HEDGING LONG-RUN COMMODITY FLOW COMMITMENTS UNDER STOCHASTIC CONVENIENCE YIELD

by

JONATHAN MANLEY GODBEY

(Under the Direction of JIMMY E. HILLIARD)

ABSTRACT

A massive futures market has evolved to enable firms to alter their exposure to various commodity prices, interest rate and currency movements. Unfortunately, the appropriate hedging strategy is not always readily apparent. The large bid-ask spread of long-dated futures contracts often makes hedging too expensive. Absent a futures market with sufficient liquidity to make a stripped hedge cost efficient, the firm must find an alternative strategy. This dissertation will describe the method to find the minimum variance hedging strategy under stochastic convenience yield. Tests of the strategy will be done on oil, gold, copper, soybeans and Yen. Simulated and actual data are used to compare the variance of the unhedged or spot position, a rollover hedge and the naïve stacked hedge with the stochastic convenience yield hedge and its approximations. The naive stacked hedge shows a reduction in variance when compared to both the unhedged position and the rollover hedge for all five assets. The stochastic convenience yield hedge is the minimum variance position for the commodities which exhibit convenience yield -- oil, copper and soybeans. Since gold and Yen do not exhibit convenience yield the stochastic convenience yield hedge and its approximations are virtually identical to the naive stacked hedge.

INDEX WORDS: Hedging, commodity, convenience yield, corporate risk management

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DEDICATION

This dissertation is dedicated to the loving memory of my father, Reverend James M. Godbey.

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I am grateful for family and friends who have encouraged me throughout this process. Most of all I am thankful for my parents. Their love and support gave me the confidence to necessary to achieve this or any other goal. Most importantly, they taught me what *Jars of Clay* call "the one thing that I know".

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CHAPTER 1

INTRODUCTION AND MOTIVATION

A wide array of financial instruments exists that allow firms or individual agents to alter their financial risk. The strong demand for these products indicates that firms, as well as individual agents, choose to alter their risk. Initially, one may think that these instruments are used to reduce risk and provide what could be considered financial insurance. Therefore, an investment in a firm that uses these products should be safe relative to an investment in a firm that does not. This situation is not necessarily the case. For example, in 1993, Germany's fourteenth largest firm, Metallgesellschaft AG (MG), lost over $1 billion as a result of using these instruments in what management claimed to be a strategy to reduce risk. This loss, along with other high profile derivative losses, renewed questions about a publicly held corporation's motivations to hedge and the appropriate strategy for a given situation.

The purpose of this dissertation is to design a minimum-variance hedging strategy for a firm that faces a situation similar to MG. The minimum-variance strategy may or may not be the optimal strategy for a given firm but it does serve as a benchmark. Knowing the minimum-variance hedge allows the firm to better choose its optimal risk-return position. If the firm has superior information it may take a view on future market conditions and choose not to employ the minimum-variance hedge. If the firm does not, it may wish to minimize one source of volatility and take risks in an area where it has a comparative advantage.

While this dissertation is not intended to be an in-depth examination of the actions or motivations of MG's management, it is helpful to have a brief summary of the situation that they faced. MG offered, among other contracts, the monthly delivery of a fixed amount of various oil

products at a set price. Since MG was not a producer of the commodities necessary to deliver on the contracts, they would have to purchase the required amount in the spot market each month. Clearly, they were exposed to an upward movement in oil prices.

Edwards and Canter (1995a,b) identify three hedging alternatives. First, MG could purchase and store the amount of oil needed to meet its obligations. Second, they could enter into long-dated futures/forwards contracts. Third, they could use a stack-and-roll strategy. Their price risk could be completely eliminated by either of the first two strategies but not without cost. Physical storage requires an enormous initial cash outflow to purchase the entire amount of oil that must be delivered. It also requires expenditures to secure storage facilities. Long-dated futures contracts are rarely feasible. Futures typically have maturities of less than three years. Contracts with maturities of more than 18 months tend to be illiquid. Kuprianov (1995) shows that the purchase of long-dated forwards from an OTC derivatives dealer may be almost as expensive as physical storage.

MG chose instead to hedge their exposure by stacking short dated futures contracts. The total number of futures contracts to be held in the nearby futures contract was equal to the total flow commitment. After each month the contracts were settled and a long position equal to the remaining flow commitment was taken in the new nearby futures contract.

The position in futures contracts exposed MG to a decline in the price of oil. By stacking the contracts, MG magnified its exposure to a decline in prices in the near term. If prices fell, MG would incur losses on their futures contracts. The fall in prices would also allow MG to purchase the oil necessary to meet flow commitments for the current period in the spot market at a lower price. At each period MG's net cash flow was the pre-specified payment from its counterparty less the spot purchase plus the profit from the futures position.

Approximately one year into the 10 year time horizon oil prices fell. The long position in futures resulted in large margin calls from NYMEX. OTC dealers refused to roll over their

contracts without collateral. MG's supervisory board replaced management. New management unwound the remaining futures contracts. Total losses were estimated to be over $1 billion.

The motivations of MG's old management and the supervisory board which replaced them have been the subject of much debate. This dissertation takes no position on that argument. Instead it will discuss incentives for hedging, empirical evidence about which firms hedge and present a strategy for a firm facing a situation similar to that of MG.

The contributions of this dissertation are as follows. A theoretical model is developed to find the minimum-variance hedging policy when the underlying asset has stochastic convenience yield. Two approximations to the model are developed to reduce the computational complexity of implementation. The first alternative model uses the expected values of future convenience yield as an approximation. The second alternative model assumes risk neutrality and that the change in the futures price in discrete time, ΔF, is equal to the change in the futures price in continuous time, dF. Tests using simulated data and actual data for oil, copper, soybeans, gold and Yen show that the above theoretical model does result in a hedging strategy which reduces the variance of cash flows.

The dissertation is organized as follows. Section II reviews the relevant literature. Section III presents the problem faced by a hypothetical firm. Section IV develops the optimal hedging policy under stochastic convenience yield. Section V develops two approximations to the model in Section IV. Section V uses simulated data to compare the models with the unhedged position, the naive hedge and a rollover hedge. Section VI uses actual oil, copper, soybean, gold and Yen data to test the models. Section VII concludes the paper.

CHAPTER 2

LITERATURE REVIEW

Financial risks may be reduced by several different means. A risk averse agent may diversify his portfolio to reduce firm specific risk. The agent may buy put options, call options, enter futures contracts or purchase any number of derivative products that provide a payoff in a state where his previous portfolio would have resulted in a loss. He could buy insurance contracts that provide a payoff in response to an event which causes financial loss. An international manufacturing firm could reduce exchange rate risk by shifting production to countries where revenues are generated. A regional retailer could reduce the risk of a slowing local economy by opening stores in other regions of the country. Many more examples may be given.

For the purposes of this dissertation, it is assumed that financial risks will be managed through the use of futures contracts or other derivative products. A firm will be said to hedge with respect to a planning horizon if it takes positions in these products that reduce the volatility of future cash flows. It will be said to speculate if it takes a position that increases cash flow volatility.

The literature relevant to this dissertation may be divided into three categories: 1) theoretical incentives to hedge, 2) empirical evidence about corporate hedging and 3) hedging strategies.

THEORETICAL INCENTIVES TO HEDGE

Johnson (1960) reviews the theory of hedging in the futures market as it exists in 1960 and presents a "reformulated concept of hedging". The theory at the time held that the futures

market consists of hedgers and speculators. The hedger's primary motivation is to eliminate price risk while the speculator was willing to bear that risk for sufficient compensation. The hedger holds a position in some commodity. A position is taken in the futures market that is designed to eliminate price risk. If the futures position results in a gain (loss) that exactly offsets the loss (gain) in the spot market then the hedge is considered to be perfectly effective. As long as a known relationship between the futures and spot price movements existed a perfect hedge could be designed.

Johnson's new theory of hedging introduces the concept of variance of returns and utility maximization to the hedging problem. He makes no distinction between the hedger and other market participants except that the hedger has a "given position in one market". The hedger then chooses futures contracts that allow him to achieve the optimal mix of expected return and risk (variance of returns) given his utility function and beliefs about the probability distribution of returns. Johnson concludes that convenience yield "could be introduced into the model."

Johnson's model combined the traditional theory with Working's (1953, 1962) view that hedgers were profit maximizers. In Working's model hedgers behaved as speculators who had a position in the spot market. They traded futures contracts based on beliefs about a change in the spot-futures relationship. Although his model implied that hedgers would always be fully hedged or completely unhedged, Working did recognize that hedgers were often partially hedged.

Ederington (1979) finds that the portfolio theory of hedging as described by Johnson (1960) is "superior" to both the traditional theory and to those of Working (1953, 1962). He evaluates 90-day Treasury Bill futures and futures on Government National Mortgage Association 8% pass through certificates as instruments for hedging. At the time of publication these contracts had been in existence for less than four years. He finds that pure risk minimizers may not hedge their entire portfolio. He cautions that the tests are not over a long enough time

frame to determine if his conclusions are valid in the long run or just in the specific market circumstance observed.

Hedging models for an individual agent were developed by, among others, Makin (1978), Anderson and Danthine (1980) and Rolfo (1980). By making an assumption about the level of risk aversion for the agent and considering the potential cash flows of each agent, an optimal level of risk can be achieved by adding derivatives to the agent's portfolio. Makin (1978) models the behavior of a manager in a firm with exchange rate risk. Anderson and Danthine (1980) describe the optimal strategy for an agent with multiple cash holdings and multiple futures contracts. Rolfo (1980) considers the case of a cocoa producer. Since the agents are all risk averse, the models result in using futures contracts to reduce cash flow volatility.

Stulz (1984) derives a hedging model for risk-averse agents and value-maximizing firms. Managers are expected to maximize their expected lifetime utility given their compensation contract. When managerial compensation is a linear function of the change in firm value, corporations will actively hedge. The manager's utility optimization problem is equivalent to that of an investor if the manager receives the full change in firm value. Corporate hedging depends solely on the nature of managerial compensation and managerial risk aversion.

Theoretical incentives for individual agents to hedge do not apply to widely-held, public corporations. Individual agents optimize their utility function given the specifics of the hedging problem. The only theoretical requirement for a utility-maximizing agent to hedge is a sufficient level of risk-aversion. Value-maximizing corporations should only hedge if it results in maximizing shareholder wealth.

Fite and Pfeilderer (1995) discuss three competing views of corporate hedging. First, corporate hedging may increase firm value since it reduces the volatility of the firm's cash flows. Investors will pay a premium for a less volatile cash flow stream. Second, corporate hedging may reduce firm value. If the firm hedges all risks and eliminates all cash flow volatility, efficient

markets imply that the firm will earn only the risk-free rate. Since the firm is taking no risk, it is not exploiting any comparative advantage. Third, corporate hedging is irrelevant.

Well-diversified investors are not concerned with sources of volatility that affect only a few firms or affect several firms in opposing ways. Even if one source of risk had a negatively affected all firms, investors would not gain by corporate hedging. The firm must compensate another party for bearing this risk. The cost of this compensation is passed on to the investor. Additionally, the investor may use hedging instruments to adjust his own portfolio. Fite and Pfeilderer (1995) give two conditions that must be met for corporate hedging to be appropriate: "(1) it must change the firm's cashflows in a way that shareholders value and the benefit to the shareholders must be greater than the cost of hedging; and (2) hedging on corporate account must be the least expensive way to bring about the beneficial change in cashflows."

Further justification for the irrelevancy argument may be inferred from the Modigliani and Miller (1958, 1961) propositions. They imply that in the absence of market imperfections hedging does not add to firm value. Therefore, a value-maximizing firm must identify a market imperfection and a method by which it may be exploited to increase firm value or remain unhedged. Current literature describes at least five incentives to hedge. They are: 1) a convex tax structure, 2) costs of financial distress, 3) managerial risk aversion, 4) contracting costs and 5) information asymmetry.

Smith and Stulz (1985) posit the first positive theory of corporate hedging for value-maximizing firms by identifying such imperfections. They show that taxes, costs of financial distress and managerial risk aversion can be sufficient incentives for a value-maximizing firm to hedge. If tax liability is a convex function of pre-tax firm value then expected tax liability can be reduced and firm value increased by reducing the volatility of pre-tax firm values. The tax schedule may be made convex by progressive marginal rates and tax preference items such as tax loss carry forwards. They also show that hedging reduces the probability that the costs of

financial distress and may reduce the compensation demanded by managers, employees and suppliers.

MacMinn (1987) shows that value-maximizing firms hedge to preserve depreciation charges or tax credits. However, he finds that corporate hedging is irrelevant in a no-tax environment since the manager can hedge on personal account. His model consists of a multiproduct firm with a manager who is also a shareholder. The manager makes production and hedging decisions for the firm but is primarily interested in maximizing his personal utility.

Campbell and Kracaw (1990) build on MacMinn's (1987) argument that hedging reduces agency costs of debt thereby reducing the firm's incentive to choose suboptimal investments. They examine the equityholder's incentive to increase the riskiness of the firm's cash flows after issuing debt. Lenders may find it difficult to observe operating risks. As financing risk increases, equityholders have an incentive to increase operating risk. Hedging decreases financing risks and the incentive to increase operating risk. Hence, hedging at the firm level adds value above that which can be gained through diversification.

The idea that equityholders may wish to increase the riskiness of a firm's cash flows in the presence of debt has been examined by Merton (1973), Jensen and Meckling (1976), Gavish and Kalay (1983), Green (1984) and Green and Talmor (1986). Since equityholders are residual claimants their holdings may be viewed as a call option on the value of the firm. Increasing volatility of cash flows increases equity value. In this case hedging would be value reducing. Futures or other derivatives should be used to speculate or increase the volatility of cash flows.

Bessembinder (1991) shows that hedging can reduce agency costs and improve contracting terms. His research considers a firm with simple senior debt. Debt creates an incentive for equityholders to underinvest (Myers 1977). Hedging will increase the number of states in which the equityholders are residual claimants. As a result the they will not pass as

many positive net present value projects. Hedging allows equityholders to negotiate better debt terms since cash flows are less volatile across states.

Froot, Scharfstein and Stein (1993) examine the case when external financing is more expensive than internal financing. Froot, Scharfstein and Stein (1989), in the context of highly indebted less developed countries, Smith, Smithson and Wilford (1990), in a corporate setting, and Stulz (1990) and Lessard (1990) all argue that hedging can make sense by reducing suboptimal investment that results from the presence of debt. Froot, Scharfstein and Stein (1993) add to the literature by showing that the optimal hedge "does not generally involve complete insulation of firm value from marketable sources of risk." They show that nonlinear hedging instruments may be better than linear ones. They also show that the optimal hedging strategy depends on the nature of the product market and the actions of the competition.

DeMarzo and Duffie (1991) show that risk averse shareholders desire for firms to hedge if management has proprietary information regarding risk exposure. DeMarzo and Duffie (1995) show that the information effect can provide an incentive to hedge even if all agents are risk neutral. By reducing earnings volatility, hedging gives a more accurate measure of managerial ability and project quality. If full disclosure of hedging activity is required management will not hedge, but they will hedge to minimize risk if disclosure is not required.

Stulz (1996) compares the theory of risk management with practice of risk management. He reviews anecdotal and survey evidence that suggests that firms practice "selective" hedging. That is, they allow their views on futures prices to influence their hedge ratios. Rather than variance minimization, Stulz suggests using derivatives to eliminate "costly lower-tail outcomes", which would result in the costs of financial distress or an alteration of the optimal investment strategy. Firms with better information have a comparative advantage in bearing risk and should adjust their risk management program accordingly. In such cases management may take speculative positions.

Stulz (1996) briefly reviews the case of MG. He argues that MG did not attempt a minimum variance hedge. He claims that they took a position that was equivalent to a bet that convenience yields would remain positive.

Mozumdar (2000) analyzes a firm's incentives to hedge or speculate in the swap market. His model implies that "good firms hedge, bad firms do not." Swaps allow a firm to align the risk of inflows and outflows. Hence, they increase debt capacity and reduce the costs of financial distress. Low quality firms may use swaps to speculate. This observation serves as a caveat to empirical studies that examine only derivative usage and not net derivative holdings. Firms holding derivatives are assumed to be hedging when they may be speculating.

EMPIRICAL EVIDENCE

With theoretical reasons for the use of derivatives established the question of how closely practice follows theory remains. Empirical analysis of the hedging activities of firms is made difficult by a lack of reliable data. Until SFAS 119 became effective on December 13, 1994 firms were not required to release detailed information on the direction and purpose of their derivative holdings. Until SFAS 133 became effective on June 15, 2000 firms were not required to report the fair value of their derivative holdings on the balance sheet. Prior to December 1994 researchers relied on survey data or footnotes to financial statements.

Nance, Smith and Smithson (1993) use survey data to examine evidence on the corporate use of derivatives. Their survey yields a 31.6% response rate. Of the responding firms over 60% hedge. They observe that the limitations of the data reduces the power of their tests. They find that firms "hedge to reduce expected tax liability, to lower expected transactions costs, and to control agency problems." Firms that hedge "have less coverage of fixed claims, are larger, have more growth options in their investment opportunity set, and employ fewer hedging substitutes." Booth, Smith and Stolz (1984), Block and Gallagher (1986) and Houston and Mueller (1988) all use survey data to examine hedging practices. Wall and Pringle (1989) use footnote data instead

of a survey. Mayers and Smith (1989) examine the purchase of reinsurance. All of these studies are generally consistent with Nance, Smith and Smithson. All of the studies except for Mayers and Smith find that large firms hedge more. This result suggests that there may be informational economies of scale. The findings of Block and Gallagher and Nance, Smith and Smithson that show research and development expenditures are positively correlated with more hedging, is supported by Lewent and Kearney (1990) in their study of Merck. They find that Merck hedged foreign exchange rate risk specifically to protect R&D expenditures.

Dolde (1995) received 244 responses from a survey of Fortune 500 firms. He found that approximately 20% of the firms which responded try to fully hedge their positions. The survey suggested that firms often have a view about future interest rates or exchange rates. Often the firms fully hedge if they believe an adverse movement is probable while they partially hedge if they believe an advantageous movement is probable. This result supports Stulz' (1996) view of selective hedging.

Berkman and Bradbury (1996) avoid the problems associated with survey data by examining New Zealand firms. In New Zealand firms are required to report the fair value and notional value of their derivative holdings. They find that "corporate derivative use increases with leverage, size, the existence of tax losses, the proportion of shares held by directors and the payout ratio and decreases with interest coverage and liquidity." When they measured derivative usage by the fair value of the firm's holdings, they found that hedging increases with growth options.

Mian (1996) uses data obtained from the 1992 annual reports of 3,022 firms rather than survey data. Of those 3,022 firms, 771 are classified as hedgers. Robust evidence is found supporting the hypothesis that larger firms hedge more. Weak and mixed evidence is found to support the notion that taxes or the investment opportunity set influence the hedging decision.

Tufano (1996) analyzes the risk management practices of the North American gold mining industry. These firms are not well-diversified and have a clear exposure to the price of gold. Investors can modify risk through gold related derivative contracts in much the same manner that the firms can. Theory suggests that asymmetric information and costs of financial distress should not affect the hedging decision in this industry. The data are consistent with the hypothesis of Smith and Stulz (1996) that managers who own more common stock manage more gold price risk while those who own more options manage less. Tufano cautions against over-interpreting the results from a study of one industry but suggests that the hedging decision is consistent with managerial utility maximization.

Geczy, Minton and Schrand (1997) use data from 1990 financial statements of 372 of the Fortune 500 non financial firms to determine reasons for use of currency derivatives. All have foreign exchange rate exposure. They find that users of currency derivatives are larger, have greater managerial ownership, a greater analyst following and more institutional ownership. Their results indicate that firms hedge to "reduce underinvestment costs associated with investment opportunities in the presence of financial constraints."

Gay and Nam (1998) focus on hedging incentives created by the underinvestment problem. Their data comes from notional amounts of interest rate and currency derivatives as reported in the 1996 Swaps Monitor database. Their sample consists of 325 users and 161 non-users of derivatives. They find that (1) derivative use is positively correlated with growth opportunities, (2) derivative use by firms with enhanced opportunity sets is greater when they have low cash stocks and (3) firms use less derivatives if their internal cash flows are positively correlated investment expenditures.

Haushalter (2000) examines the effect of contracting costs, taxes and managerial risk aversion on the hedging decision for 100 oil and gas producers from 1992 to 1994. He finds that "the fraction of production that oil and gas producers hedge against price risk is positively related

to the ratio of total debt to total assets and is greater for companies having little financial flexibility." He also finds that firms, with production in areas where the local prices are highly correlated with exchange traded contracts, are more likely to hedge.

Graham and Rogers (1999) obtain net notional derivative holdings for 531 firms for year end 1994 or 1995. They are one of the first studies to take advantage of SFAS 119 which requires disclosure of net derivative positions. They conclude that the convexity of the tax function has no effect on hedging but that hedging increases debt capacity. Expected costs of financial distress, firm size and investment opportunities all affect the hedging decision as theory suggests.

Graham and Smith (1999) examine the tax incentive to hedge. They use simulation methods in order to avoid the problems with survey and regression analysis. They use COMPUSTAT data to simulate the tax savings from reducing the volatility of taxable income. Seventy-five percent of firms have little tax-based incentive to hedge. Firms with a convex tax function save about five percent with a five percent reduction in pre-tax cash flow volatility. Some firms save up to forty percent.

In summary, the literature shows that the firm should hedge to increase shareholder wealth and not merely to reduce cash flow volatility. Hedging increases shareholder wealth in the presence of certain market imperfections. Once the firm identifies these imperfections, it should exploit them only if it can do so in a less costly manner than the shareholders. Empirical evidence shows that firms use financial instruments to alter their risk. The evidence further shows that firms do not hedge all risks and in some cases choose to speculate. In the case of MG, management took positions in futures contracts that altered the firm's risk. Whether these positions were designed to hedge or to speculate has been the subject of much debate.

MG CASE

Empirical tests have not yielded reliable, unquestionable guidelines for making risk management decisions. However, it is clear that incentives do exist for firms to hedge and that derivatives can be used to increase firm value. The question of whether to hedge, how much to hedge and what hedging method to use is best answered on a case by case basis.

This dissertation is concerned with the general hedging decision faced by MG. The MG case sparked debate in academic circles about what lessons could be learned from its loss. Kuprianov (1995) summarizes the debate. Culp and Hanke (1994) and Culp and Miller (1995a,b,c,d) defend MG's management while Mello and Parsons (1995a,b) criticize their strategy. Edwards and Canter (1995a,b) do not take a strong stand on the motivations of MG's management but do defend the basic strategy of a stack and roll hedge.

Culp and Miller (1995a, 1995b) review the MG case. They use a three period example to demonstrate that a firm can hedge long term obligations by stacking short dated futures contracts. Their example shows that a firm can "lock-in" a gross margin per period. This synthetic storage is similar to physical storage. Both require the firm to pay storage costs. Physical storers pay their own marginal cost of storage while synthetic storers pay the marginal costs of the marginal physical storer. Culp and Miller suggest that MG should have realized the potential need for cash to meet margin requirements and should not have closed out the hedge. They suggest that the use of long-dated futures would have been expensive due to liquidity problems. They challenge the auditor's claim that the hedging program lost $1.3 billion. This figure represents only one leg of the program. Culp and Miller estimate the loss to be closer to $170 million. They conclude that "the worst possible solution as of December 1993 was to eliminate the hedge and cancel the flow contracts without adequate compensation."

Bollen and Whaley (1998) support Culp and Miller's view that MG should have left the hedging program in place. They use historical prices to simulate the outcomes of various hedging strategies. They find that MG's hedging program "would have earned in excess of US$1.3 billion, covering even the most pessimistic accounts of the losses" from MG's hedging strategy. The simulations show a 33% chance of an intermediate cash shortfall of over $1 billion. They argue that a minimum-variance hedge resulting from long dated OTC contracts would not be the appropriate strategy. In their view, MG should choose a strategy based on a risk-return trade-off.

Mello and Parsons (1994) argue that MG's strategy was flawed and that MG was speculating not hedging. Using a stacked hedge strategy exposes the firm to small movements in oil prices. Mello and Parsons contend that future gains from the delivery contracts are not worth this short term risk. The stacked hedge does not "lock-in" the value of the delivery contracts since short and long term oil contracts are not perfectly correlated. By hedging a long term exposure with short term contracts, Mello and Parsons claim that MG made a bet on the yield curve of oil.

Culp and Miller (1995c) refer to Working's theory of hedging to answer Mello and Parsons and to explain MG's strategy. MG was not attempting to eliminate risk. Following a strategy of purchasing long-dated forward contracts as Mello and Parsons suggest would provide no advantage to MG even if they were available. They could eliminate risk but they could make no profit on the delivery contracts since potential customers could do the same. MG was attempting to "exploit their superior information about price relations." Their hedge was not a pure risk avoidance hedge but a carrying-charge hedge. This is an appropriate strategy since "a value-maximising firm engaged in synthetic storage exchanges its natural exposure to the absolute price level for a net exposure to *relative prices,* (emphasis theirs) synthetic storage almost always reduces the variance of the value of the firm."

Edwards and Canter (1995) agree with Culp and Miller that hedging long term commitments with short dated futures is possible but Edwards and Canter believe that the rollover risk is greater than Culp and Miller do. Unlike Culp and Miller they believe that the hedger should be able to unwind all positions at any time without "sustaining a substantial" loss. Edwards and Canter believe that a minimum-variance hedging strategy would have reduced its rollover costs. They point out that neither physical nor synthetic storage would be profitable.

The true motivations of MG may never be known. Culp and Miller (1999) point out that lawsuits and the resulting legal restrictions may prevent the full story of MG from be revealed. MG can be used as motivation to study how a firm facing a similar situation should behave. The following literature discusses the mathematics of hedging long dated obligations with short dated futures. This dissertation expands this particular strand of the literature.

Brennan and Crew (1997) develop two new hedging models based on models of futures prices developed by Brennan (1987) and Gibson and Schwartz (1990). The models are compared to the stack and roll strategy and the Edwards-Canter minimum variance hedge. The hedges are for a fixed commitment, ranging from six to 24 months. The hedging error is computed by calculating the change in the hedger's wealth after the futures contracts are rolled over each month. Both the Brennan model and the Gibson and Schwartz model allow for stochastic convenience yield and outperform the simpler models. Brennan and Crew concede that their results are limited by the availability of long dated futures contracts and the assumption of zero interest rates.

Pirrong (1997) analyzes the dynamics of crude oil futures prices to determine the wisdom of MG's strategy. He derives a minimum-variance hedge "by a sequence of myopic hedge ratios which minimize the variance of the one-period hedge gain or loss." He concludes that a one-for-one strategy overhedges which results in increasing oil price risk. He estimates hedge ratios should be as low as 0.5.

Neuberger (1998) builds a hedging model for oil which can apply to other commodities. The hedger is committed to supply some commodity in T months. The optimal hedge is derived on the assumption of a linear relationship between expected cost of delivery and the current term structure of futures prices. No assumption is made about the processes followed by state variables related to oil futures. Neuberger concedes that his approach is "inconsistent with some models of the term structure of commodity prices" but he claims it still "gives good results in practice."

Ross (1997) examines the hedging problem from a complete markets perspective. Most derivative contracts are for a relatively short time period. They have little or no liquidity if they even exist in the long run. Ross shows that in theory rolling over positions in short tern securities to replicate an ideal long term hedge is possible. In practice it is more difficult. The primary difficulty is the estimation of the underlying stochastic processes.

Hilliard (1999) derives the minimum-variance hedge under the assumption that the underlying spot price follows the usual geometric Brownian motion. He assumes that the cost-of-carry in nonstochastic. While the stacked hedge is shown to "have variance minimising properties" and to insure risk free cash flows at the end of a planning horizon, it does introduce "huge early period volatility." This dissertation builds directly on the work of Hilliard. Convenience yield is assumed to be stochastic and mean reverting. This assumption allows for a more accurate estimation of the behavior of commodity prices.

An accurate model of the behavior of the price of the asset to be hedged is necessary for optimal hedging. The models for commodity price behavior that are used in this dissertation were developed by Gibson and Schwartz (1990), Schwartz (1997) and Hilliard and Reis (1998). Schwartz (1997) describes the Kalman filter methodology necessary to obtain the parameter estimates required by the hedging model.

CHAPTER 3

THE HEDGING DECISION

Consider a firm with a long term commodity flow commitment. Assume that the firm has contracted to sell (buy) a fixed amount, m_i, of a commodity in period i at a pre-specified price for a set time horizon. When the costs of physical storage or long-dated futures/forwards contracts are prohibitive the firm may benefit from some type of stack-and-roll strategy. The firm must determine the number of contracts to hold in the nearby period. If the firm wishes to minimize the variance of the future value of the intermittent cash flows, the optimal hedging path minimizes the following:

$$(1) \qquad V_0 = \sum_{i=1}^{n} \exp\left(r\Delta(n-i)\right)\left(m_i S_i + x_{i-1}\Delta F_{i-1}\right)$$

The cash flows are continuously compounded at the reinvestment rate r until the n^{th} period to find the future value, V_0, of the intermittent cash flows. The spot price at time i is S_i and Δ is the time between the n periods. When the asset must be sold m_i is positive and when the asset must be bought it is negative. The hedge ratio at time j is x_j. . Let $F_{i,i} = F(t_i + \Delta, t_i + \Delta)$ be the price of the futures contract at settlement and $F_i = F(t_i, t_i + \Delta)$ be the price of the futures contract at initiation. $\Delta F_i = F_{i,i} - F_i$ is the change in the futures price. Let the change in the spot price be $\Delta S_i = S_{i+1} - S_i$. When there is no basis risk futures prices converge to the spot price so $F_{i,i} = S_{i+1}$.

To minimize risk, the following equation is minimized:

$$(2) \qquad Var(V_0) = Var\left(\sum_{i=1}^{n} \exp\left(r\Delta(n-i)\right)\left(m_i S_i + x_{i-1}\Delta F_{i-1}\right)\right).$$

Hilliard (1999) finds the minimum variance of equation (2) after establishing conditions under which the current hedge ratio does not depend on past or future hedge ratios. His results are:

Result 1. *The minimum variance policy path* x_i , $i = k, k+1, ..., n-1$ *is independent of earlier policies* $x_0, x_1, \ldots, x_{k-1}$ *if the hedger is a price taker and if net proceeds at earlier settlement dates are invested in assets uncorrelated with spot and futures commodity prices.*

Result 2. *Hedge ratios are state independent and therefore nonstochastic if the conditions in Result 1 hold and if*

β_{ij} *is nonstochastic,* $j= 0,1,...,n-1;\ i = k+1,...,n$; *and*

η_{ij} *is nonstochastic,* $j = 0,1,...,n-2;\ i = j+1,...,n-1$

where

$\beta_{ij} = Cov(S_i,\Delta F_j)/Var(\Delta F_j)$ *and*

$\eta_{ij} = Cov(\Delta F_i,\Delta F_j)/Var(\Delta F_j)$.

Result 3. *The hedge is myopic if Result 2 holds, and if, in addition, the increments* ΔF *are independent.*

Result 4. *Let r be the continuously compounded reinvestment rate and let the cost-of-carry model of the form* $F_i = S_i \exp(b\Delta)$ *hold at the beginning of period i and let* $F_{i,i} = S_{i+1}$ *at the settlement date. Then the hedge ratio*

$$x_k^* = -\sum_{j=k}^{n-1} m_{j+1} \exp\big((b-r)(j-k)\Delta\big),\ k=0,1,...,n-1$$

gives risk-free cash flows at the end of period n. The compounded value of these flows is

$$V_0^* = \sum_{j=0}^{n-1} m_{j+1} F_0 \exp(bj\Delta)\exp(r(n-1-j)\Delta)$$

The above results were obtained under the assumption that convenience yield is constant. However, an examination of the behavior of commodity prices indicates that convenience yield is

stochastic.[1] In the following section the implications for the above results are examined when convenience yield is assumed to be stochastic and mean-reverting.

[1] See Brennan (1991), Fama and French (1987,1988), Gibson and Schwartz (1989,1990) and Schwartz (1997)

CHAPTER 4

DERIVATION OF STOCHASTIC CONVENIENCE YIELD MODEL

The assumption that convenience yield is stochastic and mean-reverting is theoretically sound. Convenience yield is a measure of the benefits that result from physical ownership. As such it is a function of inventory levels. The expectation of a shortage (surplus) increases (decreases) the value of physical ownership and thus convenience yield. Low (high) inventory levels also result in higher (lower) spot prices. As spot prices increase (decrease) relatively higher cost producers enter (exit) the market and increase (decrease) supply. Convenience yields and spot prices are thus driven toward their long run means.

Empirical tests indicate that commodity prices are mean reverting. Gibson and Schwartz (1990) develop a model for the pricing of oil contingent claims under the assumption of stochastic and mean-reverting convenience yield. They find the model to be "reliable". Schwartz (1997) tests their model using oil and copper data. He finds strong mean reversion for both commodities.[2] This paper incorporates the Gibson and Schwartz model which assumes the spot price of the commodity and the convenience yield follow the joint diffusion process:

$$dS = \left(r + \lambda\sigma_s - \delta\right)Sdt + \sigma_s S dZ_s \tag{3}$$

$$d\delta = \kappa(\alpha - \delta)dt + \sigma_c dZ_c \tag{4}$$

where the increments to the standard Wiener process are correlated, i.e.,

$$dZ_s dZ_c = \rho_{sc} dt \; . \tag{5}$$

and where:

[2] Brennan (1991), Cortazar and Schwartz (1994), Bessembinder, Coughenour, Seguin and Smoller (1995) and Ross (1997) also consider the mean-reverting nature of commodity prices.

r = the riskfree rate of return

λ = the market price of risk

σ_s = the instantaneous volatility of the underlying asset

σ_c = the instantaneous volatility of the convenience yield

κ = the speed of adjustment

α = the long-run mean convenience yield

dZ_i = the increment to a standard Wiener process

δ = the current marginal net rate of convenience yield, defined as convenience yield net of physical storage costs.

Consider the above model and return to problem of solving equation (2). The first order condition for the optimal hedge at time j, x_j, is of the form:

$$x_j^* = -Cov\left(X + Y^*, Y \middle| t = j\Delta\right) / Var\left(Y \middle| t = j\Delta\right) \tag{6}$$

where

$$X = \sum_{i=j+1}^{} m_i S_i \exp(r\Delta(n-i))$$
$$Y^* = \sum_{i=j+1}^{} x_i^* \Delta F_i \exp(r\Delta(n-i-1))$$
$$Y = \Delta F_j \exp(r\Delta(n-j-1))$$

Let r = 0 (for notational ease) and consider equation (6) in component form:

$$x_j^* = -Cov\left[\sum_{i=j+1}^{n} m_i S_i + \sum_{i=j+1}^{n-1} x_i^* \Delta F_i, \Delta F_j\right] / Var\left[\Delta F_j\right] \tag{7}$$

Equation (7) shows that the optimal hedge ratio depends on future flow commitments, future spot prices, future hedge ratios and the changes in futures prices. The flow commitment is assumed to be known at time 0 and can be treated as a constant. If future hedge ratios, x_i are also constant the solution to equation (7) is not difficult. Assumptions about the futures price generating process determine the nature of the future hedge ratios. When the futures price is determined by the one-factor model used by Hilliard future hedge ratios are constant, and results

1-4 hold. Result 4 gives the solution to equation (7). It shows that in the absence of basis risk, period-n accumulated wealth is risk-free and depends only on the current price of the nearby futures contract.

The introduction of stochastic convenience yield changes the solution for ΔF_i and affects Results 2-4. Result 1 is not affected by assumptions about the nature of convenience yield. It will be shown that Results 2-4 no longer hold. The calculation of the optimal hedge ratio becomes computationally more complex.

Futures are now priced using a two-factor model. In the absence of basis risk the change in the futures price is given as:[3]

$$(8) \qquad \Delta F_j = S_{j+1} - A(\Delta)S_j \exp(r\Delta - H(\Delta)\delta(j\Delta))$$

where

$$H(\Delta) = \left[1 - \exp(-\kappa\Delta)\right] / \kappa$$

and

$$A(\Delta) = \exp\left\{\left[(H(\Delta) - \Delta)\left(\kappa^2\alpha - \kappa\lambda_c\sigma_c - .5\sigma_c^2 + \rho_{sc}\sigma_s\sigma_c\kappa\right)/\kappa^2\right] - \sigma_c^2 H^2(\Delta)/4\kappa\right\}$$

The solution to equation (6) becomes

$$(9) \qquad x_j^* = [\Psi 1 + \Psi 2 + \Psi 3] / \Gamma$$

where

$$\Psi 1 = -\sum_{i=j+1}^{n} \exp(r\Delta(j+1-i)) \bullet m_i \bullet Cov\left[S_i, S_{j+1} | t = j\Delta\right],$$

$$\Psi 2 = -\sum_{i=j+1}^{n-1} \exp(r\Delta(j-i)) \bullet Cov\left[x_i^* S_{i+1}, S_{j+1} | t = j\Delta\right],$$

$$\Psi 3 = \sum_{i=j+1}^{n-1} \exp(r\Delta(j+1-i)) \bullet A(\Delta) \bullet Cov\left[x_i^* S_i \exp\left(-H(\Delta)\delta(i\Delta)\right), S_{j+1} | t = j\Delta\right], \text{ and}$$

$$\Gamma = Var\left[S_{j+1} | t = j\Delta\right].$$

[3] See Hilliard and Reis (1997)

Using equation (9) the solutions for hedging horizons of one, two, three and four periods are found. The notation quickly becomes cumbersome and requires some explanation.

Let

(10a) $\Theta_{ijo} \equiv Cov\left[S_i, S_{j+1} \middle| j\Delta\right] / Var\left[S_{j+1} \middle| j\Delta\right]$; and

(10b) $\Theta_{ij1} \equiv Cov\left[S_i \exp(-H(\Delta)\delta(i\Delta)), S_{j+1} \middle| j\Delta\right] / Var\left[S_{j+1} \middle| j\Delta\right]$.

