity ratio of 24% is typical of an aggressive manager.

   (Section 29.8)

4. In terms of diversification benefits, managed futures represent an alternative investment that has recorded excellent performance in both up and down stock, currency, and commodity markets. Furthermore, managed futures exhibit low correlation to traditional asset classes so that their inclusion in a portfolio of traditional assets may reduce its risk, while potentially increasing portfolio returns.

Regarding performance, managed futures have historically provided risk-return profiles comparable to those of many traditional investments and superior to those offered by long-only investments in commodities.

(Section 29.3)

5. In single currency margining, the trading client can post the required full margin in the form of dollars (or any other allowed currency). Under single currency margining, the clearing firm converts the client's cash into collateral in a way satisfactory to the different exchanges around the world. From a client's standpoint, single currency margining represents a solution to multi-currency margining.

   (Section 29.4)

6. The answer is yes, trading on behalf of U.S. investors in futures contracts listed on an exchange outside the U.S. must be approved by the CFTC. Furthermore, those trading on exchanges outside the U.S. may also be subject to the local regulatory agencies that supervise those exchanges.

   (Section 29.2)

7. One of the advantages of futures contracts is that they come with a built-in currency hedge because futures have no net liquidating value. For CTAs, the only foreign exchange risk associated with using futures to trade comes from the value of cash or collateral balances that result from either posting margin collateral or the result of cumulated gains or losses in currencies in which the contracts are denominated. In general, though, these balances represent only a small portion of the notional values of the positions taken.

   (Section 29.6)

8. Managed accounts bear a potentially unlimited financial liability to Ms. Graham.

   (Section 29.1)

Chapter 30
Managed Futures: Strategies and Sources of Return

Exercises

Problems 1 to 5

1. Suppose the current cash price of one barrel of Brent crude oil is $90, while the four-month futures price is $87 per barrel. The annual storage cost is 6% and the annual cost of funding is 5%. Calculate the implied convenience yield.

2. Calculate the total cost of carry for Problem 1.

3. Going back to Problem #1, suppose now that the current cash price of one barrel of Brent crude oil is $87, while the four-month futures price is $90 per barrel (notice that we have reversed the spot and futures prices with respect to Problem #1). The annual storage cost remains at 6% and the annual cost of funding also remains at 5%. Calculate the implied convenience yield.

4. Calculate the total cost of carry for Problem 3.

5. The current spot price for Brent crude oil is $102 per barrel, while the four-month futures price is $105 per barrel. If the four-month expected future spot price is $111 per barrel, calculate the implied risk premium expressed in U.S. dollars.

Problems 6 to 8

Nabil Kanoute is a Commodity Trading Advisor (CTA). Historically, Mr. Kanoute has based his trades in moving-average and relative strength indicator (RSI) signals. He is currently considering incorporating a channel breakout signal system into his trading platform.

Exhibit 1 shows the evolution of the 10-day and 45-day simple moving averages (SMAs) of the settlement price of a hypothetical futures contract X. Exhibit 2 represents the settlement price of a different hypothetical futures contract Y, as well as the respective relative strength indicator (RSI), over the same period of time.

Exhibit 1 10-day and 45-day SMAs with Price Data

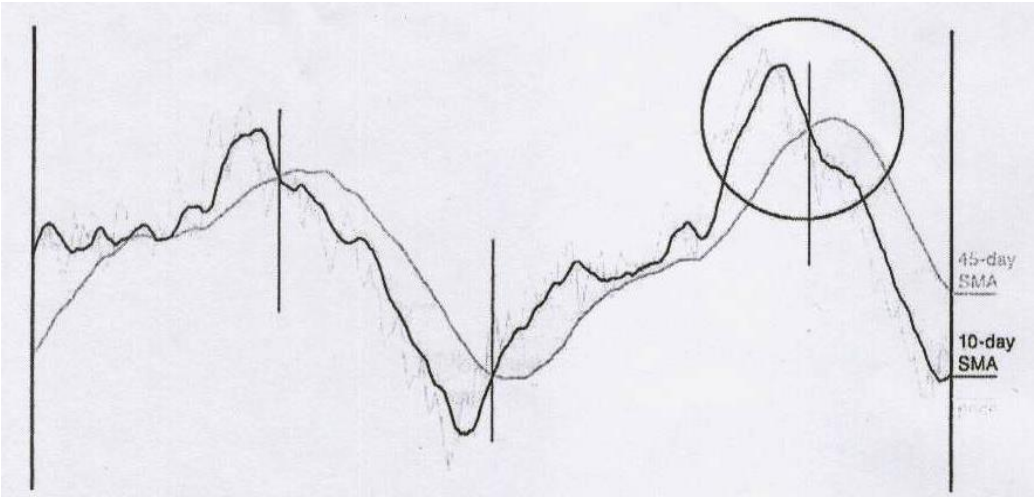
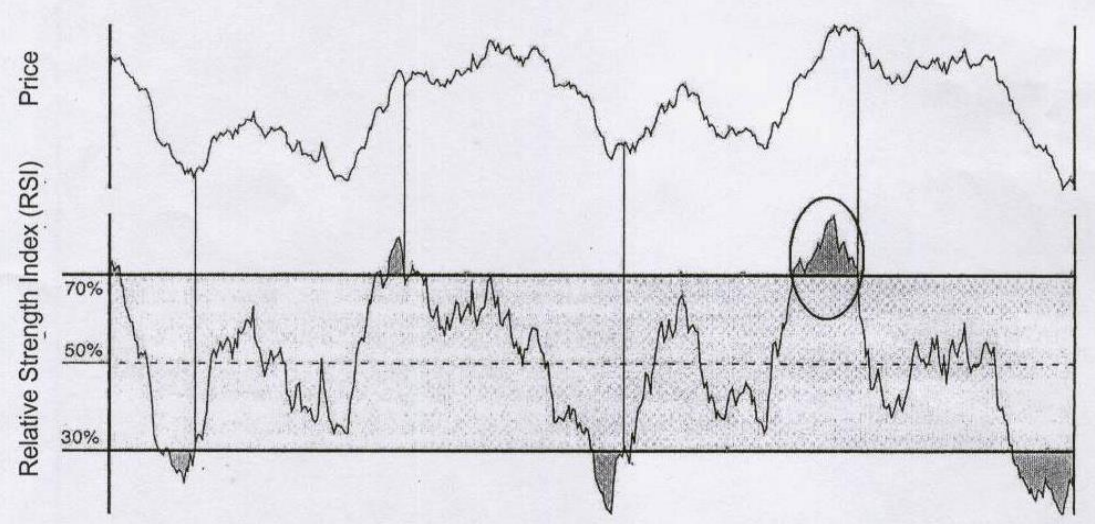


Exhibit 2 Relative Strength Index



6. Consider the point in time that corresponds to the vertical line inside the circle in Exhibit 1. Based on the moving-average crossover signal system, what trade would Mr. Kanoute have placed, assuming he had no position in the hypothetical futures contract prior to this date?

7. Consider the point in time that corresponds to the end of the circled area in Exhibit 2. What trade would Mr. Kanoute have placed, assuming he had no prior position in the hypothetical futures market?

8. Mr. Kanoute argues that "channels are created by plotting the range of expected price highs and lows." Is this statement correct?

9. Why do changes in commodity prices and changes in the volatility of commodity prices tend to be positively correlated?

10. What is the difference between the terms *backwardation* and *normal backwardation*?

Problems 11 to 12

Eames & Company is a fund-of-funds established in 1991. The fund selects CTAs mainly based on their track records. Mike Ahn, a due diligence officer at *Eames & Company*, is about to research and interview three potential new CTAs. Mr. Ahn is particularly interested in analyzing the trading strategies that each of these CTAs employs.

Jennifer Katzenberg, a trader at the first CTA, is a trend-follower focusing mainly on moving-average crossover signals. Peter Johnson, a trader at the second CTA, employs a trading strategy for which a buy signal arises when today's closing price is greater than the closing price *n* days ago.

11. Describe the circumstances under which Ms. Katzenberg is likely to go short.

12. Is the strategy employed by Mr. Johnson a volatility arbitrage strategy or a momentum strategy?

Solutions

1. The implied convenience yield can be calculated with the following equation:

   $87 – 90 = 90 \times (0.05 + 0.06 – c) \times (4/12)$

   which can be solved as follows:

   $$3\left(\frac{87-90}{90}\right) = 0.05 + 0.06 - c$$

   Solving for *c* we find: 21% per year

   (Section 30.2.2)

2. The total cost of carry is:

   $(0.05 + 0.06 – 0.21) \times (4/12) = -0.0333$ or $-3.33\% < 0$

   In this example, it is not surprising that the total cost of carry is negative (i.e., the convenience yield is greater than the cost of funding and storage), because the spot price ($90) is greater than the futures price ($87). In this case, the futures market is said to be in backwardation and the term structure of futures prices will be downward sloping.

   (Section 30.2.2)

3. The implied convenience yield can be calculated with the following equation:

   $90 - 87 = 87 \times (0.05 + 0.06 – c) \times (4/12)$

   Solving for *c* we find: 0.66% per year

   (Section 30.2.2)

4. The total cost of carry is:

   $(0.05 + 0.06 – 0.0066) \times (4/12) = 0.035$ or $3.5\% > 0$

   In this case, the total cost of carry is positive (i.e., the convenience yield is smaller than the cost of funding and storage), because the spot price ($87) is lower than the futures

price ($90). In this case, the futures market is said to be in contango and the term structure of futures prices will be upward sloping.

(Section 30.2.2)

5. The implied risk premium is equal to $6 (i.e., $111- $105).

   (Section 30.2.3)

6. He would have initiated a short position in X, because the 10-day moving average crossed down and below the 45-day moving average.

   (Section 30.5)

7. He would have taken a short position in Y, because the market was overbought.

   (Section 30.5)

8. Yes, the statement is correct.

   (Section 30.5)

9. The reason is that when inventory levels are low, demand and supply shocks generally lead to spikes (and higher price volatility) in commodity prices.

   (Section 30.2.2)

10. Backwardation refers to the term structure of futures prices and is the opposite of contango. Normal backwardation is the market condition in which the futures price is less than the expected future spot price.

    (Section 30.2.3)

11. When the short-term moving average crosses below the long-term moving average.

    (Section 30.5)

12. It is a momentum strategy

    (Section 30.5)

Exercises

Problems 1 to 3

Albert Mitropoulos is the founder and sole principal of *Larose Capital, Inc.*, a registered Commodity Trading Advisor (CTA). *Larose Capital, Inc.* utilizes a trading system that is intended to profit from daily volatilities in selected U.S. futures contracts, with a trading window that is normally longer than one day.

Table 1 shows the initial margin requirement for four selected futures contracts (S&P 500 Stock Index, Eurodollars, U.S. Long Treasury, and gold futures contracts). The value of the account holding the positions presented in Table 1 is $1,000,000 on January 28, 2009. Table 2 states the notional values of this portfolio on February 4, 2009. Mr. Mitropoulos employs a stop-loss trading rule set at 1% of the notional value of each contract. The one-day Value at Risk (*VaR*) of the portfolio has been estimated at $8,668, assuming a 95% confidence interval.

Table 1

Initial margin requirements for four selected futures contracts (as of January 28, 2009)

Futures Contract	Initial Margin Requirement
S&P 500 Stock Index	$30,938
Eurodollars	$1,485
U.S. Long Treasury	$4,320
Gold	$5,399
Total Initial Margin of a Portfolio Holding 1 Contract in each of the Futures Markets Above	$42,142

Table 2

Notional contract values of four futures contracts (February 4, 2009)

Contract	Notional Contract Value
S&P 500 Stock Index	$207,250
Eurodollars	$987,650
U.S. Long Treasury	$126,640
Gold	$90,166
Size of Notional Positions	$1,411,706

1. Calculate the margin-to-equity ratio (January 28, 2009) of a portfolio holding one contract in each of the four futures.

2. Calculate the Capital at Risk (CaR) on February 4, 2009, at 1%, for a portfolio holding one contract in each of the four futures.

3. Is the following comment by Mr. Mitropoulos correct? "…*One would expect that 95% of the time, the daily loss on the portfolio depicted above would be less than $8,668*."

4. Estimates of daily volatility, σ_t, and daily mean return, μ, of a CTA are reported to be 2.1% and 0.04%, respectively. What is the daily Value at Risk (*VaR*) of this CTA at a 95% confidence level? Note: The critical value of α for the 95% confidence level is –1.6448.

5. Suppose the net asset value (NAV) of a CTA at the end of the first six months of the year was: $98 (January), $103 (February), $99 (March), $97 (April), $96 (May), and $98 (June). Calculate the maximum drawdown of the fund during this period.

6. The following table contains the hypothetical annual returns per month on a CTA during 2011. Calculate the omega ratio, assuming that the target return was a 6% annual return.

Hypothetical Monthly Return of a CTA (Target Rate = 6% per Year)

	Realized Monthly Return
Jan-11	21.02%
Feb-11	2.01%
Mar-11	-15.40%
Apr-11	12.32%
May-11	1.06%
Jun-11	3.56%
Jul-11	-11.09%
Aug-11	22.45%
Sep-11	-5.34%
Oct-11	9.94%
Nov-11	-4.74%
Dec 11	-6.78%

7. List the potential sources of bias in CTA databases.

8. Does the empirical evidence suggest that CTAs provide downside protection during periods of market stress?

9. Briefly describe the three approaches to benchmarking managed futures performance presented in the book.

10. Should CTA return profiles be characterized as being long volatility or as being long gamma?

11. Is the following statement on long gamma traders correct? "For this type of trader, a market move in the same direction of the trade will result in stop-orders or trade reversals that minimize the potential loss from any single trade.

Solutions

1. The margin-to-equity ratio is 4.21% (i.e., $42,142 / $1,000,000).

   (Section 31.1)

2. The CaR is $14,117 (i.e., $1,411,706 × 0.01).

   (Section 31.1)

3. Yes, the comment is correct.

   (Section 31.1)

4. The daily *VaR* at 95% confidence level will be calculated as follows:

   $VaR = (-1.6448 \times 2.1\%) + 0.04\% = -3.41\%$

   (Section 31.1)

5. The highest NAV of the CTA was attained in February ($103), while the lowest NAV was registered in May ($96). Therefore, the maximum drawdown is [($96/$103) – 1] × 100 = -6.80%

   (Section 31.1)

6. The following table contains the calculations needed to compute the omega ratio. For each realized annualized monthly return, one first needs to determine whether the realized return was greater or less than the target level. These differences are presented in two columns called upper partial moment and lower partial moment. The target return in this problem is 6% per year. The averages of these upper and lower partial moments are calculated to be 5.31% and 4.25%, respectively. Finally, the omega ratio is 1.25, or the ratio of these two figures (i.e., 5.31 / 4.25). In this case, the omega ratio is greater than one, which means that the investment has provided more opportunities to earn a return that exceeds the target level.

	Realized Monthly Return	Above Target Return	Below Target Return	Upper Partial Moment	Lower Partial Moment
Jan-11	21.02%	1	0	20.52%	0.00%
Feb-11	2.01%	1	0	1.51%	0.00%
Mar-11	-15.40%	0	1	0.00%	15.90%
Apr-11	12.32%	1	0	11.82%	0.00%
May-11	1.06%	1	0	0.56%	0.00%
Jun-11	3.56%	1	0	3.06%	0.00%
Jul-11	-11.09%	0	1	0.00%	11.59%
Aug-11	22.45%	1	0	21.95%	0.00%
Sep-11	-5.34%	0	1	0.00%	5.84%
Oct-11	9.94%	1	0	9.44%	0.00%
Nov-11	-4.74%	0	1	0.00%	5.24%
Dec-11	-6.78%	0	1	0.00%	7.28%
Average				5.74%	3.82%
Omega					1.50
Target Rate	6.00%	per year			
	0.50%	per month			

(Section 31.1)

7. The following five biases are commented in the book: Selection bias, look-back bias, survivorship bias, backfill bias or instant history, and access bias.