The last subscript is a dummy variable indicating the presence of the exponential term. The above Θ terms enter Ψ2 and Ψ3 in equation (9) via x^* creating the need for the following definitions:

(10c) $\Theta_{ij0}^{kld} \equiv Cov\left[\Theta_{kld} S_i, S_{j+1} \middle| t = j\Delta\right] / Var\left[S_{j+1} \middle| t = j\Delta\right]$;

(10d) $\Theta_{ij1}^{kld} \equiv Cov\left[\Theta_{kld} S_i \exp(-H(\Delta)\delta(i\Delta)), S_{j+1} \middle| t = j\Delta\right] / Var\left[S_{j+1} \middle| t = j\Delta\right]$;

(10e) $\Theta_{ij0}^{fgh,kld} \equiv Cov\left[\Theta_{kld}^{fgh} S_i, S_{j+1} \middle| t = j\Delta\right] / Var\left[S_{j+1} \middle| t = j\Delta\right]$; and

(10f) $\Theta_{ij1}^{fgh,kld} \equiv Cov\left[\Theta_{kld}^{fgh} S_i \exp(-H(\Delta)\delta(i\Delta)), S_{j+1} \middle| t = j\Delta\right] / Var\left[S_{j+1} \middle| t = j\Delta\right]$

where d and h are dummy variables indicating the presence of the exponential term.

The solution to the one-period model is

(11) $x_0^* = -m_1$.

The solution to the two period model is

(12) $x_0^* = -m_1 - A(\Delta)\Theta_{101} m_2$ and

$x_1^* = -m_2$.

The solution to the three period model is

(13) $x_0^* = -m_1 - A(\Delta)\Theta_{101} m_2 - \exp(-r\Delta) A(\Delta)\left[\exp(r\Delta) A(\Delta)\Theta_{101}^{211} + \Theta_{201} - \Theta_{200}^{211}\right] m_3$,

$x_1^* = -m_2 - A(\Delta)\Theta_{211} m_3$ and

$$x_2^* = -m_3 .$$

The solution to the four period model is

(14) $$x_0^* = \varpi 1 + \varpi 2$$

where

$$\varpi 1 = -m_1 - A\Theta_{101} m_2 - \exp(-r\Delta) A\left[\exp(r\Delta) A\Theta_{101}^{211} + \Theta_{201} - \Theta_{200}^{211}\right] m_3 \text{ and}$$

$$\varpi 2 = -\exp(-r\Delta) A\left[\exp(r\Delta) A^2 \Theta_{101}^{321211} - A(\Theta_{101}^{321310} + \Theta_{200}^{321211}) + \exp(-r\Delta)\Theta_{200}^{321310} + A\Theta_{201}^{321} - \exp(-r\Delta)(\Theta_{300}^{321} + \Theta_{200}^{311}) + A\Theta_{101}^{311} + \exp(-r\Delta)\Theta_{301}\right]$$

$$x_1^* = -m_2 - A\Theta_{211} m_3 - \exp(-r\Delta) A\left[\exp(r\Delta) A\Theta_{211}^{321} + \Theta_{311} - \Theta_{310}^{321}\right] m_4 ,$$

$$x_2^* = -m_3 - A(\Delta)\Theta_{321} m_4 \text{ and}$$

$$x_3^* = -m_4 .$$

Consider the solution to the four period model. The firm must find the number of contracts to enter into at time 0. Since the current hedge ratio depends on future hedge ratios a backwards solution technique is employed to determine the optimal solution for x_0. First, x_3 is found to be equal to $-m_4$, nonstochastic. Using the prior solution x_2 is found. Notice that at this point $\Psi 2$ and $\Psi 3$ enter the calculation. $\Psi 3$ introduces convenience yield as a random variable. Hence, the solution for x_2 is a random variable. Using the solutions for x_2 and x_3, the solution for x_1 is found. It is a random variable also. The three prior solutions are necessary to find the optimal number of contracts that the firm should purchase.

The primary source of difficulty in the calculation of equation (9) is not the absence of myopia but rather the stochastic nature of the future hedge ratios. For any n-period model future hedge ratios, x_1, x_2, ... x_{n-2}, are stochastic. The terms $\Psi 2$ and $\Psi 3$ are much more difficult to solve. Fortunately, the covariance terms consists exclusively of constants and lognormal variates. The covariance terms from equation (9) take on two general forms. The general solution of each form is shown in the Appendix.

Equation (11) agrees with intuition and shows that the optimal hedge is a position in the futures market that is opposite to the flow commitment. This strategy not only minimizes the variance of the future value of cash flows, it eliminates the variance. Regardless of the number of periods in the horizon the final hedge ratio will always be the negative of the final flow commitment.

As equations (11)-(14) show the number of terms required to find the initial optimal hedge ratio increases exponentially with the number of periods in the hedge. An n-period hedge requires $1+3^0+3^1+...+3^{n-2}$ terms to determine the initial hedge ratio after the future hedge ratios have been estimated. In order to determine the number of contracts to be purchased at time 0 in a 10-period horizon one must compute 9,842 terms after finding $x_1, x_2,..., x_{n-1}$. A sufficiently close and easy to compute approximation to the exact model is needed for practical applications.

CHAPTER 5

APPROXIMATION MODELS

This section describes the steps necessary to create a model that makes the calculation of a solution to equation (9) relatively simple without sacrificing a significant amount of accuracy. To simplify the calculation, the stochastic nature of the future hedge ratios must be addressed. A sufficiently accurate estimate of these hedge ratios eliminates the primary source of computational complexity while producing a reliable estimate of the true solution.

EXPECTED VALUE OF FUTURE HEDGE RATIOS

As equation (9) shows, when the hedging time horizon consists of three or more periods, a covariance term of the form Cov[X Y, Z] must be calculated. X represents the stochastic future hedge ratio. Since X, Y and Z are all random variables the above covariance term is difficult to calculate. As previously demonstrated if X were nonstochastic the calculation would be simple. Let $X \equiv E[X] + \Delta X$. Substituting for X yields:

(15) $\quad \text{Cov}[X\,Y, Z] = \text{Cov}[(E(X)+\Delta X)\,Y, Z]$

$$= E(X)\,\text{Cov}[Y,Z] + \text{Cov}[\Delta X\,Y, Z]$$

To compute the approximate solution the last term is dropped from equation (15). If the last term is sufficiently small the approximation is acceptable.

The future hedge ratios are stochastic solely due to the assumption of stochastic convenience yield. Expected values of the future hedge ratios are found by replacing the actual level of convenience yield at the appropriate time with its expected value conditioned on information available at the current time. Therefore, the error in the approximation is a function

of the difference in the actual and expected values of the mean-reverting process described in equation (4). Simulations will provide evidence of the accuracy of this substitution.

The calculation of the current hedge ratio is done by replacing the stochastic future hedge ratios with their expected values. The solution is still not myopic but it is relatively simple and easily extended to an n-period model. The general solution is:

(16) $$x_j^* = [\Psi 1 + \Psi 2a + \Psi 3a]/\Gamma$$

where $$\Psi 2a = -\sum_{i=j+1}^{n-1} e^{r\Delta(j-i)} E[x_i^*] Cov[S_{i+1}, S_{j+1} | t = j\Delta]$$

and $$\Psi 3a = \sum_{i=j+1}^{n-1} e^{r\Delta(j+1-i)} A(\Delta) E[x_i^*] Cov[S_i e^{-H(\Delta)\delta(i\Delta)}, S_{j+1} | t = j\Delta].$$

This approximation does not reduce the number of terms necessary to compute a solution. It simplifies the terms that are calculated. The terms in the APX model can easily be computed for a long-term horizon.

ASSUMPTION OF RISK NEUTRALITY

The complexity of the calculation of equation (9) is greatly reduced under the assumption that $\lambda = 0$ in equation (3). Under the assumption of risk neutrality equation (9) reduces to

(17) $$x_j^* = \Psi 1/\Gamma$$

where $$\Psi 1 = -\sum_{i=j+1}^{n} \exp(r\Delta(j+1-i)) \bullet m_i \bullet Cov[S_i, S_{j+1} | t = j\Delta]$$ and

$$\Gamma = Var[S_{j+1} | t = j\Delta].$$

The solution is myopic and easily computed for the n-period model. The solution to an n-period time horizon has n terms.

EXAMPLE

Table I reports the hedge ratios suggested for the model under:

1) stochastic convenience yield (SCY),
2) its approximation using expected values of future hedge ratios (APX),
3) its approximation assuming risk neutrality (RSK),
4) the naive stacked hedge (NAV) and
5) a simple rollover hedge (ROL) for a four period time horizon.

The hedge ratios are calculated by using parameters reported by Schwartz (1997) for oil and the assumption that convenience yield stays at its long run mean. Total flow commitment is assumed to be one unit per period. Each period is assumed to be one month. As intuition suggests, all models result in a hedge ratio of -1 for the final period. As the time horizon increases the NAV model results in overhedging.

Table 1

Comparison of Hedge Ratios

	SCY	APX	RSK	NAV	ROL
X_3	-3.5416	-3.5454	-3.5480	-4.0000	-1.0000
X_2	-2.7614	-2.7613	-2.7628	-3.0000	-1.0000
X_1	-1.9163	-1.9163	-1.9169	-2.0000	-1.0000
X_0	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000

Assuming a flow commitment of one unit per month, the above shows the position in futures contracts suggested by the stochastic convenience yield (SCY) models and its approximations (APX) and (RSK) and the naive (NAV) model. The parameter values used to compute the solution are $r = 0.06$, $\alpha = 0.106$, $\kappa = 1.876$, $\lambda = 0.198$, $\mu = 0.142$, $\rho = 1.876$, $\sigma_S = 0.393$ and $\sigma_C = 0.527$. Convenience yield is assumed to remain constant at 0.106.

CHAPTER 6

COMPARISONS OF HEDGING MODELS USING SIMULATED DATA

Simulations are run to find the standard deviations of equation (1) that result from implementing the stochastic convenience yield (SCY) model derived in Section III, the approximation (APX) model in Section IVa, the risk neutral (RSK) model in Section IVb, the naive (NAV) model, the rollover (ROL) model and a unhedged or spot (SPT) strategy. Results are found for oil, copper and gold. Each commodity is tested over a four, ten and 40 period time horizon. The time between periods (Δ) is assumed to be three months for the four and 40 period hedges. It is assumed to be one month for the ten period hedges. The choice of Δ is arbitrary. Using different values for Δ has very little effect on the results. Due to computational complexity, results for the SCY model are only given for a four period horizon.

Choosing the correct parameter values for the joint stochastic process described in equations (3) - (5) is essential for describing the true evolution of the commodity price and, therefore, for finding the minimum variance hedge. For purposes of the simulations, parameter estimates are based on the findings of Schwartz (1997). Since the simulations generate future commodity prices, the model in equations (3)-(5) is, by definition, the true model with the correct parameter values. Table II shows the parameter values used.

Table 2
Parameter Estimates

Parameter	Oil	Copper	Gold
r	0.060	0.060	0.060
α	0.106	0.248	-0.002
κ	1.876	1.156	0.011
λ	0.198	0.256	0.007
μ	0.142	0.326	0.039
ρ	0.766	0.818	0.056
σ_S	0.393	0.274	0.135
σ_C	0.527	0.280	0.016

Parameter estimates are from Schwartz (1997)
Convenience yield is assumed to start at its long-run mean, α.

Schwartz finds four sets of parameter estimates for oil, one for copper and three for gold. The convenience yield parameters, α, κ, λ, ρ and σ_C, are much smaller in magnitude for gold than for the corresponding parameters for oil and copper. They are generally not significantly different from zero for gold, always significant for copper and sometimes significant for oil. His test of a three-factor model, which includes stochastic interest rates, suggest that the two-factor model is misspecified for gold but not for oil and copper. The mean reversion in the convenience yield for gold in the two-factor model is likely proxying for mean reversion in interest rates. The commercial commodities, oil and copper, differ in important ways from the investment commodity, gold. Gold is widely held for investment whereas the commercial commodities are held for consumption value. Therefore, gold is not assumed to have convenience yield like the commercial commodities. The SCY model should be an improvement over the naive hedge for the commercial commodities but not for investment commodities. This result will be better demonstrated in the next section with tests of actual data.

To compare the hedging strategies, simulations are run. At time zero the hedging policy suggested by each model is implemented. The commodity price and its convenience yield are simulated for the next period. The suggested hedging policy is implemented and the process is repeated. Each simulation run produces a cash flow resulting from equation (1) for each model.

After 10,000 simulations the standard deviation of the cash flows produced by each model are calculated. For simplicity the flow commitment for each period is assumed to be one. Results are summarized in Table III. Tables C.1 - C.3 in Appendix C show more detail.

Table 3
Comparison of Hedging Policies

Panel A ***Oil***

		SCY	APX	RSK	NAV	ROL	SPT
4 Period	StDev	2.1330	2.1423	2.1421	5.5829	40.0185	26.0449
	SCY/Other	1.0000	0.9957	0.9958	0.3821	0.0533	0.0819
10 Period	StDev		5.4100	5.3979	14.5762	79.6041	64.9107
	SCY/Other		0.9978	1.0000	0.3703	0.0678	0.0832
40 Period	StDev		2,033.74	2,041.40	5,110.91	9,878.89	8,629.64
	SCY/Other		1.0000	0.9962	0.3979	0.2059	0.2357

Panel B ***Copper***

		SCY	APX	RSK	NAV	ROL	SPT
4 Period	StDev	10.0984	10.1106	11.2175	30.5832	190.3795	124.0433
	SCY/Other	1.0000	0.9988	0.9002	0.3302	0.0530	0.0814
10 Period	StDev		18.1255	18.2985	59.6337	283.3095	232.3482
	SCY/Other		1.0000	0.9905	0.3039	0.0640	0.0780
40 Period	StDev		2,096.21	1,574.62	14,682.68	15,298.67	13,385.89
	SCY/Other		0.7512	1.0000	0.1072	0.1029	0.1176

Panel C ***Gold***

		SCY	APX	RSK	NAV	ROL	SPT
4 Period	StDev	4.3320	4.3456	4.4382	4.3252	165.9803	121.4905
	SCY/Other	1.0000	0.9969	0.9761	1.0016	0.0261	0.0357
10 Period	StDev		8.8714	8.5794	8.2987	279.5196	244.2506
	SCY/Other		0.9354	0.9673	1.0000	0.0297	0.0340
40 Period	StDev		1.18E+81	2,273.89	2,304.56	5,404.46	5,213.34
	SCY/Other		0.0000	1.0000	0.9867	0.4207	0.4362

Panel A in Table III shows results for oil. In the four period time horizon, SCY produces 38.21% of the standard deviation of NAV, 5.33% of ROL and 8.19% of SPT. APX and RSK are within 0.5% of SCY. In the ten and 40 period time horizons, APX and RSK are within 0.4% of each other. RSK performs better in the ten period horizon and APX in the 40 period horizon. In the ten period horizon, RSK produces 37.03% of the standard deviation of NAV, 6.78% of ROL and 8.32% of SPT. In the 40 period horizon APX produces 39.79% of the standard deviation of NAV, 20.59% of ROL and 23.57% of SPT.

Panel B in Table III shows results for copper. In the four period time horizon, SCY produces 33.02% of the standard deviation of NAV, 5.30% of ROL and 8.14% of SPT. APX is within 0.2% of SCY while RSK produces approximately 10% more standard deviation than SCY. In the ten period time horizon APX and RSK are within 1% of each other and in the 40 period horizon they are within 3% of each other. APX performs better in both the ten period horizon and the 40 period horizon. In the ten period horizon, APX produces 30.52% of the standard deviation of NAV, 6.42% of ROL and 7.83% of SPT. In the 40 period horizon, APX produces 24.80% of the standard deviation of NAV, 7.34% of ROL and 7.79% of SPT.

Panel C in Table III shows results for gold. Schwartz (1997) gives parameter estimates for gold but states that "mean reversion in convenience yield is proxying for mean reversion in interest rates." After including stochastic interest rates in his model he concludes that "the models are misspecified for gold." This conclusion is consistent with the conventional wisdom that gold does not have convenience yield. Therefore, SCY, APX and RSK should show no improvement over NAV. NAV results in the lowest standard deviation for both the four and ten period horizons while coming within 1.4% of the standard deviation of RSK in the 40 period horizon. In the four and ten period horizons NAV produces between 2.52% and 3.50% of the standard deviation of ROL and SPT. In the 40 period horizon NAV produces 42.64% of the standard deviation of ROL and 44.21% of the standard deviation of SPT.

In the 40 period horizon APX suggests hedge ratios that are clearly unreasonable. With 40 periods remaining the NAV model's hedge ratio is -40 while all other models' (except APX) hedge ratios are less than 40. The APX model's hedge ratio is -3.06E+79. Since APX takes the expected value of future convenience yield, it does not include terms of the form of equations 10c-f. The solution given by APX includes terms with the speed of mean reversion, κ, in the denominator. When κ is small and the time horizon long the estimated hedge ratio becomes unreasonably large. This problem will be further discussed in the tests of actual data.

The simulations demonstrate three important facts: 1) a firm seeking to minimize the variance of equation (1) should use some form of a stacked hedge, 2) adjusting the stacked hedge for stochastic convenience yield improves hedging performance for the commercial commodities but not for the investment commodity and 3) APX and RSK are adequate approximations to SCY. In the simulations for commercial commodities, using the simplest form of the stacked hedge, NAV, reduces variance when compared to SPT and ROL in every case except SPT in the 40 period hedge for copper. In this instance, NAV produces about 10% more standard deviation than SPT but less than 96% of the standard deviation resulting from ROL. In the other cases, SPT results in 1.69 to 4.67 times the standard deviation of using NAV while ROL results in 1.93 to 7.17 time the standard deviation of NAV. For gold, SPT slightly outperforms ROL but results in 2.26 to 27.53 times the standard deviation of using NAV.

The results for oil and copper show that adjusting the hedge for stochastic convenience yield will further reduce standard deviation. In each case, adjusting for convenience yield results in less than 40% of the standard deviation produced by the simple stacked hedge. This reduction occurs regardless of whether SCY or one of its approximations is used.

CHAPTER 7

COMPARISON OF HEDGING MODELS USING ACTUAL DATA

Empirical tests of the hedging models were done for three commercial commodities, oil, copper and soybeans. Test were also done for two investment commodities, gold and Yen. The simulations indicate that the SCY model and its approximations will show an improvement over the NAV model for the commercial commodities while showing little or no variance reduction for the investment commodities. Section A describes the data, Section B describes the procedure for parameter estimation, Section C describes the empirical tests and Section D discusses the results.

DATA

Weekly futures prices, daily futures prices, daily spot prices and short term interest rates are required to test the hedging models. Daily and weekly futures prices are obtained from Datastream for oil, copper, soybeans, gold and Yen. The weekly futures prices for oil are from October 5, 1984 to December 10, 2001, for copper from January 5, 1990 to December 10, 2001, for soybeans from December 13, 1985 to August 8, 2002, for gold from October 5, 1984 to December 10, 2001and for Yen from December 13, 1985 to December 10, 2001.

Due to a lack of liquidity no futures contracts with more than a year to maturity were used. Oil and copper futures were available for every month. Yen futures were available for March, June, September and December. Soybean futures were available for the odd numbered months plus August. For consistency, the August contract was ignored. Gold futures were available for the even numbered months. In addition, a contract was available for the current month and the two following months. Since these contracts often did not have a long trading history, they were not used.

Daily futures prices are obtained for all five commodities for the dates on which the a new futures position is taken. Since a futures contract does not exist in every month for gold, soybeans and Yen spot prices are obtained for the dates when a flow commitment is due.

There is no centralized spot market for soybeans. Anywhere there is a grain elevator, a spot market exists. The spot prices used in the empirical tests are for delivery to Rotterdam. The spot price reflects the cost of shipping insured soybeans from Chicago to Rotterdam.

Prices for the three month Treasury Bill from July 2,1984 to August 8, 2002 are obtained from the United States Department of Treasury.

PARAMETER ESTIMATION

Estimating the parameter for the joint diffusion process in equations (3) - (5) presents some difficulties. As Gibson and Schwartz (1990) point out neither state variable, spot price or convenience yield, is observable. One must find proxies for the unobserved state variables or use an estimation procedure which does not require them.

The Kalman filter allows for parameter estimation without observations for the state variables when the disturbances and the initial state vector are normally distributed. This procedure is described by Harvey (1989) and implemented for a similar model by Schwartz (1997). It produces the optimal estimator for the state variables at time t based on information available at time t, allows for missing observations and enables a likelihood function to be calculated. This likelihood function is then maximized with respect to the parameters which are to be estimated. The resulting parameter estimates are then be used to calculate the minimum variance hedge ratios for each model.

The procedure is as follows: First, the joint diffusion is written in state space form. This form consists of the measurement equation and the transition equation. The measurement equation relates the time series of observable variables, the futures contracts, to the unobservable state variables, spot price and convenience yield. It is obtained from the spot futures relationship

given in equation (8). The transition equation generates the unobservable state variables. It is a discrete time version of the stochastic process for the state variables in equations (3)-(5). Following Harvey's notation, they are given as:

Measurement equation:

(17) $y_t = Z_t \alpha_t + d_t + \varepsilon_t, \quad t = 1.....T$

where Z_t is an N x m matrix, d_t is an N x 1 vector and ε_t is an N x 1 vector of serially uncorrelated disturbances with mean zero and covariance matrix H_t, that is $E(\varepsilon_t) = 0$ and $Var(\varepsilon_t) = H_t$.

Transition equation:

(18) $\alpha_t = T_t \alpha_{t-1} + c_t + R_t\eta_t, \quad t = 1.....T$

where T_t is an m x m matrix, c_t is an m x 1 vector, R_t is an m x g vector and η_t is a g x 1 vector of serially uncorrelated disturbances with mean zero and covariance matrix Q_t.

For equations (3)-(5) and equation (8):

$y_t = [\ln F(T_i)]$

$Z_t = [1, -((1-\exp(-\kappa * T_i))/ \kappa]$

$d_t = [\ln\{A(T_i)\}+rT_i]$

$\alpha_t = [\ln S_t, \delta_t]'$

$c_t = [(\mu-.5\sigma_s\text{^}2)\Delta t, \kappa\alpha\Delta t]'$

$T_t = [1 \ -\Delta t; \ 0 \ 1-\kappa\Delta t]$

$Q_t = [\sigma_s\text{^}2\Delta t \ \ \rho\sigma_s\sigma_c\Delta t; \ \rho\sigma_s\sigma_c\Delta t \ \ \sigma_c\text{^}2\Delta t]$.

One can verify that equation (17) corresponds to equation (8) and that equation (18) corresponds to equations (3)-(5) by making the appropriate substitutions.

Now that the model is in state space form the Kalman filter is applied to compute the optimal estimator of the state vector at time t, based on information available at time t. Using a numerical search routine the likelihood function is maximized with respect to the parameters

which are to be estimated. Parameter estimates were updated every four months to coincide with the start of a new hedge.

In implementing the above procedure, current research does not present definitive rules for choosing which futures contracts to use as observable variables or how much historical data to use. Nor is a clear representation of the seven dimensional solution space available. Different estimates may be obtained by choosing different futures contracts, different amounts of historical data or by beginning the optimization routine for the likelihood function at a different point. Hence, different combinations of contracts and historical data were used for different starting values for the search routine. There was no apparent optimal method. Slightly different combinations were used to for each commodity to obtain good estimates for that particular commodity.

If multiple sets of starting values converged to sets of parameter estimates that were similar in magnitude and had a reasonable economic interpretation, the set of estimates was considered to be acceptable. Fortunately, a given amount of historical data generally produced similar estimates. No combination of data was found which produced estimates that contradicted what theory would suggest the estimates should be. Some starting values would converge to estimates that had no economic interpretation. For example, certain starting values would yield correlation coefficients greater than one or less than negative one. These estimates were disregarded.

Historical data from the time it became available until the time of the estimation was used for the parameter estimation of soybeans and Yen. Oil, copper and gold use the previous five years if available. Oil and copper use contracts F1, F3, F5,F7 and F9. F1 is the nearby contract, F2 is the second contract to mature, F3 the third, etc. Soybeans use F2 and F4 while gold and Yen use F1. The parameter estimates are given in Tables C.4 - C.8 in Appendix C.

As expected, the parameter estimates for the commercial commodities differ from those for the investment commodities in important ways. The model given in equations (17)-(18) was designed to explain the nature of the price evolution of commodities with convenience yield. Theory suggests that the oil, copper and soybeans have convenience yield while gold and Yen do not. It follows that estimates significantly different from zero should be found for all parameters for the commercial commodities. The investment commodities should have no long term convenience yield (α), market price of convenience yield risk (λ), speed of adjustment of convenience yield (κ), volatility of convenience yield (σ_C) or correlation (ρ) between σ_C and another factor.

Each parameter for oil is estimated for each of the 45 different four period hedges. Each parameter for the remaining commodities is estimated for each of their 30 different four period hedges. The results are consistent with theory and the findings of Schwartz (1997). Almost all the estimates for the commercial commodities are positive and strongly significant. When the estimates are not significant, they are in line with estimates which are significant in surrounding time periods. The estimates for the investment commodities are positive and consistently, strongly significant for only μ and σ_S. The estimates are close to zero and insignificant at normally accepted levels in most cases for the remaining parameters.

Table C.4 in Appendix C shows the parameter estimates for oil for each of the 45 hedging periods. The estimates of σ_S and σ_C are positive and strongly significant for every time period. The estimate for κ is positive and significant at normally accepted levels every time except August 14, 1987 when it is weakly significant and in line with estimates in the surrounding time periods. Both α and ρ are significant all but five times each. These estimates are near the estimates in the surrounding time periods when the significance is stronger. The estimates for λ and μ are significant at normally accepted levels 34 and 28 times, respectively.

Table C.5 in Appendix C shows the parameter estimates for copper for each of the 30 hedging periods. The results are similar to oil with the exception of estimates for λ. There are three weakly or insignificant estimates for α, none for κ, four for μ and ρ. Once again these estimates are close to the surrounding strongly significant estimates. The estimates for market price of copper's convenience yield risk produce the only negative and weakest estimates for any of the commercial commodities. The estimates are insignificant 17 times and are both positive and negative. It is probable that the true market price of risk changes over time and is sometimes zero or very near zero. In all but one instance, the negative estimates are small (greater than -0.0057)

Table C.6 in Appendix C shows the parameter estimates for soybeans for each of the 30 hedging periods. The estimates of σ_S and σ_C are positive and strongly significant for every time period. The estimates for κ and λ are positive and significant all but two times. Both α and ρ are positive and significant all but five times each. These estimates are near the estimates in the surrounding time periods when the significance is stronger. The estimates for λ and μ are significant at normally accepted levels 34 and 28 times, respectively.

Table C.7 in Appendix C shows the parameter estimates for gold for each of the 30 hedging periods. They are positive and strongly significant for σ_S in every case. For μ, estimates are positive and strongly for 14 of the 30 periods. The remaining estimates are weakly significant and close in magnitude to the surrounding significant estimates. The estimates for the remaining parameters should be equal to zero. Only two estimates for α are greater than 0.01 and only six are significantly different from zero. Eleven estimates for κ are significant, nine for λ, 11 for ρ and 15 for σ_C. Schwartz (1997) also finds positive and significant estimates for parameters which should be zero for gold. He then tests a three factor model which allows for stochastic, mean-reverting interest rates. His results suggest that the convenience yield

parameters proxy for stochastic interest rates. A review of Table IX shows that even when these estimates are significant, they are small in magnitude.

Table C.8 in Appendix C shows the parameter estimates for Yen for each of the 30 hedging periods. They are similar to the results for gold. The estimates are positive and strongly significant for σ_S in every case. For μ, estimates are positive and strongly for 24 of the 30 periods. The remaining estimates are weakly significant and close in magnitude to the surrounding significant estimates. Estimates for α and σ_C are very near zero and never significant at normally accepted levels while ρ is significant only twice and in both cases less than 0.0046. Speed of mean reversion is significantly different from zero ten times but is never larger than 0.0100. Estimates for λ are not significantly different from zero 16 times. As with gold, any nonzero estimates for the convenience yield parameters may be proxying for stochastic interest rates.

EMPIRICAL TESTS

The hedging strategies are tested for a four period time horizon. The hedger is assumed to be obligated to sell one contract's worth of the commodity each month to a third party. For simplicity, it is assumed that the hedger has contracted to sell the commodity to the third party for $0.00. This assumption results in an examination of the cost of the hedge rather than the profit to the hedger. The cash flows resulting from each strategy are assumed to be reinvested at the risk-free rate as given by the 3 month T-bill rate at the beginning of the hedge. It is assumed to remain constant throughout the life of the hedge. Each strategy produces a final cash flow that is compared to the cash flow that would result from a theoretical stripped hedge. The differences in these cash flows are then used to compute the standard deviation for each strategy. The calculation for each commodity's theoretical stripped hedge is described later in this section. The timing of delivery to the third party coincides with the last trading day for the futures contract on the commodity. The terms of delivery follow those specified in the futures contract

when applicable. While the hedges are essentially the same for each commodity, there are minor variations to accommodate the structure of their futures contracts, the nature of each market and the availability of data. The details of each are described below.

Tests on oil consist of 45 separate hedges beginning on December 15, 1986 and ending on December 17, 2001. Tests on copper, gold and Yen consist of 30 separate hedges beginning on December 16, 1991 and ending on December 17, 2001. Tests on soybeans consist of 30 separate hedges beginning on August 17, 1992 and ending on August 15, 2002.

For oil and copper, the hedger holds a long position in futures contracts. At each delivery date, the third party takes delivery of one futures contract while the hedger unwinds the rest and takes a new long position. The terms of delivery to the third party are assumed to be identical to those in specified by the futures contract. Since a futures contract matures in each month a theoretical stripped hedge does not need to be calculated. The stripped hedge is given by the actual prices of futures contracts maturing in the appropriate months.

Gold, Yen and soybeans do not have a futures contract that matures in each month. A theoretical stripped hedge is calculated for each using available contracts and interpolation. The hedger rolls over futures contracts in the same manner as for oil and copper. Each month the hedger purchases the commodity in the spot market to deliver to the third party.

RESULTS

Tables IV summarizes the results of the empirical tests. Tables C.9 - C.13 in Appendix C show more detail. They support the results of the simulations and demonstrate: 1) the importance of using a stacked hedge to reduce cash flow variance, 2) the necessity of adjusting the hedge for stochastic convenience yield for commercial commodities, 3) the validity of the simple stacked hedge for investment commodities, 4) the importance of accurate parameter estimates in calculating hedge ratios and 5) the accuracy of APX and RSK.

The results for oil show that the unhedged position and a rollover hedge produce a standard deviation of cash flows of 9.71 and 6.63, respectively. The SCY model results in a standard deviation of 1.56 or 16.07% of the standard deviation of the SPT model and 23.52% of the ROL model. It results in 80.82% of the standard deviation of the NAV model. The APX and RSK models produce standard deviations that are 3.02% and 0.82% greater than that of the SCY model.

Table 4
Comparison of Four Period Hedges

		SPT	ROL	NAV	SCY	RSK	APX
Oil	StDev	9.71	6.63	1.93	1.56	1.61	1.57
	SCY/Other	0.1607	0.2352	0.8082	1.0000	0.9700	0.9918
Copper	StDev	34.66	23.62	4.89	4.58	4.71	4.61
	SCY/Other	0.1323	0.1941	0.9373	1.0000	0.9725	0.9939
Soybeans	StDev	174.05	117.00	92.91	87.82	88.31	87.98
	SCY/Other	0.5045	0.7506	0.9452	1.0000	0.9944	0.9982
Gold	StDev	51.562	38.134	3.003	2.998	3.032	2.75E+97
	SCY/Other	0.0581	0.0786	0.9985	1.0000	0.9887	0.0000
Yen	StDev	0.2137	0.1350	0.0069	0.0069	0.0071	0.0069
	SCY/Other	0.0321	0.0506	0.9997	1.0000	0.9719	1.0000

The results for copper show that the unhedged position and a rollover hedge produce a standard deviation of cash flows of 34.66 and 23.62, respectively. The SCY model results in a standard deviation of 4.58 or 13.23% of the standard deviation of the SPT model and 19.41% of the ROL model. It results in 93.73% of the standard deviation of the NAV model. The APX and RSK models produce standard deviations that are 2.65% and 0.58% greater than that of the SCY model.

The reduction in standard deviation of the SCY model when compared to the SPT and ROL models is similar for oil and copper. However, when compared to the NAV model, the reduction is greater for oil. This result is likely because convenience yield is larger in magnitude and hence more crucial to accurate modeling for oil than it is for copper. Estimates for long-run

convenience yield, α, average 0.1801 for oil and range from 0.0884 to 0.3252. The average for copper is 0.1196 and ranges from 0.0594 to 0.2027.

The results for soybeans show that the unhedged position and a rollover hedge produce a standard deviation of cash flows of 174.05 and 117.00, respectively. The SCY model results in a standard deviation of 92.91 or 50.45% of the standard deviation of the SPT model and 75.06% of the ROL model. It results in 94.52% of the standard deviation of the NAV model. The APX and RSK models produce standard deviations that are 0.56% and 0.18% greater than that of the SCY model.

The SCY model does not show the reduction in standard deviation when compared to SPT and ROL that it does for oil and copper. This is because of the design of the soybean hedges. The hedges for oil and copper assumed that the third party would take possession of the contracted amount of the commodity according to the terms of delivery stated in the futures contract. The futures contracts for oil and copper, therefore, are for the asset that is to be delivered.

The soybean hedges are somewhat different. Since futures contracts do not mature each month, the assumption is made that the hedger must buy soybeans in the spot market and deliver them to the third party. There is a spot market for soybeans wherever there is a grain elevator that buys and sells them. The spot price at a given location is not perfectly correlated with the futures price. In this case, the spot prices were for delivery to Rotterdam. The SCY model does not adjust for the price difference in the two locations. The result is similar to hedging one commodity with futures contracts written on a different commodity.

The results for gold show that the unhedged position and a rollover hedge produce a standard deviation of cash flows of 51.56 and 38.13, respectively. The simple stacked hedge reduces standard deviation to 3.003. Adjusting for convenience yield reduces standard deviation by 0.16% to 2.998. RSK produces 0.12% more standard deviation than the true model. The

standard deviation of the APX model is 2.75x10^97. The APX model suggests hedge ratios as high as 5.0x10^98. Clearly, estimates of this magnitude are unreasonably large. As κ gets close to zero, the APX model produces unreliable estimates.

The results for Yen show that the unhedged position and a rollover hedge produce a standard deviation of cash flows of 0.214 and 0.136, respectively. The simple stacked hedge reduces standard deviation to 0.007. Adjusting for convenience yield shows no change in the third decimal place. Neither APX and RSK show a change in the third decimal place.

In the case of each commodity, all forms of the stacked hedge reduce cash flow variance with respect to the planning horizon when compared to the unhedged or rollover hedge position. To further reduce variance, the nature of the commodity underlying the hedge must be considered. Stacked hedges for the two investment commodities show no improvement when adjusted for convenience yield. The three commercial commodities show a reduction in variance. This reduction is larger for oil which has a larger convenience yield.

These results suggest that the firm may reduce the cash flow variance of a long-term commodity flow commitment with respect to a planning horizon by entering nearby futures contracts. The number of contracts the firm should enter is dependent on the size of the commitment and the nature of the price generating process of the underlying commodity. The simple stacked hedge used by MG will reduce variance when compared to an unhedged position. However, the firm may improve the hedge's performance by adjusting for convenience yield.

The reductions in variance are not as great in the cases of actual data as they are in the simulations. This result indicates that the model used to derive the hedges does not fully capture the evolution of the underlying commodity price or the parameter estimates are not perfectly accurate. In either case, the tests show that the hedges reduce the variance of expected cash flows. A more complete model or more robust parameter estimates should further reduce the variance of cash flows.

CHAPTER 8

CONCLUSIONS

In this dissertation, I derive a minimum-variance hedging model for a firm that faces a long-term commodity flow commitment on an asset with stochastic convenience yield. Due to the computational complexity of the hedging model, I derive two approximations that are more easily implemented. I then compare the models to the unhedged position, a rollover hedge and a naive stacked hedge. The comparisons are made using simulated data and actual data from the oil, copper, soybeans, gold and Yen markets. The results differ for commercial commodities and investment commodities. In order to minimize variance, the hedge must be adjusted for convenience yield for commercial commodities while it is not necessary to do so for investment commodities.

The sensational nature of the large losses on futures contracts which brought MG to near bankruptcy raised many questions about the appropriate role of risk management in the corporation. It has been argued that MG's management took reasonable steps to reduce risk and, conversely, that MG used futures contracts to speculate. I make no claim about the motives of MG's management but use this case to show that firms in similar situations may use a form of the stacked hedge to reduce cash flow variance with respect to a planning horizon. If the underlying commodity has convenience yield, the hedging strategy must be adjusted accordingly.

The literature shows that the firm may hedge risk if it can do so more efficiently than its shareholders. It also shows that the firm may be justified in speculating or partially hedging a risk depending on its view of future market conditions. If the firm wishes to hedge all or part of

a risk, the minimum variance hedge serves as a benchmark. Once this benchmark is established, the firm may choose the level of hedging which it believes maximizes shareholder wealth.

Entering long-term futures contracts will allow the firm to create the minimum variance hedge. Due to a lack of liquidity, long-term contracts are often too expensive. If this is the case the firm must hedge by entering some number of nearby futures contracts. Many firms, such as MG, enter a number of nearby futures contracts that is equal to the remaining commitment. Under certain conditions, this strategy produces the minimum variance hedge for the given planning horizon. However, this naive stacked hedge does not adjust for convenience yield. It is well established that many commodities exhibit stochastic, mean-reverting convenience yield. This dissertation expands the literature by deriving a hedging model, SCY, for commodities that exhibit such convenience yield. This model becomes too computationally complex to implement for planning horizons of more than about four periods.

This dissertation further expands the literature by deriving two approximations to the SCY model. One approximation model is derived by substituting the expected convenience yield for its actual value. The other approximation model is derived by assuming the market price of convenience yield risk is equal to zero. Both models are shown to be reasonable approximations under certain conditions.

This dissertation also adds to the literature by demonstrating a method for using the Kalman filter to estimate parameter values of the price generating process for oil, copper, soybeans, gold and Yen. Using a different set of historical data, I confirm the general results of Schwartz (1997) for the two factor model in equations (3)-(5) for oil, copper and gold. Consistent with Schwartz' findings, I show that modeling convenience yield is necessary to capture the true nature of the price generating process for oil and copper while it is not for gold. I further show that it is necessary for soybeans while it is not for Yen.

These results suggest that adjusting the hedge for convenience yield is necessary for commercial commodities while it is not necessary for investment commodities. Comparisons using simulated data and actual data show this to be the case. The simulations are run for four, 10 and 40 period planning horizons. In all cases, the results for oil and copper show that the SCY model or its approximations produce less than 40% of the standard deviation resulting from the naive stacked hedge and less than 24% of the standard deviation resulting from remaining unhedged. For gold, the SCY model and its approximations show little if any improvement over the NAV model.

The comparisons using actual data are complicated by the need for accurate parameter estimates. The true nature of the price generating process for the simulated data is known by definition. Hence, tests involving it are pure tests of the hedging models. The true nature of the price generating process for the actual data is not known with certainty. Tests involving the actual data are tests of the price generating model, the accuracy of the parameter estimates and the hedging model.

The results of the tests using actual data are summarized as follows. For oil, the SCY model produces 80.82% of the standard deviation of the NAV model, 23.52% of the ROL model and 16.07% of the SPT model. Both the APX and RSK models are within 3.00% of the SCY model. For copper, the SCY model produces 93.73% of the standard deviation of the NAV model, 19.41% of the ROL model and 13.23% of the SPT model. Both The APX and RSK models are within 2.75% of the SCY model. For soybeans, the SCY model produces 94.52% of the standard deviation of the NAV model, 75.06% of the ROL model and 50.45% of the SPT model. Both The APX and RSK models are within 0.56% of the SCY model. For gold, the SCY, RSK and NAV models are within 1.13% of each other. The SCY model produces 5.81% of the standard deviation of the SPT model and 5.06% of the standard deviation of the ROL model. For Yen, the SCY, APX, RSK and NAV models are within 2.81% of each other. The SCY model

produces 3.21% of the standard deviation of the SPT model and 5.06% of the standard deviation of the ROL model.

Areas for future include examining the effects of including stochastic interest rates in the hedging model, examining the role and importance of each parameter in the hedging model and examining the effect of choosing different amounts of historical data for parameter estimation on the effectiveness of the hedging model.

REFERENCES

Anderson, R.W. and J. Danthine, 1980, "Hedging and Joint Production: Theory and Illustrations", *The Journal of Finance*, 35(5), 487-498.

Berkman, H. and M.E. Bradbury, 1996, "Empirical Evidence on the Corporate Use of Derivatives", *Financial Management*, 25(2), 5-13.

Bessembinder, H., 1991, "Forward Contracts and Firm Value: Investment Incentive and Contracting Effects", *Journal of Financial and Quantitative Analysis*, 26(4), 519-532.

Bsembinder, H., J.F. Coughenour, P.J. Seguin and M.M. Smoller, 1995, "Mean Reversion in Equilibrium Asset Prices: Evidence from the Futures Term Structure", *Journal of Finance,* 50(1), 361-375.

Black, F., 1976, "The Pricing of Commodity Contracts", *Journal of Financial Economics*, 3(1/2), 167-179.

Block, S.B. and T.J. Gallagher, 1986, "The Use of Interest Rate Futures and Options by Corporate Financial Managers", *Financial Management*, 15(3), 73-78.

Bollen, N. and R. Whaley, 1998, "Simulating Supply", *Risk,* 11(9), 143-147.

Brennan, M., 1991, "The Price of Convenience Yield and the Valuation of Commodity Contingent Claims", in D. Lund and B Oksendal (eds) *Stochastic Models and Option Values,* North Holland.

Brennan, M. and N. Crew, 1997, "Hedging Long Maturity Commodity Commitments with Short-Dated Futures Contracts", in M.A.H. Dempster and S.R. Pliska (eds), *Mathematics of Derivative Securities,* Cambridge University Press, New York.

Campbell, T. S. and W.A. Kracaw, 1990, "Corporate Risk Management and the Incentive Effects of Debt", *The Journal of Finance*, 45(5), 1673-1686.

Cortazar, G. and E. Schwartz, 1994, "The Evaluation of Commodity Contingent Claims", *Journal of Derivatives,* 1, 27-39.

Culp, C.L. and S.H. Hanke, 1994, "Derivative Dingbats", *The International Economy,*8(4), 14-25.

Culp, C.L. and M.H. Miller, 1994, "Hedging a Flow of Commodity Deliveries with Futures: Lessons From Metallgesellschaft", *Derivatives Quarterly*, 1(1), 7-15.

Culp, C.L. and M.H. Miller, 1995a, "Auditing the Auditors", *Risk*, 8(4), 36-39.

Culp, C.L. and M.H. Miller, 1995b, "Basis Risk and Hedging Strategies: Reply to Mello and Parsons", *Derivatives Quarterly,* 1(4), 20-26.

Culp, C.L. and M.H. Miller, 1995c, "Hedging in the Theory of Corporate Finance: A Reply to Our Critics", *Journal of Applied Corporate Finance*, 8(1), 121-127.

Culp, C.L. and M.H. Miller, 1995d, "Metallgesellschaft and the Economics of Synthetic Storage." *Journal of Applied Corporate Finance*, 7(4), 62-75.

Culp, C.L. and M.H. Miller, 1999, *Corporate Hedging in Theory and Practice: Lessons from Metallgesellschaft,* Risk Books, London.

DeMarzo, P.M. and D. Duffie, 1991, "Corporate Financial Hedging with Proprietary Information." *Journal of Economic Theory*, 53, 261-286.

DeMarzo, P.M. and D. Duffie, 1995, "Corporate Incentives for Hedging and Hedge Accounting", *The Review of Financial Studies*, 8(3), 743-771.

Dolde, W., 1995, "Hedging. Leverage, and Primitive Risk", *Journal of Financial Engineering,* 4(2), 187-216.

Ederington, L.H., 1979, "The Hedging Performance of the New Futures Markets", *The Journal of Finance*, 34(1), 157-170.

Edwards, F. and M. Canter., 1995, "The Collapse of Metallgesellschaft: Unhedgeable Risks, Poor Hedging Strategy, or Just Bad Luck?", *Journal of Futures Markets,* 15(3), 211-264.

Fama, E. and K. French, 1987, "Commodity Futures Prices: Some Evidence on Forecast Power, Premiums, and the Theory of Storage", *Journal of Business,* 60(1), 55-73.

Fama, E. and K. French, 1988, "Business Cycles and the Behaviour of Metals Prices", *The Journal of Finance,* 43(5), 1075-1093.

Fite, D. and P. Pfleiderer, 1995, "Should Firms Use Derivatives to Manage Risk?", in W. Beaver and G. Parker (eds), *Risk Management: Problems and Solutions,* McGraw-Hill, New York.

Froot, K.A., D.S. Scharfstein, and J.C. Stein, 1993, "Risk Management: Coordinating Corporate Investment and Fiancing Policies", *The Journal of Finance*, 48(5), 1629-1658.

Gavish, B. and A. Kalay, 1983, "On The Asset Substitution Problem", *Journal of Financial and Quantitative Analysis,* 18(1), 21-30.

Gay, G.D. and J. Nam, 1998, "The Underinvestment Problem and Corporate Derivatives Use", *Financial Management*, 27(4), 53-69.

Geczy, C., B.A. Minton, and C. Schrand, 1997, "Why Firms Use Currency Derivatives", *The Journal of Finance*, 52(4), 1323-1354.

Gibson, R. and E. Schwartz, 1990, "Stochastic Convenience Yield and the Pricing of Oil Contingent Claims", *The Journal of Finance,* 45(3), 959-975.

Graham, J.R. and D.A. Rogers, ???? "Is Corporate Hedging Consistent with Value Maximization? An Empirical Analysis", unpublised working paper, Fuqua School of Business, Duke University.

Graham, J.R. and C.W. Smith, 1999, "Tax Incentives to Hedge", *The Journal of Finance*, 54(6), 2241-2262.

Green, R.C., 1984, "Investment Incentives, Debt and Warrants", *Journal of Financial Economics,* 13(1), 115-136.

Green, R.C. and E. Talmor, 1986, "Asseet Substitution and the Agency Costs of Debt Financing", *Journal of Banking and Finance,* 10(2/3), 391-399.

Harvey, A.C., 1996, *Forecasting, structural time series models and the Kalman filter*, Cambridge University Press, New York.

Haushalter, G.D., 2000, "Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers", *The Journal of Finance*, 55(1), 107-151.

Hilliard, J.E., 1999, "Analytics Underlying the Metallgesellschaft Hedge: Short Term Futures in a Multiperiod Environment", *Review of Finance and Accounting*, 12(3), 195-219.

Hilliard, J.E. and J. Reis, 1998, "Valuation of Commodity Futures and Options under Stochastic Convenience Yields, Interest Rates and Jump Diffusions in the Spot", *Journal of Financial and Quantitative Analysis*, 33(1), 61-86.

Hull, J. and A. White, 1987, "The Pricing of Options on Assets with Stochastic Volatilities", *The Journal of Finance,* 42(2), 281-300.

Jensen, M.C. and W.H. Meckling, 1976, "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure", *Journal of Financial Economics,* 3(4), 305-360.

Johnson, L.L., 1960, "The Theory of Hedging and Speculation in Commodity Futures", *The Review of Economic Studies*, 27(3), 139-151.

Kuprianov, A., 1995, "Derivatives Debacles", *Economic Quarterly,* 81(4), 1-39.

Lessard, D., 1990, "Global Competition and Corporate Finance in the 1990s", *Continental Bank Journal of Applied Corporate Finance,* 1(1), 59-72.

MacMinn, R.D., 1987, "Forward Markets, Stock Markets, and the Theory of the Firm", *The Journal of Finance*, 42(5), 1167-1185.

Makin, J.H., 1978, "Portfolio Theory and the Problem of Foreign Exchange Risk", *The Journal of Finance*, 33(2), 517-534.

Mello, A.S. and J.E. Parsons, 1995, "Hedging a Flow of Commodity Deliveries with Futures: Problems with a Rolling Stack", *Derivatives Quarterly,* 1(1), 16-19.

Mello, A.S. and J.E. Parsons, 1995, "The Maturity Structure of a Hedge Matters: Lessons from the Metallgesellschaft Debacle", *Journal of Applied Corporate Finance,* 8(1), 106-120.

Merton, R.C., 1973, "Theory of Rational Option Pricing", *Bell Journal of Economics and Management Science,* 4, 141-183.

Myers, S.C., 1977, "Determinants of Corporate Borrowing", *Journal of Financial Economics,* 5(2), 147-175.

Mian, S.L., 1996, "Evidence on Corporate Hedging Policy", *Journal of Financial and Quantitative Analysis*, 31(3), 419-439.

Modigliani, F. and M.H.Miller, 1961, "Dividend Policy, Growth and the Valuation of Shares", *Journal of Business*, 411-433.

Modigliani, F. and M.H. Miller, 1958, "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review*, 911-922.

Mozumdar, A., 2001, "Corporate Hedging and Speculative Incentives: Implications for Swap Market Default Risk", *Journal of Financial and Quantitative Analysis*, 36(2), 221-250.

Nance, D.R., C.W. Smith, and C.W. Smithson, 1993, "On the Determinants of Corporate Hedging", *The Journal of Finance*, 48(1), 267-284.

Neuberger, A., 1998, "Hedging Long-Term Exposures with Multiple Short-Term Futures Contracts." *The Review of Financial Studies,* 12(3), 429-459.

Pennings, J.M.E. and M.T.G. Meulenberg, 1997, "Hedging Efficiency: A Futures Exchange Management Approach", *The Journal of Futures Markets*, 17(5), 599-615.

Pirrong, S.C., 1997, "Metallgesellschaft: A Prudent Hedger Ruined, Or A Wildcatter On NYMEX?", *The Journal of Futures Markets*, 17(5), 543-578.

Rolfo, J., 1980, "Optimal Hedging under Price and Quantity Uncertainty: The Case of a Cocoa Producer", *Journal of Political Economy*, 88(1), 100-116.

Ross, S.A., 1997, "Hedging Long Run Commitments: Exercises in Incomplete Market Pricing." *Economic Notes by Banca Monte dei Paschi di Siena SpA*, 26(2-1997), 385-420.

Schwartz, E., 1997, "The Stochastic Behavior of Commodity Prices: Implications for Valuation and Hedging", *The Journal of Finance,* 52(3), 923-973.

Smith, C.W., 1995, "Corporate Risk Management: Theory and Practice", *The Journal of Derivatives*, 2(4) , 21-30.

Smith, C.W., C.W. Smithson and D.S. Wilford, 1990, *Strategic Risk Management* (Insitutional Investor Series in Finance), Haper and Row, New York.

Smith, C.W. and R. Stulz, 1985, "The Determinants of Firms' Hedging Policies", *Journal of Financial and Quantitative Analysis,* 20(4), 391-405.

Stulz, R.M., 1984, "Optimal Hedging Policies", *Journal of Financial and Quantitative Analysis*, 19(2), 127-140.

Stulz, R.M., 1990, "Managerial Discretion and Optimal Financing Policies", *Journal of Financial Economics,* 26(1), 3-26.

Stulz, R.M., 1996, "Risk Management: Coordinating Investment and Financing Policies – Rethinking Risk Management", *Journal of Applied Corporate Finance,* 9(3), 8-24.

Tufano, P., 1996, "Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry", *The Journal of Finance*, 51(4), 1097-1137.

Working, H., 1953, "Futures Trading and Hedging", *American Economic Review,* 43(3), 314-343.

Working, H., 1962, "New Concepts Concerning Futures Markets and Prices", *American Economice Review,* 52(3), 431-459.

APPENDIX A

DERIVATION OF MINIMUM VARIANCE SOLUTION

Minimize

(A1) $$Var\left[\sum_{i=j+1}^{n} e^{r\Delta(n-i)}\left(m_i S_i + x_{i-1}\Delta F_{i-1}\right)\right]$$

with respect to x_i.

By employing a backwards solution technique the first order condition is found to be

(A2)

$$x_j^* = \left\{-Cov\left[\sum_{i=j+1}^{n} e^{r\Delta(n-i)} m_i S_i + \sum_{i=j+1}^{n-1} e^{r\Delta(n-i-1)} x_i^* \Delta F_i, \Delta F_j \middle| t = j\Delta\right]\right\} / Var\left[e^{r\Delta(n-j-1)}\Delta F_j \middle| t = j\Delta\right]$$

Recall that $\Delta F_i = S_{i+1} - A(\Delta)e^{r\Delta - H(\Delta)\delta(\Delta)} S_i$ and substitute. Equation (A2) reduces to

(A3) $$x_j^* = [\Psi 1 + \Psi 2 + \Psi 3] / \Gamma$$

where $$\Psi 1 = -\sum_{i=j+1}^{n} e^{r\Delta(j+1-i)} m_i Cov\left[S_i, S_{j+1} \middle| t = j\Delta\right],$$

$$\Psi 2 = -\sum_{i=j+1}^{n-1} e^{r\Delta(j-i)} Cov\left[x_i^* S_{i+1}, S_{j+1} \middle| t = j\Delta\right],$$

$$\Psi 3 = \sum_{i=j+1}^{n-1} e^{r\Delta(j+1-i)} A(\Delta) Cov\left[x_i^* S_i e^{-H(\Delta)\delta(i\Delta)}, S_{j+1} \middle| t = j\Delta\right],$$

and $$\Gamma = Var\left[S_{j+1} \middle| t = j\Delta\right].$$

Note that the covariance and variance terms in equation (A3) are conditioned on information available at time jΔ. For notational ease all covariance and variance terms are assumed to be conditioned on time jΔ unless otherwise indicated. The covariance terms in equation (A3) take on one of two general forms. They are:

(A4) $$\Theta_{ij0} \equiv Cov\left[\varepsilon S_i, S_{j+1}\right] / Var\left[S_{j+1}\right] \text{ and}$$

(A5) $$\Theta_{ij1} \equiv Cov\left[\varepsilon S_i e^{-H(\Delta)\delta(i\Delta)}, S_{j+1}\right] / Var\left[S_{j+1}\right]$$

where ε is a constant or a constant and a lognormal variate. Since equations (A4) and (A5) are conditioned on time jΔ, S_i and δ(iΔ) are random variables for all i>j.

To solve equations (A4) and (A5) substitute the solution to equations (4) and (5),

(A6) $$S_i = S_{j+1} \exp\left\{\left(r + \lambda\sigma_s - .5\sigma_s^2\right)(i-j-1)\Delta - \int_{(j+1)\Delta}^{i\Delta} \delta(s)ds + \sigma_s\left(Z_{i\Delta} - Z_{(j+1)\Delta}\right)\right\} \text{ and}$$

(A7) $$\delta_t = \alpha + (\delta_v - \alpha)e^{-\kappa(t-v)} + \sigma_c e^{-\kappa t}\int_v^t e^{\kappa s} dZ_c(s).$$

Since S_i is lognormally distributed and δ(iΔ) is normally distributed, the covariance terms in equations (A4) and (A5) consist exclusively of constants and lognormal variates.

The general solution is

(A8) $$\Theta_{ij} = \exp\left(\mu_{ij} + \rho\sigma_i\sigma_{j+1}\right)\left[\exp\left(\sigma_{j+1}^2 + \rho\sigma_i\sigma_{j+1}\right) - 1\right] / \left[\exp\left(\sigma_{j+1}^2\right) - 1\right]$$

where

$$\mu_{ij} \equiv E[\log(\varepsilon)]$$

$$\sigma_{\varphi+1}^2 \equiv Var\left[\log\left(S_{j+1}\right)\right]$$

$$\sigma_t \equiv Var\left[\log(\varepsilon)\right]$$

For terms in the form of equation (A4)

(A9) $$\mu_{ij0} = \left(r + \lambda\sigma_s - .5\sigma_s^2 - \alpha\right)(i - j - 1)\Delta + \left(\delta(j\Delta) - \alpha\right)\left(e^{(j-i)\kappa\Delta} - e^{-\kappa\Delta}\right)/\kappa$$ and

(A10) $$\rho_0\sigma_i\sigma_{j+1} = M1 + M2$$

where $$M1 = \sigma_c^2\left\{-e^{(j+1-i)\kappa\Delta} + 1 + 2e^{(j-i)\kappa\Delta} - 2e^{-\kappa\Delta} - e^{(j-1-i)\kappa\Delta} + e^{-2\kappa\Delta}\right\}/2\kappa^3$$ and

$$M2 = \rho\sigma_s\sigma_c\left\{e^{(j+1-i)\kappa\Delta} - 1 - e^{(j-i)\kappa\Delta} + e^{-\kappa\Delta}\right\}/\kappa^2 .$$

For terms of form equation (A5)

(A11) $$\mu_{ij1} = \left(r + \lambda\sigma_s - .5\sigma_s^2 - \alpha\right)(i - j - 1)\Delta - H(\Delta)\alpha + \left(\delta(j\Delta) - \alpha\right)\left(e^{(j-1-i)\kappa\Delta} - e^{-\kappa\Delta}\right)/\kappa$$

(A12) $$\rho_1\sigma_i\sigma_{j+1} = M1 + M2 + M3 + M4$$

where

$$M3 = H(\Delta)\sigma_c^2\left[e^{(j+1-i)\kappa\Delta} - 2e^{(j-i)\kappa\Delta} + e^{(j-1-i)\kappa\Delta}\right]/\,2\kappa^2 \text{ and}$$

$$M4 = H(\Delta)\rho\sigma_s\sigma_c\left[e^{(j-i)\kappa\Delta} - e^{(j+1-i)\kappa\Delta}\right]/\,\kappa.$$

APPENDIX B

DERIVATION OF RISK NEUTRAL SOLUTION

For the two-factor model described in Chapter III, Hilliard and Reis (1998) show that the futures price is given by:

(B1) $F(t,T) = S\Omega(t)$

where

(B2) $\Omega(i) = A(\tau)e^{-H(\tau)\delta(t)} / P(t,T)$.

Ito's Lemma implies

(B3) $dF / F = [(\mu - \delta) - H\kappa(\alpha - \delta) + .5H^2\sigma_\delta^2 - H\rho\sigma_S\sigma_\delta/S + \Omega_t/\Omega]dt + \sigma_S dZ_S - H\sigma_\delta dZ_\delta$

Let $\beta = [(\mu - \delta) - H\kappa(\alpha - \delta) + .5H^2\sigma_\delta^2 - H\rho\sigma_S\sigma_\delta/S + \Omega_t/\Omega]$

Equation (B3) implies that:

(B4) $dF_j / F_j = \beta_j\, dt + \sigma(t_j)dZ_j^*$

The terms in equation (7) that are the primary source of complexity are now of the form:

B(5) $Cov[dF_j, x_i^* dF_i | t = t_j]$, $i>j$.

If equation (B5) equals zero the hedge is easily computed. So, using equation (B4) and expanding gives:

(B6) $Cov[dF_j, x_i^* dF_i | t=t_j] = F_j Cov[(\beta_j\, dt + \sigma_S dZ_S(t_j) - H dZ_\delta(t_j), x_i^* F_i(\beta_j\, dt + \sigma_S dZ_S(t_i) - H dZ_\delta(t_i)))]$

The drift term in equation (B3) is zero in a risk neutral world. Therefore, $\beta(t) = 0$ for all t. The terms in equation (B6) involving $\beta(t)$ are zero. Now examine the remaining individual terms all conditioned on t_j. They are all of the form:

(B7) $Cov[W, XYZ]$

where Z is independent of W, X and Y and $E[W] = 0$. Hence,

(B8) $Cov[W,XYZ] = E[WXYZ] - E[W]E[XYZ] = E[WXYZ]$.

By the law of iterated expectations:

(B9) $E[WXYZ] = E_Z[ZE[WXY|Z]]$.

By the indepenence of Z:

(B10) $E[WXYZ] = E_Z[ZE[WXY]] = E_Z[Z\Phi(W,X,Y)] = E[Z]\,\Phi(W,X,Y) = 0$.

Therefore, in a risk neutral world the optimal hedge ratio is given by:

(B11) $$x_j^* = -Cov\left[\sum_{i=j+1}^{n} m_i S_i, \Delta F_j | t = t_j\right] / Var\left[\Delta F_j | t = t_j\right]$$

APPENDIX C

SUPPORTING TABLES

Table C.1
Comparison of Four Period Hedging Policies

Panel A ***Oil***

	SCY	APX	RSK	NAV	ROL	SPT
X0	-3.1066	-3.0935	-3.0921	-4.0000	-1.0000	0.0000
X1	-2.4784	-2.4818	-2.4811	-3.0000	-1.0000	0.0000
X2	-1.7967	-1.7967	-1.7964	-2.0000	-1.0000	0.0000
X3	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	2.1330	2.1423	2.1421	5.5829	40.0185	26.0449
SCY/Other	1.0000	0.9957	0.9958	0.3821	0.0533	0.0819

Panel B ***Copper***

	SCY	APX	RSK	NAV	ROL	SPT
X0	-2.9422	-2.9538	-3.1337	-4.0000	-1.0000	0.0000
X1	-2.3724	-2.3883	-2.4915	-3.0000	-1.0000	0.0000
X2	-1.7775	-1.7775	-1.8185	-2.0000	-1.0000	0.0000
X3	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	10.0984	10.1106	11.2175	30.5832	190.3795	124.0433
SCY/Other	1.0000	0.9988	0.9002	0.3302	0.0530	0.0814

Panel C ***Gold***

	SCY	APX	RSK	NAV	ROL	SPT
X0	-3.9973	-4.0107	-3.9509	-4.0000	-1.0000	0.0000
X1	-2.9972	-3.0000	-2.9746	-3.0000	-1.0000	0.0000
X2	-2.0031	-2.0031	-1.9953	-2.0000	-1.0000	0.0000
X3	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	4.3320	4.3456	4.4382	4.3252	165.9803	121.4905
SCY/Other	1.0000	0.9969	0.9761	1.0016	0.0261	0.0357

Table C.2
Comparison of Ten Period Hedging Policies

Panel A ***Oil***

	APX	RSK	NAV	ROL	SPT
X0	-7.3868	-7.3918	-10.0000	-1.0000	0.0000
X1	-6.6808	-6.6851	-9.0000	-1.0000	0.0000
X2	-6.3370	-6.3409	-8.0000	-1.0000	0.0000
X3	-5.9369	-5.9403	-7.0000	-1.0000	0.0000
X4	-5.2215	-5.2241	-6.0000	-1.0000	0.0000
X5	-4.3914	-4.3933	-5.0000	-1.0000	0.0000
X6	-3.6460	-3.6472	-4.0000	-1.0000	0.0000
X7	-2.7774	-2.7780	-3.0000	-1.0000	0.0000
X8	-1.9312	-1.9315	-2.0000	-1.0000	0.0000
X9	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	5.4100	5.3979	14.5762	79.6041	64.9107
RSK/Other	0.9978	1.0000	0.3703	0.0678	0.0832

Panel B ***Copper***

	APX	RSK	NAV	ROL	SPT
X0	-7.2780	-7.6464	-10.0000	-1.0000	0.0000
X1	-6.5955	-6.9178	-9.0000	-1.0000	0.0000
X2	-6.1613	-6.4480	-8.0000	-1.0000	0.0000
X3	-5.4417	-5.6723	-7.0000	-1.0000	0.0000
X4	-4.8777	-5.0614	-6.0000	-1.0000	0.0000
X5	-4.1487	-4.2793	-5.0000	-1.0000	0.0000
X6	-3.4872	-3.5737	-4.0000	-1.0000	0.0000
X7	-2.7186	-2.7651	-3.0000	-1.0000	0.0000
X8	-1.8974	-1.9140	-2.0000	-1.0000	0.0000
X9	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	18.1255	18.2985	59.6337	283.3095	232.3482
APX/Other	1.0000	0.9905	0.3039	0.0640	0.0780

Panel C ***Gold***

	APX	RSK	NAV	ROL	SPT
X0	-10.1973	-9.8730	-10.0000	-1.0000	0.0000
X1	-9.0848	-8.8921	-9.0000	-1.0000	0.0000
X2	-8.0417	-7.9217	-8.0000	-1.0000	0.0000
X3	-7.0258	-6.9496	-7.0000	-1.0000	0.0000
X4	-6.0102	-5.9621	-6.0000	-1.0000	0.0000
X5	-5.0072	-4.9779	-5.0000	-1.0000	0.0000
X6	-4.0024	-3.9861	-4.0000	-1.0000	0.0000
X7	-3.0022	-2.9944	-3.0000	-1.0000	0.0000
X8	-2.0007	-1.9981	-2.0000	-1.0000	0.0000
X9	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	8.8714	8.5794	8.2987	279.5196	244.2506
NAV/Other	0.9354	0.9673	1.0000	0.0297	0.0340

Table C.3
Comparison of Forty Period Hedging Policies

Panel A ***Oil***

	APX	RSK	NAV	ROL	SPT
X0	-14.9803	-14.9482	-40.0000	-1.0000	0.0000
X1	-15.0223	-14.9905	-39.0000	-1.0000	0.0000
X2	-13.7363	-13.7077	-38.0000	-1.0000	0.0000
X3	-16.0801	-16.0468	-37.0000	-1.0000	0.0000
X4	-15.3144	-15.2832	-36.0000	-1.0000	0.0000
X5	-14.0829	-14.0548	-35.0000	-1.0000	0.0000
X6	-14.4501	-14.4217	-34.0000	-1.0000	0.0000
X7	-13.2169	-13.1914	-33.0000	-1.0000	0.0000
X8	-14.3970	-14.3696	-32.0000	-1.0000	0.0000
X9	-15.8905	-15.8606	-31.0000	-1.0000	0.0000
X10	-14.3313	-14.3049	-30.0000	-1.0000	0.0000
X11	-14.9795	-14.9523	-29.0000	-1.0000	0.0000
X12	-12.7369	-12.7145	-28.0000	-1.0000	0.0000
X13	-11.9239	-11.9034	-27.0000	-1.0000	0.0000
X14	-11.9827	-11.9624	-26.0000	-1.0000	0.0000
X15	-11.8449	-11.8253	-25.0000	-1.0000	0.0000
X16	-11.7733	-11.7542	-24.0000	-1.0000	0.0000
X17	-12.1175	-12.0983	-23.0000	-1.0000	0.0000
X18	-10.9319	-10.9151	-22.0000	-1.0000	0.0000
X19	-10.4901	-10.4743	-21.0000	-1.0000	0.0000
X20	-9.5339	-9.5201	-20.0000	-1.0000	0.0000
X21	-9.2725	-9.2594	-19.0000	-1.0000	0.0000
X22	-8.1290	-8.1181	-18.0000	-1.0000	0.0000
X23	-8.4936	-8.4824	-17.0000	-1.0000	0.0000
X24	-8.9907	-8.9791	-16.0000	-1.0000	0.0000
X25	-8.1265	-8.1165	-15.0000	-1.0000	0.0000
X26	-7.5426	-7.5337	-14.0000	-1.0000	0.0000
X27	-7.2574	-7.2492	-13.0000	-1.0000	0.0000
X28	-7.5951	-7.5868	-12.0000	-1.0000	0.0000
X29	-6.6484	-6.6416	-11.0000	-1.0000	0.0000
X30	-6.1068	-6.1009	-10.0000	-1.0000	0.0000
X31	-5.6922	-5.6871	-9.0000	-1.0000	0.0000
X32	-4.9821	-4.9781	-8.0000	-1.0000	0.0000
X33	-4.4845	-4.4812	-7.0000	-1.0000	0.0000
X34	-4.0416	-4.0390	-6.0000	-1.0000	0.0000
X35	-3.3746	-3.3728	-5.0000	-1.0000	0.0000
X36	-2.9464	-2.9451	-4.0000	-1.0000	0.0000
X37	-2.4422	-2.4415	-3.0000	-1.0000	0.0000
X38	-1.7829	-1.7826	-2.0000	-1.0000	0.0000
X39	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	2,033.74	2,041.40	5,110.91	9,878.89	8,629.64
APX/Other	1.0000	.9962	.3979	.2059	.2357

Panel B ***Copper***

	APX	RSK	NAV	ROL	SPT
X0	-16.1069	-14.9174	-40.0000	-1.0000	0.0000
X1	-16.0276	-14.9546	-39.0000	-1.0000	0.0000
X2	-16.1607	-15.1895	-38.0000	-1.0000	0.0000
X3	-15.1829	-14.3811	-37.0000	-1.0000	0.0000
X4	-14.0466	-13.4084	-36.0000	-1.0000	0.0000
X5	-13.8408	-13.3088	-35.0000	-1.0000	0.0000
X6	-10.8490	-10.5227	-34.0000	-1.0000	0.0000
X7	-11.0973	-10.8370	-33.0000	-1.0000	0.0000
X8	-9.9200	-9.7610	-32.0000	-1.0000	0.0000
X9	-11.1687	-11.0590	-31.0000	-1.0000	0.0000
X10	-11.0092	-10.9771	-30.0000	-1.0000	0.0000
X11	-11.5243	-11.5690	-29.0000	-1.0000	0.0000
X12	-10.3167	-10.4296	-28.0000	-1.0000	0.0000
X13	-11.8221	-12.0321	-27.0000	-1.0000	0.0000
X14	-11.2669	-11.5452	-26.0000	-1.0000	0.0000
X15	-11.5933	-11.9606	-25.0000	-1.0000	0.0000
X16	-10.7547	-11.1681	-24.0000	-1.0000	0.0000
X17	-10.6033	-11.0831	-23.0000	-1.0000	0.0000
X18	-10.0273	-10.5469	-22.0000	-1.0000	0.0000
X19	-9.0933	-9.6206	-21.0000	-1.0000	0.0000
X20	-9.0375	-9.6203	-20.0000	-1.0000	0.0000
X21	-8.7359	-9.3531	-19.0000	-1.0000	0.0000
X22	-8.1533	-8.7752	-18.0000	-1.0000	0.0000
X23	-8.6048	-9.3178	-17.0000	-1.0000	0.0000
X24	-7.6805	-8.3516	-16.0000	-1.0000	0.0000
X25	-7.3496	-8.0273	-15.0000	-1.0000	0.0000
X26	-7.3476	-8.0619	-14.0000	-1.0000	0.0000
X27	-6.5680	-7.2234	-13.0000	-1.0000	0.0000
X28	-6.2272	-6.8656	-12.0000	-1.0000	0.0000
X29	-5.7635	-6.3612	-11.0000	-1.0000	0.0000
X30	-5.8368	-6.4551	-10.0000	-1.0000	0.0000
X31	-5.3082	-5.8611	-9.0000	-1.0000	0.0000
X32	-4.5855	-5.0392	-8.0000	-1.0000	0.0000
X33	-4.1627	-4.5502	-7.0000	-1.0000	0.0000
X34	-3.8733	-4.2065	-6.0000	-1.0000	0.0000
X35	-3.3081	-3.5516	-5.0000	-1.0000	0.0000
X36	-2.7812	-2.9443	-4.0000	-1.0000	0.0000
X37	-2.3367	-2.4359	-3.0000	-1.0000	0.0000
X38	-1.7686	-1.8092	-2.0000	-1.0000	0.0000
X39	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	2,096.21	1,574.62	14,682.68	15,298.67	13,385.89
RSK/Other	0.7512	1.0000	0.1072	0.1029	0.1176

Panel C ***Gold***

	APX	RSK	NAV	ROL	SPT
X0	-3.06E+79	-34.2211	-40.0000	-1.0000	0.0000
X1	-2.26E+75	-32.4587	-39.0000	-1.0000	0.0000
X2	-2.28E+71	-31.9683	-38.0000	-1.0000	0.0000
X3	-2.94E+67	-31.6642	-37.0000	-1.0000	0.0000
X4	-4.85E+63	-31.4894	-36.0000	-1.0000	0.0000
X5	-1.06E+60	-32.1268	-35.0000	-1.0000	0.0000
X6	-2.59E+56	-30.6546	-34.0000	-1.0000	0.0000
X7	-8.16E+52	-29.5531	-33.0000	-1.0000	0.0000
X8	-3.28E+49	-28.5096	-32.0000	-1.0000	0.0000
X9	-1.75E+46	-28.1333	-31.0000	-1.0000	0.0000
X10	-1.21E+43	-27.9261	-30.0000	-1.0000	0.0000
X11	-9.87E+39	-26.6856	-29.0000	-1.0000	0.0000
X12	-1.13E+37	-26.7673	-28.0000	-1.0000	0.0000
X13	-1.42E+34	-24.7963	-27.0000	-1.0000	0.0000
X14	-2.41E+31	-23.6685	-26.0000	-1.0000	0.0000
X15	-5.20E+28	-22.4784	-25.0000	-1.0000	0.0000
X16	-1.48E+26	-21.6586	-24.0000	-1.0000	0.0000
X17	-5.26E+23	-20.5412	-23.0000	-1.0000	0.0000
X18	-2.42E+21	-19.5712	-22.0000	-1.0000	0.0000
X19	-1.54E+19	-19.2863	-21.0000	-1.0000	0.0000
X20	-1.17E+17	-18.2585	-20.0000	-1.0000	0.0000
X21	-1.17E+15	-17.5218	-19.0000	-1.0000	0.0000
X22	-1.49E+13	-16.5981	-18.0000	-1.0000	0.0000
X23	-2.57E+11	-16.1271	-17.0000	-1.0000	0.0000
X24	-5.44E+09	-15.1896	-16.0000	-1.0000	0.0000
X25	-1.51E+08	-14.3572	-15.0000	-1.0000	0.0000
X26	-5.14E+06	-13.1655	-14.0000	-1.0000	0.0000
X27	-2.37E+05	-12.2547	-13.0000	-1.0000	0.0000
X28	-1.41E+04	-11.2677	-12.0000	-1.0000	0.0000
X29	-1.09E+03	-10.1996	-11.0000	-1.0000	0.0000
X30	-123.8604	-9.3763	-10.0000	-1.0000	0.0000
X31	-24.1382	-8.3881	-9.0000	-1.0000	0.0000
X32	-10.5538	-7.5064	-8.0000	-1.0000	0.0000
X33	-7.4068	-6.5947	-7.0000	-1.0000	0.0000
X34	-6.0310	-5.7374	-6.0000	-1.0000	0.0000
X35	-4.9650	-4.8377	-5.0000	-1.0000	0.0000
X36	-3.9624	-3.9038	-4.0000	-1.0000	0.0000
X37	-2.9892	-2.9640	-3.0000	-1.0000	0.0000
X38	-1.9925	-1.9849	-2.0000	-1.0000	0.0000
X39	-1.0000	-1.0000	-1.0000	-1.0000	0.0000
StDev	1.18E+81	2,273.89	2,304.56	5,404.46	5,213.34
RSK/Other	0.0000	1.0000	0.9867	0.4207	0.4362