   (Section 31.3)

8. CTAs (measured using the Barclay Trader Index Discretionary and the Barclay Trader Index Systematic indices) provided positive returns during periods of market stress, in particular, during the post-Internet bubble (8/2000–12/2002) and the financial crisis (9/2008–10/2008). This is one of the major benefits of CTA investing.

   (Sections 31.6.1 and 31.6.2)

9. The first approach consists in using an index of long-only futures contracts. Because CTAs are as likely to be long as to be short, this approach is not particularly helpful.

   The second approach is to use peer groups, where managed futures are usually benchmarked to indices representing active or passive futures trading. Active benchmarks of futures trading reflect the actual performance of a universe of CTAs. Unfortunately, there are a number of issues that arise when using hedge fund/CTA databases (see Problem 7).

Finally, CTAs may be compared to passive benchmarks of futures trading. These passive indices correspond to the performance of an individual trading system (as opposed to the performance of CTAs themselves).

(Section 31.4)

10. The book argues that even though CTA return profiles may suggest that these investment vehicles are long volatility, it is more suitable to describe CTAs as being long gamma. Trend-following CTAs increase their positions' deltas as prices move in their favor and this is the essential characteristic of a long-gamma position.

    (Section 31.6.1)

11. The statement is incorrect. The correct statement would be: "For this type of trader, a market move in the opposite direction of the trade will result in stop-loss orders or trade reversals that minimize the potential loss from any single trade."

    (Section 31.6.1)

Chapter 32
Structuring Investments in CTAs

Exercises

1. Give a range of typical management fees that are likely to be charged by a CTA on a $30 million allocation.

2. What are some of the questions that investors should ask when considering investing in a CTA?

3. According to the evidence presented in the book, how many CTAs should be randomly selected in a portfolio to realize most of the expected gains from diversification?

4. Briefly explain how a typical master-feeder arrangement for CTA funds work.

5. Are multi-CTA managers an advisable investment vehicle for investors desiring to allocate a large amount to CTAs?

6. List the advantages of managed accounts to investors.

7. List the costs or disadvantages of managed accounts to investors.

8. Exhibit 1 offers a performance analysis of three hypothetical managed futures traders for the period January 1990 through December 2011, as well as the performance of the MSCI World Equity Index and the Barclays Global Aggregate Bond Index for the same period. Exhibit 2 provides a correlation matrix of the returns of the three managed futures

traders, equities, and fixed income for the same period. In the example, Manager A is a relative value trader, Manager B is a non-trend-following trader, and Manager C is a long-term trend-follower. Michael Lagat is an analyst working at *CTA XYZ*. After analyzing both exhibits, Mr. Lagat concludes that "…*Since the three managers underperformed equities and bonds so strongly, they must have followed similar strategies*." Is Mr. Lagat's assessment correct? Explain briefly.

Exhibit 1 Performance Evaluation of Three Hypothetical Managers

January 1990 through December 2011	Manager A	Manager B	Manager C	MSCI World Equity Index	Barclays Global Aggregate Bond Index
Annualized Mean Return	3.90%	4.10%	5.20%	6.55%	7.07%
Annualized Standard Deviation	13.10%	15.70%	14.20%	15.68%	5.59%
Sharpe Ratio	-0.01	0.01	0.08	0.16	0.55
Skewness	0.35	-0.10	0.32	-0.61	-0.02
Kurtosis	1.40	0.38	0.15	1.25	0.43
Maximum Drawdown	-29.70%	-24.50%	-20.10%	-54.03%	-10.08%
Best Single Month	11.10%	10.50%	9.60%	11.22%	6.21%
Worst Single Month	-9.60%	-13.30%	-12.60%	-18.96%	-3.81%
Average Positive Month	2.41%	2.53%	2.67%	3.46%	1.50%
Average Negative Month	-3.67	-3.41	-2.87	-3.64%	-1.12%

Source: Bloomberg and Authors' Calculations

Exhibit 2 Correlation Matrix of Three Hypothetical Managers

January 1990 through December 2011	Manager A	Manager B	Manager C	MSCI World Equity Index	Barclays Global Aggregate Bond Index
Manager A	1				
Manager B	0.26	1			
Manager C	0.19	0.27	1		
MSCI World Equity	-0.07	-0.41	-0.16	1	
Barclays Global Aggregate	0.03	-0.25	0.10	0.30	1

Source: Bloomberg and Authors' Calculations

9. What are "opportunity losses"?

Solutions

1. $300,000-$450,000

   (Section 32.2)

2. The following are some of the questions that investors should ask when considering investing in a CTA:

- How many managers should the investor choose?
- What are multi-CTA funds?
- How do multi-CTA funds differ from CTA funds?
- What are managed accounts?
- What are platforms?
- How does an investor compare and contrast these choices?

(Section 32.2)

3. The curve presented in Exhibit 32.2 illustrates that most of the expected gains from diversification are realized by the time the portfolio contains five or six CTAs (randomly selected or naïve diversification). After this, diversification still helps, but less so.

   (Section 32.3)

4. Under a typical master-feeder arrangement, two funds feed into a single master account. One of the feeder funds is for U.S. investors, while the other fund is for investors overseas. This arrangement is set up for tax purposes, allowing non-U.S. investors to avoid dealing with U.S. tax authorities, while U.S. investors receive the documentation needed to report to the U.S. tax authorities. Funds from both feeder funds are pooled in the master fund, which opens trading accounts at the brokerage firm. Both groups of investors perceive the same performance.

   (Section 32.4)

5. Investors desiring to allocate a large amount to CTAs should save the fees that would be paid to a multi-CTA manager and hire the staff and consultants needed to select CTAs, construct the portfolios, perform the due diligence, etc.

   (Section 32.4)

6. The following are the advantages of managed accounts to investors:

   - The key advantage to a managed account is complete control.
   - Managed accounts offer complete transparency.
   - Managed accounts virtually eliminate the risk of fraud.
   - In a managed account, investors can select the parameters for leverage based on their targeted return volatility.

   (Section 32.5)

7. The following are the costs or disadvantages of managed accounts to investors:

   - The pool of managers to choose from is reduced.
   - The transparency and control provided by managed accounts come with the responsibility for establishing and maintaining brokerage accounts. This requires

legal, risk, administrative, and investment oversight in accordance with each organization's investment standards.
- There is no administrator or auditor (unless procured by the investor).

(Section 32.5)

8. It is correct to assert that the three managers underperformed equities strongly (annualized returns for these managers ranged from 3.90% to 5.20%; risk, as measured by standard deviation, ranged from 13.10% to 15.70%; and risk-adjusted returns, as measured by the Sharpe Ratio, ranged between -0.01 and 0.08). The performance of these three managers compares quite unfavorably against equities and bonds. Exhibit 2 shows that the correlations of these managers' returns to each other are relatively low and, thus, suggests that the three managers did not follow similar strategies. Therefore, Mr. Lagat's assertion is not correct. Finally, it would be helpful to learn which market conditions explain the managers' returns.

   (Section 32.8)

9. Opportunity losses are a cost associated with liquidation and reinvestment arising from active management (the other cost is foregone interest on dormant cash). Opportunity losses occur in time intervals during which investments are not committed to enterprises that promise returns (in excess of market rates of interest).

   (Section 32.10.2)

Chapter 33
Hedge Fund Replication

Exercises

1. What are the potential benefits of replication products?

2. How does the fund bubble hypothesis explain the general rise in the beta of hedge fund indices and the corresponding decline in their alphas during the past two decades?

3. How does the capacity constraint hypothesis explain the general rise in the beta of hedge fund indices and the corresponding decline in their alphas since 1992?

4. How does the increased allocation to active funds hypothesis explain the general rise in the beta of hedge fund indices and the corresponding decline in their alphas during the past two decades?

5. Critique the following statement: "*Hedge replication products cannot provide alpha because they are not managed by skilled managers*."

6. Is it possible to identify top-tier hedge fund managers a priori, and do hedge fund managers display significant performance persistence?

7. What is the underlying assumption behind the factor-based approach?

8. Explain the criticism of the payoff-distribution approach as it relates to the consideration of diversification benefits.

Solutions

1. The most important benefit from investing in replication products is the enhancement of absolute and risk-adjusted portfolio returns (and hence they are also named *return enhancers*). This benefit can arise from earning alpha (typically measured relative to the performance of all underlying traditional or alternative beta exposures), or by investing in alternative beta exposures that are underweighted or inexistent in traditional portfolios. Liquidity risk is another source of return not available in traditional investments. Finally, a time-varying traditional source of beta (e.g., a dynamic beta that results from actively managing a portfolio) could be considered an alternative source of beta.

   (Section 33.3)

2. The fund bubble hypothesis asserts that the number of less qualified managers who went into the hedge fund industry augmented as the supply of capital to hedge funds increased during the past two decades. The correspondingly inferior returns provided by these new hedge funds diluted the aggregate industry performance.

   (Section 33.4)

3. The capacity constraint hypothesis asserts that alpha is essentially a zero-sum game and that, therefore, only a few managers can be expected to consistently deliver alpha. The per capita amount of alpha available in the marketplace has declined substantially with AUM growing almost exponentially since 1992. According to this hypothesis, alpha will be expected to continue to decline unless new sources of alpha are discovered.

   (Section 33.4)

4. The increased allocation to active funds hypothesis argues that as investments in hedge funds becomes more popular; the aggregate performance of the industry will be adversely affected by the decisions of investors who have allocations to these funds as well as to traditional assets. In other words, the systematic risks or betas of hedge funds will increase as more capital flows into the industry. For instance, during periods of financial market turmoil, investors may be forced to liquidate both their traditional and their alternative investments, increasing the correlation between these two asset classes.

   (Section 33.4)

5. First of all, and by definition, a replication product will capture the alpha offered by the benchmark (this should be true at least in an extreme case where a replication product can perfectly replicate the return properties of the benchmark). Further, replication products bear lower fees than actively managed portfolios and therefore enhance the possibility of providing alpha to investors who invest in these products. In the end, whether replication products can provide alpha is an empirical question.

   (Section 33.4.1)

6. Empirical evidence (both from the academia and from the industry) provides mixed results. For instance, some of the studies suggest that top-tier hedge funds do exhibit return persistence. However, the outperformance of these top-tier hedge funds tends to disappear as time passes and as capital flows to these top-performing funds. Other researchers have not found performance persistence among hedge fund managers, and if they find any, it tends to erode after only a few months.

   (Section 33.5)

7. The underlying assumption behind the factor-based approach is that a set of asset-based factors can explain a significant portion of a fund's returns.

   (Section 33.6)

8. The payoff-distribution approach ignores that the main reason for investing in hedge funds resides in the diversification benefits that these investment vehicles are expect to provide to investors. In other words, it is not enough to match the return distribution of a hedge fund. It is equally important to match hedge fund correlations to other assets as well.

   (Section 33.7)

Chapter 34
Convertible Arbitrage

Exercises

Problems 1 to 3

Ana Limburg, CAIA, is the manager of a convertible arbitrage hedge fund. Ms. Limburg has done a preliminary analysis of the convertible bonds of *Beta Company, Inc*. The following table presents a summary of the terms offered by Beta's convertible 2% 2011 bond, which is currently trading at 88% of its face value.

Fixed income features	
Issuer	Beta Company, Inc.
Rating	BBB
Coupon	C = 2% (annual)
Issue date	January 1, 2009 (today)
First coupon date	December 31, 2009 (in one year)
Accrued interest	0
Maturity	December 31, 2011 (in T = 3 years)
Nominal value	$1,000
Risk-free rate	R_F = 2.5% per year
Issuer credit spread	CS = 300 bps above the risk free rate
Equity features	
Issuer	Beta Company, Inc.
Stock price	S_0 = $92 per share
Stock dividend	None
Conversion features	
Conversion ratio	CR = 9
Call protection	None

1. Calculate the conversion price of Beta's convertible bond.

2. Calculate Beta's convertible bond parity.

3. Calculate Beta's convertible bond conversion premium.

Problems 4 to 6

Haruki Watanabe is the manager of a convertible arbitrage hedge fund. Mr. Watanabe is in the process of valuing the convertible bonds of *Alpha Company, Inc.* The following table presents a summary of the terms offered by Alpha's convertible 3% 2013 bond. The current market price of this bond is $984.15.

Fixed income features	
Issuer	Alpha Company, Inc.
Rating	BBB+
Coupon	C = 3% (annual)
Issue date	January 1, 2009 (today)
First coupon date	December 31, 2009 (in one year)
Accrued interest	0
Maturity	December 31, 2013 (in T = 5 years)
Nominal value	$1,000
Risk-free rate	R_F = 1.5% per year
Issuer credit spread	CS = 400 bps above the risk free rate
Equity features	
Issuer	Alpha Company, Inc.
Stock price	S_0 = $92 per share
Stock price change volatility	σ = 22% per year
Stock dividend	None

4. Calculate the pure bond price (also known as straight bond price) of Alpha's convertible bond.

5. What is the risk-neutral probability of Alpha's stock price increasing?

6. What is the value of the call option on the underlying stock?

Problems 7 to 9

Ray J. Royston is the fund manager of *Aqua Capital*, a convertible arbitrage hedge fund. Today is January 1, 2009. Mr. Royston is analyzing the convertible bonds of *Company ABC*. More specifically, he is analyzing a convertible bond from this company that pays a 3.5% annual coupon and which matures in exactly two years (on December 31, 2010).

Mr. Royston has estimated a binomial tree for this bond's convertible bond parity (see Figure 1 below) and a binomial tree for the convertible bond value (see Figure 2 below), where t=1 is December 31, 2009, and t=2 corresponds to December 31, 2010.

Because of a recent increase in volatility in financial markets, Mr. Royston is particularly concerned about the sensitivity of ABC's convertible bond to changes in the volatility of the underlying stock.