Table C.4 -- Parameter Estimates for Oil

Period Ending	α	κ	λ	μ	ρ	σ_s	σ_c
12.19.1986	0.2315 (1.752)	1.3148 (2.483)	0.3448 (1.901)	0.0164 (1.026)	0.0699 (1.909)	0.1686(30.523)	0.3918 (3.946)
04.17.1987	0.2968 (6.684)	1.3034 (4.674)	0.4129(11.266)	0.0811 (1.374)	0.0870 (1.581)	0.1625(32.365)	0.3672 (7.831)
08.14.1987	0.2877 (1.742)	1.3583 (1.503)	0.4200 (1.651)	0.1457 (1.329)	0.0808 (2.577)	0.1549(34.614)	0.3556 (2.858)
12.04.1987	0.2406 (0.664)	1.3172 (2.731)	0.3608 (0.733)	0.1240 (0.988)	0.0744 (0.601)	0.1493(30.995)	0.3350 (2.974)
04.15.1988	0.2286 (1.603)	1.3902 (2.999)	0.3132 (1.664)	0.1115 (1.189)	0.0600 (1.428)	0.1504(37.811)	0.3371 (4.884)
08.19.1988	0.1648 (7.530)	1.3037 (5.176)	0.1807 (6.773)	0.0451 (1.989)	0.0885 (2.726)	0.1539(40.282)	0.3199 (9.269)
12.16.1988	0.1946 (8.177)	1.2922 (5.630)	0.2363 (6.958)	0.0682 (0.706)	0.1023 (3.054)	0.1589(43.022)	0.3000 (9.045)
04.14.1989	0.2923 (8.816)	1.2475 (6.378)	0.3636 (5.195)	0.1629 (0.343)	0.1354 (3.554)	0.1588(44.771)	0.2879(10.417)
08.11.1989	0.2573(12.996)	1.8062 (8.842)	0.4102(15.920)	0.1666 (2.147)	0.1297 (4.260)	0.1564(45.158)	0.3577(10.437)
12.15.1989	0.2759(12.709)	1.7341 (8.345)	0.4281(16.221)	0.1969 (2.317)	0.1295 (1.829)	0.1521(43.475)	0.3375(10.218)
04.20.1990	0.2259(12.768)	1.7715 (8.280)	0.3365(14.961)	0.1747 (2.520)	0.1499 (3.778)	0.1499(47.663)	0.3691(12.729)
08.17.1990	0.2479(16.903)	2.1395(11.865)	0.4008(17.680)	0.2267 (4.542)	0.2094 (6.322)	0.1552(50.246)	0.4069(12.245)
12.14.1990	0.3252(13.206)	1.3297 (9.782)	0.3888(16.392)	0.2310 (5.303)	0.2350 (5.261)	0.1625(51.097)	0.3272(13.429)
04.19.1991	0.2264(12.617)	1.4562 (9.052)	0.2855(12.693)	0.1980 (3.555)	0.1726 (3.606)	0.1668(53.780)	0.3491(13.575)
08.16.1991	0.2206(13.673)	1.4894 (9.806)	0.2674(12.409)	0.1960 (2.507)	0.2181 (5.045)	0.1643(53.160)	0.3435(11.308)
12.13.1991	0.2218 (3.946)	1.6199 (2.686)	0.2514 (2.218)	0.2823 (0.931)	0.3008 (3.334)	0.1566(42.448)	0.3285 (3.411)
04.17.1992	0.2232 (2.705)	1.6209 (7.110)	0.2404 (1.681)	0.2455 (3.503)	0.3324 (5.155)	0.1562(44.510)	0.3170 (7.576)
08.21.1992	0.1563 (8.694)	1.6785 (8.736)	0.0895 (4.325)	0.1947 (1.392)	0.3291 (4.331)	0.1551(43.789)	0.3260 (9.227)
12.18.1992	0.1656 (5.478)	1.6531 (7.399)	0.1154 (2.424)	0.2247 (2.887)	0.3915 (5.873)	0.1533(45.513)	0.3046 (9.128)
04.16.1993	0.1401 (6.571)	1.7504 (5.380)	0.0714 (2.291)	0.1948 (3.677)	0.3743 (6.852)	0.1506(45.718)	0.3166 (6.090)
08.20.1993	0.1584 (7.684)	1.7152 (8.359)	0.1310 (4.485)	0.2139 (3.501)	0.3773 (7.406)	0.1445(47.064)	0.2974 (9.729)
12.17.1993	0.0956 (7.779)	1.7505 (9.868)	-0.0076 (-2.007)	0.1155 (4.025)	0.3639 (7.215)	0.1379(47.210)	0.3046 (9.498)
04.29.1994	0.1082 (8.000)	1.4648 (12.114)	0.0060 (0.537)	0.0731 (1.127)	0.2899 (5.564)	0.1339(45.416)	0.3086(13.378)
08.19.1994	0.1041 (5.757)	1.2580 (10.733)	0.0192 (1.627)	0.1004 (1.065)	0.3984 (7.675)	0.1341(47.508)	0.2311(12.826)
12.16.1994	0.1007 (5.766)	1.2745 (10.451)	-0.0055 (-1.915)	0.0483 (2.014)	0.3428 (5.264)	0.1346(44.937)	0.2614(11.586)
04.21.1995	0.1283 (6.927)	1.1848 (8.567)	0.0732 (3.386)	0.1281 (3.212)	0.3141 (5.899)	0.1327(46.687)	0.2445(13.262)
08.18.1995	0.0920 (6.519)	1.1226(7.935)	0.0061 (1.714)	-0.0026 (-0.865)	0.1530 (2.923)	0.1187(45.545)	0.2571(13.451)
12.15.1995	0.1177 (5.167)	1.9176 (2.720)	0.0925 (2.720)	0.0385 (0.791)	0.1642 (2.644)	0.1050(43.140)	0.3052(2.892)
04.19.1996	0.1806 (20.410)	2.1790 (17.888)	0.2858 (18.941)	0.1365 (3.564)	0.4784 (8.427)	0.0959(47.017)	0.2088(12.830)
08.16.1996	0.1968 (24.147)	2.3307(20.193)	0.3598(22.700)	0.1746(4.862)	0.5024 (7.914)	0.0984(45.414)	0.2157(13.337)
12.13.1996	0.2169 (7.531)	2.0410(14.412)	0.3783(6.671)	0.2467(5.838)	0.4444 (8.351)	0.0997(47.694)	0.2105(10.462)

Table C.4 continued -- Parameter Estimates for Oil

Period Ending	α	κ	λ	μ	ρ	σ_S	σ_C
04.18.1997	0.1855 (7.855)	1.8003(12.729)	0.2835(6.890)	0.1926(5.559)	0.4965(7.848)	0.1024(46.437)	0.1930(10.406)
08.14.1997	0.1758 (17.883)	1.7904(16.236)	0.2546(14.929)	0.1758(3.934)	0.4969(8.053)	0.1045(46.457)	0.1947(13.158)
12.19.1997	0.1670 (5.422)	1.7902 (13.580)	0.2569(4.777)	0.1754(4.349)	0.5111(7.904)	0.1072(46.197)	0.1978(10.867)
04.17.1998	0.1429(5.803)	1.7834(12.261)	0.2189(4.945)	0.1270(1.930)	0.4737(4.876)	0.1114(41.951)	0.2106(8.709)
08.14.1998	0.0948(2.361)	1.8518(6.963)	0.1382(1.983)	0.0915(0.467)	0.4014(4.285)	0.1200(42.442)	0.2829(7.925)
12.18.1998	0.1347(5.320)	1.8549(12.658)	0.1759(3.616)	0.1352(3.551)	0.5184(8.437)	0.1238(46.753)	0.2278(10.415)
04.16.1999	0.1329(7.642)	1.7650(13.610)	0.1484(5.447)	0.1722(3.450)	0.4895(9.278)	0.1243(47.318)	0.2280(11.652)
08.20.1999	0.1234(4.587)	1.8161(11.264)	0.1377(2.775)	0.1734(3.431)	0.4526(7.484)	0.1242(45.298)	0.2453(10.383)
12.17.1999	0.1713(5.896)	1.4631(10.379)	0.1659(4.558)	0.2214(4.676)	0.4981(8.420)	0.1319(47.353)	0.2224(10.572)
04.14.2000	0.1434(7.455)	1.4491(11.997)	0.0813(2.771)	0.1759(3.140)	0.4932(8.675)	0.1361(47.680)	0.2294(11.009)
08.18.2000	0.1644(7.263)	1.4169(11.264)	0.1170(3.879)	0.2666(3.364)	0.5128(8.252)	0.1387(46.637)	0.2209(11.212)
12.15.2000	0.1690(9.232)	1.3373(11.793)	0.0791(3.851)	0.2422(3.594)	0.4951(8.041)	0.1464(47.684)	0.2291(10.509)
04.27.2001	0.0894(0.566)	1.0421(3.682)	-0.0889(-0.448)	0.1739(0.874)	0.4147(2.662)	0.1401(38.615)	0.2101(8.611)
08.24.2001	0.0884(2.107)	0.9696(5.919)	-0.1371(-2.717)	0.1181(2.540)	0.3881(6.566)	0.1394(46.207)	0.2239(10.707)

Parameter estimate divided by standard error is shown is parentheses.

Table C.5 -- Parameter Estimates for Copper

Period Ending	α	κ	λ	μ	ρ	σ_S	σ_C
12.27.1991	0.2027 (0.719)	1.3372 (3.774)	0.0934 (0.233)	0.1720 (1.620)	0.2501 (2.591)	0.0897 (28.207)	0.1818 (6.016)
04.24.1992	0.1699 (3.375)	1.1738 (4.231)	0.0619 (1.052)	0.1582 (2.814)	0.2456 (2.735)	0.0848 (30.726)	0.1644 (7.060)
08.21.1992	0.1392 (2.580)	1.1726 (4.712)	0.0332 (0.512)	0.1907 (2.681)	0.2623 (3.166)	0.0816 (33.403)	0.1472 (6.069)
12.25.1992	0.0946 (5.084)	1.0208 (5.700)	-0.0056 (-0.711)	0.1261 (2.823)	0.2449 (3.077)	0.0808 (35.034)	0.1363 (7.467)
04.23.1993	0.0979 (2.217)	0.9602 (3.558)	-0.0034 (-0.085)	0.0565 (1.398)	0.1475 (0.453)	0.0817 (23.244)	0.1434 (6.398)
08.27.1993	0.0534 (1.161)	1.6750 (10.199)	-0.0631 (-0.729)	0.0690 (1.246)	0.0331 (0.906)	0.0816 (38.469)	0.2818 (11.210)
12.24.1993	0.0900 (5.203)	0.8613 (6.522)	0.0050 (0.347)	0.0355 (2.182)	0.0887 (2.146)	0.0807 (42.418)	0.1342 (10.601)
04.22.1994	0.0686 (1.664)	0.9208 (3.592)	0.0040 (0.616)	0.0652 (0.850)	0.0705 (2.036)	0.0814 (43.309)	0.1339 (8.180)
08.26.1994	0.0870 (5.568)	0.8395 (5.994)	0.0020 (0.646)	0.1053 (3.601)	0.0630 (3.329)	0.0818 (45.829)	0.1281 (9.506)
12.23.1994	0.1611 (6.482)	0.5878 (4.336)	0.0424 (4.124)	0.1520 (4.653)	0.1268 (3.853)	0.0852 (47.710)	0.1137 (10.828)
04.21.1995	0.1524 (4.692)	0.4745 (5.626)	0.0242 (1.543)	0.1518 (2.182)	0.1352 (3.789)	0.0847 (48.609)	0.1070 (11.045)
08.25.1995	0.1885 (3.824)	0.3454 (3.695)	0.0188 (2.434)	0.1581 (4.714)	0.1552 (5.361)	0.0855 (51.608)	0.0964 (11.165)
12.22.1995	0.1916 (4.069)	0.4362 (2.269)	0.0271 (4.169)	0.1605 (5.622)	0.1596 (2.952)	0.0860 (52.462)	0.1061 (12.428)
04.26.1996	0.1574 (2.434)	0.4748 (3.564)	0.0245 (3.320)	0.1498 (5.324)	0.1740 (0.984)	0.0861 (42.615)	0.1071 (6.362)
08.23.1996	0.1268 (7.099)	0.6302 (4.281)	0.0247 (5.345)	0.1085 (2.673)	0.1734 (1.529)	0.0922 (41.968)	0.1241 (5.128)
12.27.1996	0.1573 (8.056)	0.6609 (6.977)	0.0464 (3.940)	0.1286 (2.955)	0.1593 (3.807)	0.0931 (55.295)	0.1270 (13.741)
04.25.1997	0.1561 (9.278)	0.6796 (7.439)	0.0501 (6.069)	0.1478 (5.540)	0.1622 (2.275)	0.0925 (56.020)	0.1255 (11.455)
08.22.1997	0.1545 (7.347)	0.6693 (5.571)	0.0438 (4.714)	0.1339 (6.424)	0.1707 (7.442)	0.0927 (59.166)	0.1234 (10.646)
12.26.1997	0.1558 (5.345)	0.5989 (4.109)	0.0392 (4.798)	0.0998 (5.876)	0.1794 (5.278)	0.0922 (60.253)	0.1202 (10.740)
04.24.1998	0.1010 (4.639)	0.6000 (7.439)	0.0050 (2.521)	0.0990 (5.040)	0.1665 (7.855)	0.0917 (61.993)	0.1192 (14.797)
08.21.1998	0.1095 (6.606)	0.6306 (9.252)	0.0103 (3.564)	0.0790 (6.172)	0.1723 (8.954)	0.0918 (63.072)	0.1222 (13.752)
12.25.1998	0.0800 (2.210)	0.5700 (5.635)	-0.0050 (-2.270)	0.0604 (5.260)	0.1486 (7.749)	0.0908 (65.300)	0.1160 (14.356)
04.23.1999	0.0800 (5.005)	0.5500 (10.616)	-0.0047 (-4.264)	0.0600 (3.564)	0.1395 (5.874)	0.0902 (65.791)	0.1147 (14.516)
08.27.1999	0.0876 (8.945)	0.5603 (7.845)	0.0010 (0.360)	0.0728 (4.825)	0.0991 (6.668)	0.0912 (66.066)	0.1169 (13.710)
12.24.1999	0.0868 (3.086)	0.5603 (4.364)	0.0006 (0.143)	0.0806 (2.413)	0.0920 (3.410)	0.0910 (59.115)	0.1167 (7.973)
04.21.2000	0.0836 (10.846)	0.5665 (10.846)	-0.0021 (-1.320)	0.0625 (5.564)	0.0647 (4.072)	0.0900 (66.839)	0.1175 (15.485)
08.25.2000	0.0886 (3.738)	0.5797 (8.357)	0.0016 (0.871)	0.0689 (2.982)	0.0738 (11.843)	0.0896 (69.887)	0.1154 (12.590)
12.22.2000	0.0900 (5.173)	0.5700 (7.902)	-0.0022 (-0.729)	0.0783 (6.506)	0.0789 (10.770)	0.0890 (71.366)	0.1146 (14.479)
04.20.2001	0.0900 (11.960)	0.5700 (10.870)	-0.0015 (-0.723)	0.0652 (5.492)	0.0685 (5.505)	0.0882 (72.536)	0.1130 (11.550)
08.24.2001	0.0869 (2.848)	0.6482 (4.273)	-0.0024 (-1.571)	0.0521 (2.010)	0.0644 (2.025)	0.0879 (57.427)	0.1165 (12.544)

Parameter estimate divided by standard error is shown is parentheses.

Table C.6 -- Parameter Estimates for Soybeans

Period Ending	α	κ	λ	μ	ρ	σ_S	σ_C
08.17.1992	0.0330 (1.650)	0.4519 (1.650)	0.0428 (2.388)	0.0769 (2.196)	0.3115 (4.905)	0.1404 (30.622)	0.3160 (12.870)
12.15.1992	0.0239 (0.866)	0.4445 (3.673)	0.0494 (3.273)	0.0804 (2.070)	0.3131 (5.095)	0.1376 (31.232)	0.3080 (12.382)
04.15.1993	0.0274 (3.106)	0.4664 (3.959)	0.0508 (1.627)	0.0825 (1.065)	0.3100 (2.472)	0.1346 (28.861)	0.3044 (11.385)
08.16.1993	0.0734 (3.054)	0.4582 (3.526)	0.0822 (3.253)	0.1064 (1.627)	0.2507 (5.255)	0.1340 (33.083)	0.2975 (12.094)
12.15.1993	0.0663 (2.782)	0.4854 (3.519)	0.0686 (5.439)	0.0995 (4.139)	0.2546 (6.358)	0.1333 (35.057)	0.2947 (12.549)
04.15.1994	0.0637 (2.032)	0.4309 (3.709)	0.0609 (2.817)	0.0904 (3.756)	0.2472 (2.232)	0.1311 (30.382)	0.2883 (8.286)
08.15.1994	0.0747 (2.459)	0.4919 (5.635)	0.0650 (2.817)	0.0765 (2.817)	0.2430 (5.440)	0.1317 (35.916)	0.2933 (11.523)
12.15.1994	0.0311 (3.086)	0.4875 (3.564)	0.0752 (3.917)	0.0874 (2.146)	0.2456 (2.418)	0.1299 (25.100)	0.2908 (12.670)
04.17.1995	0.0599 (1.188)	0.4624 (2.520)	0.0773 (3.564)	0.0858 (2.057)	0.2340 (7.977)	0.1276 (38.061)	0.2837 (14.671)
08.15.1995	0.0606 (4.255)	0.4619 (6.383)	0.0871 (4.355)	0.0821 (5.480)	0.2236 (1.752)	0.1264 (30.872)	0.2811 (13.952)
12.15.1995	0.0755 (2.938)	0.4542 (2.938)	0.0759 (3.683)	0.1000 (3.863)	0.2253 (4.247)	0.1251 (35.431)	0.2756 (14.714)
04.15.1996	0.0797 (6.027)	0.4468 (8.053)	0.0747 (2.413)	0.1041 (4.179)	0.2236 (8.063)	0.1240 (40.097)	0.2701 (14.920)
08.15.1996	0.0792 (3.440)	0.4470 (4.312)	0.0785 (4.273)	0.1100 (3.489)	0.2240 (6.130)	0.1246 (39.210)	0.2692 (15.528)
12.16.1996	0.0675 (2.919)	0.4989 (6.362)	0.0760 (3.086)	0.0936 (3.086)	0.2101 (7.052)	0.1240 (40.245)	0.2711 (12.704)
04.15.1997	0.0894 (5.399)	0.4398 (5.663)	0.0738 (2.520)	0.1166 (1.782)	0.2471 (6.395)	0.1297 (42.323)	0.2714 (13.548)
08.15.1997	0.0838 (3.507)	0.4675 (4.437)	0.0798 (5.635)	0.1111 (7.529)	0.3132 (8.375)	0.1302 (41.555)	0.3085 (16.429)
12.15.1997	0.0617 (5.540)	0.4493 (9.103)	0.1129 (3.086)	0.1321 (2.333)	0.3657 (8.706)	0.1315 (41.420)	0.3176 (17.188)
04.15.1998	0.0710 (1.316)	0.4465 (3.086)	0.0909 (4.416)	0.1130 (5.613)	0.3085 (8.396)	0.1283 (43.385)	0.3094 (14.278)
08.17.1998	0.0737 (3.539)	0.4662 (7.507)	0.0903 (3.883)	0.0965 (3.473)	0.3125 (9.620)	0.1292 (43.094)	0.3089 (16.306)
12.15.1998	0.0787 (1.639)	0.4721 (8.357)	0.1029 (4.735)	0.1044 (6.411)	0.3149 (11.850)	0.1287 (44.712)	0.3070 (17.364)
04.15.1999	0.0764 (5.195)	0.4623 (5.611)	0.1068 (1.260)	0.1026 (3.564)	0.3059 (9.338)	0.1283 (45.005)	0.3036 (19.905)
08.16.1999	0.0881 (1.782)	0.4435 (0.578)	0.1037 (6.209)	0.0823 (7.133)	0.2837 (8.144)	0.1300 (44.993)	0.2997 (18.019)
12.15.1999	0.0676 (4.934)	0.6025 (4.273)	0.0997 (7.968)	0.0893 (2.520)	0.2773 (11.196)	0.1293 (45.889)	0.3114 (15.973)
04.17.2000	0.0678 (3.266)	0.4552 (8.165)	0.1012 (7.173)	0.0966 (9.379)	0.2693 (8.867)	0.1285 (47.649)	0.2953 (18.804)
08.15.2000	0.0477 (4.714)	0.5834 (2.357)	0.0949 (2.010)	0.0792 (6.667)	0.2595 (14.585)	0.1281 (48.059)	0.3061 (19.604)
12.15.2000	0.0637 (3.984)	0.5841 (3.253)	0.0937 (5.164)	0.0827 (5.164)	0.2497 (11.021)	0.1276 (49.240)	0.3043 (20.473)
04.16.2001	0.0806 (5.774)	0.4884 (4.083)	0.0947 (6.947)	0.0787 (7.767)	0.2422 (8.693)	0.1266 (46.767)	0.2928 (13.023)
08.15.2001	0.0301 (8.817)	0.5445 (11.434)	0.1131 (8.230)	0.0920 (4.298)	0.2328 (6.807)	0.1269 (44.164)	0.2940 (13.980)
12.17.2001	0.0304 (7.015)	0.5398 (4.437)	0.0890 (4.508)	0.0752 (4.508)	0.2348 (7.216)	0.1262 (46.301)	0.2908 (18.444)
04.15.2002	0.0492 (3.984)	0.5538 (9.759)	0.0864 (2.882)	0.0722 (8.048)	0.2291 (3.919)	0.1257 (42.971)	0.2907 (6.577)

Parameter estimate divided by standard error is shown is parentheses.

Table C.7 -- Parameter Estimates for Gold

Period Ending	α	κ	λ	μ	ρ	σ_S	σ_C
12.16.1991	0.0030 (0.442)	0.0040 (1.268)	0.0105 (1.249)	0.0407 (1.168)	0.0043 (0.079)	0.0888 (22.269)	0.0365 (0.403)
04.13.1992	0.0004 (0.066)	0.0042 (1.871)	0.0128 (1.045)	0.0276 (0.934)	-0.0024 (-0.184)	0.0868 (23.498)	0.0351 (1.091)
08.10.1992	0.0082 (0.366)	0.0088 (0.498)	0.0151 (0.996)	0.0246 (0.532)	-0.0087 (-1.717)	0.0863 (24.219)	0.0279 (1.551)
12.14.1992	0.0080 (1.673)	0.0090 (1.086)	0.0180 (1.029)	0.0238 (1.782)	0.0076 (1.141)	0.0847 (24.942)	0.0269 (1.065)
04.12.1993	0.0184 (2.077)	0.0081 (1.432)	0.0104 (1.782)	0.0341 (1.890)	0.0092 (1.451)	0.0831 (25.157)	0.0227 (0.931)
08.16.1993	0.0020 (0.469)	0.0110 (2.089)	0.0102 (0.630)	0.0347 (1.409)	0.0085 (0.485)	0.0862 (23.069)	0.0268 (0.176)
12.13.1993	0.0080 (0.975)	0.0110 (1.667)	0.0090 (0.694)	0.0248 (1.543)	0.0071 (1.572)	0.0860 (26.897)	0.0207 (1.472)
04.11.1994	0.0080 (1.326)	0.0102 (1.179)	0.0107 (1.140)	0.0320 (1.260)	0.0081 (0.960)	0.0850 (26.288)	0.0231 (1.013)
08.15.1994	0.0091 (0.937)	0.0018 (0.313)	0.0179 (1.737)	0.0311 (1.942)	0.0087 (0.743)	0.0841 (28.414)	0.0001 (0.023)
12.12.1994	0.0073 (1.383)	0.0243 (1.782)	0.0097 (1.923)	0.0247 (1.782)	0.0101 (1.255)	0.0827 (28.390)	0.0191 (0.878)
04.10.1995	0.0073 (1.218)	0.0233 (2.488)	0.0064 (1.862)	0.0266 (2.618)	0.0068 (0.771)	0.0818 (28.822)	0.0200 (1.134)
08.14.1995	0.0071 (1.355)	0.0123 (2.089)	0.0064 (0.275)	0.0266 (0.891)	0.0064 (1.366)	0.0806 (29.797)	0.0175 (2.306)
12.11.1995	0.0090 (2.636)	0.0110 (1.974)	0.0063 (1.579)	0.0272 (1.680)	0.0246 (3.481)	0.0793 (30.698)	0.0158 (3.000)
04.15.1996	0.0051 (1.184)	0.0159 (2.318)	0.0024 (0.342)	0.0286 (3.883)	0.0081 (3.277)	0.0786 (30.921)	0.0188 (4.161)
08.12.1996	0.0049 (1.605)	0.0110 (4.692)	0.0045 (1.204)	0.0290 (2.656)	0.0078 (2.157)	0.0773 (31.644)	0.0186 (1.726)
12.16.1996	0.0070 (0.885)	0.0211 (1.188)	0.0110 (2.448)	0.0282 (3.462)	0.0120 (0.763)	0.0763 (32.389)	0.0180 (2.951)
04.14.1997	0.0039 (1.168)	0.0109 (2.121)	0.0114 (2.936)	0.0152 (3.171)	0.0044 (1.842)	0.0764 (32.706)	0.0150(4.440)
08.18.1997	0.0090 (3.777)	0.0106 (0.934)	0.0093 (1.903)	0.0165 (1.782)	0.0053 (2.535)	0.0759 (33.147)	0.0142 (4.601)
12.15.1997	0.0068 (1.278)	0.0095 (2.294)	0.0143 (1.409)	0.0112 (1.725)	0.0311 (3.932)	0.0768)33.503)	0.0205 (3.354)
04.13.1998	0.0038 (0.485)	0.0051 (0.403)	0.0110 (2.520)	0.0200 (1.878)	0.0215 (3.398)	0.0773 (33.524)	0.0237 (5.172)
08.17.1998	0.0052 (1.616)	0.0089 (1.041)	0.0062 (1.987)	0.0194 (3.434)	0.0040 (0.768)	0.0773 (34.338)	0.0250 (1.073)
12.14.1998	-0.0027 (-0.883)	0.0057 (0.972)	0.0051 (1.160)	0.0242 (2.254)	-0.0055 (-2.908)	0.0772 (34.913)	0.0298 (3.923)
04.12.1999	0.0002 (0.098)	0.0110 (4.914)	0.0002 (0.043)	0.0192 (2.955)	-0.0012 (-0.388)	0.0767 (35.857)	0.0247 (4.532)
08.16.1999	0.0002 (0.079)	0.0110 (3.922)	0.0811 (2.182)	0.0298 (3.333)	0.0091 (5.188)	0.0829 (35.592)	0.0237 (6.000)
12.13.1999	0.0033 (1.601)	0.0005 (0.993)	0.0087 (3.095)	0.0272 (2.710)	0.0023 (0.761)	0.0837 (36.182)	0.0216 (2.983)
04.10.2000	0.0033 (0.577)	0.0005 (2.872)	0.0120 (4.381)	0.0253 (5.306)	0.0069 (2.540)	0.0851 (37.118)	0.0197 (3.794)
08.14.2000	0.0084 (2.676)	0.0091 (6.750)	0.0128 (2.108)	0.0255 (2.722)	0.0040 (0.326)	0.0850 (24.474)	0.0181 (0.768)
12.11.2000	0.0103 (2.192)	0.0040 (2.685)	0.0810 (3.333)	0.0263 (2.265)	0.0062 (3.791)	0.0842 (38.053)	0.0175 (5.206)
04.16.2001	0.0090 (1.421)	0.0149 (4.578)	0.0166 (1.914)	0.0220 (1.471)	-0.0074 (-2.267)	0.0839 (37.668)	0.0175 (3.876)
08.13.2001	0.0089 (2.598)	0.0150 (1.782)	0.0152 (2.910)	0.0248 (5.819)	0.0017 (0.580)	0.0845 (29.428)	0.0169 (1.386)

Parameter estimate divided by standard error is shown is parentheses.

Table C.8 -- Parameter Estimates for Yen

Period Ending	α	κ	λ	μ	ρ	σ_S	σ_C
12.16.1991	0.0020 (0.127)	0.0060 (0.347)	-0.0398 (-0.914)	0.0806 (2.794)	0.0004 (0.088)	0.0801 (24.968)	0.0001 (0.016)
04.15.1992	0.0020 (0.233)	0.0051 (0.705)	-0.0394 (-0.891)	0.0708 (2.673)	0.0002 (0.007)	0.0793 (23.302)	0.0000 (0.001)
08.17.1992	0.0022 (0.232)	0.0066 (0.670)	-0.0375 (-1.613)	0.0761 (1.829)	0.0004 (0.026)	0.0782 (25.370)	0.0000 (0.001)
12.15.1992	0.0033 (0.490)	0.0040 (0.389)	0.0057 (0.903)	0.0758 (2.062)	0.0024 (0.547)	0.0774 (26.742)	0.0000 (-0.001)
04.15.1993	0.0032 (0.451)	0.0041 (0.468)	0.0061 (0.387)	0.0841 (1.782)	0.0019 (0.329)	0.0768 (26.947)	0.0000 (0.011)
08.16.1993	0.0030 (0.330)	0.0069 (0.438)	0.0091 (1.340)	0.0835 (2.500)	0.0042 (0.617)	0.0767 (27.403)	0.0000 (-0.004)
12.15.1993	0.0063 (0.978)	0.0070 (0.539)	0.0023 (0.353)	0.0868 (1.091)	0.0038 (0.504)	0.0761 (28.844)	0.0000 (-0.002)
04.15.1994	0.0086 (1.533)	0.0063 (0.651)	0.0060 (2.190)	0.0908 (3.859)	0.0030 (0.835)	0.0762 (29.431)	0.0000 (-0.002)
08.15.1994	0.0051 (0.782)	0.0068 (1.820)	-0.0047 (-1.733)	0.0885 (1.980)	0.0030 (0.289)	0.0760 (28.663)	0.0000 (-0.007)
12.15.1994	0.0035 (0.810)	0.0068 (1.376)	-0.0007 (-0.267)	0.0835 (1.543)	0.0043 (0.847)	0.0753 (29.861)	0.0000 (0.004)
04.17.1995	-0.0004 (-0.063)	0.0080 (0.713)	-0.0105 (-1.913)	0.0969 (4.102)	0.0042 (0.517)	0.0764 (31.264)	0.0000 (0.000)
08.15.1995	0.0019 (0.446)	0.0078 (1.156)	0.0112 (3.534)	0.0857 (2.634)	0.0045 (1.475)	0.0775 (31.969)	0.0000 (-0.015)
12.15.1995	0.0031 (1.202)	0.0060 (0.440)	0.0137 (1.937)	0.0723 (2.271)	0.0042 (0.836)	0.0780 (28.244)	0.0000 (0.001)
04.15.1996	0.0010 (0.161)	0.0062 (2.051)	0.0158 (3.962)	0.0631 (3.759)	0.0046 (1.253)	0.0772 (31.859)	0.0000 (-0.017)
08.15.1996	0.0023 (0.368)	0.0067 (2.374)	0.0145 (1.260)	0.0620 (0.398)	0.0042 (1.048)	0.0766 (33.214)	0.0000 (-0.014)
12.16.1996	0.0028 (0.736)	0.0080 (1.938)	0.0178 (2.955)	0.0575 (2.643)	0.0027 (0.747)	0.0759 (33.628)	0.0000 (-0.012)
04.15.1997	0.0007 (0.067)	0.0064 (0.878)	0.0198 (2.140)	0.0444 (2.916)	0.0089 (0.951)	0.0757 (31.928)	-0.0001 (-0.014)
08.15.1997	0.0030 (0.379)	0.0060 (0.239)	0.0120 (3.060)	0.0506 (2.586)	0.0043 (1.401)	0.0764 (33.514)	0.0000 (0.016)
12.15.1997	0.0001 (0.033)	0.0100 (1.217)	0.0183 (1.667)	0.0388 (4.714)	0.0037 (1.111)	0.0763 (34.139)	-0.0001 (-0.056)
04.15.1998	0.0005 (0.135)	0.0087 (1.096)	0.0120 (3.065)	0.0371 (3.753)	0.0042 (1.312)	0.0765 (34.877)	-0.0001 (-0.039)
08.17.1998	0.0023 (0.701)	0.0076 (3.035)	0.0130 (4.016)	0.0388 (3.732)	0.0043 (0.901)	0.0772 (36.357)	0.0000 (0.005)
12.15.1998	0.0030 (1.058)	0.0060 (2.925)	0.0189 (1.455)	0.0461 (2.520)	0.0040 (1.731)	0.0832 (36.251)	0.0000 (-0.030)
04.15.1999	0.0001 (0.029)	0.0065 (2.736)	0.0194 (2.768)	0.0429 (4.969)	0.0040 (0.500)	0.0838 (37.041)	0.0000 (0.007)
08.16.1999	0.0025 (0.776)	0.0061 (3.803)	0.0228 (4.091)	0.0452 (3.917)	0.0049 (1.172)	0.0837 (37.603)	0.0000 (-0.021)
12.15.1999	0.0030 (0.168)	0.0076 (0.959)	0.0363 (4.134)	0.0534 (5.139)	0.0042 (2.193)	0.0839 (37.734)	0.0000 (0.012)
04.17.2000	0.0003 (0.157)	0.0069 (3.534)	0.0239 (3.322)	0.0473 (4.479)	0.0042 (0.875)	0.0838 (37.327)	0.0000 (0.014)
08.15.2000	0.0009 (0.225)	0.0068 (0.698)	0.0493 (4.448)	0.0456 (5.345)	0.0045 (2.624)	0.0834 (39.011)	-0.0001 (-0.065)
12.15.2000	0.0011 (0.575)	0.0077 (2.014)	0.0461 (1.782)	0.0412 (3.984)	0.0041 (0.590)	0.0828 (39.361)	0.0000 (0.003)
04.16.2001	0.0010 (0.391)	0.0070 (4.099)	0.0313 (5.345)	0.0342 (2.965)	0.0043 (1.687)	0.0828 (39.663)	0.0001 (0.039)
08.15.2001	0.0010 (0.640)	0.0070 (2.405)	0.0178 (3.940)	0.0334 (2.955)	0.0043 (1.192)	0.0824 (38.725)	0.0001 (0.030)

Parameter estimate divided by standard error is shown is parentheses.