Figure 1 Binomial tree for ABC's 3.5% 2010 convertible bond parity

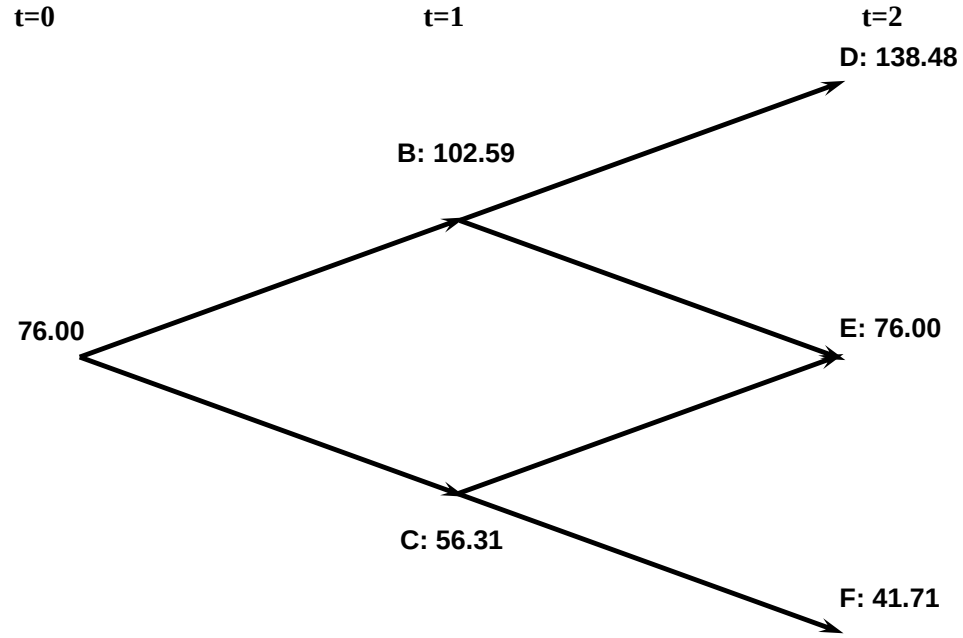
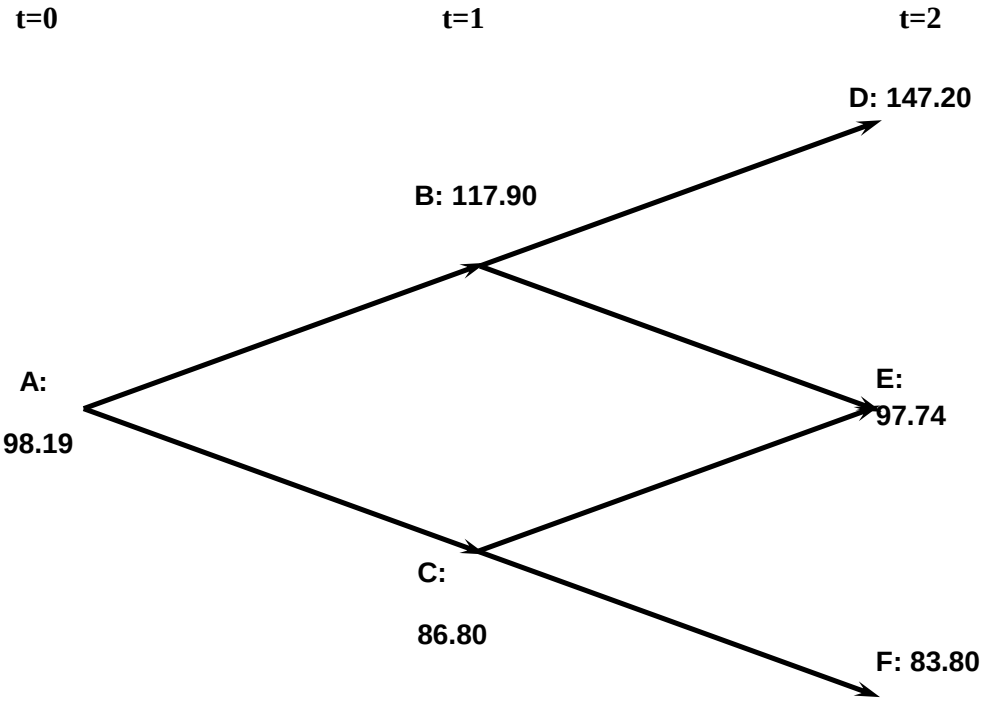


Figure 2 Binomial tree for ABC's 3.5% 2010 convertible bond value



7. What is the value of delta when measured at the initial node (node A) for ABC's convertible bond?

8. At time t=2, in which case, if any, should conversion occur?

9. What is the measure of sensitivity about which Mr. Royston is expressing concerns?

10. What is an asset swap in a convertible bond? What are the parties usually involved on each side of the swap? Explain briefly.

Solutions

1. $111.11

   (Section 34.2)

2. 82.80%

   (Section 34.2)

3. 6.28% as calculated by (bond price – parity)/parity = (88 – 82.8)/82.8 = 6.28%

   (Section 34.2)

4. The pure bond Price of Alpha's convertible bond is $893.24 (in a financial calculator, n=5, i=5.5, PMT = 30, FV = 1,000, and solve for PV).

   (Section 34.3.2)

5. The answer is: $p = [\exp(r_f) - d]/[u\text{-}d] = [\exp(0.015) - 0.8025]/[1.2461\text{-}0.8025] = 0.479$

   u was estimated as exp(0.22) and d was estimated as exp(-0.22)

   (Sections 34.3.1 and 34.3.2)

6. The call option value is: $984.15 – $893.24 = $90.91

   (Section 34.4.1)

7. Delta is 0.67, calculated as: (117.90-86.80)/102.58-56.31)

   (Section 34.3.2)

8. Conversion should occur only in node D.

   (Section 34.4.3)

9. Vega

(Section 34.4.3)

10. An asset swap is a relatively new instrument that facilitates the separation of a convertible bond into its two components: the fixed-income component and the equity call option. Typically, the asset swap involves a credit seller (usually arbitrageurs), who will acquire the equity option, and a credit buyer (typically investment banks and prime brokers), who will keep the fixed-income part. This unlocks the theoretical value of the convertible bond and greatly facilitates the implementation of arbitrage strategies.

    (Section 34.6)

Chapter 35
Global Macro and Currency Strategies

Exercises

Problems 1 to 3

Howard Jenkins is a global macro hedge fund manager. Mr. Jenkins relies primarily on economic theories and financial models to analyze market movements, detect policy mistakes of governments and central banks, or extract implied market expectations and compare them to his estimates.

Mr. Jenkins has been analyzing the US$/Euro relation, as well as the anticipated inflation rates in the U.S. and in the Euro-zone. He anticipates that the inflation rate in the U.S. will be 2.50%, and that the Euro-zone anticipated inflation rate will be 1.50%. The spot exchange rate (US$/Euro) is 1.32.

1. According to the Purchasing Power Parity (PPP), what is the expected percentage change in the US$/Euro quotation between today and one year from now?

2. According to the Purchasing Power Parity (PPP) and to the information presented above, should one expect any currency to depreciate over time against the other?

3. According to the CAIA reading, which school of thought on the sources of returns for global macro fund managers may Mr. Jenkins most likely be ascribed to?

Problems 4 to 5

Mary A. Davies is the global macro hedge fund manager of *World Forex Fund*, a macro hedge fund specializing in trading in the foreign exchange markets of mature and emerging economies. Ms. Davies is currently observing the following data for the U.S. dollar and the British pound in the screen of her computer:

Spot exchange rate (U.S.$/£) = 1.80
Forward exchange rate (U.S.$/£) = 1.82

1-year U.S.$ LIBOR rate = 2.00%
1-year £ LIBOR rate = 2.75%

4. Given the above figures, describe the carry trade that Ms. Davies should implement.

5. Calculate the expected spot exchange rate for the British pound one year from now.

6. Suppose that the prices of gold in Berlin and London are Euro 1,200 and GBP 1,300 per ounce, respectively. If the Law of One Price holds, what should be the exchange rate between the GBP and the Euro?

7. Suppose annual short-term interest rates in the U.S. and Japan are 4% and 1%, respectively. In addition, the current spot rate and 1-year forward rate for the USD/Yen are $0.0099 and $0.010, respectively. Does covered interest rate parity hold, assuming zero transactions costs?

Problems 8 and 9

Suppose that annual interest rates in the U.S. and the U.K. are 3% and 2.5%, respectively. In addition, the current spot rate and the 1-year forward rate for USD versus GBP are 1.20 USD/GBP, and 1.25 USD/GBP, respectively.

8. Demonstrate that an arbitrage opportunity exists.

9. Calculate the arbitrage profit assuming that either USD 1 million or GBP 1 million is available to be borrowed at the respective interest rates shown above.

10. Suppose short-term rates in South Africa and the U.S. are 6% and 2%, respectively. The current value of the South African Rand (ZAR) in terms of the USD is $0.1200. Suppose that, after 1 year, the spot value of the Rand in terms of USD is $0.1198. Assuming zero transactions costs or bid-ask spreads, was a carry trade (assuming borrowing in USD and lending in ZAR) profitable in this case?

Problems 11 to 15

Note: The following five problems adapt the long/short strategy explained in the next chapter for the case of equity investments to the case of global macro hedge funds that invest in fixed-income.

It is the first of April and coupon payments have just been made. Consider the following two bonds issued by the same government and denominated in U.S. dollars:

- A 3-year, 10% coupon bond, trading at 104.34% of face value. Coupon payments are made at the end of March and September.
- A 10-year, 10% coupon bond, trading at 102.50% of face value. Coupon payments are made at the end of March and September.

Ignore transaction costs when answering the following questions. All bond prices in the five problems are expressed as a percentage of face value including accrued interest.

11. On May 1st an investor makes an unleveraged $1,000,000 purchase of the 10-year bond at the price depicted above. On June 24th, the investor sells the bond for 106.98% of its face value (including accrued interests). Calculate the dollar profit (loss) realized by the investor.

12. Continuing with the previous question, suppose that on June 24th the government defaults on its debts and the 10-year bond trades at 25% of its face value. Calculate the dollar profit (loss) realized by the investor.

13. Consider now the case of a global macro hedge fund that uses the long/short strategy. The manager of the fund predicts that the yield curve for the sovereign debt of this country will steepen in the coming month or two. What should the hedge fund do?

14. On June 24th, the 3-year bond trades at 105.23% and the 10-year bond trades at 106.98% of its face value, both including accrued interests. Calculate the dollar profit (loss) realized by the hedge fund assuming that each position that the hedge fund takes is for $1,000,000.

15. Continuing with the previous question, suppose that on June 24th, and in the midst of a financial crisis, the government defaults on all of its debts and that each bond now trades at 25% of its face value. Calculate the dollar profit (loss) realized by the hedge fund.

Solutions

1. (1.025/1.0150) – 1 = 0.99%

   (Section 35.4.3)

2. Over time, one should expect the U.S. Dollar to depreciate against the Euro.

   (Section 35.4.3)

3. This is the school known as the model-based global macro manager.

   (Section 35.1.2)

4. A carry trade will involve borrowing in U.S. dollars and lending in British pounds without hedging the exchange rate risk.

   (Sections 35.4.1, 35.1.2, and 35.4)

5. 1.7869 U.S.$/£ [i.e., 1.80 U.S.$/£ × (1.02/1.0275)]

   (Section 35.4.1)

6. GBP 1,300 / Euro 1,200 = 1.0833 GBP/Euro

(Section 35.4.3)

7. In this case, the yen is the FCU and the dollar is the DCU. Thus,

$$(1+r_{FCU})\times\frac{\text{Forward Price of } FCU}{\text{Spot Price of } FCU}=(1+r_{DCU})$$

$$(1+0.01)\times\frac{0.010}{0.0099}=(1+0.04)$$

It can be verified that the above equality does not hold. This is because the interest rate differential between the U.S. and Japan is approximately 3%, whereas the Yen is only around 1% appreciated in the 1-year forward rate when compared to the current spot rate. Therefore, the covered interest parity is NOT satisfied.

(Section 35.4.1)

8. In this case, we have that (See Equation 35.1):

$(1 + r_{FCU})$ x $F_t/S_t = (1 + r_{DCU})$

(1 + 0.025) x 1.25/1.20 > (1 + 0.03)

It can be seen that the left-hand-side of the equation (1.0677) is greater than the right-hand-side (1.03), and therefore the covered interest rate parity does not hold and there are arbitrage opportunities.

(Section 35.4.1)

9. In this case, an arbitrageur would follow the following steps:

Since $F_t/St > [(1+r_{DCU})/(1+r_{FCU})]$

Then, to restore equilibrium:

F_t should fall
S_t should rise
r_{DCU} should rise
r_{FCU} should fall

And an arbitrageur would:

F_t should fall ➔ Sell forward at F_t
S_t should rise ➔ Buy spot at S_t
r_{DCU} should rise ➔ Borrow at r_{DCU}
r_{FCU} should fall ➔ Lend at r_{FCU}

Therefore, in t=0, an arbitrageur: borrows USD 1 million at 3%, converts this amount to GBP at the current spot rate of 1.20 USD/GBP (i.e., USD 1,000,000/1.20 GBP/USD = GBP 833,333), invests this GBP proceeds at 2.5%, and enters a position in the forward market to exchange the GBP deposit and interests perceived in one year for USD at the rate of 1.25 USD/GBP.

In t=1, the GBP deposit would have grown to GBP 854,166 (i.e., GBP 833,333 × 1.025), the investor would convert this amount to USD via the forward contract, resulting in USD 1,067,708 (i.e., CBP 854,166 × 1.25 USD/GBP), and she would then pay off the USD debt assumed in t=0, which is equal to USD 1,030,000 (amount initially borrowed plus interests). The resulting arbitrage profit is equal to USD 1,067,708 – USD 1,030,000 = USD 37,708.

(Section 35.4.1)

10. First, because the short-term rate is higher in South Africa than in the U.S., the carry trade requires an investor to borrow short-term in the U.S. at 2% per year and invest the proceeds in ZAR denominated instruments, earning 6% per year. Suppose the investor borrows $1 million. After conversion into ZAR, the investor invests (1 million USD / 0.12) in ZAR denominated instruments. After 1 year, this investment will grow to (1/0.12) × (1+0.06) million ZAR, and after conversion into USD, it will be:

(1 million USD / 0.12) 0.1198 = 1.058233 million USD

This sum is more than what the investor will need to repay the loan acquired in the U.S.: 1.02 million USD. In this case, the slight decline in ZAR was not enough to offset the gain from investing in higher yielding instruments denominated in ZAR. This carry trade generated a profit.

(Section 35.4.1)

11. Profit = $1,000,000 × [(106.98 – 102.50)/102.50] = $43,707.32

(Section 35.1.1, see also next chapter)

12. Profit = $1,000,000 × [(25.00 – 102.50)/102.50] = -$756,097.56

(Section 35.1.1, see also next chapter)

13. The hedge fund should go short the 10-year bond and long the 3-year bond.

(Section 35.1.1, see also next chapter)

14. Loss from the short position = $1,000,000 × [(106.98 – 102.50)/102.50] = $43,707.32

Profit from the long position = $1,000,000 × [(105.23 – 104.34)/104.34] = -$8,529.81

Total profit = -43,707.32 + 8,529.81 = -$35,177.51

(Section 35.1.1, see also next chapter)

15. Profit from the short position = $1,000,000 × [(102.50 - 25.00)/102.50] = -$756,097.56

    Loss from the long position = $1,000,000 × [(25.00 - 104.34)/104.34] = $760,398.70

    Total profit = $756,097.56 - $760,398.70 = -$4,301.14

    Notice that the long/short strategy was profitable even though the government defaulted on its debts.

    (Section 35.1.1, see also next chapter)

Chapter 36
Fundamental Equity Hedge Fund Strategies

Exercises

Problems 1 to 2

Altamira Investments is a fund of hedge funds that was founded in 1997. The fund has been performing due diligence on the following two equity long/short hedge funds to determine whether they should be added to the fund's current holdings: *Hudson Investment Fund* and *Cambridge Star Fund*. The following are some highlights of each of these two equity long/short funds:

Hudson Investment Fund follows a contrarian approach and employs traditional valuation metrics (e.g., book-to-market, price-earnings ratios (P/E), and ratio of P/E to earnings growth rate) to search for undervalued companies.

Cambridge Star Fund is a corporate governance activist fund which takes a very public stance on its investments and has been very open about criticizing current management and the board of directors of the companies in which they invest in. Recently, in two well publicized cases, the fund was very effective in changing the composition of the board of directors of two companies.

1. Which approach (e.g., value, growth, momentum, etc.) is most likely to categorize the investment style of *Hudson Investment Fund*?

2. According to the CAIA reading, are corporate governance activist funds effective in changing the composition of a company's board of directors?

Problems 3 to 5

Consider a long/short manager with $200 of assets under management. The fund only has the following two positions: Long $200 of Company Alpha, where Alpha pays a $3.50 dividend at the end of the year, and short $70 of Company Beta, where Beta pays a $2.00 dividend at the end of the year.

Suppose we wanted to attribute the total performance of this long/short fund over a given specific period of one year. We also assume that no other trades were executed over that year.