Table C.9 -- Oil Hedges

(StDev of SCY)/(StDev of each strategy) =							*0.1607*	*0.2352*	*0.8082*	*1.0000*	*0.9700*	*0.9918*	
			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/86	16.58	-		3.9633	3.9303	3.9647							
01/15/87	18.81	19.14	16.58	2.9300	2.9344	2.9511	-19.41	-16.81	-9.03	-9.12	-9.21	-9.12	-16.81
02/16/87	17.79	17.85	16.68	1.9927	1.9871	1.9927	-18.01	-18.98	-20.92	-20.85	-20.85	-20.87	-16.83
03/16/87	18.39	18.64	16.66	1.0000	1.0000	1.0000	-18.73	-17.87	-17.02	-17.03	-17.03	-17.03	-16.74
04/15/87		18.47	16.64				-18.47	-18.39	-18.39	-18.39	-18.39	-18.39	-16.64
				Total CF			-74.62	-72.06	-65.35	-65.39	-65.48	-65.40	-67.02
Risk-free rate	5.67%			**CFi - CF**			-7.60	-5.03	1.67	1.64	1.54	1.62	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/87	18.13	-		3.8321	3.8500	3.8547							
05/15/87	19.32	19.80	18.13	2.9393	2.9319	2.9343	-20.11	-18.42	-13.33	-13.61	-13.58	-13.57	-18.42
06/15/87	19.77	20.06	17.94	1.9754	1.9747	1.9754	-20.27	-19.52	-18.03	-18.07	-18.08	-18.08	-18.13
07/15/87	21.35	22.15	17.84	1.0000	1.0000	1.0000	-22.27	-19.88	-17.49	-17.55	-17.55	-17.55	-17.94
08/17/87		19.83	17.77				-19.83	-21.35	-21.35	-21.35	-21.35	-21.35	-17.77
				Total CF			-82.49	-79.17	-70.19	-70.58	-70.56	-70.55	-72.26
Risk-free rate	6.11%			**CFi - CF**			-10.23	-6.92	2.06	1.67	1.70	1.71	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/87	19.68	-		3.9092	3.9433	3.9152							
09/15/87	19.39	19.70	19.68	2.9459	2.9647	2.9508	-20.00	-19.98	-19.92	-19.92	-19.92	-19.92	-19.98
10/15/87	19.71	19.75	19.64	1.9937	1.9984	1.9937	-19.95	-19.59	-18.86	-18.88	-18.87	-18.88	-19.84
11/16/87	18.55	18.65	19.61	1.0000	1.0000	1.0000	-18.74	-19.81	-20.87	-20.86	-20.87	-20.86	-19.70
12/15/87		18.51	19.60				-18.51	-18.55	-18.55	-18.55	-18.55	-18.55	-19.60
				Total CF			-77.20	-77.92	-78.20	-78.21	-78.21	-78.21	-79.12
Risk-free rate	6.06%			**CFi - CF**			1.92	1.20	0.93	0.91	0.91	0.91	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/87	16.41	-		3.9045	3.9367	3.9156							
01/15/88	16.77	16.95	16.41	2.9701	2.9759	2.9654	-17.19	-16.64	-15.00	-15.05	-15.03	-15.04	-16.64
02/15/88	16.73	16.75	16.43	1.9931	1.9966	1.9931	-16.91	-16.93	-16.97	-16.97	-16.97	-16.97	-16.58
03/15/88	15.57	15.68	16.40	1.0000	1.0000	1.0000	-15.75	-16.81	-17.86	-17.86	-17.86	-17.86	-16.48
04/15/88		18.37	16.25				-18.37	-15.57	-15.57	-15.57	-15.57	-15.57	-16.25
				Total CF			-68.22	-65.95	-65.40	-65.44	-65.43	-65.44	-65.95
Risk-free rate	5.61%			**CFi - CF**			-2.27	0.01	0.55	0.51	0.52	0.51	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/88	18.29	-		3.9572	3.9726	3.9592							
05/16/88	17.87	17.66	18.29	3.0818	3.0485	3.0417	-17.93	-18.57	-20.49	-20.46	-20.47	-20.46	-18.57
06/15/88	16.62	16.53	18.18	2.0026	2.0048	2.0026	-16.70	-18.05	-20.76	-20.87	-20.83	-20.82	-18.37
07/15/88	14.97	14.86	18.08	1.0000	1.0000	1.0000	-14.94	-16.71	-18.48	-18.48	-18.48	-18.48	-18.17
08/15/88		15.61	18.00				-15.61	-14.97	-14.97	-14.97	-14.97	-14.97	-18.00
				Total CF			-65.18	-68.30	-74.70	-74.78	-74.75	-74.73	-73.11
Risk-free rate	6.11%			**CFi - CF**			7.93	4.81	-1.58	-1.67	-1.64	-1.62	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/88	15.81	-		3.9941	3.9625	3.9858							
09/15/88	14.69	14.90	15.81	2.9226	2.9395	2.9507	-15.17	-16.10	-18.88	-18.87	-18.84	-18.86	-16.10
10/17/88	14.67	15.21	15.95	1.9728	1.9691	1.9728	-15.39	-14.86	-13.81	-13.85	-13.84	-13.84	-16.14
11/15/88	13.79	13.90	16.12	1.0000	1.0000	1.0000	-13.98	-14.76	-15.53	-15.51	-15.51	-15.51	-16.22
12/15/88		16.35	16.22				-16.35	-13.79	-13.79	-13.79	-13.79	-13.79	-16.22
				Total CF			-60.89	-59.51	-62.01	-62.02	-61.98	-62.00	-64.67
Risk-free rate	7.21%			**CFi - CF**			3.78	5.16	2.66	2.65	2.69	2.67	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/88	15.74	-		3.8106	3.8212	3.8380							
01/16/89	17.95	18.88	15.74	2.8065	2.8415	2.8497	-19.27	-16.06	-6.45	-7.06	-7.02	-6.97	-16.06
02/15/89	17.47	18.25	15.43	1.9439	1.9411	1.9439	-18.50	-18.20	-17.59	-17.65	-17.64	-17.63	-15.64
03/15/89	19.19	19.77	15.26	1.0000	1.0000	1.0000	-19.92	-17.60	-15.28	-15.41	-15.42	-15.41	-15.37
04/17/89		21.22	15.17				-21.22	-19.19	-19.19	-19.19	-19.19	-19.19	-15.17
				Total CF			-78.91	-71.05	-58.51	-59.31	-59.27	-59.21	-62.25
Risk-free rate	8.17%			**CFi - CF**			-16.66	-8.80	3.74	2.94	2.98	3.04	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/89	20.29	-		3.5730	3.6622	3.6418							
05/15/89	18.99	20.51	20.29	2.8195	2.8277	2.8172	-20.98	-20.75	-20.08	-20.17	-20.15	-20.16	-20.75
06/15/89	18.96	20.57	19.53	1.9539	1.9576	1.9539	-20.88	-19.28	-16.07	-16.36	-16.34	-16.36	-19.82
07/17/89	19.92	20.45	18.95	1.0000	1.0000	1.0000	-20.60	-19.10	-17.59	-17.66	-17.66	-17.66	-19.08
08/15/89		18.68	18.52				-18.68	-19.92	-19.92	-19.92	-19.92	-19.92	-18.52
				Total CF			-81.13	-79.04	-73.66	-74.11	-74.08	-74.10	-78.18
Risk-free rate	8.93%			**CFi - CF**			-2.95	-0.86	4.52	4.07	4.11	4.08	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/89	18.29	-		3.8268	3.8654	3.8381							
09/15/89	19.60	19.96	18.29	2.9214	2.9336	2.9198	-20.37	-18.66	-13.55	-13.85	-13.78	-13.83	-18.66
10/16/89	20.31	20.59	18.07	1.9744	1.9790	1.9744	-20.87	-19.86	-17.86	-17.94	-17.92	-17.94	-18.31
11/15/89	19.52	19.52	17.96	1.0000	1.0000	1.0000	-19.65	-20.45	-21.24	-21.22	-21.22	-21.22	-18.08
12/15/89		21.10	17.84				-21.10	-19.52	-19.52	-19.52	-19.52	-19.52	-17.84
				Total CF			-81.99	-78.49	-72.17	-72.52	-72.45	-72.51	-72.90
Risk-free rate	8.13%			**CFi - CF**			-9.09	-5.60	0.73	0.37	0.45	0.39	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/89	20.67	-		3.8191	3.8752	3.8316							
01/15/90	21.49	22.36	20.67	2.7921	2.8607	2.8398	-22.80	-21.07	-15.91	-16.22	-16.12	-16.20	-21.07
02/15/90	22.43	22.84	20.37	1.9784	1.9858	1.9784	-23.13	-21.77	-19.03	-19.32	-19.22	-19.25	-20.63
03/15/90	20.68	20.38	20.02	1.0000	1.0000	1.0000	-20.52	-22.58	-24.65	-24.60	-24.62	-24.60	-20.16
04/16/90		17.85	19.82				-17.85	-20.68	-20.68	-20.68	-20.68	-20.68	-19.82
				Total CF			-84.30	-86.10	-80.26	-80.82	-80.64	-80.73	-81.68
Risk-free rate	7.78%			**CFi - CF**			-2.62	-4.42	1.42	0.87	1.04	0.95	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/16/90	18.67	-		4.1031	4.0898	4.0526							
05/15/90	19.92	19.59	18.67	2.9922	3.0252	3.0071	-19.98	-19.05	-16.23	-16.13	-16.15	-16.18	-19.05
06/15/90	17.59	16.62	19.26	2.0163	2.0224	2.0163	-16.84	-20.18	-26.87	-26.85	-26.96	-26.90	-19.52
07/16/90	19.85	18.67	19.57	1.0000	1.0000	1.0000	-18.79	-17.70	-16.62	-16.60	-16.59	-16.60	-19.70
08/15/90		26.46	19.77				-26.46	-19.85	-19.85	-19.85	-19.85	-19.85	-19.77
				Total CF			-82.08	-76.78	-79.57	-79.43	-79.54	-79.53	-78.03
Risk-free rate	7.89%			**CFi - CF**			-4.05	1.24	-1.54	-1.40	-1.52	-1.50	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/90	26.36	-		3.7643	3.8282	3.7706							
09/17/90	32.16	33.63	26.36	2.8592	2.8965	2.8675	-34.27	-26.86	-4.64	-6.38	-5.91	-6.34	-26.86
10/15/90	36.54	37.95	25.81	1.9464	1.9562	1.9464	-38.45	-32.58	-20.85	-21.68	-21.46	-21.63	-26.15
11/15/90	30.64	31.12	25.42	1.0000	1.0000	1.0000	-31.33	-36.78	-42.24	-41.95	-42.00	-41.95	-25.59
12/17/90		27.05	25.03				-27.05	-30.64	-30.64	-30.64	-30.64	-30.64	-25.03
				Total CF			-131.10	-126.87	-98.37	-100.65	-100.01	-100.55	-103.63
Risk-free rate	7.58%			**CFi - CF**			-27.47	-23.24	5.26	2.98	3.62	3.08	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/17/90	26.21	-		3.6880	3.7706	3.7167							
01/15/91	29.05	30.07	26.21	2.9293	2.9281	2.8997	-30.60	-26.67	-14.89	-16.11	-15.79	-16.00	-26.67
02/15/91	18.94	20.88	25.25	1.9518	1.9613	1.9518	-21.12	-29.38	-45.91	-45.32	-45.31	-45.08	-25.54
03/15/91	19.42	20.01	24.33	1.0000	1.0000	1.0000	-20.13	-19.05	-17.98	-18.03	-18.02	-18.03	-24.48
04/15/91		21.91	23.61				-21.91	-19.42	-19.42	-19.42	-19.42	-19.42	-23.61
				Total CF			-93.75	-94.52	-98.19	-98.88	-98.54	-98.53	-100.29
Risk-free rate	7.02%			**CFi - CF**			6.54	5.77	2.10	1.41	1.75	1.76	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/91	21.43	-		3.8214	3.8857	3.8303							
05/15/91	21.00	20.92	21.43	2.9709	2.9767	2.9483	-21.22	-21.74	-23.29	-23.20	-23.23	-23.20	-21.74
06/17/91	19.98	19.94	20.99	1.9871	1.9967	1.9871	-20.12	-21.19	-23.33	-23.30	-23.31	-23.28	-21.18
07/15/91	21.31	21.47	20.70	1.0000	1.0000	1.0000	-21.57	-20.08	-18.58	-18.60	-18.58	-18.60	-20.80
08/15/91		21.44	20.49				-21.44	-21.31	-21.31	-21.31	-21.31	-21.31	-20.49
				Total CF			-84.36	-84.32	-86.51	-86.41	-86.44	-86.39	-84.21
Risk-free rate	5.69%			**CFi - CF**			-0.15	-0.11	-2.30	-2.20	-2.22	-2.18	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/91	21.43	-		3.8404	3.8929	3.8368							
09/16/91	21.72	21.82	21.43	2.8962	2.9323	2.9041	-22.12	-21.72	-20.54	-20.60	-20.58	-20.60	-21.72
10/15/91	23.56	23.86	21.41	1.9630	1.9725	1.9630	-24.08	-21.92	-17.60	-17.83	-17.75	-17.81	-21.61
11/15/91	22.67	22.78	21.37	1.0000	1.0000	1.0000	-22.88	-23.67	-24.45	-24.42	-24.43	-24.42	-21.47
12/16/91		19.76	21.27				-19.76	-22.67	-22.67	-22.67	-22.67	-22.67	-21.27
				Total CF			-88.84	-89.98	-85.26	-85.52	-85.43	-85.50	-86.07
Risk-free rate	5.41%			**CFi - CF**			-2.77	-3.91	0.81	0.55	0.64	0.57	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/91	19.74	-		3.7653	3.8617	3.7615							
01/15/92	19.00	18.85	19.74	2.9028	2.9443	2.8926	-19.05	-19.95	-22.65	-22.44	-22.53	-22.44	-19.95
02/17/92	19.63	19.46	19.68	1.9650	1.9827	1.9650	-19.59	-19.13	-18.20	-18.25	-18.23	-18.25	-19.81
03/16/92	19.28	19.15	19.61	1.0000	1.0000	1.0000	-19.22	-19.70	-20.18	-20.16	-20.17	-20.16	-19.68
04/15/92		19.87	19.57				-19.87	-19.28	-19.28	-19.28	-19.28	-19.28	-19.57
				Total CF			-77.73	-78.06	-80.32	-80.13	-80.21	-80.13	-79.02
Risk-free rate	4.29%			**CFi - CF**			1.28	0.95	-1.30	-1.12	-1.19	-1.12	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/92	19.98	-		3.7828	3.8566	3.7706							
05/15/92	20.86	20.69	19.98	2.8835	2.9269	2.8828	-20.89	-20.17	-18.02	-18.18	-18.12	-18.18	-20.17
06/15/92	22.40	22.36	20.03	1.9573	1.9724	1.9573	-22.50	-20.99	-17.97	-18.15	-18.08	-18.15	-20.16
07/15/92	21.60	21.71	20.03	1.0000	1.0000	1.0000	-21.78	-22.47	-23.17	-23.14	-23.15	-23.14	-20.10
08/17/92		21.45	20.00				-21.45	-21.60	-21.60	-21.60	-21.60	-21.60	-20.00
				Total CF			-86.62	-85.24	-80.76	-81.06	-80.95	-81.07	-80.42
Risk-free rate	3.67%			**CFi - CF**			-6.20	-4.81	-0.34	-0.64	-0.53	-0.65	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/92	21.35	-		3.7107	3.7829	3.7166							
09/15/92	22.02	22.18	21.35	2.8614	2.8921	2.8578	-22.36	-21.52	-19.01	-19.25	-19.19	-19.25	-21.52
10/15/92	22.25	22.33	21.28	1.9530	1.9649	1.9530	-22.45	-22.14	-21.51	-21.56	-21.55	-21.56	-21.39
11/16/92	20.38	20.37	21.20	1.0000	1.0000	1.0000	-20.42	-22.31	-24.19	-24.10	-24.12	-24.10	-21.25
12/15/92		18.95	21.11				-18.95	-20.38	-20.38	-20.38	-20.38	-20.38	-21.11
				Total CF			-84.17	-86.34	-85.09	-85.29	-85.24	-85.29	-85.27
Risk-free rate	3.16%			**CFi - CF**			1.10	-1.07	0.18	-0.01	0.03	-0.01	0.00

Oil

		Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/92	19.10	-		3.7204	3.7927	3.7147							
01/15/93	19.03	18.87	19.10	2.8644	2.9001	2.8595	-19.03	-19.26	-19.95	-19.89	-19.90	-19.89	-19.26
02/15/93	19.98	19.98	19.19	1.9510	1.9650	1.9510	-20.09	-19.13	-17.22	-17.35	-17.32	-17.36	-19.29
03/15/93	20.30	20.16	19.26	1.0000	1.0000	1.0000	-20.22	-20.04	-19.86	-19.86	-19.86	-19.86	-19.31
04/15/93		20.22	19.31				-20.22	-20.30	-20.30	-20.30	-20.30	-20.30	-19.31
				Total CF			-79.55	-78.73	-77.33	-77.40	-77.38	-77.41	-77.17
Risk-free rate	3.32%			**CFi - CF**			-2.37	-1.55	-0.16	-0.23	-0.21	-0.23	0.00

		Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/93	20.42	-		3.7392	3.7994	3.7315							
05/17/93	19.83	19.51	20.42	2.8643	2.8979	2.8627	-19.65	-20.57	-23.32	-23.08	-23.14	-23.07	-20.57
06/15/93	18.90	18.58	20.56	1.9547	1.9668	1.9547	-18.67	-19.93	-22.44	-22.27	-22.31	-22.27	-20.66
07/15/93	17.92	17.67	20.63	1.0000	1.0000	1.0000	-17.72	-18.95	-20.18	-20.13	-20.14	-20.13	-20.68
08/16/93		17.86	20.68				-17.86	-17.92	-17.92	-17.92	-17.92	-17.92	-20.68
				Total CF			-73.90	-77.37	-83.86	-83.40	-83.51	-83.39	-82.60
Risk-free rate	2.94%			**CFi - CF**			8.69	5.23	-1.27	-0.80	-0.91	-0.79	0.00

		Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/93	18.30	-		3.7621	3.8248	3.7491							
09/15/93	17.24	16.86	18.30	2.8854	2.9187	2.8794	-16.99	-18.44	-22.79	-22.45	-22.54	-22.43	-18.44
10/15/93	18.38	18.27	18.58	1.9533	1.9667	1.9533	-18.36	-17.33	-15.26	-15.38	-15.34	-15.38	-18.68
11/15/93	17.06	16.76	18.76	1.0000	1.0000	1.0000	-16.80	-18.43	-20.05	-19.97	-20.00	-19.97	-18.81
12/15/93		14.41	18.90				-14.41	-17.06	-17.06	-17.06	-17.06	-17.06	-18.90
				Total CF			-66.57	-71.26	-75.16	-74.86	-74.94	-74.85	-74.82
Risk-free rate	3.08%			**CFi - CF**			8.26	3.57	-0.34	-0.04	-0.11	-0.02	0.00

Oil

			Futures				Net Cash Flows						
Date	Enter	Unwind	Curve	SCY	RSK	APX	Spot	Rollover	Stacked	SCY	RSK	APX	Standard
12/15/93	14.80	-		3.8271	3.8381	3.8034							
01/17/94	15.19	15.10	14.80	2.8656	2.8958	2.8782	-15.21	-14.91	-14.00	-14.06	-14.05	-14.06	-14.91
02/15/94	14.28	14.06	15.15	1.9583	1.9644	1.9583	-14.13	-15.27	-17.54	-17.39	-17.42	-17.40	-15.23
03/15/94	14.83	14.83	15.43	1.0000	1.0000	1.0000	-14.87	-14.32	-13.77	-13.79	-13.79	-13.79	-15.47
04/15/94		16.58	15.68				-16.58	-14.83	-14.83	-14.83	-14.83	-14.83	-15.68
				Total CF			-60.79	-59.33	-60.14	-60.06	-60.09	-60.08	-61.29
Risk-free rate	3.11%			CFi - CF			0.49	1.96	1.15	1.23	1.20	1.21	0.00

			Futures				Net Cash Flows						
Date	Enter	Unwind	Curve	SCY	RSK	APX	Spot	Rollover	Stacked	SCY	RSK	APX	Standard
04/15/94	16.44	-		3.7681	3.7817	3.7702							
05/16/94	17.52	18.06	16.44	2.8525	2.8693	2.8635	-18.24	-16.60	-11.69	-12.07	-12.05	-12.07	-16.60
06/15/94	19.05	19.86	16.38	1.9485	1.9505	1.9485	-19.99	-17.64	-12.92	-13.27	-13.23	-13.25	-16.49
07/15/94	19.38	19.89	16.36	1.0000	1.0000	1.0000	-19.96	-19.11	-18.27	-18.31	-18.31	-18.31	-16.41
08/15/94		18.20	16.38				-18.20	-19.38	-19.38	-19.38	-19.38	-19.38	-16.38
				Total CF			-76.38	-72.73	-62.27	-63.04	-62.98	-63.01	-65.88
Risk-free rate	3.92%			CFi - CF			-10.50	-6.85	3.61	2.84	2.91	2.87	0.00

			Futures				Net Cash Flows						
Date	Enter	Unwind	Curve	SCY	RSK	APX	Spot	Rollover	Stacked	SCY	RSK	APX	Standard
08/15/94	18.19	-		3.7129	3.7365	3.7171							
09/15/94	16.85	16.70	18.19	2.8795	2.8800	2.8698	-16.90	-18.40	-22.93	-22.49	-22.53	-22.50	-18.40
10/17/94	17.22	17.06	18.14	1.9494	1.9529	1.9494	-17.19	-16.98	-16.55	-16.58	-16.58	-16.58	-18.28
11/15/94	17.61	17.58	18.09	1.0000	1.0000	1.0000	-17.65	-17.29	-16.92	-16.94	-16.94	-16.94	-18.16
12/15/94		16.73	18.03				-16.73	-17.61	-17.61	-17.61	-17.61	-17.61	-18.03
				Total CF			-68.46	-70.28	-74.02	-73.63	-73.66	-73.64	-72.87
Risk-free rate	4.68%			CFi - CF			4.41	2.59	-1.14	-0.76	-0.79	-0.76	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/94	16.83	-		3.7664	3.7557	3.7641							
01/16/95	17.78	17.88	16.83	2.8380	2.8492	2.8536	-18.14	-17.08	-13.88	-14.13	-14.14	-14.13	-17.08
02/15/95	18.34	18.42	16.96	1.9485	1.9470	1.9485	-18.60	-17.96	-16.66	-16.77	-16.76	-16.76	-17.13
03/15/95	18.10	18.11	17.08	1.0000	1.0000	1.0000	-18.21	-18.44	-18.67	-18.66	-18.66	-18.66	-17.17
04/17/95		19.73	17.17				-19.73	-18.10	-18.10	-18.10	-18.10	-18.10	-17.17
				Total CF			-74.68	-71.57	-67.31	-67.66	-67.66	-67.65	-68.55
Risk-free rate	5.88%			**CFi - CF**			-6.14	-3.02	1.23	0.89	0.89	0.90	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/95	19.67	-		3.7075	3.7507	3.7240							
05/15/95	19.73	19.90	19.67	2.8669	2.8770	2.8632	-20.19	-19.95	-19.25	-19.32	-19.31	-19.32	-19.95
06/15/95	18.76	18.94	19.50	1.9548	1.9595	1.9548	-19.12	-19.92	-21.51	-21.41	-21.42	-21.40	-19.69
07/17/95	16.97	17.20	19.24	1.0000	1.0000	1.0000	-17.28	-18.84	-20.41	-20.34	-20.35	-20.34	-19.33
08/15/95		17.47	19.02				-17.47	-16.97	-16.97	-16.97	-16.97	-16.97	-19.02
				Total CF			-74.06	-75.69	-78.15	-78.04	-78.05	-78.03	-77.99
Risk-free rate	5.68%			**CFi - CF**			3.93	2.30	-0.16	-0.05	-0.06	-0.05	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/95	17.23	-		3.8713	3.8512	3.8826							
09/15/95	18.42	18.92	17.23	2.9204	2.9124	2.9281	-19.18	-17.47	-12.33	-12.55	-12.58	-12.53	-17.47
10/16/95	17.37	17.59	17.03	1.9806	1.9753	1.9806	-17.75	-18.59	-20.26	-20.20	-20.19	-20.20	-17.19
11/15/95	17.63	17.93	17.04	1.0000	1.0000	1.0000	-18.01	-17.45	-16.89	-16.90	-16.90	-16.90	-17.12
12/15/95		19.51	17.03				-19.51	-17.63	-17.63	-17.63	-17.63	-17.63	-17.03
				Total CF			-74.45	-71.14	-67.11	-67.27	-67.30	-67.26	-68.80
Risk-free rate	5.53%			**CFi - CF**			-5.65	-2.33	1.69	1.53	1.50	1.54	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/95	18.97	-		3.8465	3.8459	3.8578							
01/15/96	18.05	18.38	18.97	2.9242	2.9191	2.9250	-18.63	-19.23	-21.02	-20.93	-20.93	-20.94	-19.23
02/15/96	18.37	19.04	18.58	1.9733	1.9713	1.9733	-19.21	-18.21	-16.21	-16.29	-16.29	-16.29	-18.75
03/15/96	20.08	21.99	18.35	1.0000	1.0000	1.0000	-22.09	-18.45	-14.82	-14.92	-14.92	-14.92	-18.43
04/15/96		25.06	18.16				-25.06	-20.08	-20.08	-20.08	-20.08	-20.08	-18.16
				Total CF			-84.99	-75.97	-72.13	-72.21	-72.23	-72.22	-74.57
Risk-free rate	5.41%			**CFi - CF**			-10.42	-1.41	2.43	2.35	2.34	2.35	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/96	22.48	-		3.4741	3.5257	3.4975							
05/15/96	20.41	21.48	22.48	2.7791	2.7771	2.7618	-21.75	-22.76	-25.80	-25.27	-25.32	-25.29	-22.76
06/17/96	20.70	22.14	20.77	1.9192	1.9247	1.9192	-22.32	-20.57	-17.09	-17.47	-17.48	-17.50	-20.94
07/15/96	21.71	22.48	19.71	1.0000	1.0000	1.0000	-22.58	-20.79	-19.00	-19.14	-19.13	-19.14	-19.79
08/15/96		21.90	19.09				-21.90	-21.71	-21.71	-21.71	-21.71	-21.71	-19.09
				Total CF			-88.54	-85.84	-83.60	-83.60	-83.64	-83.65	-82.58
Risk-free rate	4.97%			**CFi - CF**			-5.96	-3.25	-1.01	-1.01	-1.06	-1.06	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/96	21.40	-		3.7340	3.8061	3.7549							
09/16/96	22.83	23.19	21.40	2.8784	2.9024	2.8763	-23.49	-21.68	-16.24	-16.72	-16.59	-16.68	-21.68
10/15/96	25.02	25.42	20.92	1.9553	1.9642	1.9553	-25.64	-23.03	-17.80	-18.12	-18.06	-18.13	-21.10
11/15/96	24.01	24.17	20.45	1.0000	1.0000	1.0000	-24.28	-25.13	-25.98	-25.95	-25.95	-25.95	-20.54
12/16/96		25.74	20.02				-25.74	-24.01	-24.01	-24.01	-24.01	-24.01	-20.02
				Total CF			-99.15	-93.85	-84.03	-84.80	-84.61	-84.76	-83.34
Risk-free rate	5.14%			**CFi - CF**			-15.81	-10.51	-0.70	-1.46	-1.27	-1.43	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/96	25.09	-		3.5748	3.6586	3.5845							
01/15/97	25.34	25.95	25.09	2.7702	2.8130	2.7740	-26.27	-25.40	-22.79	-23.16	-23.08	-23.15	-25.40
02/17/97	22.03	22.41	24.50	1.9282	1.9421	1.9282	-22.58	-25.54	-31.44	-30.76	-30.89	-30.77	-24.69
03/17/97	20.85	20.92	23.90	1.0000	1.0000	1.0000	-21.00	-22.12	-23.23	-23.15	-23.17	-23.15	-23.99
04/15/97		19.83	23.31				-19.83	-20.85	-20.85	-20.85	-20.85	-20.85	-23.31
				Total CF			-89.68	-93.90	-98.31	-97.92	-97.99	-97.92	-97.39
Risk-free rate	4.93%			**CFi - CF**			7.71	3.49	-0.92	-0.53	-0.60	-0.53	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/97	19.78	-		3.6267	3.6771	3.6252							
05/15/97	21.29	21.30	19.78	2.7955	2.8261	2.7987	-21.58	-20.04	-15.42	-16.00	-15.92	-16.00	-20.04
06/16/97	19.17	19.01	19.80	1.9379	1.9476	1.9379	-19.18	-21.47	-26.07	-25.60	-25.67	-25.61	-19.97
07/15/97	19.76	19.67	19.80	1.0000	1.0000	1.0000	-19.76	-19.26	-18.75	-18.78	-18.78	-18.78	-19.89
08/15/97		20.07	19.80				-20.07	-19.76	-19.76	-19.76	-19.76	-19.76	-19.80
				Total CF			-80.59	-80.53	-80.01	-80.15	-80.13	-80.16	-79.70
Risk-free rate	5.26%			**CFi - CF**			-0.88	-0.83	-0.31	-0.44	-0.43	-0.45	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/97	20.26	-		3.6447	3.6859	3.6404							
09/15/97	19.41	19.27	20.26	2.8154	2.8382	2.8142	-19.53	-20.53	-23.54	-23.18	-23.22	-23.18	-20.53
10/15/97	20.70	20.57	20.33	1.9316	1.9400	1.9316	-20.75	-19.58	-17.24	-17.46	-17.43	-17.46	-20.51
11/17/97	20.48	20.26	20.36	1.0000	1.0000	1.0000	-20.34	-20.78	-21.23	-21.20	-21.20	-21.20	-20.44
12/15/97		18.17	20.36				-18.17	-20.48	-20.48	-20.48	-20.48	-20.48	-20.36
				Total CF			-78.79	-81.37	-82.49	-82.31	-82.33	-82.31	-81.84
Risk-free rate	5.28%			**CFi - CF**			3.05	0.47	-0.64	-0.47	-0.49	-0.47	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/97	18.35	-		3.6540	3.6921	3.6466							
01/15/98	16.51	16.34	18.35	2.8338	2.8512	2.8270	-16.55	-18.59	-24.69	-23.99	-24.07	-23.97	-18.59
02/16/98	16.25	16.02	18.54	1.9409	1.9494	1.9409	-16.15	-16.65	-17.63	-17.55	-17.56	-17.55	-18.69
03/16/98	13.65	13.28	18.72	1.0000	1.0000	1.0000	-13.34	-16.32	-19.30	-19.13	-19.15	-19.13	-18.80
04/15/98		15.46	18.86				-15.46	-13.65	-13.65	-13.65	-13.65	-13.65	-18.86
				Total CF			-61.50	-65.20	-75.28	-74.32	-74.43	-74.30	-74.94
Risk-free rate	5.18%			**CFi - CF**			13.44	9.74	-0.34	0.62	0.51	0.64	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/98	15.82	-		3.7166	3.7284	3.7020							
05/15/98	15.32	14.47	15.82	2.8688	2.8739	2.8600	-14.66	-16.03	-20.13	-19.75	-19.76	-19.73	-16.03
06/15/98	13.03	11.56	16.14	1.9678	1.9728	1.9678	-11.66	-15.46	-23.04	-22.55	-22.57	-22.51	-16.28
07/15/98	15.02	14.87	16.40	1.0000	1.0000	1.0000	-14.94	-13.09	-11.24	-11.30	-11.29	-11.30	-16.48
08/17/98		13.20	16.63				-13.20	-15.02	-15.02	-15.02	-15.02	-15.02	-16.63
				Total CF			-54.47	-59.60	-69.44	-68.61	-68.64	-68.56	-65.42
Risk-free rate	5.14%			**CFi - CF**			10.96	5.82	-4.02	-3.19	-3.22	-3.14	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/98	13.47	-		3.7522	3.7478	3.7350							
09/15/98	14.70	14.57	13.47	2.8326	2.8504	2.8438	-14.75	-13.64	-10.30	-10.57	-10.58	-10.59	-13.64
10/15/98	14.24	14.05	13.79	1.9496	1.9519	1.9496	-14.17	-14.82	-16.14	-16.03	-16.04	-16.03	-13.91
11/16/98	13.12	12.82	14.08	1.0000	1.0000	1.0000	-12.87	-14.30	-15.72	-15.65	-15.65	-15.65	-14.14
12/15/98		11.55	14.35				-11.55	-13.12	-13.12	-13.12	-13.12	-13.12	-14.35
				Total CF			-53.34	-55.88	-55.28	-55.37	-55.39	-55.40	-56.03
Risk-free rate	5.04%			**CFi - CF**			2.69	0.15	0.76	0.66	0.64	0.64	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/98	11.95	-		3.7332	3.7428	3.7350							
01/15/99	12.20	12.11	11.95	2.8153	2.8453	2.8438	-12.24	-12.08	-11.60	-11.64	-11.64	-11.64	-12.08
02/15/99	11.96	11.88	12.26	1.9398	1.9458	1.9496	-11.97	-12.29	-12.93	-12.87	-12.88	-12.88	-12.35
03/15/99	14.50	14.45	12.51	1.0000	1.0000	1.0000	-14.50	-12.01	-9.51	-9.66	-9.64	-9.63	-12.56
04/15/99		16.87	12.76				-16.87	-14.50	-14.50	-14.50	-14.50	-14.50	-12.76
				Total CF			-55.59	-50.88	-48.54	-48.67	-48.66	-48.65	-49.75
Risk-free rate	4.47%			**CFi - CF**			-5.84	-1.13	1.21	1.08	1.09	1.09	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/99	16.89	-		3.6214	3.6749	3.6261							
05/17/99	17.83	17.94	16.89	2.8072	2.8318	2.8060	-18.13	-17.07	-13.89	-14.29	-14.23	-14.28	-17.07
06/15/99	18.67	18.55	16.83	1.9392	1.9483	1.9392	-18.69	-17.96	-16.51	-16.65	-16.63	-16.65	-16.95
07/15/99	20.40	20.16	16.71	1.0000	1.0000	1.0000	-20.24	-18.74	-17.24	-17.34	-17.32	-17.34	-16.77
08/16/99		21.36	16.56				-21.36	-20.40	-20.40	-20.40	-20.40	-20.40	-16.56
				Total CF			-78.41	-74.17	-68.04	-68.67	-68.59	-68.67	-67.36
Risk-free rate	4.27%			**CFi - CF**			-11.06	-6.81	-0.68	-1.32	-1.23	-1.31	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/99	21.52	-		3.6146	3.6708	3.6232							
09/15/99	23.88	24.13	21.52	2.7624	2.8019	2.7772	-24.42	-21.78	-13.85	-14.87	-14.72	-14.85	-21.78
10/15/99	22.82	22.82	21.46	1.9345	1.9433	1.9345	-23.00	-24.07	-26.21	-25.95	-26.00	-25.97	-21.63
11/15/99	25.05	25.13	21.22	1.0000	1.0000	1.0000	-25.23	-22.91	-20.59	-20.74	-20.72	-20.74	-21.30
12/15/99		26.36	20.87				-26.36	-25.05	-25.05	-25.05	-25.05	-25.05	-20.87
				Total CF			-99.01	-93.81	-85.70	-86.62	-86.49	-86.61	-85.58
Risk-free rate	4377%			**CFi - CF**			-13.43	-8.23	-0.12	-1.04	-0.91	-1.03	0.00

Oil

		Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/99	25.83	-		3.6662	3.7237	3.6895							
01/17/00	27.14	28.02	25.83	2.8015	2.8330	2.8155	-28.39	-26.17	-19.52	-20.26	-20.13	-20.21	-26.17
02/15/00	29.19	30.06	24.99	1.9464	1.9526	1.9464	-30.33	-27.39	-21.49	-22.08	-21.99	-22.04	-25.22
03/15/00	29.03	30.72	24.16	1.0000	1.0000	1.0000	-30.87	-29.33	-27.79	-27.88	-27.87	-27.88	-24.28
04/17/00		25.89	23.42				-25.89	-29.03	-29.03	-29.03	-29.03	-29.03	-23.42
				Total CF			-115.49	-111.92	-97.83	-99.24	-99.01	-99.15	-99.09
Risk-free rate	5.32%			**CFi - CF**			-16.40	-12.83	1.25	-0.15	0.08	-0.06	0.00

Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/00	24.57	-		3.7672	3.8033	3.7685							
05/15/00	29.73	29.92	24.57	2.8849	2.9011	2.8832	-30.36	-24.93	-8.65	-9.91	-9.71	-9.90	-24.93
06/15/00	30.95	32.95	24.28	1.9585	1.9646	1.9585	-33.27	-30.02	-23.52	-23.89	-23.84	-23.90	-24.52
07/17/00	29.76	30.83	24.07	1.0000	1.0000	1.0000	-30.97	-31.09	-31.21	-31.21	-31.21	-31.21	-24.18
08/15/00		31.67	23.87				-31.67	-29.76	-29.76	-29.76	-29.76	-29.76	-23.87
				Total CF			-126.27	-115.80	-93.14	-94.77	-94.52	-94.77	-97.50
Risk-free rate	5.80%			**CFi - CF**			-28.77	-18.30	4.36	2.73	2.98	2.73	0.00

		Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/00	30.96	-		3.5663	3.6649	3.5858							
09/15/00	34.72	35.92	30.96	2.7740	2.8193	2.7775	-36.48	-31.44	-16.33	-18.52	-18.02	-18.42	-31.44
10/16/00	32.39	32.92	30.32	1.9393	1.9544	1.9393	-33.26	-35.08	-38.71	-38.30	-38.39	-38.31	-30.63
11/15/00	34.99	35.58	29.74	1.0000	1.0000	1.0000	-35.76	-32.56	-29.35	-29.54	-29.50	-29.54	-29.89
12/15/00		28.87	29.19				-28.87	-34.99	-34.99	-34.99	-34.99	-34.99	-29.19
				Total CF			-134.37	-134.07	-119.38	-121.35	-120.89	-121.26	-121.16
Risk-free rate	6.22%			**CFi - CF**			-13.21	-12.91	1.77	-0.20	0.27	-0.10	0.00

Oil

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/00	27.86	-		3.5852	3.6745	3.6040							
01/15/01	28.76	30.05	27.86	2.7872	2.8267	2.7895	-30.50	-28.27	-21.61	-22.53	-22.33	-22.49	-28.27
02/15/01	28.71	28.80	27.40	1.9315	1.9447	1.9315	-29.08	-29.04	-28.96	-28.97	-28.97	-28.97	-27.67
03/15/01	26.82	26.55	27.05	1.0000	1.0000	1.0000	-26.69	-28.86	-31.03	-30.88	-30.91	-30.88	-27.19
04/16/01		28.79	26.73				-28.79	-26.82	-26.82	-26.82	-26.82	-26.82	-26.73
				Total CF			-115.05	-112.99	-108.42	-109.20	-109.03	-109.15	-109.86
Risk-free rate	5.90%			**CFi - CF**			-5.19	-3.13	1.45	0.66	0.83	0.71	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/16/01	29.19	-		3.7083	3.7752	3.7173							
05/15/01	29.35	28.98	29.19	2.8351	2.8722	2.8424	-29.26	-29.47	-30.11	-30.05	-30.06	-30.05	-29.47
06/15/01	28.62	28.51	29.35	1.9476	1.9580	1.9476	-28.69	-29.54	-31.23	-31.09	-31.12	-31.09	-29.54
07/16/01	25.91	26.06	29.22	1.0000	1.0000	1.0000	-26.14	-28.71	-31.28	-31.14	-31.17	-31.14	-29.31
08/15/01		27.56	28.86				-27.56	-25.91	-25.91	-25.91	-25.91	-25.91	-28.86
				Total CF			-111.65	-113.63	-118.52	-118.19	-118.26	-118.19	-117.18
Risk-free rate	3.80%			**CFi - CF**			5.53	3.55	-1.34	-1.01	-1.08	-1.02	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/01	26.74	-		3.6703	3.7237	3.6887							
09/17/01	29.17	28.81	26.74	2.8463	2.8619	2.8436	-29.06	-26.97	-20.70	-21.39	-21.28	-21.35	-26.97
10/15/01	22.58	22.29	26.71	1.9482	1.9546	1.9482	-22.42	-29.34	-43.18	-42.12	-42.23	-42.10	-26.87
11/15/01	17.84	17.45	26.58	1.0000	1.0000	1.0000	-17.50	-22.65	-27.79	-27.53	-27.56	-27.53	-26.66
12/17/01		19.22	26.36				-19.22	-17.84	-17.84	-17.84	-17.84	-17.84	-26.36
				Total CF			-88.20	-96.80	-109.52	-108.88	-108.91	-108.82	-106.85
Risk-free rate	3.40%			**CFi - CF**			18.66	10.06	-2.67	-2.02	-2.05	-1.97	0.00

Table C.10 -- Copper

(StDev of SCY)/(StDev of each strategy) = *0.1323* *0.1941* *0.9373* *1.0000* *0.9725* *0.9939*

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/91	97.70	-		3.8124	3.8680	3.8108							
01/15/92	95.50	95.40	97.70	2.9145	2.9392	2.9100	-96.43	-98.75	-105.72	-105.29	-105.42	-105.28	-98.75
02/17/92	102.40	102.40	97.75	1.9685	1.9784	1.9685	-103.10	-96.15	-82.26	-82.85	-82.68	-82.88	-98.42
03/16/92	101.00	101.10	97.55	1.0000	1.0000	1.0000	-101.46	-102.76	-104.07	-104.03	-104.04	-104.03	-97.89
04/15/92		99.55	97.50				-99.55	-101.00	-101.00	-101.00	-101.00	-101.00	-97.50
				Total CF			-400.53	-398.67	-393.05	-393.17	-393.14	-393.19	-392.56
Risk-free rate		4.29%		**CFi - CF**			-7.97	-6.10	-0.49	-0.60	-0.57	-0.63	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/92	99.55	-		3.8299	3.8828	3.8284							
05/15/92	100.45	100.40	99.55	2.9146	2.9414	2.9137	-101.35	-100.50	-97.92	-98.07	-98.02	-98.07	-100.50
06/15/92	103.45	103.50	99.70	1.9698	1.9792	1.9698	-104.16	-101.09	-94.95	-95.21	-95.13	-95.21	-100.33
07/15/92	115.80	115.75	99.95	1.0000	1.0000	1.0000	-116.13	-103.79	-91.45	-91.83	-91.71	-91.83	-100.28
08/17/92		115.20	100.05				-115.20	-115.80	-115.80	-115.80	-115.80	-115.80	-100.05
				Total CF			-436.85	-421.18	-400.12	-400.90	-400.66	-400.91	-401.16
Risk-free rate		3.67%		**CFi - CF**			-35.68	-20.02	1.04	0.26	0.50	0.25	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/92	115.40	-		3.8365	3.9062	3.8332							
09/15/92	107.20	106.95	115.40	2.9178	2.9536	2.9165	-107.80	-116.31	-141.86	-140.47	-141.06	-140.44	-116.31
10/15/92	100.05	99.80	115.40	1.9718	1.9844	1.9718	-100.33	-107.77	-122.65	-122.03	-122.30	-122.02	-116.01
11/16/92	95.90	95.60	115.40	1.0000	1.0000	1.0000	-95.84	-100.30	-104.76	-104.64	-104.69	-104.64	-115.69
12/15/92		98.80	115.40				-98.80	-95.90	-95.90	-95.90	-95.90	-95.90	-115.40
				Total CF			-402.76	-420.28	-465.17	-463.04	-463.96	-463.00	-463.41
Risk-free rate		3.16%		**CFi - CF**			60.65	43.13	-1.76	0.37	-0.54	0.41	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/92	99.15	-		3.8649	3.9046	3.8619							
01/15/93	98.40	98.15	99.15	2.9277	2.9500	2.9284	-98.96	-99.97	-102.99	-102.85	-102.89	-102.85	-99.97
02/15/93	98.50	98.25	99.50	1.9755	1.9828	1.9755	-98.78	-98.93	-99.23	-99.22	-99.22	-99.22	-100.04
03/15/93	96.30	96.00	99.85	1.0000	1.0000	1.0000	-96.27	-98.78	-101.29	-101.22	-101.24	-101.22	-100.13
04/15/93		87.10	100.20				-87.10	-96.30	-96.30	-96.30	-96.30	-96.30	-100.20
				Total CF			-381.11	-393.97	-399.81	-399.60	-399.66	-399.59	-400.33
Risk-free rate		3.32%		**CFi - CF**			19.23	6.36	0.53	0.74	0.67	0.74	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/93	87.40	-		3.9406	3.9483	3.9365							
05/17/93	79.15	79.05	87.40	2.9590	2.9684	2.9625	-79.63	-88.04	-113.28	-112.78	-112.84	-112.74	-88.04
06/15/93	82.55	82.70	87.80	1.9846	1.9866	1.9846	-83.11	-79.55	-72.41	-72.56	-72.52	-72.54	-88.24
07/15/93	83.90	83.60	88.20	1.0000	1.0000	1.0000	-83.82	-82.76	-81.71	-81.73	-81.72	-81.73	-88.43
08/16/93		84.50	88.60				-84.50	-83.90	-83.90	-83.90	-83.90	-83.90	-88.60
				Total CF			-331.06	-334.25	-351.30	-350.96	-350.99	-350.91	-353.31
Risk-free rate		2.94%		**CFi - CF**			22.25	19.06	2.01	2.35	2.32	2.40	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/93	84.45	-		4.1134	4.1337	4.1128							
09/15/93	82.05	81.95	84.45	3.0677	3.0745	3.0645	-82.58	-85.10	-92.66	-92.94	-93.00	-92.94	-85.10
10/15/93	74.95	74.75	84.50	2.0240	2.0272	2.0240	-75.14	-82.47	-97.15	-97.65	-97.70	-97.62	-84.94
11/15/93	74.10	74.10	84.55	1.0000	1.0000	1.0000	-74.29	-75.14	-75.99	-76.01	-76.02	-76.01	-84.76
12/15/93		78.60	84.60				-78.60	-74.10	-74.10	-74.10	-74.10	-74.10	-84.60
				Total CF			-310.61	-316.81	-339.90	-340.70	-340.81	-340.68	-339.40
Risk-free rate		3.08%		**CFi - CF**			28.80	22.59	-0.50	-1.30	-1.40	-1.28	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/93	78.65	-		3.9671	3.9679	3.9675							
01/17/94	84.90	85.00	78.65	2.9758	2.9792	2.9790	-85.64	-79.24	-60.05	-60.26	-60.25	-60.26	-79.24
02/15/94	86.25	86.20	78.90	1.9944	1.9945	1.9944	-86.63	-85.33	-82.71	-82.75	-82.74	-82.74	-79.30
03/15/94	92.15	92.20	79.20	1.0000	1.0000	1.0000	-92.44	-86.48	-80.51	-80.55	-80.55	-80.55	-79.41
04/15/94		87.15	79.35				-87.15	-92.15	-92.15	-92.15	-92.15	-92.15	-79.35
				Total CF			-351.87	-343.20	-315.43	-315.70	-315.69	-315.69	-317.30
Risk-free rate		3.11%		**CFi - CF**			-34.57	-25.90	1.87	1.60	1.61	1.60	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/94	87.15	-		3.9736	3.9883	3.9758							
05/16/94	102.50	102.85	87.15	2.9711	2.9840	2.9778	-103.86	-88.01	-40.44	-40.86	-40.63	-40.83	-88.01
06/15/94	110.30	110.40	87.30	1.9949	1.9969	1.9949	-111.13	-103.17	-87.27	-87.50	-87.40	-87.45	-87.87
07/15/94	112.15	112.00	87.50	1.0000	1.0000	1.0000	-112.37	-110.67	-108.96	-108.97	-108.97	-108.97	-87.79
08/15/94		108.60	87.50				-108.60	-112.15	-112.15	-112.15	-112.15	-112.15	-87.50
				Total CF			-435.96	-414.00	-348.83	-349.48	-349.14	-349.39	-351.17
Risk-free rate		3.92%		**CFi - CF**			-84.79	-62.83	2.35	1.69	2.03	1.78	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/94	108.60	-		3.9706	4.0014	3.9736							
09/15/94	116.20	119.80	108.60	2.8597	2.9235	2.9103	-121.21	-109.87	-75.88	-76.21	-75.86	-76.18	-109.87
10/17/94	114.55	116.70	108.55	1.9788	1.9833	1.9788	-117.59	-117.08	-116.07	-116.15	-116.11	-116.12	-109.37
11/15/94	129.05	130.00	108.50	1.0000	1.0000	1.0000	-130.50	-114.99	-99.48	-99.81	-99.74	-99.81	-108.92
12/15/94		138.90	108.45				-138.90	-129.05	-129.05	-129.05	-129.05	-129.05	-108.45
				Total CF			-508.19	-471.00	-420.49	-421.22	-420.77	-421.16	-436.62
Risk-free rate		4.68%		**CFi - CF**			-71.58	-34.38	16.13	15.40	15.85	15.46	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/94	138.85	-		3.9144	3.9631	3.9200							
01/16/95	136.65	137.70	138.85	2.9247	2.9600	2.9386	-139.73	-140.90	-144.40	-144.30	-144.36	-144.31	-140.90
02/15/95	133.45	134.20	137.50	1.9819	1.9891	1.9819	-135.53	-138.00	-142.95	-142.76	-142.85	-142.80	-138.86
03/15/95	136.35	139.80	136.15	1.0000	1.0000	1.0000	-140.55	-134.16	-127.78	-127.89	-127.85	-127.89	-136.88
04/17/95		136.25	132.65				-136.25	-136.35	-136.35	-136.35	-136.35	-136.35	-132.65
				Total CF			-552.05	-549.41	-551.48	-551.31	-551.40	-551.35	-549.28
Risk-free rate		5.88%		**CFi - CF**			-2.77	-0.13	-2.19	-2.02	-2.12	-2.06	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/95	135.80	-		3.8901	3.9456	3.9015							
05/15/95	125.35	125.90	135.80	2.9446	2.9690	2.9469	-127.72	-137.76	-167.89	-166.78	-167.34	-166.90	-137.76
06/15/95	138.95	139.90	134.25	1.9802	1.9876	1.9802	-141.23	-126.55	-97.17	-97.98	-97.62	-97.95	-135.53
07/17/95	140.25	141.10	132.70	1.0000	1.0000	1.0000	-141.74	-139.58	-137.42	-137.46	-137.45	-137.46	-133.30
08/15/95		138.85	131.00				-138.85	-140.25	-140.25	-140.25	-140.25	-140.25	-131.00
				Total CF			-549.54	-544.13	-542.72	-542.48	-542.66	-542.56	-537.59
Risk-free rate		5.68%		**CFi - CF**			-11.95	-6.54	-5.13	-4.89	-5.07	-4.97	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/95	138.95	-		3.9090	3.9624	3.9143							
09/15/95	129.55	129.45	138.95	2.9576	2.9815	2.9573	-131.25	-140.88	-169.77	-168.90	-169.41	-168.95	-140.88
10/16/95	127.85	128.05	137.95	1.9836	1.9917	1.9836	-129.22	-130.73	-133.76	-133.70	-133.73	-133.70	-139.21
11/15/95	130.20	134.60	136.00	1.0000	1.0000	1.0000	-135.21	-128.43	-121.65	-121.76	-121.71	-121.76	-136.62
12/15/95		133.15	134.95				-133.15	-130.20	-130.20	-130.20	-130.20	-130.20	-134.95
				Total CF			-528.83	-530.24	-555.39	-554.56	-555.05	-554.61	-551.66
Risk-free rate		5.53%		**CFi - CF**			22.83	21.41	-3.73	-2.90	-3.39	-2.95	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/95	130.10	-		3.7440	3.8335	3.7863							
01/15/96	112.95	113.20	130.10	2.9831	2.9715	2.9467	-114.74	-131.87	-183.26	-178.87	-180.40	-179.59	-131.87
02/15/96	113.65	114.70	126.90	1.9761	1.9844	1.9761	-115.72	-113.96	-110.43	-110.46	-110.48	-110.52	-128.03
03/15/96	117.70	118.45	123.90	1.0000	1.0000	1.0000	-119.00	-114.17	-109.35	-109.47	-109.43	-109.47	-124.47
04/15/96		118.25	121.90				-118.25	-117.70	-117.70	-117.70	-117.70	-117.70	-121.90
				Total CF			-467.71	-477.70	-520.73	-516.49	-518.01	-517.28	-506.27
Risk-free rate		5.41%		**CFi - CF**			38.56	28.57	-14.46	-10.22	-11.74	-11.01	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/96	117.75	-		3.8652	3.9233	3.8774							
05/15/96	126.15	128.15	117.75	2.8856	2.9291	2.9063	-129.77	-119.23	-87.64	-89.06	-88.45	-88.93	-119.23
06/17/96	93.90	99.85	116.50	1.9474	1.9549	1.9474	-100.66	-127.17	-180.19	-177.16	-178.31	-177.71	-117.44
07/15/96	87.10	86.85	116.05	1.0000	1.0000	1.0000	-87.22	-94.30	-101.38	-101.00	-101.06	-101.00	-116.54
08/15/96		92.80	115.20				-92.80	-87.10	-87.10	-87.10	-87.10	-87.10	-115.20
				Total CF			-410.44	-427.80	-456.31	-454.32	-454.92	-454.74	-468.41
Risk-free rate		4.97%		**CFi - CF**			57.98	40.62	12.11	14.09	13.50	13.67	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/96	92.55	-		3.8738	3.9081	3.8832							
09/16/96	87.10	87.30	92.55	2.9429	2.9547	2.9421	-88.43	-93.74	-109.70	-109.03	-109.21	-109.08	-93.74
10/15/96	91.30	91.90	91.85	1.9766	1.9808	1.9766	-92.71	-87.86	-78.18	-78.46	-78.40	-78.46	-92.66
11/15/96	101.45	101.25	91.25	1.0000	1.0000	1.0000	-101.69	-91.70	-81.71	-81.94	-81.90	-81.94	-91.65
12/16/96		100.05	90.55				-100.05	-101.45	-101.45	-101.45	-101.45	-101.45	-90.55
				Total CF			-382.87	-374.76	-371.03	-370.87	-370.96	-370.93	-368.60
Risk-free rate		5.14%		**CFi - CF**			-14.28	-6.16	-2.43	-2.27	-2.36	-2.33	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/96	98.65	-		3.8108	3.8706	3.8357							
01/15/97	108.10	109.40	98.65	2.9191	2.9357	2.9180	-110.74	-99.86	-67.21	-69.27	-68.62	-69.00	-99.86
02/17/97	107.70	108.30	97.65	1.9790	1.9850	1.9790	-109.14	-108.94	-108.53	-108.55	-108.55	-108.55	-98.40
03/17/97	110.75	112.60	96.65	1.0000	1.0000	1.0000	-113.04	-108.12	-103.20	-103.31	-103.28	-103.31	-97.03
04/15/97		107.80	95.25				-107.80	-110.75	-110.75	-110.75	-110.75	-110.75	-95.25
				Total CF			-440.72	-427.66	-389.70	-391.88	-391.19	-391.61	-390.54
Risk-free rate		4.93%		**CFi - CF**			-50.18	-37.12	0.84	-1.34	-0.65	-1.07	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/97	106.25	-		3.8051	3.8728	3.8308							
05/15/97	117.00	117.00	106.25	2.9754	2.9728	2.9511	-118.56	-107.67	-74.99	-77.11	-76.37	-76.83	-107.67
06/16/97	122.20	122.00	105.50	1.9852	1.9925	1.9852	-123.06	-118.02	-107.93	-108.05	-108.07	-108.18	-106.42
07/15/97	105.20	108.10	104.75	1.0000	1.0000	1.0000	-108.58	-122.75	-136.91	-136.70	-136.80	-136.70	-105.22
08/15/97		99.40	103.95				-99.40	-105.20	-105.20	-105.20	-105.20	-105.20	-103.95
				Total CF			-449.60	-453.63	-425.03	-427.06	-426.44	-426.91	-423.25
Risk-free rate		5.26%		**CFi - CF**			-26.35	-30.38	-1.77	-3.81	-3.19	-3.65	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/97	100.00	-		3.9072	3.9452	3.9082							
09/15/97	94.60	94.30	100.00	2.9596	2.9760	2.9573	-95.55	-101.33	-118.65	-118.12	-118.34	-118.12	-101.33
10/15/97	96.35	95.90	100.00	1.9871	1.9934	1.9871	-96.75	-95.44	-92.82	-92.87	-92.85	-92.87	-100.89
11/17/97	89.15	89.00	99.75	1.0000	1.0000	1.0000	-89.36	-96.74	-104.12	-104.03	-104.07	-104.03	-100.15
12/15/97		79.00	99.60				-79.00	-89.15	-89.15	-89.15	-89.15	-89.15	-99.60
				Total CF			-360.66	-382.65	-404.74	-404.16	-404.40	-404.17	-401.97
Risk-free rate		5.28%		**CFi - CF**			41.31	19.31	-2.77	-2.19	-2.44	-2.20	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/97	79.30	-		3.9140	3.9333	3.9128							
01/15/98	77.50	77.20	79.30	2.9589	2.9682	2.9578	-78.19	-80.32	-86.70	-86.52	-86.56	-86.51	-80.32
02/16/98	75.95	75.70	79.80	1.9849	1.9884	1.9849	-76.33	-78.14	-81.77	-81.70	-81.71	-81.69	-80.46
03/16/98	82.55	82.25	80.30	1.0000	1.0000	1.0000	-82.60	-76.27	-69.95	-70.04	-70.02	-70.04	-80.64
04/15/98		85.50	80.95				-85.50	-82.55	-82.55	-82.55	-82.55	-82.55	-80.95
				Total CF			-322.62	-317.28	-320.97	-320.81	-320.84	-320.80	-322.37
Risk-free rate		5.18%		**CFi - CF**			-0.25	5.09	1.40	1.57	1.53	1.57	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/98	85.65	-		3.9096	3.9336	3.9126							
05/15/98	78.15	77.80	85.65	2.9686	2.9742	2.9636	-78.84	-86.79	-110.66	-109.94	-110.13	-109.96	-86.79
06/15/98	73.30	73.00	85.55	1.9873	1.9909	1.9873	-73.65	-78.85	-89.24	-89.08	-89.10	-89.05	-86.31
07/15/98	76.25	76.00	85.50	1.0000	1.0000	1.0000	-76.35	-73.64	-70.93	-70.96	-70.95	-70.96	-85.90
08/17/98		73.30	85.20				-73.30	-76.25	-76.25	-76.25	-76.25	-76.25	-85.20
				Total CF			-302.14	-315.53	-347.07	-346.22	-346.43	-346.22	-344.20
Risk-free rate		5.14%		**CFi - CF**			42.06	28.67	-2.87	-2.02	-2.23	-2.02	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/98	73.40	-		3.9035	3.9184	3.9067							
09/15/98	76.85	77.00	73.40	2.9392	2.9505	2.9446	-77.97	-74.33	-63.39	-63.74	-63.69	-63.73	-74.33
10/15/98	72.55	72.40	73.65	1.9856	1.9876	1.9856	-73.01	-77.50	-86.48	-86.20	-86.25	-86.23	-74.27
11/16/98	70.40	70.15	73.70	1.0000	1.0000	1.0000	-70.43	-72.84	-75.25	-75.22	-75.22	-75.22	-74.00
12/15/98		65.60	74.00				-65.60	-70.40	-70.40	-70.40	-70.40	-70.40	-74.00
				Total CF			-287.02	-295.07	-295.52	-295.56	-295.56	-295.57	-296.60
Risk-free rate		5.04%		**CFi - CF**			9.58	1.53	1.08	1.04	1.03	1.02	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/98	66.05	-		3.9597	3.9599	3.9541							
01/15/99	65.90	65.75	66.05	2.9581	2.9685	2.9655	-66.48	-66.78	-67.69	-67.68	-67.68	-67.68	-66.78
02/15/99	65.50	65.35	66.60	1.9882	1.9892	1.9882	-65.82	-66.38	-67.49	-67.46	-67.47	-67.47	-67.08
03/15/99	61.35	61.20	67.00	1.0000	1.0000	1.0000	-61.43	-65.75	-70.07	-70.01	-70.02	-70.01	-67.25
04/15/99		66.80	67.35				-66.80	-61.35	-61.35	-61.35	-61.35	-61.35	-67.35
				Total CF			-260.54	-260.26	-266.59	-266.51	-266.52	-266.51	-268.47
Risk-free rate		4.47%		**CFi - CF**			7.93	8.21	1.88	1.96	1.95	1.96	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/99	67.15	-		3.9555	3.9588	3.9522							
05/17/99	70.90	70.65	67.15	2.9677	2.9743	2.9710	-71.41	-67.87	-57.26	-57.41	-57.40	-57.43	-67.87
06/15/99	63.25	63.00	67.60	1.9905	1.9916	1.9905	-63.46	-71.42	-87.33	-87.07	-87.13	-87.10	-68.09
07/15/99	79.60	79.35	68.00	1.0000	1.0000	1.0000	-79.65	-63.49	-47.33	-47.48	-47.46	-47.48	-68.26
08/16/99		77.30	68.35				-77.30	-79.60	-79.60	-79.60	-79.60	-79.60	-68.35
				Total CF			-291.81	-282.37	-271.51	-271.57	-271.59	-271.61	-272.57
Risk-free rate		4.27%		**CFi - CF**			-19.25	-9.81	1.05	1.00	0.98	0.96	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/99	77.50	-		3.9596	3.9709	3.9605							
09/15/99	82.05	81.70	77.50	2.9875	2.9898	2.9846	-82.68	-78.43	-65.68	-65.85	-65.80	-65.84	-78.43
10/15/99	78.50	78.35	77.80	1.9927	1.9945	1.9927	-78.98	-82.71	-90.17	-90.12	-90.13	-90.11	-78.42
11/15/99	78.20	77.90	78.10	1.0000	1.0000	1.0000	-78.21	-78.81	-79.41	-79.41	-79.41	-79.41	-78.41
12/15/99		82.35	78.45				-82.35	-78.20	-78.20	-78.20	-78.20	-78.20	-78.45
				Total CF			-322.21	-318.14	-313.45	-313.57	-313.54	-313.56	-313.71
Risk-free rate		4.77%		**CFi - CF**			-8.50	-4.44	0.25	0.13	0.17	0.15	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/99	82.95	-		3.9926	3.9982	3.9865							
01/17/00	85.80	85.45	82.95	2.9806	2.9915	2.9857	-86.59	-84.06	-76.46	-76.48	-76.46	-76.49	-84.06
02/15/00	82.70	82.35	83.45	1.9949	1.9969	1.9949	-83.10	-86.58	-93.54	-93.47	-93.51	-93.49	-84.21
03/15/00	80.55	80.15	83.95	1.0000	1.0000	1.0000	-80.54	-83.10	-85.66	-85.65	-85.65	-85.65	-84.35
04/17/00		74.20	84.30				-74.20	-80.55	-80.55	-80.55	-80.55	-80.55	-84.30
				Total CF			-324.42	-334.29	-336.21	-336.15	-336.18	-336.18	-336.92
Risk-free rate		5.32%		**CFi - CF**			12.49	2.63	0.71	0.77	0.74	0.74	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/00	74.35	-		3.9705	3.9739	3.9736							
05/15/00	83.75	83.55	74.35	2.9874	2.9873	2.9872	-84.78	-75.44	-47.44	-47.71	-47.68	-47.69	-75.44
06/15/00	81.80	81.50	74.85	1.9971	1.9971	1.9971	-82.29	-84.57	-89.11	-89.08	-89.08	-89.08	-75.58
07/17/00	84.25	84.05	75.30	1.0000	1.0000	1.0000	-84.44	-82.18	-79.92	-79.92	-79.92	-79.92	-75.65
08/15/00		86.90	75.70				-86.90	-84.25	-84.25	-84.25	-84.25	-84.25	-75.70
				Total CF			-338.41	-326.44	-300.72	-300.97	-300.94	-300.94	-302.37
Risk-free rate		5.80%		**CFi - CF**			-36.04	-24.07	1.66	1.40	1.43	1.43	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/00	87.05	-		3.9605	3.9658	3.9645							
09/15/00	92.35	92.00	87.05	2.9918	2.9887	2.9880	-93.44	-88.41	-73.33	-73.53	-73.50	-73.51	-88.41
10/16/00	89.20	89.15	87.25	1.9930	1.9932	1.9930	-90.07	-93.30	-99.76	-99.74	-99.73	-99.73	-88.15
11/15/00	82.70	82.60	87.55	1.0000	1.0000	1.0000	-83.02	-89.66	-96.29	-96.24	-96.25	-96.24	-88.00
12/15/00		87.25	87.75				-87.25	-82.70	-82.70	-82.70	-82.70	-82.70	-87.75
				Total CF			-353.78	-354.07	-352.08	-352.21	-352.17	-352.18	-352.31
Risk-free rate		6.22%		**CFi - CF**			-1.47	-1.76	0.22	0.10	0.13	0.13	0.00

Copper

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/00	87.25	-		3.9462	3.9598	3.9528							
01/15/01	84.35	84.45	87.25	2.9732	2.9780	2.9745	-85.70	-88.54	-97.07	-96.91	-96.95	-96.93	-88.54
02/15/01	82.80	82.70	87.30	1.9940	1.9952	1.9940	-83.51	-85.17	-88.50	-88.46	-88.47	-88.46	-88.15
03/15/01	80.60	80.25	87.20	1.0000	1.0000	1.0000	-80.67	-83.23	-85.79	-85.78	-85.78	-85.78	-87.65
04/16/01		76.50	86.95				-76.50	-80.60	-80.60	-80.60	-80.60	-80.60	-86.95
				Total CF			-326.37	-337.54	-351.96	-351.75	-351.80	-351.77	-351.30
Risk-free rate		5.90%		**CFi - CF**			24.92	13.75	-0.67	-0.46	-0.51	-0.48	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/16/01	76.80	-		3.9854	3.9941	3.9840							
05/15/01	75.05	74.75	76.80	2.9982	3.0009	2.9958	-75.47	-77.54	-83.75	-83.72	-83.74	-83.72	-77.54
06/15/01	71.95	71.65	77.15	1.9989	2.0005	1.9989	-72.11	-75.53	-82.37	-82.37	-82.37	-82.36	-77.64
07/16/01	70.45	70.20	77.45	1.0000	1.0000	1.0000	-70.42	-72.18	-73.93	-73.93	-73.93	-73.93	-77.69
08/15/01		65.60	77.75				-65.60	-70.45	-70.45	-70.45	-70.45	-70.45	-77.75
				Total CF			-283.60	-295.69	-310.50	-310.46	-310.49	-310.45	-310.62
Risk-free rate		3.80%		**CFi - CF**			27.03	14.93	0.12	0.16	0.13	0.17	0.00

			Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/01	65.85	-		3.9979	4.0013	3.9941							
09/17/01	65.15	65.05	65.85	2.9868	2.9946	2.9910	-65.60	-66.41	-68.83	-68.83	-68.83	-68.83	-66.41
10/15/01	63.65	63.45	66.25	1.9986	1.9998	1.9986	-63.82	-65.53	-68.95	-68.93	-68.94	-68.94	-66.64
11/15/01	66.70	67.05	66.65	1.0000	1.0000	1.0000	-67.25	-63.84	-60.43	-60.43	-60.43	-60.43	-66.85
12/17/01		67.40	67.00				-67.40	-66.70	-66.70	-66.70	-66.70	-66.70	-67.00
				Total CF			-264.08	-262.48	-264.91	-264.89	-264.91	-264.90	-266.90
Risk-free rate		3.40%		**CFi - CF**			2.82	4.42	1.99	2.00	1.99	2.00	0.00

Table C.11 -- Soybeans

(StDev of SCY)/(Stdev of each strategy) = ***0.5045 0.7506 0.9452 1.0000 0.9944 0.9982***