Suppose shares of Alpha go up 13% over the year and shares of Beta go down by 6% over the same year. Also suppose that the short rebate is 2% per year where the interest rate on proceeds from the short sales is 3% and the cost to borrow the Beta shares is 1% per year.

3. Calculate the total dollar return earned from the long position.

4. Calculate the total dollar return earned from the short position.

5. Suppose now that the shares of Beta went up by 7% over the same year, instead of the previously stated negative return of 6%. Calculate the total dollar return earned from the short position.

6. Are shares of open-end investment companies considered a 13F security?

7. Suppose the case of a long/short manager with $100 of assets under management and only two positions:

- Long $100 of shares of Company XYZ, which pays a $2 dividend
- Short $70 of shares of Company ABC, which pays a $3 dividend

Suppose that the objective is to attribute the total performance of this long/short fund over the specific period of one year. Also, assume that no other trades were executed over that year, that XYZ's share price rises 5% over the year, and that ABC's share price declines 10% over the same year. Assume that the short rebate is 2%, and is composed of the rate of return paid to the fund on the proceeds of the short sale (2.50% per year) and the cost to borrow the ABC shares (0.50% per year). Finally, assume that the fund is able to post its long shares as collateral for the short sales. Note that there is no excess cash. Calculate the total dollar return. Ignore commissions for simplicity.

8. Repeat the previous problem, but assuming now that XYZ's share price rises 2% over the year, and that ABC's share price rises 10% over the same year.

9. On February 3rd, 2005, Qwest announced a $6.3 billion offer to acquire MCI. On February 10th, Verizon also made an offer to acquire MCI, matching Qwest's offer. On February 10th, shares of Verizon were trading at $36, MCI was trading at $20, and Qwest was trading at $4.2. Qwest, MCI and Verizon were three U.S. companies belonging to the telecommunications industry. The typical merger arbitrage hedge fund would go long the stocks of the target company (MCI) and short the stocks of the bidding companies (Qwest and Verizon).

   In the following months, a battle for the acquisition of MCI developed. By October 10, 2005, Verizon had won the bidding contest and paid $8.44 billion for MCI. At that moment, Verizon was trading at $30 per share, MCI at $25.5, and Qwest at $4.2. Calculate the profit (loss) that the hedge fund would have obtained by following the strategy depicted in the previous paragraph. Suppose for simplicity that the hedge fund takes long or short positions, depending on the case, of 100,000 shares of Verizon and Qwest, and 200,000 shares in the case of MCI. Assume that the short rebate is 1%, and is composed of the rate of return paid to the fund on the proceeds of the short sale (1.50% per year) and the cost to borrow the shares (0.50% per year). Finally, assume that the fund is able to post its long shares as collateral for the short sales. Calculate the total dollar return. Ignore commissions and dividends for simplicity.

Problems 10 to 12

Hedge fund XYZ is a sector specific hedge fund dedicated to the biotech sector. The partners at XYZ consider that they have superior abilities to pick out-performing stocks in the biotech sector. The current market value of XYZ's portfolio stands at $10,000,000. XYZ uses a short-sale strategy to eliminate general market risk from the fund, where an exchanged-traded fund (ETF) of the general market is sold short. The last price of the market ETF was $75. XYZ sells ETFs based on the following model:

Expected XYZ portfolio return = $\alpha + \beta \times$ Market Return

The estimated model using the ETF yields the following regression result:

XYZ portfolio return = 2% + 1.5 × Market Return

10. How much of the market index ETF should XYZ sell short? (Express the answer in total dollar amount and in number of ETFs).

11. If the aggregate market rises 10%, construct a hedged portfolio to demonstrate that XYZ will be expected to generate a portfolio return equal to its alpha.

12. If the aggregate market declines 10%, construct a hedged portfolio to demonstrate that XYZ will be expected to once again generate a portfolio return equal to its alpha.

Solutions

1. The investment style of Hudson Investment Fund is most likely categorized as a value approach.

   (Section 36.1.3)

2. The answer is yes, empirical evidence suggests that these types of hedge funds are effective in changing the composition of a company's board of directors.

   (Section 31.6.1)

3. $29.50 [i.e., ($200 × 0.13) + $3.5]

   (Sections 36.3.5 and 36.5)

4. $3.6 [i.e., ($70 × 0.06) - $2.00 + ($70 × 0.02)]

   (Sections 36.3.5 and 36.5)

5. -$5.5 [i.e., -($70 × 0.07) - $2.00 + ($70 × 0.02)]

   (Sections 36.3.5 and 36.5)

6. The answer is no. A 13F security only includes the following investment vehicles:

   - Exchange-traded (NYSE, AMEX) or NASDAQ-quoted stocks
   - Equity options and warrants
   - Shares of closed-end investment companies
   - Certain convertible debt securities

7. The following exhibit illustrates the cash flows:

Dollar returns from long position (XYZ):	
Price appreciation / depreciation	+$5.00 ($105.00 – $100.00)
Dividends received	+$2.00
Margin interest cost of longs if leveraged	$0.00
Interest earned on cash	$0.00
Total dollar change from long position	+$7.00
Dollar returns from short position (ABC):	
Price depreciation/appreciation	+$7.00 ($70.00 - $63.00)
Short rebate	+$1.40 (0.02 × $70.00)
Dividend payments	-$3.00

Total dollar change from short position	+$5.40
Total dollar return	+$12.40

In this case, the long/short investor would have earned a gross return of 12.4% (i.e., the profit of $12.4 divided by investor capital of $100). In fully invested, unlevered funds, long positions equal the amount of investor capital. In the example, the long side was fully invested and unlevered, so there was no margin interest expense and no interest income earned on cash.

(Section 36.5)

8. The following exhibit illustrates the cash flows:

Dollar returns from long position (XYZ):	
Price appreciation/depreciation	+$2.00 ($102.00 – $100.00)
Dividends received	+$2.00
Margin interest cost of longs if leveraged	$0.00
Interest earned on cash	$0.00
Total dollar change from long position	+$4.00
Dollar returns from short position (ABC):	
Price depreciation/appreciation	-$7.00 ($70.00 - $77.00)
Short rebate	+$1.40 (0.02 × $70.00)
Dividend payments	-$3.00
Total dollar change from short position	-$8.60
Total dollar return	-$4.60

In this case, the long/short investor would have suffered a loss of 4.6% (i.e., the loss of $4.6 divided by investor capital of $100). In fully invested, unlevered funds, long positions equal the amount of investor capital. In the example, the long side was fully invested and unlevered, so there was no margin interest expense and no interest income earned on cash.

(Section 36.5)

9. The hedge fund would, on February 10th:

- Short sell 100,000 shares of Verizon @ $36 and receive proceeds of $3,600,000
- Short sell 100,000 shares of Qwest @ $4.2 and receive proceeds of $420,000
- Buy 200,000 shares of MCI @ $20, thus spending $4,000,000

By October 10, 2005, the returns to each of these positions are as follows:

Dollar Returns from Long Positions in MCI:		
Dollar Returns from Price Change	200,000 x (25.50-20)	1,100,000.00
Dollar Returns from Short Positions in Verizon:		
Dollar Returns from Price Change	100,000 x (36-30)	600,000.00
Rebate	100,000 x 36 x 1%	36,000.00
Dollar Returns from Short Positions in Quest:		
Dollar Returns from Price Change	100,000 x (4.20-4.20)	0.00
Rebate	100,000 x 4.2 x 1%	4,200.00
Total		1,740,200.00

(Section 36.3.5)

10. Given that the portfolio's beta with the market is 1.5, a total of $15,000,000 of the market ETF should be short sold. At the last price of $75, this implies that 200,000 (i.e., $15,000,000/$75) shares of the ETF should be sold.

    (Section 36.1.5)

11. Assuming an alpha of 2% and a beta of 1.5 for the portfolio:

t=o	Initial Value	t=1 ETF market +10%
Long portfolio	$10,000,000.00	$11,700,000.00
Short ETF market	$15,000,000.00	$13,500,000.00
Total	$25,000,000.00	$25,200,000.00
	Return on Hedged Portfolio	2.00%

Where:

The expected return on the long portfolio in *t*=1 is E(XYZ) = Alpha + Beta × RM = 2% + 1.5 (10%) = 17%, and thus the market value of the long portfolio is $10,000,000 × 1.17 = $11,700,000.

The expected return on the short ETF market is -10% in *t*=1 and thus the market value of the ETF declines to $15,000,000 × 0.90 = $13,500,000.

The total value of the hedge portfolio increased from $25,000,000 to $25,200,000. Therefore, XYZ earned $200,000 when the market went up 10%. This profit represents 2% of the value of the long portfolio, which is the alpha that XYZ is supposed to be able to produce based on their superior skills to pick out-performing stocks in the biotech sector.

(Section 36.1.5)

Note: Review the book Investments by Bodie, Kane, and Marcus if you need to refresh concepts related to index models and to hedging (Chapters 8 and 23).

12. Assuming an alpha of 2% and a beta of 1.5 for the portfolio:

t=o	Initial Value	t=1 ETF market -10%
Long portfolio	$10,000,000.00	$8,700,000.00
Short ETF market	$15,000,000.00	$16,500,000.00
Total	$25,000,000.00	$25,200,000.00
	Return on Hedged Portfolio	2.00%

Where:

The expected return on the long portfolio in t=1 is E(XYZ) = Alpha + Beta × RM = 2% + 1.5 (-10%) = -13%, and thus the market value of the long portfolio is $10,000,000 × 0.87 = $8,700,000.

The expected return on the short ETF market is +10% in t=1 and thus the market value of the ETF rises to $15,000,000 × 1.1 = $16,500,000.

As in the previous question, the total value of the hedge portfolio increased from $25,000,000 to $25,200,000. Therefore, XYZ earned $200,000 when the market went down 10%. Once again, this profit represents 2% of the value of the long portfolio, which is the alpha that XYZ is supposed to be able to generate based on their superior abilities to pick out-performing stocks in the biotech sector.

(Section 36.1.5)

Chapter 37
Quantitative Equity Hedge Fund Strategies

Exercises

1. Suppose that upon z-scoring, we get values of −1.2, 1.4, 1.5, 3.3, and −2.5 for the price-to-cash-flow ratio of five different firms. What would be the values of the series after Winsorizing by setting outliers back to 2 or –2, respectively?

Problems 2 to 4

Mei Chu is a research assistant working for *ABC*, a global macro hedge fund. The hedge fund manager at *ABC* has been intrigued by the recent rise in the use of momentum

strategies throughout the industry and has asked Ms. Chu to write a review report on the academic literature on momentum investing. The review includes the following three excerpts.

2. "*There exists a consensus that monthly stock returns exhibit momentum.*" Is this conclusion by Ms. Chu correct? Explain.

3. "*It appears that much of any momentum-based alpha at the stock level disappears once real-world trading costs and constraints are added*." Is this statement by Ms. Chu correct? Explain.

4. "*Momentum represents a market anomaly and thus is not consistent with efficient markets. Therefore, momentum returns may disappear once investors learn about it*." Is this comment by Ms. Chu correct? Explain.

5. *XYZ* is an equity market-neutral (EMN) hedge fund. *XYZ* specifies linear regression pricing models as part of their investment process. *XYZ* then uses the residuals from these regressions as an indication of mispricing. May these residuals be considered a signal of mispricing in security selection?

6. *FXHF* is a U.K. global macro hedge fund specializing in foreign exchange (FX) trading. *FXHF* uses state of the art trading infrastructure and has access to foreign exchange quotes from markets located throughout the world.

   At this moment, the following two foreign exchange real time quotes are available in FX market "A":

   Swiss Franc (SFr) / U.S. dollar ($) = SFr 1.5971/$
   Canadian dollar (C$) / U.S. dollar ($) = $C 1.8215/$

   On the other hand, the following quote is also available at this same moment in time in FX market "B" (market "B" refreshes quotes every 100 milliseconds):

   Canadian dollar (C$) / Swiss Franc (SFr) = $C 1.1460/SFr

   Demonstrate that an arbitrage opportunity exists. What steps should *FXHF* follow to earn an arbitrage profit? For simplicity, ignore commissions and foreign exchange bid-ask spreads and assume the possibility of unlimited and costless lending and borrowing in any of the three currencies.

7. ETF RUBY is a hypothetical ETF constituted by ten stocks. Each stock trades at $20 and the ETF trades at $200. ETF RUBY tracks an index (Index RUBY) consisting of the same ten stocks. The index is currently at 1,000.

   Suppose that on the next trading day (t=1), Index RUBY declines 5%, each of the stocks that make up ETF RUBY decline to $19, and ETF RUBY declines to $186. Is there an

arbitrage opportunity? If so, what steps would an arbitrageur follow? What would be the arbitrage profit? (For simplicity, ignore commissions, transaction costs, and interest rates).

Problems 8 to 9

Using monthly stock returns of U.S. companies between 1926 and 2005, Kenneth French estimated that the average monthly return of the four factors of the Fama-French-Carhart model are: 0.64% for the market portfolio minus the risk free rate (MKT), 0.17% for the Small minus Big (SMB) portfolio, 0.53% for the High minus Low (HML) portfolio, and 0.76% for the price-one year momentum (PR1YR) portfolio.

The factor betas of stock XYZ have been estimated for a recent period as: $\beta_{MKT} = 0.26$, $\beta_{SMB} = 0.39$, $\beta_{HML} = 0.45$, and $\beta_{PR1YR} = -0.22$. The current monthly risk free rate is 0.25%.

8. Calculate the monthly expected return of investing in XYZ.

9. What is the underlying assumption of the use of fundamental factors such as the Fama-French-Carhart model to establish positions?

Solutions

1. After Winsorizing, we would get z-score values of −1.2, 1.4, 1.5, 2.0, and −2.0.

   (Section 37.2.3)

2. The answer is no. Evidence suggests that, depending on the historical time period used, stock returns may or may not exhibit momentum. They may also exhibit mean reversion, or exhibit neither, there exists no consensus.

   (Section 37.2.4)

3. This statement is correct. Although individual stock momentum has been documented using historical data, much of any momentum-based alpha at the stock level seems to disappear once trading costs and constraints are added.

   (Section 37.2.4)

4. This comment by the Ms. Chu is not correct. There exists no consensus in the academic literature on this issue. While some argue that momentum represents a market anomaly and thus is not consistent with the efficient markets hypothesis, others in academia argue that momentum (as well as size and value) are associated with risk factors, and thus returns to these factors are consistent with efficient markets.

   (Section 37.4.3)

5. The answer is yes, these residuals may be viewed as a signal of mispricing in security selection. In a linear regression, a residual is usually that component that is assumed to be the error left over (i.e., the noise) once a model has been specified. Many successful EMN managers construct long/short portfolios such that the resultant residuals behave well when tail events occur.

   (Section 37.3.4)

6. An arbitrage opportunity exists because the implicit exchange rate between the Canadian dollar and the Swiss Franc in market "A" is:

   $C/SFr = $C/$ × $/SFr = ($C/$)/(SFr/$) = 1.8215/1.5971 = $C 1.1405/SFr.

   However, the quoted exchange rate between the Canadian dollar and the Swiss Franc in market "B" (i.e., $C1.1460/SFr) is greater than the implicit exchange rate in market "A".

   In this case, *FXHF* would:

   Sell U.S. dollars in market "A" to obtain Swiss Francs: Let us suppose the hedge fund sells $1,000,000 to obtain SFr 1,597,100 (i.e., $1,000,000 × SFr 1.5971/$).

   Then, *FXHF* would change the Swiss Francs to Canadian dollars in market "B": SFr 1,597,100 × $C 1.1460 = $C 1,830,276.60.

   Finally, *FXHF* would sell Canadian dollars to buy U.S. dollars in market "A":
   $C 1,830,276.60 / $C 1.8215 / $ = $1,004,818.34.