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/92	553.25	-		4.0000	3.7488	3.7687	3.7530							
09/15/92	556.75	561.50	616.98	3.0000	2.8959	2.8958	2.8878	-621.86	-613.54	-588.60	-590.69	-590.52	-590.65	-557.63
10/15/92	535.00	535.00	593.57	2.0000	1.9619	1.9646	1.9619	-596.71	-618.58	-662.31	-660.03	-660.03	-659.85	-553.79
11/16/92	558.50	558.00	621.74	1.0000	1.0000	1.0000	1.0000	-623.30	-600.25	-577.19	-578.07	-578.00	-578.07	-549.88
12/15/92		570.75	647.05					-647.05	-634.80	-634.80	-634.80	-634.80	-634.80	-552.25
					Total CF			-2488.93	-2467.17	-2462.89	-2463.59	-2463.36	-2463.37	-2213.55
Risk-free rate		3.16%			**CFi - CF**			-275.38	-253.62	-249.35	-250.04	-249.81	-249.83	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/92	570.75	-		4.0000	3.7645	3.7817	3.7650							
01/15/93	581.50	583.00	656.03	3.0000	2.8745	2.8855	2.8770	-661.42	-649.07	-612.02	-614.93	-614.72	-614.92	-575.44
02/15/93	570.50	570.50	647.59	2.0000	1.9588	1.9616	1.9588	-651.07	-662.13	-684.25	-682.86	-682.99	-682.89	-575.83
03/15/93	580.50	579.50	626.77	1.0000	1.0000	1.0000	1.0000	-628.54	-619.51	-610.49	-610.86	-610.84	-610.86	-576.37
04/15/93		590.50	671.00					-671.00	-661.00	-661.00	-661.00	-661.00	-661.00	-577.50
					Total CF			-2612.04	-2591.72	-2567.76	-2569.65	-2569.54	-2569.68	-2305.15
Risk-free rate		3.32%			**CFi - CF**			-306.89	-286.57	-262.61	-264.51	-264.39	-264.53	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/93	590.50	-		4.0000	3.7585	3.7803	3.7607							
05/17/93	599.50	600.50	697.26	3.0000	2.8568	2.8751	2.8653	-702.39	-692.32	-662.10	-664.53	-664.31	-664.51	-594.84
06/15/93	582.75	582.75	651.00	2.0000	1.9547	1.9581	1.9547	-654.26	-671.09	-704.76	-702.35	-702.66	-702.49	-595.09
07/15/93	708.00	707.00	766.53	1.0000	1.0000	1.0000	1.0000	-768.51	-643.94	-519.37	-525.01	-524.59	-525.01	-595.28
08/16/93		652.75	716.99					-716.99	-772.24	-772.24	-772.24	-772.24	-772.24	-594.88
					Total CF			-2842.15	-2779.59	-2658.46	-2664.13	-2663.80	-2664.25	-2380.09
Risk-free rate		2.94%			**CFi - CF**			-462.06	-399.50	-278.37	-284.04	-283.71	-284.16	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/93	652.25	-		4.0000	3.8144	3.8481	3.8177							
09/15/93	631.50	640.00	698.76	3.0000	2.9225	2.9320	2.9167	-704.15	-716.49	-753.52	-751.23	-751.65	-751.27	-657.28
10/15/93	614.50	614.50	675.49	2.0000	1.9717	1.9768	1.9717	-678.98	-696.06	-730.24	-728.92	-729.08	-728.82	-655.24
11/15/93	686.75	679.50	735.10	1.0000	1.0000	1.0000	1.0000	-736.96	-671.79	-606.63	-608.47	-608.14	-608.47	-653.15
12/15/93		680.25	728.83					-728.83	-735.33	-735.33	-735.33	-735.33	-735.33	-653.25
					Total CF			-2848.91	-2819.68	-2825.72	-2823.95	-2824.20	-2823.90	-2618.92
Risk-free rate		3.08%			**CFi - CF**			-229.99	-200.76	-206.80	-205.03	-205.28	-204.98	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/93	680.25	-		4.0000	3.8096	3.8405	3.8134							
01/17/94	709.75	702.50	779.73	3.0000	2.9098	2.9217	2.9081	-785.60	-763.18	-695.93	-700.20	-699.50	-700.11	-685.37
02/15/94	677.50	677.50	747.75	2.0000	1.9653	1.9699	1.9653	-751.52	-783.93	-848.76	-845.83	-846.22	-845.78	-686.94
03/15/94	689.50	686.50	759.31	1.0000	1.0000	1.0000	1.0000	-761.32	-752.29	-743.27	-743.58	-743.54	-743.58	-688.57
04/15/94		652.75	672.22					-672.22	-708.97	-708.97	-708.97	-708.97	-708.97	-687.63
					Total CF			-2970.66	-3008.38	-2996.93	-2998.58	-2998.24	-2998.44	-2748.51
Risk-free rate		3.11%			**CFi - CF**			-222.15	-259.87	-248.42	-250.08	-249.73	-249.94	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/94	652.75	-		4.0000	3.6859	3.7393	3.7208							
05/16/94	678.50	684.00	678.48	3.0000	2.8401	2.8561	2.8468	-685.14	-653.59	-558.92	-568.83	-567.14	-567.73	-659.16
06/15/94	705.25	705.25	748.29	2.0000	1.9621	1.9654	1.9621	-753.21	-726.28	-672.43	-676.74	-676.30	-676.56	-656.03
07/15/94	590.00	614.00	650.59	1.0000	1.0000	1.0000	1.0000	-652.76	-744.31	-835.87	-832.40	-832.70	-832.40	-652.92
08/15/94		565.75	646.23					-646.23	-670.48	-670.48	-670.48	-670.48	-670.48	-638.88
					Total CF			-2737.34	-2794.66	-2737.69	-2748.44	-2746.62	-2747.16	-2606.99
Risk-free rate		3.92%			**CFi - CF**			-130.35	-187.67	-130.71	-141.46	-139.63	-140.17	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/94	565.75	-		4.0000	3.8056	3.8223	3.8134							
09/15/94	557.50	564.00	633.99	3.0000	2.9428	2.9327	2.9282	-641.43	-643.20	-648.51	-648.17	-648.20	-648.18	-572.39
10/17/94	543.00	543.00	613.57	2.0000	1.9751	1.9766	1.9751	-618.23	-632.84	-662.06	-661.22	-661.08	-661.01	-566.02
11/15/94	568.00	560.25	648.55	1.0000	1.0000	1.0000	1.0000	-651.05	-633.73	-616.42	-616.85	-616.82	-616.85	-559.90
12/15/94		562.75	659.49					-659.49	-664.74	-664.74	-664.74	-664.74	-664.74	-560.25
					Total CF			-2570.20	-2574.51	-2591.73	-2590.98	-2590.84	-2590.78	-2258.56
Risk-free rate		4.68%			**CFi - CF**			-311.64	-315.96	-333.17	-332.42	-332.28	-332.23	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/94	562.75	-		4.0000	3.8385	3.8472	3.8389							
01/16/95	556.50	553.25	671.54	3.0000	2.9189	2.9229	2.9187	-681.46	-691.10	-720.02	-718.46	-718.55	-718.46	-571.06
02/15/95	558.00	558.00	655.49	2.0000	1.9722	1.9736	1.9722	-661.96	-660.45	-657.42	-657.54	-657.54	-657.54	-573.61
03/15/95	585.75	576.50	678.21	1.0000	1.0000	1.0000	1.0000	-681.83	-663.23	-644.63	-645.15	-645.12	-645.15	-576.31
04/17/95		574.50	695.77					-695.77	-707.02	-707.02	-707.02	-707.02	-707.02	-577.63
					Total CF			-2721.02	-2721.79	-2729.08	-2728.17	-2728.22	-2728.17	-2298.60
Risk-free rate		5.88%			**CFi - CF**			-422.42	-423.19	-430.48	-429.57	-429.62	-429.57	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/95	574.50	-		4.0000	3.8544	3.8620	3.8534							
05/15/95	567.50	558.25	638.48	3.0000	2.9311	2.9334	2.9291	-647.69	-664.17	-713.62	-711.22	-711.35	-711.21	-582.78
06/15/95	592.25	592.25	682.29	2.0000	1.9755	1.9770	1.9755	-688.80	-663.81	-613.84	-615.56	-615.50	-615.61	-585.78
07/17/95	643.75	643.75	718.22	1.0000	1.0000	1.0000	1.0000	-721.47	-669.74	-618.00	-619.27	-619.19	-619.27	-588.65
08/15/95		587.00	685.56					-685.56	-742.31	-742.31	-742.31	-742.31	-742.31	-588.00
					Total CF			-2743.51	-2740.03	-2687.78	-2688.37	-2688.36	-2688.40	-2345.22
Risk-free rate		5.68%			**CFi - CF**			-398.29	-394.81	-342.56	-343.15	-343.14	-343.18	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/95	590.25	-		4.0000	3.8745	3.8788	3.8713							
09/15/95	631.75	622.00	712.78	3.0000	2.9361	2.9395	2.9357	-722.68	-690.48	-593.91	-597.95	-597.81	-598.06	-598.44
10/16/95	656.50	656.50	734.28	2.0000	1.9766	1.9778	1.9766	-740.99	-716.01	-666.06	-667.65	-667.57	-667.66	-600.18
11/15/95	674.75	669.50	753.87	1.0000	1.0000	1.0000	1.0000	-757.30	-744.25	-731.19	-731.49	-731.48	-731.49	-601.98
12/15/95		720.75	811.98					-811.98	-765.98	-765.98	-765.98	-765.98	-765.98	-604.25
					Total CF			-3032.94	-2916.72	-2757.14	-2763.08	-2762.84	-2763.19	-2404.86
Risk-free rate		5.53%			**CFi - CF**			-628.09	-511.86	-352.28	-358.22	-357.98	-358.34	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/95	720.75	-		4.0000	3.8304	3.8536	3.8367							
01/15/96	741.25	733.00	835.25	3.0000	2.9217	2.9285	2.9200	-846.59	-834.18	-796.93	-799.03	-798.74	-798.95	-730.54
02/15/96	732.50	732.50	814.29	2.0000	1.9746	1.9775	1.9746	-821.56	-830.39	-848.05	-847.36	-847.42	-847.34	-731.98
03/15/96	724.50	716.00	794.01	1.0000	1.0000	1.0000	1.0000	-797.67	-814.24	-830.82	-830.40	-830.45	-830.40	-733.61
04/15/96		789.75	876.07					-876.07	-810.82	-810.82	-810.82	-810.82	-810.82	-731.88
					Total CF			-3341.89	-3289.63	-3286.61	-3287.61	-3287.43	-3287.51	-2928.01
Risk-free rate		5.41%			**CFi - CF**			-413.89	-361.62	-358.61	-359.60	-359.42	-359.51	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/96	789.75	-		4.0000	3.7711	3.8124	3.7917							
05/15/96	815.50	809.50	881.51	3.0000	2.8719	2.8909	2.8806	-892.62	-872.62	-812.63	-817.20	-816.38	-816.79	-799.71
06/17/96	773.00	773.00	839.06	2.0000	1.9585	1.9620	1.9585	-845.83	-888.67	-974.36	-968.87	-969.68	-969.24	-800.28
07/15/96	838.00	841.00	885.59	1.0000	1.0000	1.0000	1.0000	-889.34	-821.05	-752.76	-755.60	-755.36	-755.60	-801.38
08/15/96		829.75	884.10					-884.10	-892.35	-892.35	-892.35	-892.35	-892.35	-798.50
					Total CF			-3511.89	-3474.69	-3432.09	-3434.02	-3433.77	-3433.98	-3199.86
Risk-free rate		4.97%			**CFi - CF**			-312.03	-274.83	-232.23	-234.16	-233.91	-234.12	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/96	800.25	-		4.0000	3.8044	3.8399	3.8171							
09/16/96	793.00	814.50	891.04	3.0000	2.9363	2.9365	2.9249	-902.53	-888.10	-844.80	-847.62	-847.11	-847.44	-810.57
10/15/96	692.50	692.50	772.51	2.0000	1.9743	1.9782	1.9743	-779.28	-880.67	-1083.43	-1076.97	-1076.99	-1075.82	-799.07
11/15/96	696.75	699.00	782.31	1.0000	1.0000	1.0000	1.0000	-785.73	-779.20	-772.68	-772.84	-772.82	-772.84	-787.43
12/16/96		711.50	785.85					-785.85	-771.10	-771.10	-771.10	-771.10	-771.10	-787.25
					Total CF			-3253.40	-3319.07	-3472.00	-3468.54	-3468.02	-3467.20	-3184.32
Risk-free rate		5.14%			**CFi - CF**			-69.08	-134.75	-287.68	-284.21	-283.69	-282.87	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/96	711.50	-		4.0000	3.8389	3.8633	3.8471							
01/15/97	745.50	744.50	831.84	3.0000	2.9266	2.9331	2.9250	-842.01	-808.61	-708.40	-713.78	-712.96	-713.51	-720.20
02/17/97	761.00	761.00	848.04	2.0000	1.9728	1.9755	1.9728	-854.59	-838.97	-807.73	-808.88	-808.78	-808.91	-714.73
03/17/97	825.00	821.00	922.61	1.0000	1.0000	1.0000	1.0000	-926.23	-866.00	-805.76	-807.40	-807.24	-807.40	-709.77
04/15/97		836.00	906.01					-906.01	-895.01	-895.01	-895.01	-895.01	-895.01	-705.63
					Total CF			-3528.85	-3408.59	-3216.90	-3225.07	-3223.99	-3224.82	-2850.33
Risk-free rate		4.93%			**CFi - CF**			-678.52	-558.26	-366.57	-374.74	-373.66	-374.49	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/97	836.00	-		4.0000	3.4749	3.5801	3.5575							
05/15/97	857.75	862.00	909.00	3.0000	2.7067	2.7430	2.7316	-921.13	-894.78	-815.74	-829.58	-826.81	-827.40	-847.16
06/16/97	838.50	838.50	900.02	2.0000	1.9202	1.9243	1.9202	-907.84	-927.25	-966.09	-960.39	-961.10	-960.88	-845.78
07/15/97	775.50	811.00	877.97	1.0000	1.0000	1.0000	1.0000	-881.90	-909.52	-937.15	-934.94	-935.06	-934.94	-844.77
08/15/97		791.75	864.09					-864.09	-847.84	-847.84	-847.84	-847.84	-847.84	-834.75
					Total CF			-3574.96	-3579.40	-3566.82	-3572.75	-3570.80	-3571.06	-3372.45
Risk-free rate		5.26%			**CFi - CF**			-202.50	-206.95	-194.36	-200.30	-198.35	-198.61	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/97	656.00	-		4.0000	3.6111	3.6647	3.6441							
09/15/97	634.75	734.50	725.29	3.0000	2.9014	2.8802	2.8693	-734.90	-655.36	-416.74	-447.68	-443.41	-445.05	-664.69
10/15/97	704.50	704.50	784.35	2.0000	1.9569	1.9607	1.9569	-791.30	-720.93	-580.20	-587.14	-588.62	-589.40	-639.24
11/17/97	726.25	733.75	790.34	1.0000	1.0000	1.0000	1.0000	-793.55	-764.18	-734.81	-736.08	-735.97	-736.08	-613.73
12/15/97		688.75	790.34					-790.34	-827.84	-827.84	-827.84	-827.84	-827.84	-612.75
					Total CF			-3110.09	-2968.31	-2559.59	-2598.73	-2595.84	-2598.36	-2530.41
Risk-free rate		5.28%			**CFi - CF**			-579.68	-437.90	-29.17	-68.32	-65.42	-67.95	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/97	688.75	-		4.0000	3.6587	3.6957	3.6658							
01/15/98	667.00	667.25	741.35	3.0000	2.8330	2.8474	2.8320	-750.88	-772.66	-837.99	-830.55	-831.36	-830.71	-697.60
02/16/98	679.00	679.00	761.08	2.0000	1.9436	1.9489	1.9436	-767.37	-755.27	-731.07	-733.09	-732.92	-733.11	-694.57
03/16/98	654.50	654.00	718.49	1.0000	1.0000	1.0000	1.0000	-721.56	-746.66	-771.77	-770.35	-770.49	-770.35	-691.94
04/15/98		639.50	700.26					-700.26	-715.26	-715.26	-715.26	-715.26	-715.26	-690.88
					Total CF			-2940.07	-2989.85	-3056.09	-3049.26	-3050.02	-3049.43	-2774.99
Risk-free rate		5.18%			**CFi - CF**			-165.08	-214.86	-281.10	-274.27	-275.04	-274.44	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/98	639.50	-		4.0000	3.6440	3.6927	3.6704							
05/15/98	641.25	647.75	713.59	3.0000	2.8328	2.8438	2.8324	-723.10	-714.74	-689.66	-692.64	-692.23	-692.41	-648.02
06/15/98	608.75	608.75	641.06	2.0000	1.9456	1.9496	1.9456	-646.77	-679.56	-745.14	-739.66	-740.02	-739.65	-645.96
07/15/98	620.50	641.25	642.97	1.0000	1.0000	1.0000	1.0000	-645.96	-613.31	-580.66	-582.44	-582.31	-582.44	-643.99
08/17/98		565.50	579.56					-579.56	-634.56	-634.56	-634.56	-634.56	-634.56	-641.13
					Total CF			-2595.40	-2642.17	-2650.02	-2649.29	-2649.12	-2649.06	-2579.09
Risk-free rate		5.14%			**CFi - CF**			-16.31	-63.09	-70.94	-70.20	-70.03	-69.97	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/98	539.25	-		4.0000	3.7464	3.7642	3.7484							
09/15/98	534.25	532.00	611.94	3.0000	2.8945	2.8942	2.8861	-619.68	-627.02	-649.04	-647.18	-647.31	-647.20	-546.07
10/15/98	556.00	556.00	616.30	2.0000	1.9603	1.9631	1.9603	-621.51	-599.58	-555.71	-558.03	-558.03	-558.21	-544.44
11/16/98	577.50	569.75	622.56	1.0000	1.0000	1.0000	1.0000	-625.06	-611.25	-597.45	-598.00	-597.96	-598.00	-542.67
12/15/98		553.00	607.31					-607.31	-631.81	-631.81	-631.81	-631.81	-631.81	-545.50
					Total CF			-2473.56	-2469.66	-2434.01	-2435.01	-2435.11	-2435.21	-2178.68
Risk-free rate		5.04%			**CFi - CF**			-294.88	-290.98	-255.33	-256.33	-256.43	-256.53	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/98	553.00	-		4.0000	3.7580	3.7784	3.7565							
01/15/99	532.25	530.25	598.74	3.0000	2.8733	2.8858	2.8747	-605.38	-628.38	-697.38	-691.82	-692.29	-691.78	-559.13
02/15/99	492.25	492.25	598.74	2.0000	1.9580	1.9618	1.9580	-603.08	-643.37	-723.95	-718.85	-719.35	-718.90	-560.66
03/15/99	471.00	464.50	598.74	1.0000	1.0000	1.0000	1.0000	-601.02	-628.87	-656.73	-655.56	-655.66	-655.56	-562.38
04/15/99		489.50	552.07					-552.07	-533.57	-533.57	-533.57	-533.57	-533.57	-564.13
					Total CF			-2361.55	-2434.19	-2611.63	-2599.79	-2600.87	-2599.81	-2246.30
Risk-free rate		4.47%			**CFi - CF**			-115.25	-187.90	-365.34	-353.50	-354.58	-353.52	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/99	489.50	-		4.0000	3.7624	3.7846	3.7625							
05/17/99	470.75	463.00	552.07	3.0000	2.8804	2.8914	2.8802	-557.98	-584.76	-665.11	-658.75	-659.34	-658.75	-494.74
06/15/99	463.25	463.25	552.07	2.0000	1.9600	1.9639	1.9600	-556.09	-563.64	-578.75	-577.85	-577.93	-577.85	-497.97
07/15/99	423.75	429.50	552.07	1.0000	1.0000	1.0000	1.0000	-554.14	-588.02	-621.89	-620.54	-620.67	-620.54	-501.12
08/16/99		456.50	552.07					-552.07	-519.32	-519.32	-519.32	-519.32	-519.32	-502.00
					Total CF			-2220.28	-2255.74	-2385.08	-2376.46	-2377.27	-2376.46	-1995.84
Risk-free rate		4.27%			**CFi - CF**			-224.44	-259.91	-389.24	-380.62	-381.43	-380.63	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/99	456.50	-		4.0000	3.8142	3.8194	3.8089							
09/15/99	489.00	485.50	552.07	3.0000	2.8998	2.9066	2.9013	-558.67	-529.33	-441.29	-446.74	-446.59	-446.90	-461.96
10/15/99	492.00	492.00	556.83	2.0000	1.9651	1.9669	1.9651	-561.29	-558.26	-552.21	-552.52	-552.50	-552.51	-463.68
11/15/99	469.25	462.25	517.50	1.0000	1.0000	1.0000	1.0000	-519.53	-549.40	-579.27	-578.23	-578.28	-578.23	-465.32
12/15/99		452.75	520.09					-520.09	-536.59	-536.59	-536.59	-536.59	-536.59	-468.38
					Total CF			-2159.58	-2173.58	-2109.36	-2114.07	-2113.95	-2114.22	-1859.34
Risk-free rate		4.77%			**CFi - CF**			-300.25	-314.24	-250.02	-254.73	-254.61	-254.89	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/99	452.75	-		4.0000	3.8033	3.8129	3.8017							
01/14/00	496.25	485.50	559.96	3.0000	2.9033	2.9075	2.9018	-567.68	-534.48	-434.88	-441.41	-441.09	-441.46	-459.00
02/15/00	508.75	508.75	583.09	2.0000	1.9653	1.9672	1.9653	-588.38	-575.77	-550.54	-551.76	-551.71	-551.78	-460.01
03/14/00	530.00	520.00	606.77	1.0000	1.0000	1.0000	1.0000	-609.78	-598.48	-587.17	-587.56	-587.54	-587.56	-461.28
04/17/00		531.50	628.54					-628.54	-627.04	-627.04	-627.04	-627.04	-627.04	-462.00
					Total CF			-2394.39	-2335.77	-2199.63	-2207.78	-2207.38	-2207.85	-1842.29
Risk-free rate		5.32%			**CFi - CF**			-552.10	-493.48	-357.34	-365.49	-365.09	-365.56	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/00	531.50	-		4.0000	3.8019	3.8161	3.8036							
05/12/00	565.75	551.50	641.47	3.0000	2.8995	2.9063	2.9000	-651.23	-630.92	-570.01	-574.03	-573.74	-574.00	-539.58
06/15/00	510.00	510.00	564.99	2.0000	1.9616	1.9637	1.9616	-570.49	-626.79	-739.37	-733.71	-734.10	-733.74	-542.99
07/14/00	450.25	465.25	532.34	1.0000	1.0000	1.0000	1.0000	-535.05	-580.03	-625.01	-623.28	-623.38	-623.28	-546.77
08/15/00		457.50	532.34					-532.34	-525.09	-525.09	-525.09	-525.09	-525.09	-545.63
					Total CF			-2289.11	-2362.83	-2459.48	-2456.12	-2456.31	-2456.11	-2174.97
Risk-free rate		5.80%			**CFi - CF**			-114.14	-187.86	-284.51	-281.15	-281.34	-281.14	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/00	457.50	-		4.0000	3.8465	3.8429	3.8404							
09/15/00	483.25	484.50	557.51	3.0000	2.9179	2.9197	2.9184	-566.22	-538.80	-456.54	-460.74	-460.84	-460.91	-464.65
10/16/00	465.00	465.00	536.01	2.0000	1.9709	1.9714	1.9709	-541.52	-559.96	-596.83	-595.32	-595.35	-595.33	-467.00
11/14/00	477.75	472.00	546.22	1.0000	1.0000	1.0000	1.0000	-549.11	-542.08	-535.04	-535.24	-535.24	-535.24	-469.47
12/15/00		507.25	576.29					-576.29	-546.79	-546.79	-546.79	-546.79	-546.79	-472.25
					Total CF			-2233.14	-2187.62	-2135.20	-2138.10	-2138.23	-2138.27	-1873.37
Risk-free rate		6.22%			**CFi - CF**			-359.77	-314.25	-261.82	-264.72	-264.85	-264.90	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/00	507.25	-		4.0000	3.8269	3.8331	3.8274							
01/12/01	482.50	479.25	573.57	3.0000	2.9191	2.9194	2.9165	-582.35	-610.78	-696.07	-691.15	-691.32	-691.16	-515.02
02/15/01	450.25	450.25	547.03	2.0000	1.9700	1.9710	1.9700	-552.36	-584.93	-650.05	-647.42	-647.43	-647.34	-516.99
03/14/01	444.00	442.00	542.27	1.0000	1.0000	1.0000	1.0000	-545.17	-553.46	-561.76	-561.51	-561.52	-561.51	-519.51
04/16/01		432.75	516.96					-516.96	-528.21	-528.21	-528.21	-528.21	-528.21	-520.00
					Total CF			-2196.84	-2277.38	-2436.09	-2428.28	-2428.48	-2428.22	-2071.52
Risk-free rate		5.90%			**CFi - CF**			-125.32	-205.86	-364.57	-356.76	-356.96	-356.70	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/16/01	432.75	-		4.0000	3.8026	3.8244	3.8106							
05/14/01	443.25	463.00	500.77	3.0000	2.8779	2.8949	2.8880	-505.59	-475.05	-383.42	-389.45	-388.79	-389.21	-436.91
06/15/01	458.50	458.50	526.08	2.0000	1.9674	1.9697	1.9674	-529.38	-514.03	-483.34	-485.21	-484.95	-485.06	-437.98
07/13/01	526.50	522.00	602.01	1.0000	1.0000	1.0000	1.0000	-604.02	-540.31	-476.60	-478.67	-478.52	-478.67	-439.21
08/14/01		516.00	593.98					-593.98	-604.48	-604.48	-604.48	-604.48	-604.48	-437.00
					Total CF			-2232.96	-2133.87	-1947.84	-1957.82	-1956.74	-1957.42	-1751.10
Risk-free rate		3.80%			**CFi - CF**			-481.86	-382.76	-196.74	-206.72	-205.64	-206.32	0.00

Soybeans

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/01	517.50	-		4.0000	3.7970	3.8313	3.8096							
09/14/01	474.00	471.50	555.06	3.0000	2.9337	2.9327	2.9217	-559.94	-606.35	-745.56	-736.14	-737.73	-736.73	-522.05
10/15/01	429.50	429.50	510.56	2.0000	1.9770	1.9807	1.9770	-513.57	-558.33	-647.85	-644.88	-644.84	-644.35	-518.28
11/14/01	447.25	448.00	516.96	1.0000	1.0000	1.0000	1.0000	-518.55	-499.99	-481.44	-481.87	-481.80	-481.87	-514.58
12/17/01		436.75	517.50					-517.50	-528.00	-528.00	-528.00	-528.00	-528.00	-514.88
					Total CF			-2109.56	-2192.67	-2402.85	-2390.89	-2392.37	-2390.94	-2069.79
Risk-free rate		3.40%			**CFi - CF**			-39.77	-122.88	-333.06	-321.10	-322.58	-321.15	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/17/01	436.75	-		4.0000	3.8636	3.8825	3.8601							
01/14/02	446.75	446.00	530.02	3.0000	2.9289	2.9402	2.9290	-532.35	-523.06	-495.19	-496.46	-496.28	-496.49	-438.67
02/15/02	437.25	437.25	528.25	2.0000	1.9758	1.9796	1.9758	-529.75	-539.28	-558.34	-557.66	-557.77	-557.66	-439.12
03/14/02	468.50	457.50	534.79	1.0000	1.0000	1.0000	1.0000	-535.62	-515.33	-495.05	-495.54	-495.47	-495.54	-439.68
04/15/02		456.50	528.80					-528.80	-540.80	-540.80	-540.80	-540.80	-540.80	-441.00
					Total CF			-2126.52	-2118.48	-2089.38	-2090.46	-2090.31	-2090.49	-1758.47
Risk-free rate		1.76%			**CFi - CF**			-368.05	-360.01	-330.91	-331.99	-331.84	-332.02	0.00

								Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Stacked**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/02	456.50	-		4.0000	3.8230	3.8510	3.8299							
05/14/02	476.00	474.50	539.82	3.0000	2.9213	2.9288	2.9183	-542.18	-524.10	-469.86	-473.06	-472.56	-472.94	-458.49
06/17/02	498.75	498.75	557.51	2.0000	1.9707	1.9743	1.9707	-559.05	-536.24	-490.61	-492.41	-492.24	-492.48	-458.89
07/12/02	534.40	578.00	608.54	1.0000	1.0000	1.0000	1.0000	-609.51	-530.13	-450.76	-453.08	-452.80	-453.08	-459.48
08/15/02		592.20	619.83					-619.83	-562.03	-562.03	-562.03	-562.03	-562.03	-456.00
					Total CF			-2330.57	-2152.50	-1973.26	-1980.59	-1979.62	-1980.53	-1832.87
Risk-free rate		1.71%			**CFi - CF**			-497.70	-319.64	-140.40	-147.72	-146.76	-147.66	0.00

Table C.12 -- Gold

(StDev of SCY)/(StDev of each strategy) = .05810 0.0786 0.9985 1.0000 0.9887 0.0000

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/91	360.90	-			4.0029	3.9998	20.9885							
01/15/92	354.70	354.70	354.55	360.15	3.0014	2.9999	3.0174	-358.36	-364.63	-383.43	-383.45	-383.43	-489.89	-364.02
02/17/92	355.10	353.70	354.50	360.90	2.0005	2.0000	2.0005	-356.92	-357.93	-359.95	-359.95	-359.95	-359.96	-363.37
03/16/92	343.90	343.90	343.20	362.05	1.0000	1.0000	1.0000	-344.41	-355.65	-366.89	-366.90	-366.89	-366.90	-363.33
04/15/92		336.00	337.40	363.20				-337.40	-345.30	-345.30	-345.30	-345.30	-345.30	-363.20
					Total CF			-1397.10	-1423.51	-1455.57	-1455.59	-1455.56	-1562.05	-1453.92
Risk-free rate		4.29%			**CFi - CF**			56.82	30.41	-1.65	-1.67	-1.64	-108.13	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/92	337.00	-			4.0043	3.9973	11.0782							
05/15/92	338.40	338.40	339.40	336.50	3.0021	2.9987	3.0219	-342.62	-341.21	-336.97	-336.96	-336.97	-326.97	-339.70
06/15/92	344.90	340.50	343.00	337.00	2.0007	1.9996	2.0007	-345.18	-343.07	-338.84	-338.84	-338.84	-338.79	-339.14
07/15/92	354.70	354.70	351.85	337.95	1.0000	1.0000	1.0000	-353.02	-343.19	-333.35	-333.35	-333.36	-333.35	-339.07
08/17/92		336.90	337.30	338.90				-337.30	-355.10	-355.10	-355.10	-355.10	-355.10	-338.90
					Total CF			-1378.12	-1382.56	-1364.26	-1364.25	-1364.27	-1354.21	-1356.81
Risk-free rate		3.67%			**CFi - CF**			-21.31	-25.75	-7.45	-7.44	-7.46	2.60	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/92	338.20	-			4.0040	3.9980	4.0074							
09/15/92	346.90	346.90	346.35	337.10	3.0019	2.9990	3.0025	-349.09	-340.32	-314.01	-313.98	-314.03	-313.95	-339.77
10/15/92	341.10	341.00	342.00	338.20	2.0006	1.9997	2.0006	-343.81	-349.74	-361.60	-361.62	-361.60	-361.62	-339.99
11/16/92	333.90	333.90	335.75	339.05	1.0000	1.0000	1.0000	-336.59	-343.81	-351.03	-351.03	-351.03	-351.03	-339.90
12/15/92		334.50	335.05	339.90				-335.05	-334.45	-334.45	-334.45	-334.45	-334.45	-339.90
					Total CF			-1364.54	-1368.32	-1361.10	-1361.08	-1361.11	-1361.05	-1359.56
Risk-free rate		3.16%			**CFi - CF**			-4.98	-8.77	-1.54	-1.52	-1.55	-1.49	0.00

Gold

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/92	335.30	-			4.0013	3.9943	4.0047							
01/15/93	327.00	327.00	327.85	334.90	3.0006	2.9972	3.0012	-330.54	-338.91	-364.02	-364.03	-363.97	-364.06	-337.65
02/15/93	330.00	329.60	328.55	335.30	2.0002	1.9991	2.0002	-330.32	-327.70	-322.48	-322.47	-322.48	-322.47	-337.10
03/15/93	329.80	329.80	328.65	335.85	1.0000	1.0000	1.0000	-329.58	-329.78	-329.98	-329.98	-329.98	-329.98	-336.80
04/15/93		337.20	338.15	336.40				-338.15	-330.75	-330.75	-330.75	-330.75	-330.75	-336.40
					Total CF			-1328.59	-1327.15	-1347.22	-1347.23	-1347.18	-1347.26	-1347.96
Risk-free rate		3.32%			**CFi - CF**			19.36	20.81	0.73	0.72	0.77	0.70	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/93	338.30	-			4.0005	4.0009	4.0003							
05/17/93	368.00	368.00	368.20	337.60	3.0003	3.0005	3.0002	-370.91	-340.99	-251.23	-251.22	-251.21	-251.22	-340.08
06/15/93	370.80	369.60	365.75	338.30	2.0001	2.0002	2.0001	-367.58	-365.97	-362.76	-362.76	-362.76	-362.76	-339.99
07/15/93	393.90	393.90	394.00	338.95	1.0000	1.0000	1.0000	-395.02	-371.86	-348.70	-348.70	-348.69	-348.70	-339.82
08/16/93		373.10	373.75	339.60				-373.75	-394.55	-394.55	-394.55	-394.55	-394.55	-339.60
					Total CF			-1507.26	-1473.37	-1357.24	-1357.22	-1357.21	-1357.23	-1359.50
Risk-free rate		2.94%			**CFi - CF**			-147.75	-113.87	2.26	2.28	2.29	2.27	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/93	374.50	-			4.0009	4.0007	4.0010							
09/15/93	347.90	347.90	347.60	367.90	3.0005	3.0003	3.0005	-350.28	-377.08	-457.50	-457.52	-457.52	-457.53	-370.74
10/15/93	366.20	364.90	364.75	374.50	2.0002	2.0001	2.0002	-366.63	-349.54	-315.37	-315.36	-315.36	-315.36	-376.43
11/15/93	375.70	375.20	374.25	375.45	1.0000	1.0000	1.0000	-375.20	-366.18	-357.15	-357.15	-357.15	-357.15	-376.40
12/15/93		387.40	385.00	376.40				-385.00	-373.30	-373.30	-373.30	-373.30	-373.30	-376.40
					Total CF			-1477.11	-1466.10	-1503.32	-1503.34	-1503.33	-1503.34	-1499.97
Risk-free rate		3.08%			**CFi - CF**			22.86	33.87	-3.35	-3.37	-3.36	-3.37	0.00

Gold

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/93	389.00	-			4.0009	4.0007	4.0010							
01/17/94	392.20	392.20	392.50	388.00	3.0005	3.0003	3.0005	-395.45	-392.23	-382.56	-382.55	-382.56	-382.55	-390.92
02/15/94	385.50	383.80	384.50	389.00	2.0002	2.0001	2.0002	-386.44	-394.88	-411.76	-411.77	-411.77	-411.77	-390.96
03/15/94	387.60	387.60	386.25	389.95	1.0000	1.0000	1.0000	-387.27	-385.17	-383.06	-383.06	-383.06	-383.06	-390.98
04/15/94		377.70	377.25	390.90				-377.25	-387.15	-387.15	-387.15	-387.15	-387.15	-390.90
					Total CF			-1546.41	-1559.43	-1564.53	-1564.53	-1564.53	-1564.53	-1563.76
Risk-free rate		3.11%			**CFi - CF**			17.35	4.34	-0.77	-0.77	-0.77	-0.77	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/94	379.40	-			4.0007	3.9962	4.0017							
05/16/94	383.70	383.70	380.20	378.50	3.0003	2.9981	3.0005	-383.93	-379.59	-366.57	-366.56	-366.58	-366.56	-382.22
06/15/94	389.00	386.80	386.75	379.40	2.0001	1.9994	2.0001	-389.29	-386.17	-379.93	-379.93	-379.94	-379.93	-381.89
07/15/94	386.40	386.40	385.20	380.70	1.0000	1.0000	1.0000	-386.48	-389.09	-391.70	-391.70	-391.70	-391.70	-381.97
08/15/94		377.20	377.35	382.00				-377.35	-386.55	-386.55	-386.55	-386.55	-386.55	-382.00
					Total CF			-1537.06	-1541.41	-1524.75	-1524.74	-1524.77	-1524.74	-1528.08
Risk-free rate		3.92%			**CFi - CF**			-8.98	-13.33	3.33	3.34	3.31	3.34	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/94	379.50	-			4.0004	3.9902	4.0004							
09/15/94	388.90	388.90	388.25	378.00	3.0002	2.9951	3.0002	-392.81	-383.30	-354.77	-354.76	-354.86	-354.76	-382.44
10/17/94	392.10	389.80	389.20	379.50	2.0001	1.9984	2.0001	-392.16	-391.25	-389.43	-389.43	-389.44	-389.43	-382.38
11/15/94	387.40	387.40	386.95	380.95	1.0000	1.0000	1.0000	-388.44	-393.16	-397.88	-397.88	-397.87	-397.88	-382.42
12/15/94		380.20	379.85	382.40				-379.85	-387.05	-387.05	-387.05	-387.05	-387.05	-382.40
					Total CF			-1553.25	-1554.75	-1529.13	-1529.12	-1529.22	-1529.12	-1529.64
Risk-free rate		4.68%			**CFi - CF**			-23.62	-25.12	0.51	0.51	0.42	0.51	0.00

Gold

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/94	382.70	-			4.0001	3.9810	4.0006							
01/16/95	378.30	378.30	377.60	381.00	3.0001	2.9905	3.0002	-383.18	-387.64	-401.04	-401.04	-400.95	-401.04	-386.63
02/15/95	378.60	376.60	376.40	382.70	2.0000	1.9968	2.0000	-380.12	-381.83	-385.27	-385.27	-385.25	-385.27	-386.48
03/15/95	387.20	387.20	386.60	384.70	1.0000	1.0000	1.0000	-388.66	-380.01	-371.37	-371.37	-371.40	-371.37	-386.75
04/17/95		394.10	389.10	386.70				-389.10	-382.20	-382.20	-382.20	-382.20	-382.20	-386.70
					Total CF			-1541.05	-1531.69	-1539.87	-1539.87	-1539.80	-1539.88	-1546.56
Risk-free rate		5.88%			**CFi - CF**			5.50	14.87	6.68	6.68	6.76	6.68	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/95	396.50	-			4.0005	3.9828	4.0010							
05/15/95	385.60	385.60	384.40	395.20	3.0003	2.9914	3.0004	-389.94	-401.00	-434.17	-434.18	-433.98	-434.18	-400.90
06/15/95	393.90	391.70	389.80	396.50	2.0001	1.9971	2.0001	-393.52	-387.36	-375.04	-375.04	-375.10	-375.04	-400.28
07/17/95	389.90	389.90	389.00	398.20	1.0000	1.0000	1.0000	-390.76	-394.78	-398.80	-398.80	-398.78	-398.80	-400.00
08/15/95		385.30	386.60	399.90				-386.60	-391.20	-391.20	-391.20	-391.20	-391.20	-399.90
					Total CF			-1560.82	-1574.34	-1599.21	-1599.22	-1599.06	-1599.22	-1601.08
Risk-free rate		5.68%			**CFi - CF**			40.26	26.74	1.87	1.87	2.02	1.86	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/95	388.00	-			4.0004	3.9840	4.0017							
09/15/95	386.50	386.50	385.65	386.50	3.0002	2.9920	3.0004	-391.00	-392.52	-397.09	-397.09	-397.06	-397.09	-391.87
10/16/95	386.00	383.90	383.95	388.00	2.0001	1.9973	2.0001	-387.46	-390.08	-395.33	-395.33	-395.31	-395.33	-391.54
11/15/95	385.60	385.60	385.75	389.45	1.0000	1.0000	1.0000	-387.51	-387.91	-388.31	-388.31	-388.31	-388.31	-391.22
12/15/95		386.40	386.00	390.90				-386.00	-385.20	-385.20	-385.20	-385.20	-385.20	-390.90
					Total CF			-1551.97	-1555.71	-1565.93	-1565.93	-1565.88	-1565.93	-1565.53
Risk-free rate		5.53%			**CFi - CF**			13.57	9.82	-0.39	-0.39	-0.35	-0.40	0.00

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			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/95	387.60	-			3.9985	3.9832	3.9997							
01/15/96	396.10	396.10	395.20	387.00	2.9992	2.9916	2.9995	-400.57	-391.95	-366.10	-366.12	-366.25	-366.11	-392.26
02/15/96	405.70	403.40	404.35	387.60	1.9998	1.9972	1.9998	-407.96	-400.60	-385.87	-385.87	-385.93	-385.87	-391.06
03/15/96	396.90	396.90	395.45	388.55	1.0000	1.0000	1.0000	-397.27	-406.11	-414.95	-414.95	-414.93	-414.95	-390.34
04/15/96		393.00	392.65	389.50				-392.65	-396.55	-396.55	-396.55	-396.55	-396.55	-389.50
					Total CF			-1598.45	-1595.21	-1563.47	-1563.49	-1563.66	-1563.48	-1563.16
Risk-free rate		5.41%			**CFi - CF**			-35.29	-32.05	-0.32	-0.33	-0.50	-0.32	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/96	395.50	-			4.0003	3.9881	4.0009							
05/15/96	393.50	393.50	392.70	394.00	3.0001	2.9941	3.0003	-397.65	-399.68	-405.75	-405.75	-405.73	-405.75	-398.97
06/17/96	387.30	385.00	384.95	395.50	2.0000	1.9980	2.0000	-388.06	-396.62	-413.76	-413.76	-413.71	-413.76	-398.69
07/15/96	385.70	385.70	383.25	396.60	1.0000	1.0000	1.0000	-384.87	-386.48	-388.08	-388.08	-388.08	-388.08	-398.28
08/15/96		386.60	386.30	397.70				-386.30	-385.40	-385.40	-385.40	-385.40	-385.40	-397.70
					Total CF			-1556.88	-1568.18	-1593.00	-1593.00	-1592.92	-1593.00	-1593.63
Risk-free rate		4.97%			**CFi - CF**			36.76	25.46	0.64	0.64	0.72	0.63	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/96	388.80	-			4.0004	3.9874	4.0018							
09/16/96	382.90	382.90	382.80	387.40	3.0002	2.9937	3.0005	-387.74	-393.71	-411.64	-411.64	-411.57	-411.65	-392.40
10/15/96	383.30	381.50	381.45	388.80	2.0001	1.9979	2.0001	-384.80	-386.21	-389.03	-389.03	-389.02	-389.03	-392.21
11/15/96	381.10	381.10	379.45	390.25	1.0000	1.0000	1.0000	-381.11	-383.32	-385.53	-385.53	-385.52	-385.53	-391.96
12/16/96		368.40	368.85	391.70				-368.85	-381.55	-381.55	-381.55	-381.55	-381.55	-391.70
					Total CF			-1522.49	-1544.79	-1567.75	-1567.76	-1567.66	-1567.76	-1568.26
Risk-free rate		5.14%			**CFi - CF**			45.77	23.47	0.51	0.51	0.60	0.50	0.00

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			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/96	369.90	-			4.0000	3.9876	4.0003							
01/15/97	353.20	353.20	354.25	369.15	3.0000	2.9938	3.0000	-358.58	-375.49	-426.20	-426.20	-425.99	-426.20	-373.66
02/17/97	346.70	346.40	344.25	369.90	2.0000	1.9979	2.0000	-346.91	-353.76	-367.47	-367.47	-367.43	-367.47	-372.76
03/17/97	348.30	348.30	349.35	371.00	1.0000	1.0000	1.0000	-350.72	-349.11	-347.51	-347.51	-347.51	-347.51	-372.46
04/15/97		341.70	341.95	372.10				-341.95	-348.55	-348.55	-348.55	-348.55	-348.55	-372.10
					Total CF			-1398.16	-1426.91	-1489.73	-1489.73	-1489.48	-1489.73	-1490.98
Risk-free rate		4.93%			**CFi - CF**			92.82	64.06	1.25	1.25	1.50	1.25	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/97	343.90	-			4.0006	3.9801	4.0021							
05/15/97	348.40	348.40	346.65	342.50	3.0003	2.9900	3.0006	-351.28	-346.72	-333.04	-333.03	-333.13	-333.03	-347.07
06/16/97	344.80	342.90	341.95	343.90	2.0001	1.9967	2.0001	-344.92	-350.47	-361.56	-361.56	-361.51	-361.57	-346.89
07/15/97	319.00	319.00	320.15	345.20	1.0000	1.0000	1.0000	-321.58	-347.50	-373.41	-373.42	-373.33	-373.42	-346.75
08/15/97		325.70	324.55	346.50				-324.55	-317.85	-317.85	-317.85	-317.85	-317.85	-346.50
					Total CF			-1342.33	-1362.53	-1385.86	-1385.87	-1385.81	-1385.86	-1387.20
Risk-free rate		5.26%			**CFi - CF**			44.87	24.67	1.34	1.34	1.39	1.34	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/97	327.60	-			4.0004	3.9810	4.0017							
09/15/97	323.30	323.30	322.15	326.65	3.0002	2.9905	3.0005	-326.42	-330.78	-343.85	-343.85	-343.76	-343.85	-330.98
10/15/97	328.10	326.10	326.85	327.60	2.0001	1.9968	2.0001	-329.75	-326.92	-321.27	-321.27	-321.30	-321.27	-330.50
11/17/97	304.70	304.70	303.90	328.55	1.0000	1.0000	1.0000	-305.13	-328.63	-352.12	-352.13	-352.05	-352.13	-329.88
12/15/97		284.50	285.45	329.50				-285.45	-305.65	-305.65	-305.65	-305.65	-305.65	-329.50
					Total CF			-1246.75	-1291.98	-1322.89	-1322.90	-1322.76	-1322.90	-1320.87
Risk-free rate		5.28%			**CFi - CF**			74.12	28.89	-2.03	-2.03	-1.90	-2.04	0.00

Gold

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/97	286.40	-			3.9975	3.9754	4.0021							
01/15/98	286.40	286.40	284.35	285.45	2.9988	2.9877	2.9996	-288.01	-288.01	-288.01	-288.01	-288.01	-288.01	-289.12
02/16/98	301.60	300.60	298.25	286.40	1.9996	1.9959	1.9996	-300.72	-286.40	-257.76	-257.78	-257.94	-257.77	-288.77
03/16/98	295.10	295.10	294.25	287.25	1.0000	1.0000	1.0000	-295.51	-302.03	-308.56	-308.56	-308.53	-308.56	-288.48
04/15/98		307.10	307.45	288.10				-307.45	-295.45	-295.45	-295.45	-295.45	-295.45	-288.10
					Total CF			-1191.68	-1171.89	-1149.78	-1149.79	-1149.93	-1149.78	-1154.46
Risk-free rate		5.18%			**CFi - CF**			-37.21	-17.42	4.68	4.67	4.53	4.68	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/98	309.00	-			3.9988	3.9813	3.9813							
05/15/98	301.90	301.90	300.45	308.05	2.9994	2.9906	2.9906	-304.45	-311.65	-333.23	-333.22	-333.10	-333.10	-312.15
06/15/98	286.60	284.60	285.25	309.00	1.9998	1.9969	1.9969	-287.79	-305.25	-340.15	-340.14	-339.99	-339.99	-311.75
07/15/98	294.50	294.50	293.05	310.10	1.0000	1.0000	1.0000	-294.42	-286.48	-278.54	-278.54	-278.57	-278.57	-311.54
08/17/98		285.30	284.55	311.20				-284.55	-293.75	-293.75	-293.75	-293.75	-293.75	-311.20
					Total CF			-1171.21	-1197.12	-1245.68	-1245.66	-1245.40	-1245.40	-1246.65
Risk-free rate		5.14%			**CFi - CF**			75.44	49.53	0.97	0.99	1.25	1.25	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/98	286.70	-			4.0017	3.9844	4.0087							
09/15/98	290.50	290.50	289.70	285.80	3.0008	2.9922	3.0019	-293.36	-289.52	-277.97	-277.96	-278.03	-277.94	-289.41
10/15/98	299.20	297.50	297.85	286.70	2.0003	1.9974	2.0003	-300.37	-293.31	-279.19	-279.19	-279.25	-279.18	-289.13
11/16/98	295.60	295.60	294.85	287.90	1.0000	1.0000	1.0000	-296.03	-299.65	-303.26	-303.26	-303.25	-303.26	-289.06
12/15/98		292.50	292.75	289.10				-292.75	-295.85	-295.85	-295.85	-295.85	-295.85	-289.10
					Total CF			-1182.52	-1178.32	-1156.27	-1156.26	-1156.38	-1156.23	-1156.69
Risk-free rate		5.04%			**CFi - CF**			-25.82	-21.63	0.42	0.43	0.31	0.47	0.00