   Thus, an arbitrage profit equal to $4,818.34 (i.e., $1,004,818.34 - $1,000,000) has been generated. This is known as triangular arbitrage.

   (Section 37.4.1)

7. In t=0 there were no arbitrage opportunities. In t=1, Index RUBY declined 5% (from 1,000 to 950), each of the stocks that make up ETF RUBY also declined 5% to $19, but shares of the ETF declined more (7%, from $200 to $186). ETF RUBY is therefore trading at a discount to its net asset value (NAV) and an arbitrageur would:

   - Buy shares of ETF RUBY in the market. Let us suppose that the arbitrageur buys 1 ETF share for $186.
   - Tender the shares of ETF RUBY in exchange for shares in the ETF's underlying portfolio of stocks.
   - Sell the shares received from the tender into the market. Since each of the stocks in the portfolio is trading at $19, the arbitrageur would receive $190 (i.e., $19 × 10). This generates an arbitrage profit of $4 (i.e., $190 - $186) for each ETF.

   (Section 37.4.2)

8. Substituting the values in the equation of the Fama-French-Carhart model we get:

   $E[R_{XYZ}] = 0.25\% + 0.26 \times 0.64\% + 0.39 \times 0.17\% + 0.45 \times 0.53\% - 0.22 \times 0.76\% = 0.554\%$

   (Section 37.1.2)

   Note: Review the book Invetsments by Bodie, Kane and Marcus if you need to refresh concepts related to the use of the Fama-French-Carhart model (Chapter 13).

9. The underlying assumption is that the relation is stable. Specifically, the fund manager is assuming that relative future expected returns can be predicted and that the past relationship between indicators and returns is likely to hold over time.

   (Section 37.1.2)

Chapter 38
Funds-of-Hedge-Funds

Exercises

Problems 1 to 2

The pension fund of ABC University is considering allocating funds to hedge fund investments. Laura Monahan, a member of the pension fund's investment committee, has been arguing that the best way to access the hedge fund asset class is by investing through a fund of hedge funds (FOF). To this end, she has been analyzing *123 Associates*, a fund of hedge funds that was founded in 2002. The manager selection process at *123 Associates* attempts to identify investment managers that specialize in merger arbitrage, distressed securities, and short sales and that have recorded superior returns through different market cycles. The fund currently has investments in thirty hedge fund managers.

Carlos Ramírez, another member of the pension fund's investment committee, argues that the pension fund of ABC University should access the hedge fund universe via investments in investible hedge fund indices instead of following the FoF route.

1. Should an investment in *123 Associates* protect the pension fund of ABC University from manager selection risk?

2. Compare investible hedge fund indices and non-investible hedge fund indices as it pertains to strategic exposures.

Strategies (2001-2008)	Annualized Return	Standard Deviation
CISDM Equity Market-neutral	5.6%	2.0%
CISDM Fixed Income Arbitrage	3.6%	4.8%
CISDM Convertible Arbitrage	3.3%	6.2%
CISDM Distressed Securities	7.6%	6.0%
CISDM Merger Arbitrage	4.8%	3.4%
CISDM Emerging Markets	7.9%	10.5%
CISDM Equity Long/Short	4.4%	6.0%
CISDM Global Macro	6.4%	3.3%

Source: Edited from Schneeweis, Crowder, and Kazemi (2010)

3. Calculate equally weighted and equally risk-weighted allocations to the following strategies.

4. List the seven disadvantages of funds of hedge funds (FOF) discussed in the book.

5. According to empirical evidence, how do funds of hedge fund (FOF) compare to single hedge funds in terms of drawdowns, standard deviation of returns, and average returns?

6. Mary Helstrom is a young, high net worth individual. Up to now, Mary has invested her financial wealth in U.S. large cap stocks. However, recent financial turmoil has prompted Mary to revise her investment strategy. She is considering investing a portion of her financial wealth in funds of hedge funds (FOF). Using the information presented in the following table, calculate the expected return and standard deviation of returns of a portfolio that is 80% invested in U.S. stocks and 20% invested in FOF. Interpret the results obtained.

1991-2008	Annualized Return	Standard Deviation	Correlation with FOF
U.S. Stocks (S&P 500)	7.90%	14.40%	0.58
CISDM Funds of Funds Diversified Index	7.90%	5.10%	1

Source: Edited from INGARM, "The Benefits of Hedge Funds," August 2009.

Solutions

1. The answer is yes, an investment in *123 Associates* should protect the pension fund of ABC University from manager selection risk.

   (Section 38.11.2)

2. Investible hedge fund indices and non-investible hedge fund indices often have considerably different strategic exposures.

   (Section 38.11)

3. The following table shows the allocations. The equally weighted method is easy to apply; each strategy is allocated 12.5% (i.e., 100%/8). In the case of the equally risk-weighted method, to obtain the allocations to each strategy, first one needs to use the following formula:

$$\text{Equal risk weight } i = \frac{1 \big/ \text{Annualized Standard Deviation } i}{\sum_{i=1}^{n} 1 \big/ \text{Annualized Standard Deviation } i}$$

Where: The numerator is the inverse of each strategy's whole-period annualized standard deviations and the denominator is the sum of the inversed standard deviations.

Strategies (2001-2008)	Equally Weighted	Equally risk-weighted
CISDM Equity Market-neutral	12.50%	26.38%
CISDM Fixed Income Arbitrage	12.50%	10.99%
CISDM Convertible Arbitrage	12.50%	8.51%
CISDM Distressed Securities	12.50%	8.79%
CISDM Merger Arbitrage	12.50%	15.52%
CISDM Emerging Markets	12.50%	5.02%
CISDM Equity Long/Short	12.50%	8.79%
CISDM Global Macro	12.50%	15.99%

When analyzing the allocations generated by the equally-risk method, it is not surprising that Equity Market-Neutral, the strategy with the lowest risk (with a low 2% annual standard deviation), is assigned the highest allocation (26.38%) of all the strategies. On the other hand, Emerging Markets had the highest standard deviation (10.5%) and is therefore assigned the lowest allocation (5.02%).

(Sections 38.4.1 and 38.4.2)

4. The seven disadvantages of FOF are: Existence of a double layer of fees, performance fees on portions of the portfolio, inefficient taxation, lack of transparency, exposure to other investors' cash flows, lack of control, and lack of customization.
(Section 38.9)

5. Empirical evidence presented in the book indicates that FOF have fairly low drawdowns and standard deviations, and lower drawdowns and standard deviations than the average individual hedge fund. However, during the same period (1990-November 2011) average returns on FOFs were only a little more than half of those of individual hedge funds. These results can be explained by the double layer of fees charged by FOFs and by the upward bias in the reported performance of individual hedge funds caused by survivorship bias.

(Section 38.10)

6. The expected return of the portfolio $E(R_p)$ is equal to the weight of each asset in the portfolio multiplied by its expected return:

   $E(R_p) = 0.80 \times 7.9\% + 0.20 \times 7.9\% = 7.9\%$
   The formula for the standard deviation of returns of the portfolio (σ_p) is:

   $$\sigma_p = [(w_{SP500})^2 \times \sigma^2_{SP500} + (w_{FOF})^2 \times \sigma^2_{FOF} + (2 \times w_{SP500} \times w_{FOF} \times \sigma_{SP500} \times \sigma_{FOF} \times \rho_{SP500,\,FOF})]^{1/2}$$
   $$= [(0.80)^2 \times (0.144)^2 + (0.20)^2 \times (0.051)^2 + (2 \times 0.80 \times 0.20 \times 0.144 \times 0.051 \times 0.58)]^{1/2}$$
   $$= 12.14\%$$

   Where: w are the weights of each asset in the portfolio and ρ is the correlation coefficient between the returns of the two assets.

   In this case, the expected return of the portfolio is exactly the same as the return on each of the assets, which is 7.9%. The benefit from adding funds of hedge funds to the portfolio of U.S. large cap stocks resides in the reduction in portfolio risk that is achieved (the standard deviation of the portfolio declines from 14.4% to 12.14% when funds of hedge funds are added to the U.S. stock portfolio). The decline would be larger if a higher percentage of FOF is added to the portfolio of U.S. stocks.

   (Section 38.4.3)

   Note: Review the book Investments by Bodie, Kane, and Marcus if you need to refresh concepts related to the calculation of expected returns and risk of portfolios of two risky assets (Chapter 7).

Chapter 39
Regulation and Compliance

Exercises

Problems 1 to 4

It is October, 2010. *Alpha, LLC* is a U.S. hedge fund that is concerned about the potential effects and costs of the recent enactment of the Dodd-Frank Act. *Alpha* has hired a legal consultant to help determine the steps that the fund should take in the near future to adapt to the mandates contained in the Act. The partners at Alpha also have inquiries regarding the Advisers Act. The legal consultant is making a preliminary presentation to *Alpha*.

1. At the beginning of the presentation, the consultant expresses that "…*I believe that the Dodd-Frank Act upholds the private adviser exemption from the Advisers Act."* Is this assertion correct? Explain.

Note: The private adviser exemption allows an investment adviser to claim an exemption from registration if he (1) had fewer than 15 clients during the previous 12 months, (2) did not publicly hold himself out as an investment adviser, and (3) did not advise registered investment companies.

2. Further in the presentation, the consultant comments that "…*I think that the Dodd-Frank Act revised the definition of accredited investor under Regulation D of the Securities Act of 1933 to exclude the value of a person's primary residence in calculating an investor's net worth.*" Is this assessment correct?

3. Towards the end of the presentation, the consultant comments that "…*As far as I remember, the Dodd-Frank Act requires an adviser who beneficially owns more than 1% of a class of publicly traded equity securities to file disclosure reports.*" Is this comment by the consultant correct? Explain.

4. Finally, the consultant states that "…*I believe that in the U.S., a registered investment adviser is required to adopt and implement compliance policies and procedures reasonably designed to prevent violations of the act by the adviser or her supervised persons*." Is this statement correct? Explain.

5. *XYZ* is a non-U.S. hedge fund that has 12 U.S. clients. Under the Dodd-Frank Act, does *XYZ* have to register with the SEC?

6. *123* is an unregistered U.S. hedge fund dedicated to the convertible arbitrage strategy. In the last monthly letter to its investors, *123* included the following testimonial from Jack Laffite, one of the fund's current investors: "*123 is as solid as a rock, they managed to generate positive returns when the rest of the convertible funds were losing money during the recent market turmoil*." Is the inclusion of Jack's testimonial by *123* in its monthly letter legal or prohibited? Does the answer to this question change if *123* was registered with the SEC?

7. *MNO* is a U.S. hedge fund. The fund currently has $200 million assets under management (AUM). Its client base is mostly retail. The fund charges fees that are performance-based and has a strong compliance program. According to the SEC, are there any factors contributing to categorize *MNO*'s hedge fund manager as a high risk profile?

8. Hedge fund *ABC* is a merger arbitrage hedge fund registered in New York. *ABC* has just sent a written communication to its partners explaining the recent performance of the fund. *ABC*'s communication states that the fund generated a net of fees return (although custodial fees were not netted out) of 2.5% during the past quarter. No mention is made about the aggregate equity market performance during the same period. *ABC*'s communication presents gross performance figures side by side with net figures. The communication also discloses how the fund's performance was calculated indicating that the highest fee charged to a client was deducted to arrive at the net of fees performance

figure. According to the SEC, is the chief compliance officer (CCO) of hedge fund *ABC* in full compliance? Explain.

9. Is the regulation of hedge funds very similar across Europe?

10. Which financial centers in Asia desire to become the next centers for hedge funds? Are the costs of starting and running a hedge fund in these centers higher or lower than those in New York?

Solutions

1. The statement is incorrect because the Dodd-Frank Act actually eliminates the so-called private adviser exemption. This exemption was used throughout the years by many hedge fund managers to avoid SEC registration. Exemptions from registration are now available only to advisers who exclusively advise private funds or venture capital funds with less than $150 million in assets under management in the U.S. Foreign private advisers and advisers to licensed small business investment companies are also exempt. All other investment advisers had to register with the SEC by March 30, 2012.

   (Section 39.1.2)

2. Yes, it is correct.

   (Section 39.1.3)

3. The comment by the consultant is incorrect. The Dodd-Frank Act requires an adviser who beneficially owns more than 5% (and not 1%) of a class of publicly traded equity securities to file disclosure reports. This filing must be done within 10 days of the acquisition of those securities, identifying, among other things, the source and amount of funds used for the acquisition and the purpose of the acquisition.

   (Section 39.3)

4. The statement is correct; this compliance requirement appears in the Advisers Act. Further, the adviser must also appoint a chief compliance officer (CCO) to administer the compliance policies and procedures, and the SEC expects that senior management will be proactive in building a culture of compliance.

   (Section 39.1.2)

5. Under the Dodd-Frank Act, overseas hedge funds with more than 15 U.S. clients will have to register with the SEC. *XYZ* only has 12 U.S. clients and, therefore, it does not have to register with the SEC. A hedge fund must complete and file Form ADV once it determines that it must register with the SEC.

   (Section 39.2)

6. The inclusion of an investor's testimonial by an investment adviser in any written communication addressed to more than one person is prohibited. This prohibition applies to both registered and unregistered investment advisers. In order for a hedge fund manager to avoid violating the rule against fraudulent, deceptive, or manipulative activities, its chief compliance officer (CCO) must review all documents that communicate information to investors to make sure they conform to regulatory guidelines.

   (Section 39.2.2.1)

7. Yes, the following three factors contribute to a high risk profile for *MNO*'s hedge fund manager: the fund has a large amount of AUM, its client base is retail, and fees are charged based on performance. In theory, the fact that MNO has a strong compliance program helps to somewhat lessen these three high risk factors.

   (Section 39.2.3.1)

8. The CCO is not in full compliance with the SEC regarding the following issue: The fund manager must provide information on the effect of market or economic conditions on the performance results presented. According to the question, *ABC* made no mention about the aggregate equity market performance during the quarter over which *ABC* presented its results. This may mislead some investors.

   On the other hand, the CCO was in compliance regarding the following four issues:

   i. Performance results were presented net of fees
   ii. The fact that custodial fees were not netted out is acceptable
   iii. Gross performance figures were presented side by side with net figures
   iv. *ABC* disclosed to investors that the highest fee charged to a client was deducted from performance results, and explained how the performance figure was calculated

   (Section 39.2.2.1)

9. The answer is no. Hedge fund regulation varies widely across Europe. On one extreme of the spectrum lies Ireland and Luxembourg, where hedge funds are even allowed to list on the stock exchange. France is on the other end of the spectrum, placing strict restrictions on hedge funds and strongly discouraging offshore investing.

   (Section 39.4.1)

10. In recent years, Hong Kong and Singapore seem to want to become the next centers for hedge funds to rival those of New York and London. The costs of starting and running a hedge fund in these two financial centers are much lower than those in New York. Income tax rates are also lower. Hong Kong and Singapore require hedge funds to register with the appropriate government regulatory body.

(Section 39.4.2)

Chapter 40
Operational Due Diligence

Exercises

Problem 1

FSR Due Diligence is a firm specializing in performing hedge fund due diligence on behalf of its clients, which are mostly institutional investors. Susan Cantor, CAIA, and Raphael James are two of the firms due diligence experts. They are both currently having a preliminary meeting intended to estimate the operational risk of *Axis Convertible Fund*, a convertible arbitrage hedge fund that was founded in 1997.

At the beginning of the meeting Ms. Cantor points out to Mr. James the importance of reviewing the lessons of a notorious hedge fund "blow-up" in which most analysts agree that there was no fraud, but rather there was a lack of appropriate risk management. Later, Ms. Cantor and Mr. James review the valuation policies followed by *Axis Convertible Fund*.

1. Among Bayou Fund, Amaranth, and Madoff, which one corresponds to the hedge fund "blow-up" that Ms. Cantor is referring to?

Problems 2 to 4

Inquisitorial Due Diligence, Inc. specializes in hedge fund due diligence on behalf of its clients, which include pension funds, endowments, and high net-worth investors. Karl Easterbrook and Shu Jiang are two of the firms due diligence "detectives."

Mr. Easterbrook has been performing due diligence on *The Vulture King Fund*, a distressed hedge fund founded in 1994. He has already determined that the fund's positions are more illiquid than the average distressed securities hedge fund. Mr. Easterbrook has also been analyzing the *Terry Fund*, a fixed income arbitrage hedge fund founded in 1999 and specializing in the U.S. corporate bond markets.

Ms. Jiang is performing due diligence on *Axiom Multi-Strategy*, a multi-strategy hedge fund that offers long-term capital appreciation through investments in a diversified portfolio of excelling hedge fund managers. This hedge fund was founded in 2004. Ms. Jiang has already raised a yellow flag on this fund.

2. Explain why the following question is not an essential due diligence question for *The Vulture King Fund*? "Is the manager doing naked short selling, covered short selling, or both?"

3. Explain why the following question is not an essential due diligence question for *Terry Fund*? "Does the hedge fund invest in frontier markets?"

4. Explain why the following finding is likely to represent a red flag raised by Ms. Jiang when performing due diligence on *Axiom Multi-Strategy*? "Ms. Jiang found that that the fund charges incentives fees at the individual book level."

5. In hedge fund operational due diligence, what does the term "triangulation" refers to?

Solutions

1. Amaranth

   (Section 40.2.6)

2. The strategy involves securities that are generally difficult to short and the strategy does not require the manager to take short position in underlying securities.

   (Section 40.2.7)

3. The question related to the investment strategies of the hedge funds and is not a critical question to ask a fund of fund manager.

   (Section 40.2.4)

4. One key advantage of multi-strategy funds is that they would charge performance fees on the whole fund, thus reducing the total performance fee paid by investors. This is particularly true if one were to compare a multi-strategy fund to a fund of funds or to a portfolio of hedge funds.

   (Section 40.2.6)

5. The term triangulation consists in obtaining deeper useful information about a fund manager from a source that is familiar with the manager (for example, someone in the manager's network who may personally know the manager and is also willing to answer the investor's questions about the manager).

Reading 2, Article A
Are Funds of Funds Simply Multi-Strategy Managers with Extra Fees?

The article contrasts two principal ways to obtain hedge fund exposure: (1) funds of hedge funds, and (2) a portfolio of multi-strategy hedge funds. The advantages and disadvantages of each approach are examined along three main dimensions: alpha potential, risk management, and business model. Rather than directly comparing the performance of multi-strategy funds and funds of hedge funds, the authors attempt to quantify the potential differences in performance by modeling factors that affect both investment types.

The methodology section contains a brief discussion of problems inherent in directly comparing performance of funds of funds and multi-strategy funds. The focus of this discussion is on the data biases affecting non-investable and investable database indices. The key finding of this section is the implications of the biases present in database. The article then examines the factors relating to alpha potential. Here, the article focuses on strategy allocation and manager selection.

Further, the article compares how manager selection and strategy selection affect hedge fund investments (rather than traditional investments). Historical evidence on the performance dispersion among various hedge fund strategies and among individual managers within each strategy is presented. The study compares how manager selection and strategy allocation affect investments in funds of hedge funds and multi-strategy funds.

The factors relating to risk management are examined. Using an allocation simulation, the authors attempt to quantify (in terms of Sharpe ratios and Sortino ratios) and contrast the benefits of diversification to investments in funds of hedge funds and multi-strategy funds. Differences of operational risk implications for both hedge fund allocation approaches are also briefly discussed. Finally, the study recognizes how the extra layer of due diligence provided by funds of hedge funds may help mitigate headline risk associated with investing in a new investment style such as hedge funds. The paper also examines the factors relating to business model. The focus of this section is management fees, incentive fees, and talent retention.

Exercises

1. What are the advantages and disadvantages of multi-strategy funds when compared to funds of funds?

Solutions

1. The authors analyzed multi-strategy hedge funds and funds of funds to examine whether they are two potential sources of alpha and reached the following three main conclusions:

    i. Funds of funds can potentially provide many benefits that are not offered by multi-strategy managers. In addition, the differential in fees between funds of funds and multi-strategy managers is smaller than most investors realize, even when one takes into account the effect of fee netting.
    ii. Funds of funds that are able to select better than median managers have the potential to more than offset any fee advantage offered by multi-strategy managers.
    iii. The diversification benefits offered by funds of funds can lead to a significant enhancement in Sharpe and Sortino ratios. This is explained by the low correlation between managers within most hedge fund strategies.

    (Pages 186-198)

Reading 2, Article B
Investing in Credit Series Distressed Debt

The article serves as an overview of the distressed debt asset class. After an introduction to the evolution of distressed debt as a sub-asset class, the author surveys the distressed debt market conditions and the U.S. bankruptcy regulation as of 2011. The author proceeds with a discussion of general characteristics of distressed securities with a focus on the left tail characteristics of their payoff distribution. Value generation, distribution and the main return drivers in distressed situations are discussed next. The examples contained in the grayed-out boxes provide case-study style examples of various distressed situations, such as tender offers, reorganizations, private workouts, and bankruptcy. In the section dedicated to return drivers, a distinction is made between value adding through active management and deal sourcing. Jain follows up by identifying various types of distressed securities managers and trading strategies. The focus of the trading strategies section is on the contrast between non-control/trading oriented investing and control-oriented investing. The various ways an investor can gain control as well as types of exit and monetization are explained and discussed. The article concludes by identifying the main risks specific to distressed investing, focusing on headline/regulation, process, and market liquidity risks

Exercises

1. Discuss methods that institutional investors can employ to access the distressed securities asset class.

Solutions

1. Institutional investors (e.g., endowments and foundations, public and corporate pension plans, as well as funds of funds) have been large investors in the distressed sector. They may trade in:

    - Distressed and out of favor credits (e.g., commercial loans, corporate loans, and asset-backed securities)
    - Residential sub-performing or non-performing loans and securities
    - Corporate and commercial loans, mezzanine loans, and other investments in subordinate levels of the capital structure of issuers
    - Publicly traded or privately negotiated equity securities (e.g., preferred stock, common stock and warrants) of stressed and distressed firms

    (Pages 199-218)

Topic 6: Structured Products and Liquid Alternatives

Readings

1. *CAIA Level II: Core and Integrated Topics*, Institutional Investor, Inc., 2015, ISBN: 978-1-939942-02-9. Part V: Investment Products: Structured Products.
   A. Coval, J., J. Jurek, and E. Stafford. "The Economics of Structured Finance." *Journal of Economic Perspectives*, Winter 2009, Vol. 23, No. 1, pp. 3–25.
   B. Weistroffer, C. "Insurance Linked Securities." Deutsche Bank Research, October 2010.
   C. "Going Mainstream: Developments and Opportunities for Hedge Fund Managers in the '40 Act Space." Barclays. April 2014
   D. Maxey, C. "Alternative Strategy Mutual Funds: Opportunity or Mirage?" Fortigent, LLC. October 2013.

Reading 2, Article A
The Economics of Structured Finance

The article provides a synopsis of the mechanics of structured products with extra focus on the details of the how the challenges of rating of these products affected the financial crisis of 2007-2008. The authors use the example of a prototypical collateralized debt obligation to illustrate the processes of pooling and tranching, and how these processes amplify errors in evaluating the risk of the underlying securities. The details of tranching outlined in the section titled "Manufacturing AAA-rated Securities" are important, since these are crucial in understanding the way structured products repackage risk. This section also explains how small errors in estimating the risks and correlations of the underlying assets can translate into much larger errors in estimating the risks of the tranches. The risk estimation for tranches becomes even more challenging in the case of CDO-squared securities.

The article focuses on the challenges of rating tranches of structured products in the section titled "The Challenge of Rating Structured Finance Assets." The article provides both a conceptual framework for understanding these challenges and empirical results illustrating sensitivity of risk estimates to errors in parameter estimation. In the section titled "The Relation of Structured Finance to Subprime," the article provides a historical overview of the events and market participants associated with the subprime crisis.

The section titled "The Pricing of Systematic Risk in Structured Products" highlights how pooling and tranching effectively manufactures securities whose payoff profiles resemble those of digital call options on the market index, providing investors with substantial exposure to systematic risk. Finally, in the last two sections of the article, the authors look at the history of structured product markets leading up to the crisis and the implications of the crisis for the future of structured products. Of particular interest in these sections is the conflict of interest between various market participants.

Exercises

1. How did the factors shaping expected losses on tranches of collateralized debt obligations backed by mortgage-backed securities affect investors during the recent subprime crisis?

Solutions

1. All of the factors shaping expected losses on tranches of collateralized debt obligations backed by mortgage-backed securities had been biased against the investor during the recent subprime crisis. First, the overlap in vintages and geographic locations within mortgage pools increased the likelihood of higher-than-expected default correlations. Second, the deterioration in credit quality of subprime borrowers and the predominance of "fire sales" of assets (which in turn led to lower asset prices) increased the probability of default and worsened expected recovery values. Finally, the commonness of CDO^2 structures further exacerbated the harmful effects of errors in estimates of expected losses on the underlying mortgages for investors.

   (Pages 220-242)

Reading 2, Article B
Insurance Linked Securities

The author provides a primer on a fast-expanding niche asset class: insurance-linked securities (ILS). The article discusses the economics of how ILS work: by complementing and extending traditional reinsurance, expanding insurance capacity overall, offering additional hedging opportunities to insurers, serving as an additional source of funding for insurers, and their role as a potential portfolio diversifier. The mechanisms of how ILS structures are discussed, explaining how risk transfer works using catastrophe bonds. The author then describes the role of reserve capital requirements in the growth of ILS, as well as the basis risk for the insurer. Finally, the author concludes with a discussion of the current market of ILS, which evolves into a discussion of the future of ILS, and the role of new regulations, for example Solvency II, in the growth of ILS.

Exercises

1. Describe cat bonds.

Solutions

1. In a cat bond transaction, the investor loses a portion of or the complete principal if the loss from a predetermined event materializes. Typical predetermined events are hurricanes in the U.S. and winter storms in Europe. The cat bond investors in turn are paid by a premium – proportional to the risk they are bearing – in addition to being compensated the market rate on the principal (e.g., LIBOR). In practice, the cat bond is issued by a special purpose vehicle (SPV) sponsored by the insurer. An SPV is a legally independent, bankruptcy remote vehicle, that is set up for the sole purpose of arranging

the transaction. Finally, most cat bonds are being rated below investment grade. This is in contrast to senior tranches in credit securitizations.

(Pages 243-257)

Reading 1, Article C
Going Mainstream: Developments and Opportunities for Hedge Fund Managers in the ’40 Act Space

While the private placement hedge fund business has seen slowing growth in assets under management, assets are growing quickly in the '40 Act space, where hedge funds are offered in a mutual fund format. Hedge fund managers may find this mutual fund business to be attractive, as they can increase asset flows while diversifying their investor base. Managers with a larger and more diverse asset base may find that their asset management company has a higher valuation multiple, even as average fees decline.

However, managers must enter this space carefully. In order to offer a mutual fund product, the investment strategy must adhere to the rules of the Investment Company Act of 1940, from which the private placement manager is specifically exempted. These rules include restrictions on leverage, short selling, and asset concentration, while requiring greater levels of liquidity and transparency. Not all strategies fit well into the '40 Act framework, as some relative value and credit strategies may employ too much leverage or have too little liquidity to meet the regulatory requirements.

Managers will also need to consider whether raising assets in the lower-fee mutual fund will cannibalize their assets and fee income in the higher-fee hedge fund product. Finally, raising assets for a hedge fund is quite different than raising assets for a mutual fund, so some hedge fund managers have created joint venture or sub-advisory relationships with traditional mutual fund firms with strong distribution capabilities.

Exercises

1. In what ways do mutual funds regulated by the Investment Company Act of 1940 ('40 Act) differ from hedge funds that are exempt from the '40 Act? What changes to investment strategy are necessary before hedge funds can offer funds that are compliant with the '40 Act?

2. List and discuss three ways that hedge fund managers may enter the '40 Act space. Specifically address the characteristics of a hedge fund manager that would choose one fund vehicle over another.

Solutions

1. Mutual funds subject to the regulations of the '40 Act have specific rules regarding leverage, short selling, liquidity, diversification, and transparency. While hedge fund managers typically do not have limits on their investment strategies, managers who choose to offer their funds in a

mutual fund format must comply with all regulations of the '40 Act. Specifically hedge funds will need to 1) have a maximum leverage of 1.33x or asset coverage of 300%, 2) carefully segregate assets to cover short selling risks, 3) strike a daily NAV and offer daily liquidity, 4) limit illiquid securities to 15% of assets, 5) limit position sizes to comply with diversification requirements, and 6) file quarterly, semi-annual, and annual reports providing transparency into fund positions.

(Pages 258-277)

2. A. Sub-advise a multi-manager '40 Act product. This style is most similar to a fund of funds, where the hedge fund manager implements their strategy on only a portion of fund assets. Because the '40 Act rules on diversification, concentration, and leverage apply to the full fund and not individual strategies, the choice to sub-advise a multi-manager product may be most appropriate for managers whose natural strategy has positions that are far from compliance with the '40 Act regulations. For example, a highly levered relative value fund manager may choose this structure to avoid reducing the level of leverage in their portion of the multi-manager product. This structure is also appropriate for managers who do not want to directly disclose their positions, as the transparency from the multi-manager fund will commingle the positions of all of the fund's managers.

(Pages 258-277)

B. Sub-advise a single-manager '40 Act product. In this structure, the manager will run their fund with a strategy similar to their hedge fund, but partner with a traditional mutual fund company who has experience in the regulation and distribution of mutual fund products. This strategy allows the hedge fund manager to focus on investment management, while leaving the fund raising and mechanics of fund management to another firm.

(Pages 258-277)

C. Sponsor and distribute their own '40 Act product. In this structure, the hedge fund manager will manage, distribute, and build the infrastructure for their own mutual fund product. This structure is best suited for a manager who has the operational infrastructure to handle both '40 Act and private placement products.

Both structures B and C subject the manager to cannibalization risk. Investors who see the same fund manager operating both a higher fee hedge fund and a lower fee mutual fund will demand better performance from the hedge fund to justify the difference in fees. If performance of the hedge fund is not significantly better than the mutual fund, hedge fund managers run the risk of seeing redemptions from the hedge funds with the proceeds potentially flowing into their mutual fund vehicle. Investors in structure A don't have this risk, as this structure doesn't create the opportunity for investors to directly invest in the single manager's strategy in a mutual fund format.

(Pages 258-277)

Reading 1, Article D
Alternative Strategy Mutual Funds: Opportunity or Mirage?

Following the financial crisis of 2007-2008, investors and asset managers began searching for invest products that could participate in rising markets in a meaningful way, but at the same time provide significant protection during down markets. Privately placed products such as hedge funds and manage futures displayed some of these properties during the crisis, but they were not available to retail investors in most countries. Therefore, attempts have been underway during the last several years to package these privately placed products so that they can be offered to retail investors under the general title of liquid alternatives. These industry attempts have been helped by changes in the regulatory environment in the U.S., in particular.

This article explores the challenges and the opportunities presented by the evolution of alternative mutual funds for investors and asset managers. It begins with a brief description of various alternative strategies and then proceeds to examine the benefits of adding alternative to a traditional portfolio.