Gold

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/98	294.30	-			4.0044	3.9923	4.0714							
01/15/99	287.40	287.40	286.25	293.40	3.0021	2.9962	3.0064	-289.42	-296.40	-317.33	-317.36	-317.27	-317.83	-296.65
02/15/99	291.20	290.50	289.50	294.30	2.0007	1.9987	2.0007	-291.60	-288.48	-282.23	-282.23	-282.24	-282.21	-296.43
03/15/99	287.60	287.60	289.85	295.25	1.0000	1.0000	1.0000	-290.95	-294.57	-298.18	-298.18	-298.18	-298.18	-296.37
04/15/99		281.60	282.35	296.20				-282.35	-288.35	-288.35	-288.35	-288.35	-288.35	-296.20
					Total CF			-1154.32	-1167.79	-1186.09	-1186.12	-1186.04	-1186.57	-1185.66
Risk-free rate					**CFi - CF**			31.33	17.87	-0.43	-0.46	-0.39	-0.91	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/99	285.30	-			4.0024	3.9889	4.0054							
05/17/99	276.20	276.20	276.15	284.40	3.0012	2.9944	3.0017	-279.11	-288.30	-315.90	-315.92	-315.79	-315.94	-287.44
06/15/99	261.00	261.10	259.75	285.30	2.0004	1.9981	2.0004	-261.64	-276.85	-307.27	-307.29	-307.19	-307.30	-287.38
07/15/99	254.80	254.80	253.55	286.30	1.0000	1.0000	1.0000	-254.50	-260.72	-266.95	-266.95	-266.94	-266.95	-287.37
08/16/99		261.70	259.20	287.30				-259.20	-252.30	-252.30	-252.30	-252.30	-252.30	-287.30
					Total CF			-1054.45	-1078.18	-1142.41	-1142.46	-1142.22	-1142.49	-1149.49
Risk-free rate		4.27%			**CFi - CF**			95.05	71.32	7.08	7.04	7.28	7.00	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/99	262.00	-			4.0021	3.9894	4.0047							
09/15/99	256.60	256.60	257.35	261.65	3.0010	2.9947	3.0015	-260.43	-265.89	-282.29	-282.30	-282.23	-282.31	-264.78
10/15/99	316.40	314.90	316.30	262.00	2.0003	1.9982	2.0003	-318.83	-260.06	-142.53	-142.47	-142.84	-142.44	-264.10
11/15/99	292.50	292.50	290.75	262.35	1.0000	1.0000	1.0000	-291.89	-315.89	-339.88	-339.89	-339.84	-339.89	-263.38
12/15/99		282.60	282.75	262.70				-282.75	-292.65	-292.65	-292.65	-292.65	-292.65	-262.70
					Total CF			-1153.90	-1134.49	-1057.35	-1057.31	-1057.56	-1057.29	-1054.96
Risk-free rate		4.77%			**CFi - CF**			-98.94	-79.54	-2.39	-2.35	-2.60	-2.34	0.00

Gold

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/99	284.60	-			4.0013	3.9860	5.0E+98							
01/17/00	284.90	284.90	285.40	283.50	3.0006	2.9930	1.5E+31	-289.21	-288.91	-287.99	-287.99	-288.00	1.53E+98	-287.29
02/15/00	304.10	301.70	303.38	284.60	2.0002	1.9977	2.0002	-306.13	-289.18	-255.28	-255.27	-255.39	2.52E+32	-287.18
03/15/00	289.60	289.60	289.25	285.60	1.0000	1.0000	1.0000	-290.64	-305.21	-319.78	-319.79	-319.75	-319.79	-286.98
04/17/00		282.10	281.95	286.60				-281.95	-289.45	-289.45	-289.45	-289.45	-289.45	-286.60
					Total CF			-1167.94	-1172.75	-1152.51	-1152.50	-1152.59	1.53E+98	-1148.05
Risk-free rate		5.32%			**CFi - CF**			-19.89	-24.71	-4.46	-4.45	-4.55	1.53E+98	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/00	284.20	-			4.0006	3.9820	5.6E+81							
05/15/00	276.40	276.40	275.50	283.15	3.0003	2.9910	3.8E+25	-279.56	-287.47	-311.22	-311.22	-311.07	-4.47E+82	-287.32
06/15/00	292.10	289.60	288.75	284.20	2.0001	1.9970	2.0001	-291.56	-278.23	-251.58	-251.57	-251.70	5.06E+26	-286.97
07/17/00	284.20	284.20	282.45	285.50	1.0000	1.0000	1.0000	-283.75	-291.69	-299.63	-299.63	-299.60	-299.63	-286.82
08/15/00		274.60	274.65	286.80				-274.65	-284.25	-284.25	-284.25	-284.25	-284.25	-286.80
					Total CF			-1129.52	-1141.65	-1146.67	-1146.67	-1146.62	-4.47E+82	-1147.91
Risk-free rate		5.80%			**CFi - CF**			18.38	6.26	1.24	1.23	1.28	-4.47E+82	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/00	276.70	-			4.0008	3.9802	4.0042							
09/15/00	273.00	273.00	272.40	280.60	3.0004	2.9901	3.0010	-276.66	-280.41	-291.69	-291.69	-291.61	-291.70	-284.99
10/16/00	273.90	271.50	271.80	276.70	2.0001	1.9967	2.0001	-274.59	-276.11	-279.14	-279.14	-279.12	-279.14	-279.54
11/15/00	265.60	265.60	264.95	278.15	1.0000	1.0000	1.0000	-266.31	-274.65	-282.99	-282.99	-282.97	-282.99	-279.58
12/15/00		270.40	270.20	279.60				-270.20	-265.40	-265.40	-265.40	-265.40	-265.40	-279.60
					Total CF			-1087.76	-1096.57	-1119.22	-1119.23	-1119.10	-1119.24	-1123.70
Risk-free rate		6.22%			**CFi - CF**			35.95	27.13	4.48	4.48	4.60	4.47	0.00

Gold

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/00	272.90	-			4.0019	3.9813	4.0445							
01/15/01	264.60	264.60	263.60	271.65	3.0010	2.9906	3.0052	-267.51	-275.93	-301.20	-301.21	-301.04	-301.57	-275.68
02/15/01	256.90	255.10	258.45	272.90	2.0003	1.9969	2.0003	-260.97	-270.56	-289.75	-289.76	-289.66	-289.80	-275.56
03/15/01	260.30	260.30	261.65	274.15	1.0000	1.0000	1.0000	-263.01	-259.59	-256.17	-256.17	-256.18	-256.17	-275.57
04/16/01		263.30	260.05	275.40				-260.05	-257.05	-257.05	-257.05	-257.05	-257.05	-275.40
					Total CF			-1051.53	-1063.13	-1104.17	-1104.19	-1103.93	-1104.59	-1102.21
Risk-free rate		5.90%			**CFi - CF**			50.67	39.08	-1.96	-1.98	-1.72	-2.38	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/16/01	264.00	-			4.0021	3.9902	4.0026							
05/15/01	268.50	268.50	267.35	263.50	3.0010	2.9951	3.0011	-269.92	-265.38	-251.75	-251.74	-251.79	-251.74	-266.04
06/15/01	272.30	271.20	271.60	264.00	2.0003	1.9984	2.0003	-273.33	-270.61	-265.18	-265.18	-265.19	-265.18	-265.68
07/16/01	267.40	267.40	267.70	264.70	1.0000	1.0000	1.0000	-268.54	-273.45	-278.37	-278.37	-278.36	-278.37	-265.53
08/15/01		275.70	275.20	265.40				-275.20	-266.90	-266.90	-266.90	-266.90	-266.90	-265.40
					Total CF			-1086.99	-1076.35	-1062.20	-1062.19	-1062.25	-1062.18	-1062.65
Risk-free rate		3.80%			**CFi - CF**			-24.34	-13.70	0.45	0.46	0.40	0.46	0.00

			Futures					Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/01	277.00	-			4.0010	3.9934	4.0013							
09/17/01	290.30	290.30	289.50	276.20	3.0005	2.9967	3.0006	-291.96	-278.55	-238.31	-238.30	-238.40	-238.29	-278.55
10/15/01	285.70	284.90	282.25	277.00	2.0002	1.9989	2.0002	-283.91	-289.34	-300.21	-300.21	-300.19	-300.21	-278.63
11/15/01	275.00	275.00	275.30	277.65	1.0000	1.0000	1.0000	-276.12	-286.85	-297.59	-297.59	-297.57	-297.59	-278.48
12/17/01		277.70	278.00	278.30				-278.00	-275.30	-275.30	-275.30	-275.30	-275.30	-278.30
					Total CF			-1130.00	-1130.05	-1111.40	-1111.39	-1111.46	-1111.39	-1113.96
Risk-free rate		3.40%			**CFi - CF**			-16.04	-16.09	2.56	2.57	2.50	2.57	0.00

Table C.13-- Yen

(StDev of SCY)/(StDev of each strategy) =								*0.0321*	*0.0506*	*0.9997*	*1.0000*	*0.9719*	*1.0000*
				Futures				Net Cash Flows					
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/16/91	0.7754			0.7789	3.9992	4.0173	3.9992							
01/15/92	0.7750	0.7750	0.7770	0.7777	2.9996	3.0086	2.9996	-0.79	-0.79	-0.79	-0.79	-0.79	-0.79	-0.79
02/17/92	0.7818	0.7818	0.7877	0.7766	1.9999	2.0029	1.9999	-0.79	-0.79	-0.77	-0.77	-0.77	-0.77	-0.78
03/16/92	0.7459	0.7457	0.7474	0.7754	1.0000	1.0000	1.0000	-0.75	-0.79	-0.82	-0.82	-0.82	-0.82	-0.78
04/15/92		0.7490	0.7498	0.7742				-0.75	-0.75	-0.75	-0.75	-0.75	-0.75	-0.77
					Total CF			-3.08	-3.10	-3.13	-3.13	-3.13	-3.13	-3.12
Risk-free rate		4.29%			**CFi - CF**			0.04	0.02	-0.01	-0.01	-0.01	-0.01	0.00

				Futures				Net Cash Flows					
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/92	0.7487			0.7498	3.9992	4.0155	3.9992							
05/15/92	0.7700	0.7700	0.7695	0.7494	2.9996	3.0078	2.9996	-0.78	-0.76	-0.69	-0.69	-0.69	-0.69	-0.76
06/15/92	0.7878	0.7894	0.7875	0.7490	1.9999	2.0026	1.9999	-0.79	-0.77	-0.73	-0.73	-0.73	-0.73	-0.75
07/15/92	0.7981	0.7981	0.7991	0.7487	1.0000	1.0000	1.0000	-0.80	-0.79	-0.78	-0.78	-0.78	-0.78	-0.75
08/17/92		0.7951	0.7955	0.7485				-0.80	-0.80	-0.80	-0.80	-0.80	-0.80	-0.75
				0.7482										
					Total CF			-3.17	-3.12	-3.00	-3.00	-3.00	-3.00	-3.01
Risk-free rate		3.67%			**CFi - CF**			-0.16	-0.11	0.01	0.01	0.01	0.01	0.00

				Futures				Net Cash Flows					
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/92	0.7951				3.9992	4.0208	3.9992							
09/14/92	0.8020	0.8020	0.8054	0.7951	2.9996	3.0104	2.9996	-0.81	-0.80	-0.78	-0.78	-0.78	-0.78	-0.80
10/15/92	0.8309	0.8309	0.8307	0.7949	1.9999	2.0035	1.9999	-0.84	-0.81	-0.75	-0.75	-0.75	-0.75	-0.80
11/16/92	0.8014	0.8014	0.8013	0.7946	1.0000	1.0000	1.0000	-0.80	-0.83	-0.86	-0.86	-0.86	-0.86	-0.80
12/14/92		0.8078	0.8081	0.7944				-0.81	-0.80	-0.80	-0.80	-0.80	-0.80	-0.79
					Total CF			-3.26	-3.25	-3.20	-3.20	-3.20	-3.20	-3.19
Risk-free rate		3.16%			**CFi - CF**			-0.07	-0.05	0.00	0.00	0.00	0.00	0.00

Yen

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/14/92	0.8112			0.8078	4.0001	4.0199	4.0001							
01/15/93	0.7925	0.7925	0.7933	0.8079	3.0001	3.0099	3.0001	-0.80	-0.82	-0.88	-0.88	-0.88	-0.88	-0.81
02/15/93	0.8289	0.8289	0.8265	0.8080	2.0000	2.0033	2.0000	-0.83	-0.79	-0.72	-0.72	-0.72	-0.72	-0.81
03/15/93	0.8440	0.8449	0.8439	0.8081	1.0000	1.0000	1.0000	-0.85	-0.83	-0.81	-0.81	-0.81	-0.81	-0.81
04/15/93		0.8832	0.8826	0.8082				-0.88	-0.84	-0.84	-0.84	-0.84	-0.84	-0.81
					Total CF			-3.36	-3.29	-3.25	-3.25	-3.25	-3.25	-3.25
Risk-free rate		3.32%			**CFi - CF**			-0.11	-0.04	-0.01	-0.01	-0.01	-0.01	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/93	0.8832			0.8826	4.0001	4.0260	4.0001							
05/17/93	0.9020	0.9020	0.8981	0.8829	3.0001	3.0130	3.0001	-0.90	-0.89	-0.83	-0.83	-0.83	-0.83	-0.89
06/11/93	0.9426	0.9423	0.9430	0.8832	2.0000	2.0043	2.0000	-0.95	-0.91	-0.83	-0.83	-0.83	-0.83	-0.89
07/15/93	0.9245	0.9245	0.9235	0.8832	1.0000	1.0000	1.0000	-0.93	-0.94	-0.96	-0.96	-0.96	-0.96	-0.89
08/16/93		0.9849	0.9862	0.8832				-0.99	-0.93	-0.93	-0.93	-0.93	-0.93	-0.88
				0.8832										
					Total CF			-3.76	-3.66	-3.54	-3.54	-3.54	-3.54	-3.55
Risk-free rate		2.94%			**CFi - CF**			-0.22	-0.12	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/93	0.9849				4.0002	4.0250	4.0002							
09/13/95	0.9424	0.9377	0.9430	0.9849	3.0001	3.0125	3.0001	-0.89	-0.94	-1.07	-1.07	-1.07	-1.07	-0.93
10/15/93	0.9341	0.9341	0.9350	0.9852	2.0000	2.0042	2.0000	-0.94	-0.95	-0.96	-0.96	-0.96	-0.96	-0.99
11/15/93	0.9376	0.9376	0.9408	0.9855	1.0000	1.0000	1.0000	-0.94	-0.94	-0.94	-0.94	-0.94	-0.94	-0.99
12/13/93		0.9178	0.9179	0.9857				-0.92	-0.94	-0.94	-0.94	-0.94	-0.94	-0.99
					Total CF			-3.69	-3.76	-3.91	-3.91	-3.91	-3.91	-3.90
Risk-free rate		3.08%			**CFi - CF**			0.20	0.13	-0.01	-0.01	-0.02	-0.01	0.00

Yen

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/13/93	0.9200			0.9178	4.0000	4.0265	4.0000							
01/17/94	0.9000	0.9000	0.9003	0.9185	3.0000	3.0132	3.0000	-0.91	-0.93	-0.99	-0.99	-0.99	-0.99	-0.93
02/15/94	0.9701	0.9701	0.9699	0.9193	2.0000	2.0044	2.0000	-0.97	-0.90	-0.76	-0.76	-0.76	-0.76	-0.92
03/14/94	0.9450	0.9451	0.9445	0.9200	1.0000	1.0000	1.0000	-0.95	-0.97	-1.00	-1.00	-1.00	-1.00	-0.92
04/15/94		0.9688	0.9648	0.9207				-0.96	-0.94	-0.94	-0.94	-0.94	-0.94	-0.92
					Total CF			-3.79	-3.74	-3.69	-3.69	-3.69	-3.69	-3.69
Risk-free rate		3.11%			**CFi - CF**			-0.10	-0.05	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/94	0.9688			0.9648	4.0001	4.0245	4.0001							
05/16/94	0.9555	0.9555	0.9562	0.9668	3.0001	3.0122	3.0001	-0.97	-0.98	-1.02	-1.02	-1.02	-1.02	-0.98
06/13/94	0.9778	0.9705	0.9695	0.9688	2.0000	2.0041	2.0000	-0.98	-0.96	-0.93	-0.93	-0.93	-0.93	-0.98
07/15/94	1.0260	1.0260	1.0214	0.9706	1.0000	1.0000	1.0000	-1.02	-0.98	-0.93	-0.93	-0.93	-0.93	-0.97
08/15/94		1.0013	0.9974	0.9725				-1.00	-1.02	-1.02	-1.02	-1.02	-1.02	-0.97
				0.9743										
					Total CF			-3.96	-3.94	-3.90	-3.90	-3.90	-3.90	-3.90
Risk-free rate		3.92%			**CFi - CF**			-0.07	-0.04	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/94	1.0013				3.9999	4.0195	3.9999							
09/15/94	1.0127	1.0061	1.0062	1.0013	2.9999	3.0097	2.9999	-1.02	-1.01	-1.00	-1.00	-1.00	-1.00	-1.01
10/17/94	1.0298	1.0298	1.0220	1.0037	2.0000	2.0032	2.0000	-1.03	-1.01	-0.98	-0.98	-0.98	-0.98	-1.01
11/15/94	1.0155	1.0155	1.0181	1.0068	1.0000	1.0000	1.0000	-1.02	-1.04	-1.05	-1.05	-1.05	-1.05	-1.01
12/15/94		0.9965	0.9969	1.0084				-1.00	-1.02	-1.02	-1.02	-1.02	-1.02	-1.01
					Total CF			-4.07	-4.08	-4.04	-4.04	-4.04	-4.04	-4.04
Risk-free rate		4.68%			**CFi - CF**			-0.02	-0.03	0.00	0.00	0.00	0.00	0.00

Yen

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/94	1.0074			0.9965	4.0000	4.0110	4.0000							
01/16/95	1.0208	1.0208	1.0191	0.9996	3.0000	3.0055	3.0000	-1.03	-1.02	-0.98	-0.98	-0.98	-0.98	-1.01
02/15/95	1.0199	1.0199	1.0162	1.0026	2.0000	2.0018	2.0000	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03	-1.01
03/13/95	1.1129	1.1101	1.1083	1.0057	1.0000	1.0000	1.0000	-1.11	-1.02	-0.93	-0.93	-0.93	-0.93	-1.01
04/17/95		1.2288	1.2184	1.0088				-1.22	-1.10	-1.10	-1.10	-1.10	-1.10	-1.01
					Total CF			-4.39	-4.17	-4.04	-4.04	-4.04	-4.04	-4.05
Risk-free rate		5.88%			**CFi - CF**			-0.35	-0.13	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/95	1.2288			1.2184	3.9998	4.0187	3.9998							
05/15/95	1.1608	1.1608	1.1521	1.2236	2.9999	3.0093	2.9999	-1.17	-1.24	-1.44	-1.44	-1.45	-1.44	-1.24
06/15/95	1.1961	1.1819	1.1792	1.2288	2.0000	2.0031	2.0000	-1.19	-1.17	-1.13	-1.13	-1.13	-1.13	-1.24
07/17/95	1.1363	1.1363	1.1255	1.2339	1.0000	1.0000	1.0000	-1.13	-1.19	-1.25	-1.25	-1.25	-1.25	-1.24
08/15/95		1.0364	1.0340	1.2390				-1.03	-1.13	-1.13	-1.13	-1.13	-1.13	-1.24
				1.2441										
					Total CF			-4.52	-4.73	-4.96	-4.96	-4.96	-4.96	-4.96
Risk-free rate		5.68%			**CFi - CF**			0.44	0.23	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/95	1.0364				4.0002	4.0137	4.0002							
09/15/95	0.9748	0.9618	0.9647	1.0364	3.0001	3.0069	3.0001	-0.98	-1.05	-1.28	-1.28	-1.28	-1.28	-1.05
10/16/95	1.0042	1.0042	0.9970	1.0408	2.0000	2.0023	2.0000	-1.01	-0.98	-0.92	-0.92	-0.92	-0.92	-1.05
11/15/95	0.9916	0.9916	0.9898	1.0466	1.0000	1.0000	1.0000	-0.99	-1.01	-1.02	-1.02	-1.02	-1.02	-1.05
12/15/95		0.9794	0.9793	1.0495				-0.98	-0.99	-0.99	-0.99	-0.99	-0.99	-1.05
					Total CF			-3.96	-4.03	-4.21	-4.21	-4.21	-4.21	-4.20
Risk-free rate		5.53%			**CFi - CF**			0.24	0.17	-0.01	-0.01	-0.01	-0.01	0.00

Yen

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/95	0.9928			0.9794	4.0003	4.0076	4.0003							
01/15/96	0.9592	0.9592	0.9506	0.9839	3.0001	3.0038	3.0001	-0.96	-1.00	-1.10	-1.10	-1.10	-1.10	-1.00
02/15/96	0.9502	0.9502	0.9424	0.9883	2.0000	2.0013	2.0000	-0.95	-0.96	-0.98	-0.98	-0.98	-0.98	-1.00
03/15/96	0.9567	0.9451	0.9443	0.9928	1.0000	1.0000	1.0000	-0.95	-0.95	-0.96	-0.96	-0.96	-0.96	-1.00
04/15/96		0.9291	0.9227	0.9973				-0.92	-0.95	-0.95	-0.95	-0.95	-0.95	-1.00
					Total CF			-3.79	-3.86	-3.99	-3.99	-3.99	-3.99	-3.99
Risk-free rate		5.41%			**CFi - CF**			0.20	0.13	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/96	0.9291			0.9227	4.0003	4.0052	4.0003							
05/15/96	0.9392	0.9392	0.9358	0.9259	3.0002	3.0026	3.0002	-0.95	-0.94	-0.91	-0.91	-0.91	-0.91	-0.94
06/17/96	0.9290	0.9184	0.9187	0.9291	2.0001	2.0009	2.0001	-0.93	-0.95	-0.99	-0.99	-0.99	-0.99	-0.94
07/15/96	0.9146	0.9146	0.9064	0.9328	1.0000	1.0000	1.0000	-0.91	-0.92	-0.94	-0.94	-0.94	-0.94	-0.94
08/15/96		0.9298	0.9266	0.9366				-0.93	-0.91	-0.91	-0.91	-0.91	-0.91	-0.94
				0.9403										
					Total CF			-3.71	-3.72	-3.75	-3.75	-3.75	-3.75	-3.75
Risk-free rate		4.97%			**CFi - CF**			0.04	0.03	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/96	0.9298				4.0003	4.0038	4.0003							
09/16/96	0.9191	0.9053	0.9061	0.9298	3.0002	3.0019	3.0002	-0.92	-0.94	-1.02	-1.02	-1.02	-1.02	-0.94
10/15/96	0.8987	0.8987	0.8904	0.9337	2.0001	2.0006	2.0001	-0.90	-0.92	-0.96	-0.96	-0.96	-0.96	-0.94
11/15/96	0.9038	0.9038	0.9001	0.9388	1.0000	1.0000	1.0000	-0.90	-0.90	-0.89	-0.89	-0.89	-0.89	-0.94
12/16/96		0.8784	0.8768	0.9414				-0.88	-0.90	-0.90	-0.90	-0.90	-0.90	-0.94
					Total CF			-3.60	-3.66	-3.77	-3.77	-3.77	-3.77	-3.77
Risk-free rate		5.14%			**CFi - CF**			0.17	0.11	-0.01	-0.01	-0.01	-0.01	0.00

Yen

Date	Enter	Unwind	Spot	Futures Curve	SCY	RSK	APX	Net Cash Flows Spot	Rollover	Stacked	SCY	RSK	APX	Standard
12/16/96	0.8893			0.8784	4.0004	4.0027	4.0004							
01/15/97	0.8634	0.8634	0.8537	0.8817	3.0002	3.0013	3.0002	-0.86	-0.89	-0.97	-0.97	-0.97	-0.97	-0.89
02/17/97	0.8082	0.8082	0.8036	0.8850	2.0001	2.0004	2.0001	-0.81	-0.87	-0.98	-0.98	-0.98	-0.98	-0.89
03/17/97	0.8192	0.8091	0.8085	0.8883	1.0000	1.0000	1.0000	-0.81	-0.81	-0.81	-0.81	-0.81	-0.81	-0.89
04/15/97		0.8003	0.7915	0.8916				-0.79	-0.81	-0.81	-0.81	-0.81	-0.81	-0.89
					Total CF			-3.28	-3.38	-3.57	-3.57	-3.57	-3.57	-3.57
Risk-free rate		4.93%			**CFi - CF**			0.29	0.19	0.00	0.00	0.00	0.00	0.00

Date	Enter	Unwind	Spot	Futures Curve	SCY	RSK	APX	Net Cash Flows Spot	Rollover	Stacked	SCY	RSK	APX	Standard
04/15/97	0.8003			0.7915	4.0004	3.9945	4.0004							
05/15/97	0.8665	0.8665	0.8613	0.7959	3.0002	2.9972	3.0002	-0.87	-0.81	-0.60	-0.60	-0.60	-0.60	-0.81
06/16/97	0.8932	0.8808	0.8814	0.8003	2.0001	1.9991	2.0001	-0.89	-0.87	-0.85	-0.85	-0.85	-0.85	-0.81
07/15/97	0.8732	0.8732	0.8659	0.8040	1.0000	1.0000	1.0000	-0.87	-0.89	-0.91	-0.91	-0.91	-0.91	-0.81
08/15/97		0.8519	0.8543	0.8077				-0.85	-0.88	-0.88	-0.88	-0.88	-0.88	-0.81
				0.8114										
					Total CF			-3.49	-3.45	-3.24	-3.24	-3.24	-3.24	-3.23
Risk-free rate		5.26%			**CFi - CF**			-0.26	-0.22	-0.01	-0.01	-0.01	-0.01	0.00

Date	Enter	Unwind	Spot	Futures Curve	SCY	RSK	APX	Net Cash Flows Spot	Rollover	Stacked	SCY	RSK	APX	Standard
08/15/97	0.8519				4.0002	3.9974	4.0002							
09/15/97	0.8421	0.8318	0.8314	0.8519	3.0001	2.9987	3.0001	-0.84	-0.86	-0.92	-0.92	-0.92	-0.92	-0.86
10/15/97	0.8324	0.8324	0.8237	0.8556	2.0000	1.9996	2.0000	-0.83	-0.84	-0.86	-0.86	-0.86	-0.86	-0.86
11/17/97	0.7987	0.7987	0.7951	0.8605	1.0000	1.0000	1.0000	-0.80	-0.83	-0.87	-0.87	-0.87	-0.87	-0.86
12/15/97		0.7648	0.7646	0.8630				-0.76	-0.80	-0.80	-0.80	-0.80	-0.80	-0.86
					Total CF			-3.24	-3.33	-3.45	-3.45	-3.45	-3.45	-3.45
Risk-free rate		5.28%			**CFi - CF**			0.22	0.12	0.00	0.00	0.00	0.00	0.00

Yen

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/97	0.7757			0.7648	4.0004	3.9921	4.0004							
01/15/98	0.7774	0.7774	0.7660	0.7684	3.0002	2.9960	3.0002	-0.78	-0.77	-0.77	-0.77	-0.77	-0.77	-0.78
02/16/98	0.8018	0.8018	0.7934	0.7721	2.0001	1.9987	2.0001	-0.80	-0.78	-0.73	-0.73	-0.73	-0.73	-0.78
03/16/98	0.7807	0.7719	0.7713	0.7757	1.0000	1.0000	1.0000	-0.77	-0.80	-0.83	-0.83	-0.83	-0.83	-0.78
04/15/98		0.7755	0.7732	0.7793				-0.77	-0.78	-0.78	-0.78	-0.78	-0.78	-0.78
					Total CF			-3.12	-3.13	-3.11	-3.11	-3.11	-3.11	-3.12
Risk-free rate		5.18%			**CFi - CF**			-0.01	-0.02	0.01	0.01	0.01	0.01	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/98	0.7755			0.7732	4.0003	3.9914	4.0003							
05/15/98	0.7464	0.7464	0.7458	0.7744	3.0001	2.9957	3.0001	-0.76	-0.79	-0.87	-0.87	-0.87	-0.87	-0.78
06/15/98	0.6929	0.6837	0.6834	0.7755	2.0000	1.9986	2.0000	-0.69	-0.75	-0.88	-0.88	-0.88	-0.88	-0.78
07/15/98	0.7179	0.7179	0.7121	0.7789	1.0000	1.0000	1.0000	-0.72	-0.69	-0.67	-0.67	-0.67	-0.67	-0.78
08/17/98		0.6880	0.6856	0.7822				-0.69	-0.72	-0.72	-0.72	-0.72	-0.72	-0.78
				0.7856										
					Total CF			-2.85	-2.94	-3.13	-3.13	-3.13	-3.13	-3.13
Risk-free rate		5.14%			**CFi - CF**			0.29	0.19	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/17/98	0.6880				4.0003	3.9927	4.0003							
09/14/98	0.7646	0.7497	0.7516	0.6880	3.0001	2.9964	3.0001	-0.76	-0.70	-0.51	-0.51	-0.51	-0.51	-0.70
10/15/98	0.8567	0.8567	0.8527	0.6910	2.0000	1.9988	2.0000	-0.86	-0.77	-0.58	-0.58	-0.58	-0.58	-0.70
11/16/98	0.8348	0.8348	0.8348	0.6949	1.0000	1.0000	1.0000	-0.84	-0.86	-0.88	-0.88	-0.88	-0.88	-0.70
12/14/98		0.8660	0.8664	0.6969				-0.87	-0.84	-0.84	-0.84	-0.84	-0.84	-0.70
					Total CF			-3.33	-3.16	-2.81	-2.81	-2.81	-2.81	-2.79
Risk-free rate		5.04%			**CFi - CF**			-0.54	-0.37	-0.02	-0.02	-0.02	-0.02	0.00

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				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/14/98	0.8770			0.8660	4.0004	3.9990	4.0004							
01/15/99	0.8836	0.8836	0.8784	0.8697	3.0002	2.9995	3.0002	-0.89	-0.88	-0.86	-0.86	-0.86	-0.86	-0.88
02/15/99	0.8767	0.8767	0.8656	0.8733	2.0001	1.9998	2.0001	-0.87	-0.88	-0.89	-0.89	-0.89	-0.89	-0.88
03/15/99	0.8599	0.8467	0.8470	0.8770	1.0000	1.0000	1.0000	-0.85	-0.88	-0.91	-0.91	-0.91	-0.91	-0.88
04/15/99		0.8483	0.8396	0.8807				-0.84	-0.85	-0.85	-0.85	-0.85	-0.85	-0.88
					Total CF			-3.45	-3.49	-3.52	-3.52	-3.52	-3.52	-3.52
					CFi - CF			0.07	0.03	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/15/99	0.8483			0.8396	4.0004	3.9983	4.0004							
05/17/99	0.8132	0.8132	0.8120	0.8440	3.0002	2.9992	3.0002	-0.82	-0.86	-0.96	-0.96	-0.96	-0.96	-0.85
06/14/99	0.8399	0.8303	0.8306	0.8483	2.0001	1.9997	2.0001	-0.84	-0.82	-0.79	-0.79	-0.79	-0.79	-0.85
07/15/99	0.8346	0.8346	0.8306	0.8518	1.0000	1.0000	1.0000	-0.83	-0.84	-0.84	-0.84	-0.84	-0.84	-0.85
08/16/99		0.8755	0.8715	0.8553				-0.87	-0.83	-0.83	-0.83	-0.83	-0.83	-0.86
				0.8588										
					Total CF			-3.36	-3.35	-3.42	-3.42	-3.42	-3.42	-3.42
Risk-free rate		4.27%			**CFi - CF**			0.06	0.07	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/16/99	0.8755				4.0005	3.9970	4.0005							
09/13/99	0.9521	0.9400	0.9415	0.8755	3.0002	2.9985	3.0002	-0.95	-0.89	-0.69	-0.69	-0.69	-0.69	-0.89
10/15/99	0.9578	0.9578	0.9469	0.8795	2.0001	1.9995	2.0001	-0.95	-0.95	-0.94	-0.94	-0.94	-0.94	-0.89
11/15/99	0.9573	0.9573	0.9528	0.8848	1.0000	1.0000	1.0000	-0.96	-0.96	-0.96	-0.96	-0.96	-0.96	-0.89
12/13/99		0.9691	0.9693	0.8874				-0.97	-0.96	-0.96	-0.96	-0.96	-0.96	-0.89
					Total CF			-3.83	-3.75	-3.54	-3.54	-3.54	-3.54	-3.55
Risk-free rate		4.77%			**CFi - CF**			-0.28	-0.20	0.00	0.00	0.00	0.00	0.00

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				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/13/99	0.9835			0.9691	4.0008	3.9983	4.0008							
01/17/00	0.9547	0.9547	0.9543	0.9739	3.0004	2.9992	3.0004	-0.97	-1.00	-1.08	-1.08	-1.08	-1.08	-0.99
02/15/00	0.9204	0.9204	0.9198	0.9787	2.0001	1.9997	2.0001	-0.93	-0.96	-1.03	-1.03	-1.03	-1.03	-0.99
03/13/00	0.9626	0.9527	0.9491	0.9835	1.0000	1.0000	1.0000	-0.95	-0.92	-0.89	-0.89	-0.89	-0.89	-0.99
04/17/00		0.9692	0.9592	0.9883				-0.96	-0.95	-0.95	-0.95	-0.95	-0.95	-0.99
					Total CF			-3.81	-3.83	-3.96	-3.96	-3.96	-3.96	-3.95
Risk-free rate		5.32%			**CFi - CF**			0.14	0.12	-0.01	-0.01	-0.01	-0.01	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/17/00	0.9692			0.9592	4.0005	3.9929	4.0005							
05/15/00	0.9186	0.9186	0.9133	0.9642	3.0002	2.9965	3.0002	-0.93	-0.98	-1.13	-1.13	-1.13	-1.13	-0.98
06/15/00	0.9541	0.9383	0.9392	0.9692	2.0001	1.9988	2.0001	-0.95	-0.93	-0.89	-0.89	-0.89	-0.89	-0.98
07/17/00	0.9332	0.9332	0.9222	0.9743	1.0000	1.0000	1.0000	-0.93	-0.95	-0.97	-0.97	-0.97	-0.97	-0.98
08/15/00		0.9216	0.9171	0.9795				-0.92	-0.93	-0.93	-0.93	-0.93	-0.93	-0.98
				0.9846										
					Total CF			-3.72	-3.78	-3.92	-3.92	-3.92	-3.92	-3.92
Risk-free rate		5.80%			**CFi - CF**			0.20	0.13	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/00	0.9216				4.0010	3.9900	4.0010							
09/15/00	0.9468	0.9322	0.9331	0.9216	3.0005	2.9950	3.0005	-0.95	-0.94	-0.90	-0.90	-0.90	-0.90	-0.94
10/16/00	0.9351	0.9351	0.9234	0.9266	2.0002	1.9983	2.0002	-0.93	-0.94	-0.97	-0.97	-0.97	-0.97	-0.94
11/15/00	0.9234	0.9234	0.9206	0.9332	1.0000	1.0000	1.0000	-0.93	-0.94	-0.95	-0.95	-0.95	-0.95	-0.94
12/15/00		0.8889	0.8898	0.9365				-0.89	-0.92	-0.92	-0.92	-0.92	-0.92	-0.94
					Total CF			-3.70	-3.74	-3.75	-3.75	-3.75	-3.75	-3.75
Risk-free rate		6.22%			**CFi - CF**			0.05	0.00	0.00	0.00	0.00	0.00	0.00

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				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
12/15/00	0.9019			0.8889	4.0010	3.9894	4.0010							
01/15/01	0.8533	0.8533	0.8408	0.8932	3.0005	2.9947	3.0005	-0.85	-0.90	-1.05	-1.05	-1.05	-1.05	-0.91
02/15/01	0.8687	0.8687	0.8642	0.8976	2.0002	1.9982	2.0002	-0.87	-0.86	-0.83	-0.83	-0.83	-0.83	-0.91
03/15/01	0.8270	0.8174	0.8210	0.9019	1.0000	1.0000	1.0000	-0.83	-0.88	-0.93	-0.93	-0.93	-0.93	-0.91
04/16/01		0.8109	0.8028	0.9062				-0.80	-0.82	-0.82	-0.82	-0.82	-0.82	-0.91
					Total CF			-3.35	-3.46	-3.62	-3.62	-3.62	-3.62	-3.63
Risk-free rate		5.90%			**CFi - CF**			0.27	0.17	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
04/16/01	0.8109			0.8028	4.0006	3.9964	4.0006							
05/15/01	0.8130	0.8130	0.8105	0.8069	3.0003	2.9982	3.0003	-0.82	-0.82	-0.81	-0.81	-0.81	-0.81	-0.81
06/15/01	0.8200	0.8124	0.8179	0.8109	2.0001	1.9994	2.0001	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82	-0.82
07/16/01	0.8023	0.8023	0.7977	0.8139	1.0000	1.0000	1.0000	-0.80	-0.82	-0.84	-0.84	-0.84	-0.84	-0.82
08/15/01		0.8387	0.8338	0.8168				-0.83	-0.80	-0.80	-0.80	-0.80	-0.80	-0.82
				0.8198										
					Total CF			-3.28	-3.26	-3.27	-3.27	-3.27	-3.27	-3.26
Risk-free rate		3.80%			**CFi - CF**			-0.01	0.01	0.00	0.00	0.00	0.00	0.00

				Futures				Net Cash Flows						
Date	**Enter**	**Unwind**	**Spot**	**Curve**	**SCY**	**RSK**	**APX**	**Spot**	**Rollover**	**Stacked**	**SCY**	**RSK**	**APX**	**Standard**
08/15/01	0.8387				4.0004	3.9980	4.0004							
09/17/01	0.8574	0.8535	0.8490	0.8387	3.0002	2.9990	3.0002	-0.86	-0.84	-0.80	-0.80	-0.80	-0.80	-0.85
10/15/01	0.8302	0.8302	0.8260	0.8411	2.0001	1.9997	2.0001	-0.83	-0.86	-0.91	-0.91	-0.91	-0.91	-0.85
11/15/01	0.8182	0.8182	0.8160	0.8443	1.0000	1.0000	1.0000	-0.82	-0.83	-0.84	-0.84	-0.84	-0.84	-0.85
12/17/01		0.7838	0.7830	0.8459				-0.78	-0.82	-0.82	-0.82	-0.82	-0.82	-0.85
					Total CF			-3.29	-3.35	-3.37	-3.37	-3.37	-3.37	-3.38
Risk-free rate		3.40%			**CFi - CF**			0.10	0.04	0.02	0.02	0.02	0.02	0.00