Not all privately placed products can be packaged in liquid form that can be made available to retail investors. The article compares and contrasts privately placed products with their liquid counterparts, addressing issues such as fees and investment structures. Finally, the article examines the due diligence issues and various types of risks that arise while considering liquid alternatives.

Exercises

1. Describe regulatory requirements that are applicable to alternative mutual fund strategies.

2. Explain the challenges involved in evaluating alternative mutual funds

Solutions

1. In the U.S., the Company Act or the 1940 Act is the primary source of regulation for mutual funds and closed-end funds. Mutual funds, whether offering traditional or alternative investment strategies must meet the regulatory framework set by this act. The regulations most directly applicable to alternative strategies include the following:

- Redemptions must be paid within seven days.
- No more than 15 percent of assets may be invested in illiquid assets.
- Mutual funds should not charge performance fees, unless designed as a fulcrum structure where fees rise and fall depending on the performance of the fund.
- For at least 75 percent of the portfolio, diversified mutual funds may invest more than more than 5 percent in any one issuer, may not own more than 10 percent of the outstanding voting securities of an issuer, and may not invest more than 25 percent in a particular industry group.
- May not generate more than 10 percent of income from non-securities, such as commodity futures.

- Mutual funds may employ leverage, as long as it maintains 300-percent asset coverage. For practical purposes, this limits leverage to 33 percent.

(Pages 278-288)

2. Several issues arise when evaluating an alternative mutual fund:

- Limited track record. This pertains more to experience across different types of specific periods of time.
- Long-only managers launching alternative funds despite limited experience with shorts or derivatives.
- Operational infrastructure and its impact on a manager's ability to establish quality counterparty relationships.
- Disparity of style and approach across time (style drift).
- Personnel turnover.
- Investor turnover or sudden loss of assets.
- Strategies that we do not believe have the potential to perform well within the constraints of the mutual fund structure.

(Pages 278-288)

Topic 7: Asset Allocation and Portfolio Management

Readings

1. *CAIA Level II: Advanced Core Topics in Alternative Investments*, Wiley, 2012, ISBN: 978-1-118-36975-3. Part One: Asset Allocation and Portfolio Management, Chapters 2–4.
2. *CAIA Level II: Core and Integrated Topics*, Institutional Investor, Inc., 2015, ISBN: 978-1-939942-02-9. Section VI: Asset Allocation and Portfolio Management.
   A. Perold, A. F. and W.F. Sharpe. "Dynamic Strategies for Asset Allocation." *Financial Analysts Journal*, January/February 1995, Vol. 51, No. 1, pp.149-160.
   B. Ilmanen, A. "Understanding Expected Returns." CFA Institute, cfapubs.org, June 2012, CFA Institute Conference Proceedings Quarterly.

Reading 1, Chapter 2
The Endowment Model

Exercises

Problems 1 to 5

123 is a relatively large U.S. endowment that is considering allocating funds to alternative investments. To this end, 123 hired a consultant who has just made a preliminary presentation in which she discusses whether each of the following five factors can explain the returns earned by large endowments in recent years: the degree of aggressiveness of asset allocation, the effectiveness or ineffectiveness of investment manager research, whether there exists a first mover advantage, the potential impact of having access to a network of talented alumni, and the effects of a specific type of risk.

1. At the beginning of the presentation, the consultant comments that "…*In the case of traditional investments, security selection and market timing of pension plans explained a very large percentage of the variance in pension fund returns. The remaining portion of fund returns can be explained by strategic asset allocation*." Is this comment by the consultant correct? Explain.

2. Later, the consultant asserts that "…*The value added by active managers in alternative investments can be quite substantial*." Is this assertion by the consultant empirically sound? Explain.

3. An analyst working at 123 is concerned about the returns that 123 might obtain if they decide to invest in top managers in alternative assets and asks the consultant about the empirical evidence on this issue, considering that 123 is new to the world of alternative investments. The consultant replies that "…*Newer investors accessing top managers in alternative asset classes, especially in venture capital, are expected to outperform when the top managers allow commitments only from those investors who participated in their earlier funds*." Is the consultant's reply correct? Explain.

4. The consultant explains that "…*Empirical evidence suggests that hedge fund managers who attended undergraduate colleges with higher average SAT scores earned higher performance.*" Is this statement correct? Explain.

5. Towards the end of the presentation, the consultant asserts that "…*As the longest-term investors, charged with protecting the real value of endowment principal for future generations of students, universities are seeking to earn a premium by investing in privately held vehicles, with the idea that their perpetual nature allows them to easily handle this specific type of risk.*" What type of risk is the consultant most likely to be referring to?

Solutions

1. This comment by the consultant is incorrect. In the case of traditional investments, studies indicate that the strategic asset allocation of pension plans accounted for more than 90% of the variance in fund returns. The remaining portion of fund returns, which is below 10%, is explained by security selection and market timing.

   (Section 2.4.1)

2. This assessment is consistent with empirical evidence. Managers working in inefficient markets have a greater opportunity to profit from information, skill, and access to deal flow. Inefficient markets are inherent to many alternative asset classes.

   (Section 2.4.2)

3. The consultant's reply is incorrect. This is because empirical evidence shows that newer investors seeking access to top managers in alternative investments, especially in venture capital, are expected to underperform when the top managers allow commitments only from those investors who participated in their earlier funds.

   (Section 2.4.3)

4. This statement is correct. Research shows that hedge fund managers who attended universities with higher average SAT scores have higher returns and lower risk than the median fund managers.

   (Section 2.4.4)

5. Liquidity risk.

   (Section 2.4.5)

Exercises

1. Consider the following two put options contracts: the first is 15% out-of-the-money and the second is 25% out-of-the-money. How could a put bear spread be created?

2. How can the growth rate of an endowment be calculated?

Problems 3 to 7

ABC is a U.S. endowment that up to now has invested only a marginal portion of its portfolio in alternative investments. ABC is considering allocating more funds to alternative investments, including hedge funds, but is afraid of the negative effects that the illiquidity of some of these alternative assets may have on the riskiness of its portfolio. To this end, ABC hires a consultant to determine, among other issues, the effects of lockup periods in returns, the costs of liquidity risk during periods of market stress, how to manage liquidity risks, the potential effects of gates on investors, as well as the effects that the smoothing of data reported by a number of alternative assets may have on allocations to these investments. The consultant has just handed in a report to ABC addressing these questions.

3. The consultant comments that "…*Everything else being the same, evidence suggests that funds with long lockup periods normally provide a higher rate of return to investors*." Is this comment by the consultant correct? Explain.

4. The consultant states that "…*When a small fraction of a fund's investors redeem their shares during periods of market turmoil, the cost of liquidity risk remains essentially the same for all investors, even in the case in which the underlying assets of the fund are less liquid than the liquidity provisions it offers to its investors*." Is this statement by the consultant empirically sound? Explain.

5. The consultant comments that "… *During the recent financial crisis, many funds experienced severe liquidity squeezes due to ineffective liquidity risk management. This forced some funds to sell part of their illiquid assets at fire sale prices in secondary markets, to delay the funding of important projects, and, in some cases, to borrow funds in the debt market during a period of extreme market stress. These incidents have led some to discourage endowments and pension funds from allocating a significant portion of their portfolios to alternative investments.*" Is this statement correct?

6. Towards the end of the report, the consultant cautions that, during times of market turmoil "…*Endowments that invest in leveraged hedge funds must be prepared for the potentially large drawdowns in these strategies, as well as the potential for the erection of gates*." Is this advice by the consultant correct?

7. At the end of the report, the consultant expresses that "… *To the extent that certain alternative investments have smoothed returns or net asset values that are reported with a time lag, liquid alternatives and traditional assets will decline in allocation rapidly during times of crisis*." What is the underlying principle of this analysis?

Solutions

1. The investor could create a put bear spread by selling the put option that is 25% out-of-the-money (i.e., the contract that is farther out-of-the-money) and buying the put option that is 15% out-of-the-money.

   (Section 3.4)

2. The growth rate of a total endowment is approximately equal to:

   The rate of return on endowment funds + The gift to endowment rate
   The endowment's spending rate

   (Section 3.1)

3. The consultant's comment is correct. A long lockup period helps managers to decrease the cost of liquidity risk. For instance, during the recent financial crisis, funds with long lockup periods had the advantage of not being under pressure to sell their assets at fire sale prices.

   (Section 3.2)

4. This statement is not empirically sound. According to evidence, when the underlying assets of a fund are less liquid than the liquidity provisions it offers to its investors, then the cost of liquidity risk would increase for all investors, even if only a small fraction of the fund's investors decide to redeem their shares during periods of market turmoil.

   (Section 3.2)

5. This comment by the consultant is correct.

   (Section 3.2)

6. This advice by the consultant is correct and consistent with events during the recent financial crisis.

   (Section 3.2)

7. In the case of relatively illiquid investments (e.g., certain alternative investments such as private equity and hedge funds) the net asset value adjusts slowly to changes in public market valuation. As a result, in periods of crisis, prices of liquid assets decline rapidly

and investors may react by only rebalancing within the liquid assets, while slowly changing allocations to relatively illiquid alternative investments by modifying the size of future commitments.

(Section 3.3)

Reading 1, Chapter 4
Pension Fund Portfolio Management

Exercises

1. Suppose the case of an employer that offers a retirement benefit of 2% of salary for each year the employee worked before retirement. If the final salary to which the benefits apply is $75,000, and the employee has worked for 35 years, calculate the retirement income-replacement ratio.

2. Suppose the case of a retiree earning a pension of $2,500 per month. Calculate the retiree's pension in seven years if inflation rates are 5% per year and the cost of living adjustment (COLA) is 80%.

Problems 3 to 7

Lisa Larsson and Karl Lehman worked for 40 years at XYZ. Mike Mancini worked for 20 years at ABC and for the following twenty years at XYZ. Both XYZ and ABC provide their employees with a benefit of 1.5% of the average of the final four years of salary multiplied by the number of years of service.

Lisa started with an income of $18,000 in 1972 and retired in 2011 with an income of $65,000. Her final four years of salary were $65,000 (2011), $63,050 (2010), $61,789 (2009), and $59,940 (2008).

Mike also started with an income of $18,000 in 1972 and also retired in 2011 with the same income as Lisa ($65,000). Mike worked for ABC from 1972 to 1991, with an average annual salary in the final four years of $32,041. His final four years of salary at XYZ, his second employer (1992-2011), were the same as those of Lisa.

Finally, and paralleling the case of Lisa, Karl Lehman also worked at XYZ for forty years, also started with a salary of $18,000 in 1972 and also retired when he was earning a salary of $65,000 in 2011, enjoying the same average annual salary raises as Lisa. However, Karl had a Defined Contribution (DC) plan in which 5% of his salary was invested and earned employer contributions in a similar amount (i.e., annual contributions were for 10% of his salary). Investment returns in the DC plan averaged 7% per year.

3. Calculate the average annual salary increase received by Lisa and Mike.

4. Calculate the annual benefit perceived by Lisa.

5. Calculate the annual benefit perceived by Mike and compare it to the annual benefit perceived by Lisa.

6. Calculate the amount that Karl would have accumulated on his DC plan at retirement.

7. Determine the amount accumulated by Karl in his DC plan that corresponds to contributions by Karl and XYZ, and the amount that corresponds to investment earnings.

Solutions

1. In this problem, the retiree will be paid retirement benefits in the amount of $52,500 per year (i.e., 2% × 35 years × $75,000) for the rest of his life. This provides the worker with a retirement income-replacement ratio of 70% (i.e., $52,500/$75,000). This is the pension benefit as a portion of the final salary.

   (Section 4.1)

2. The retiree will have a cost of living adjustment of 4% (i.e., 80% × 5%) per year. Therefore, the retiree's pension in seven years will be: $2,500 × $(1.04)^7$ = $3,289.83 per month.

   (Section 4.1.4)

3. In both cases, the average annual salary increase was 3.26% (i.e., in a financial calculator: n = 40, PV = -18,000, PMT = 0, FV= 65,000, and solve for i or r).

   (Section 4.1)

4. For Lisa, the average annual salary for the final four years was $62,444.75 (i.e., ($65,000 + $63,050 + $61,789 + $59,940)/4).

   The annual benefit perceived by Lisa would be $37,466.85 (i.e., 1.5% × 40 years × $62,444.75).

   (Section 4.1)

5. The annual benefit perceived by Mike at ABC would be of $9,612.30 (i.e., 1.5% × 20 years × $32,041). This annual benefit is determined in 1991, but not paid until retirement in 2011. The second employer, XYZ, pays annual benefits in the amount of $18,733.43 (i.e., 1.5% × 20 years × $62,444.75).

   Compared to the annual benefit of $37,466.85 perceived by Lisa after working her entire career for XYZ, Mike only earns an annual pension of $28,345.73 (i.e., $9,612.30 + $18,733.43), which is $9,121.12 per year less than Lisa (who worked her entire career for a single firm, XYZ).

   (Section 4.1)

6. We already calculated in Problem 3 that the average annual salary increase enjoyed by Lisa was 3.26%. This is the same percentage salary increase perceived by Karl.

   Karl would have accumulated $547,041.46 at retirement. This value is found using the formula for the future value of a growing annuity (*FVGA*), which is:

$$FVGA = C\left[\frac{(1+r)^n - (1+g)^n}{r-g}\right]$$

   Where:

   C is Karl's first annual contribution (i.e., 1971), which is equal to $18,000 × 10% = $1,800
   r is the average annual returns in the DC plan, which in this case is 7%
   g is the average annual salary increase, which in the case of Karl is 3.26%
   n is the total number of years that Karl and XYZ contributed to the DC plan, which in this case is 40 years.

   Therefore,

$$FVGA = \$1{,}800\left[\frac{(1+0.07)^{40} - (1+0.0326)^{40}}{0.07-0.0326}\right] = \$547{,}041.46$$

   (Section 4.3)

7. The contributions by Karl and XYZ totaled $144,008.39 (i.e., in a financial calculator: *n* = 40, *r* = 3.26, *PV* = 0, *PMT* = $1,800, and solve for *FV*). Half of this ($72,004.19) was contributed by Karl and the other half by XYZ. The amount that corresponds to investment earning is $403,033.07 (i.e., $547,041.46 - $144,008.39).

   (Section 4.3)

Reading 2, Article A
Dynamic Strategies for Asset Allocation

Fluctuating asset values inevitably result in changes of portfolio weights. Dynamic strategies are explicit rules for managing rebalancing of portfolio weights. The article provides an introduction to four types of dynamic strategies: buy-and-hold, constant-mix, constant-proportion portfolio insurance, and option-based portfolio insurance. The important contributions of this paper are contained in the examples contained in the article. They demonstrate the implications of the different dynamic strategies on expected payoffs of portfolios under various market scenarios (for example, up-market, down-market, volatile market, low-volatility market). The discussion of this link is aided by the payoff and exposure diagrams presented in the article. The reader will learn how to implement various types of dynamic strategies and to calculate the appropriate allocation changes given a change in the market value of the different portfolio components. The article makes an important distinction between concave and convex strategy types. In addition,

the paper discusses that the effectiveness of these strategies may change if a large segment of the investment industry decides to follow them. Yet another point of interest is the discussion of resetting of dynamic strategy parameters: Should a portfolio manager reset these parameters as market values of the portfolio components change or not?

Exercises

1. Describe constant-mix strategies in relation to risk tolerance and rebalancing.

2. Consider a $100 million portfolio. The portfolio is to be managed using the CPPI approach with the goal of protecting 95% of the initial investment. The time horizon is 1-year and the current 1-year U.S. Treasury rate is 2%. A multiplier of m = 3 will be used and the portfolio will be rebalanced on a weekly basis.

   - What should be the initial allocation to the risky asset?
   - What should be the new allocation to equity if the equity asset class declines by 4% during the first week?
   - Given m = 3, what is the maximum weekly decline in the equity asset class that the portfolio can tolerate before the principal protection is violated?

Solutions

1. Constant-mix strategies preserve an exposure to stocks that is a constant proportion of wealth. Investors following constant-mix strategies have risk tolerances that vary proportionally with their wealth and will hold stocks at all wealth levels.

   Constant-mix strategies are dynamic approaches to investment decision-making. Whenever the relative values of assets change, purchases and sales are required to return to the desired mix. In general, rebalancing to a constant-mix requires the purchase of stocks as they fall in value and the sale of stocks as they rise in value. Strictly speaking, changes in value are measured in relative terms.

   (Pages 290-301)

2. The portfolio will be allocated between equity and U.S. Treasury in order to protect 95% of the initial principal. The following formula will be use

   Equity Allocation = m $\times$ (Total Assets – Floor)

   To calculate the floor we obtain the PV of the 95% principal using the Treasury rate.

   Floor = (95% $\times$ 100) / (1 + 2%) = 93.14

   Equity Allocation = 3 $\times$ (100 – 93.14) = 20.58

   Fixed Income Allocation = 100 – 20.58 = 79.42

If the equity asset class declines by 4% during the first week, then the new allocation to equity should be as follows:

Equity value will be 20.58 * (1-4%) = 19.76

Total Portfolio will be 79.42 + 19.757 = 99.18

New Equity Allocation = 3 * (99.18 – 93.14) = 18.12

New Fixed Income Allocation = 99.18 = 18.12 = 81.06

(Pages 290-301)

3. Given m = 3, what is the maximum weekly decline in the equity asset class that the portfolio can tolerate before the principal protection is violated?

   Maximum Weekly Decline = 1/m = 1/3 = 33%

Reading 2, Article B
Understanding Expected Returns

The author takes a long-term view on the topic of expected returns. The main theme of the article is that investors should find multiple risk premiums to diversify their portfolio and try to avoid having their portfolios dominated by equity market directional risk. The author compares historical performance of various traditional asset classes and several allocation strategies: value, carry, trend-and-momentum, volatility, and liquidity. The main points candidates are expected to take away from this study are the historical differences in expected returns between these different allocation strategies, and implications of each strategy for risk management purposes. While the exact performance numbers are interesting, they will change as different time periods are considered. However, and more importantly, the general relative performance comparisons (e.g., which strategy tended to perform well, when, and why) are likely to remain valid in general.

Exercises

1. What are the three classic ways of reducing risk?

2. Explain the behavioral interpretations that have been proposed as compelling explanations for the historical underperformance of growth stocks.

3. Did carry-seeking strategies generated excess returns in either fixed-income or currency market strategies between 1993 and 2000? Do carry-seeking strategies generate stronger performance when executed within one market or across countries?

4. Has a simple strategy of buying an asset that has been going up in the last year or selling one that has been going down added value in the long-run in many contexts (commodity futures, interest rate futures, equity country indices, and currencies)?

Solutions

1. The three classic ways of reducing risk are: (i) a move towards a riskless assets, (ii) insurance, and (iii) diversification.

   (Pages 302-310)

2. The behavioral interpretation consists in that if a stock (or a sector or a country) is experiencing high growth, investors will tend to extrapolate further subsequent growth, resulting in high valuations for growth stocks. In other words, there exists an overpricing of the hope for growth, which leads to sharp declines in the stock prices of growth stocks during bear markets.

   (Pages 302-310)

3. Carry investing involves selling low-yielding assets to buy high-yielding assets. Carry-seeking strategies generated excess returns in both fixed-income and currency market strategies between 1993 and 2000. The strategy generates stronger performance when executed across countries, rather than within one market. However, the carry strategy can suffer rare but large losses that tend to be concentrated during bad times.

   (Pages 302-310)

4. The answer is yes. Evidence suggests that winners tend to persist in performance for up to a year, and after that, a reversal effect tends to take over.

   (Pages 302-310)

Topic 8: Risk and Risk Management

Readings

1. *CAIA Level II: Core and Integrated Topics*, Institutional Investor, Inc., 2015, ISBN: 978-1-939942-02-9. Part VII: Risk and Risk Management.
   A. Hill, J.M. "A Perspective on Liquidity Risk and Horizon Uncertainty." *The Journal of Portfolio Management*, Summer 2009, Vol. 35, No. 4, pp. 60-68.
   B. Berger, A. "Chasing Your Own Tail (Risk)." AQR Capital Management, LLC, Summer 2011.

Reading 1, Article A
A Perspective on Liquidity Risk and Horizon Uncertainty

Investors have historically measured risk by standard deviation and beta. These risk measures, though, seem less relevant during times of crisis, when liquidity risk concerns become dominant and market risk measures increase and become more volatile. Tail risk increases during times of crisis due to changes in investor behavior regarding leverage, risk, and liquidity preferences. A history of financial crises in the U.S. market is presented, with a focus on the behavior of investors during times of increased market risk and liquidity risk.

Liquidity risk is ultimately related to the time horizon of investors. When large numbers of investors simultaneously shorten their time horizons, markets can quickly become less stable, as market equilibrium depends on a diversity of investor time horizons. The crisis can deepen if market participants withdraw liquidity to prey on specific investors or asset types in distress. Investors who can hold less liquid assets should be compensated by earning a liquidity risk premium.

Investors need to manage their portfolios with a balance of more liquid and less liquid investments. The key is having access to liquidity during a crisis, which can come through holding short-horizon assets and the appropriate use of derivative products. Having liquidity during a crisis can allow investors to benefit, rather than suffer, during times of selling contagion.

Exercises

1. Comment on the three primary forces explaining why the returns of broad equity indices go to extremes during a tail-risk event.

Solutions

1. The following are the three primary forces explaining why the returns of broad equity indices go to extremes during a tail-risk event:

   i. The risk of individual stocks rises during a tail-risk event because of the higher fundamental and flow-related risk at the company level.

ii. Delevering and de-risking occur at the same time across a wide array of securities inducing short-term correlations to rise.
iii. Bid–ask spreads widen and the market impact of trades becomes large as market makers charge higher prices for providing liquidity. Eventually, these factors affect all risky assets and lead to higher short-term correlations.

(Pages 312-320)

Reading 1, Article B
Chasing Your Own Tail (Risk)

This article argues that simple strategies, such as diversification and allocating to low beta equities, might be a more effective means of reducing tail risk. In the wake of 2008, investors are now painfully aware of tail risk – the risk of unexpectedly large losses. Today, many institutional investors are insuring against tail risk directly, often by purchasing puts or structuring collars. Unfortunately, experience and financial theory suggest that the long-term cost of such insurance strategies will be larger than the payouts. The expected return for perpetual insurance buyers is negative and conversely positive for insurance sellers. Arguably, relatively risk-tolerant investors should be selling tail-risk insurance rather than buying it.

The article recommends five approaches to reducing tail risk which do not require the investor to purchase derivatives. The paper argues that by modifying the portfolio structure itself and by addressing risk management policy, tail risk can be reduced at a lower long-term cost. The authors believe that these five approaches, when used in combination, will be effective in reducing tail risk: (1) diversify by risk, not just by assets, (2) actively manage volatility, (3) embrace uncorrelated alternatives, (4) take advantage of low-beta equities, and (5) have a crisis plan before the investor needs one.

The rest of the paper is devoted to further discussion of these five approaches. For example, the paper argues that there are many sources of risk and return in markets and that most institutional portfolio have too much exposure to equity risk and not enough to other risk factors. With regard to volatility management, the paper argues that the approach will lead to lower risk exposure during turbulent times and will thus reduce the tail risk of the portfolio. The paper argues in favor of managed futures and low beta stocks.

Exercises

1. Indicate the five approaches considered in the paper for reducing tail risk.

Solutions

1. The following are the five approaches considered in the paper for reducing tail risk:

   i. Diversify by risk and not just by assets
   ii. Actively manage volatility
   iii. Increase exposure to uncorrelated alternatives

iv. Take advantage of low-beta equities
v. Have a crisis plan before a crisis strikes

The authors suggest that these five approaches are most effective when used in combination.

(Pages 321-332)

Topic 9: Manager Selection, Due Diligence, and Regulation

Readings

1. *CAIA Level II: Core and Integrated Topics*, Institutional Investor, Inc., 2015, ISBN: 978-1-939942-02-9. Part VIII: Manager Selection, Due Diligence, and Regulation.
   A. De Souza, C. and S. Gokcan. "Hedge Fund Investing: A Quantitative Approach to Hedge Fund Manager Selection and De-Selection." *The Journal of Wealth Management*, Spring 2004, Vol. 6, No. 4, pp. 52-73.
   B. Clare, A. and N. Motson. "Locking in the Profits or Putting It All on Black? An Empirical Investigation into the Risk-Taking Behavior of Hedge Fund Managers." *The Journal of Alternative Investments*, Fall 2009, Vol. 12, No. 2, pp. 7-25.
   C. Tuchschmid, N. and E. Wallerstein. "UCITS: Can They Bring Funds of Hedge Funds On-Shore?" *The Journal of Wealth Management.* Spring 2013, Vol. 15, No. 4, p. 94-109.

Reading 1, Article A
Hedge Fund Investing: A Quantitative Approach to Hedge Fund Manager Selection and De-Selection

The process of allocating to hedge funds involves several steps. First, we would decide on the size of overall allocation to hedge funds. Second, we would examine each strategy and decide on the size of allocation to each strategy. Having identified the appropriate strategy mix, the next step of the portfolio construction process, and the subject of this article, is individual manager research and due diligence to identify those hedge fund managers that are the "best-in-class" and suitable to execute each of the selected strategies. Historically, this process has to a large extent been qualitative, with quantitative analysis primarily focusing on the elementary analysis of return series. The scope of this article is to present a number of quantitative tools for different phases of manager selection or de-selection. The authors recognize as practitioners that there are no substitutes for an understanding of the nuances of investment philosophy, risk control, capital management, timely, and accurate information transfer, and ultimately fund level transparency.

The introductory section of the paper makes the case that hedge fund managers belonging to the same strategy still form a rather heterogeneous group. As a result, even if the right strategies have been selected for allocation, the portfolio manager can add substantial value to the portfolio by selecting the best managers from each strategy.

To determine if manager selection can add any value to the process, the authors' next task is to find out whether there is persistence in hedge fund performance. This topic is discussed in sections 3-4 using varying methods. The paper finds that there is no persistence in certain properties of managers' returns, while others display significant persistence.

The paper examines characteristics of funds that have been liquidated to determine if failing funds can be identified ahead of time. It proposes a quantitative measure to monitor the performance of selected managers through time. The authors argue in favor of a quantitative

measure of performance that does not depend on specific assumptions about return distributions and therefore would be suitable for evaluations of hedge fund performance.

Exercises

1. The authors of the article use non-parametric contingency tables to test for persistence. What do they conclude about the persistence of hedge fund strategies with regard to: (1) returns, (2) standard deviations, and (3) Sharpe ratios?

Solutions

1. When the authors use non-parametric contingency tables, results presented in the study show that none of the strategies display statistically significant persistence in their returns or Sharpe ratios. However, results suggest more persistence in standard deviations (with the exception of fixed income and merger arbitrage).

   (Pages 334-355)

Reading 1, Article B
Locking in the Profits or Putting It All on Black? An Empirical Investigation into the Risk-Taking Behavior of Hedge Fund Managers

This paper empirically examines the impact of the optionality embedded in hedge fund incentive fees on the risk taking behavior of hedge fund managers. As discussed in CAIA core readings, the incentive fee structure of hedge funds has a payoff that is similar to the payoff from a call option on fund's profits. There are important reasons for providing hedge fund managers with such a fee structure. The ideal fee structure aligns the incentives of the investor with those of the fund manager. Investors will normally be looking to maximize their risk-adjusted return, while fund managers will seek to maximize the present value of their fees. Perhaps, the most interesting issue is whether the incentive fee perfectly aligns the interests of investors with those of the manager. We know from option pricing models that the value of the option increases as volatility increases. Thus, the manager may have the incentive to increase the fund's volatility.

The introductory section of the paper introduces the issue, with the next section providing a summary of theoretical findings related to the impact of incentive fees on risk taking behavior of hedge fund managers. The paper discusses that many factors affect the benefits received by the hedge fund manager (e.g., the manager may have his/her own capital invested in the fund), and, therefore, it is not clear that it is in the best interest of the manager to increase the fund's riskiness. The section titled "Methodology" describes the way the moneyness of the incentive fee option is measured. The paper then uses various methods to determine if for hedge funds there is a relationship between the volatility of funds' returns and the moneyness of the incentive options. The broad conclusion is that fund managers adjust the return volatility of their fund in reaction to changes in the moneyness of the incentive fee option. In the final two sections, the paper examines the impact of two fund characteristics, namely, size and age, on the above relationship.

Exercises

1. Do the authors of the article "Locking in the Profits or Putting It All on Black? An Empirical Investigation into the Risk-Taking Behavior of Hedge Fund Managers" find that hedge fund managers adjust the risk profile of their funds in reaction to their performance relative to their peers? Explain.

Solutions

1. Yes, the authors found evidence to suggest that hedge fund managers adjust the risk profile of their funds in reaction to their performance relative to their peers. More specifically, they found that managers of relatively poor (strong) performing funds increase (decrease) the risk profile of their funds. These findings, which are similar to those of Brown, Harlow, and Starks (1996) for mutual funds, are rather surprising as hedge funds have generally been depicted as investment vehicles following absolute returns.

   (Pages 356-374)

Reading 1, Article C
UCITS: Can They Bring Funds of Hedge Funds On-Shore?

This article analyses UCITS hedge funds. Because this regulatory regime allows for a relatively large degree of latitude, the funds are potentially attractive to hedge-fund manager and may satisfy the call by some investors for greater regulation and oversight of the alternative investment products.

UCITS hedge funds, or alternative UCITS funds, are mainly targeted for European hedge-fund investors. Since UCITS framework is an EU directive, the EU constitution mandates that each EU member state apply the directive into national law within certain time frame. However, each country has some freedom in how to implement each directive. The article explains the impact of UCITS directive on the type of investments that a fund is allowed to have and its requirement regarding risk management at UCITS funds. The article argues that the implementation of risk management directive centers on the VaR measure, and then discusses how the four aspects of risk, concentration risk, leverage, liquidity, and counterparty risk should be addressed in UCITS funds. The article uses performance on UCITS and less regulated funds to examine the impact on regulation of risk-return profiles on UCITs funds. It concludes that alternative UCITS funds do generate performance that is at comparable levels to the less regulated hedge-fund industry.

Exercises

1. Discuss the main objectives behind the European Union (EU) UCITS directive.

2. Discuss regulatory restrictions on alternative UCITS funds' leverage.

Solutions

1. The European Union (EU) implemented the UCITS directive with the goal of facilitating cross-border marketing of investment funds while offering a high level of investor protection. The main pillars of the directive are to regulate the organization and oversight of UCITS funds and to impose constraints concerning diversification, liquidity, and use of leverage.

(Pages 375-390)

2. Leverage through borrowing is prohibited for UCITS funds, but it is allowed in general to achieve leverage through derivatives instruments. There are two approaches to defining limits on leverage levels for UCITS: the commitment approach, or the VaR and stress test. The commitment approach applies to all non-sophisticated UCITS and defines a limit of 200% leverage of NAV.

Sophisticated UCITS do not fall under a rule that explicitly limits leverage. Instead, the relative or absolute VaR requirements will limit their leverage. In other words, the 99% monthly VaR may not exceed twice the level of a reference portfolio, or the 99% monthly VaR may not exceed 20% of NAV. If the absolute VaR approach is used, then the stress test may also impose limits on leverage.

(Pages 375-390)

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