



UNIVERSITETET I AGDER

**Testing momentum and simple moving average strategies  
in precious metal's, equity indices and currency markets**

**Anders Braathen**

**Supervisor**

**Valeriy Zakamulin**

This Masters Thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

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Faculty of Economics and Social Sciences

Department of Economics and Business Administration

## **Abstract**

This study examines whether technical analysis using the time-series momentum (MOM) and simple moving average (SMA) rules can be implemented in 4 precious metal's, 4 equity indices and 12 currency markets, to outperform a passive buy and hold strategy. The results show that technical analysis and the strategies tested, performed very well on in-sample data for the total period from 1970 to 2012, and out-performed the buy and hold strategy with both higher return's and lower risk. Of the assets tested, the strategies worked best on precious metal's and equity indices, with good but poorer results for the currency pairs. The performance of testing the precious metal's in three sub sets, revealed that the extraordinary performance of the metal's in the 70's and in the last decade, would have been less impressive had a portfolio been actively traded in the time period from 1980-2000. However, note that palladium was the exception and delivered extraordinary results also in this time period.

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# 1 Introduction

Technical analysis is considered by many to be the original form of investment analysis, dating back to the 1800's. It came into widespread use before the period of extensive and fully disclosed financial information, which in turn enabled the practice of fundamental analysis to develop. Traders can arguably save a lot of time when analyzing companies if they use technical analysis to determine if a company has potential and is worth the further fundamental time-consuming research that is necessary. In the United States, the use of trading rules to detect patterns in stock prices is probably as old as the stock market itself.

It is widely discussed between academics and practitioners if technical analysis applied to the markets can improve portfolio return compared to a buy and hold (B&H) strategy. The buy and hold strategy is a passive strategy where a trader or investor buys an asset and holds for a predetermined period of time, as opposed to trading actively in and out of the asset trying to capture the gains and minimize the losses. After the stock market crash in 2000 and 2008, the efficient market hypothesis, which will be discussed later in this paper, lost some ground. There have been several studies (see literature review section) that confirm the effectiveness of technical analysis applied to different markets and that have proven to give risk-adjusted returns in excess of average market returns. Technical analysts attempt to forecast prices by the study of past prices and by using chart patterns to predict future movements in the price action created by shifts in supply and demand. Moving average strategies are most common in technical analysis. There are many variations of the moving average, but I will focus on the most used moving average in practice, the simple moving average (SMA). In the figure below the simple moving average is applied to the gold price. The strategy involves buying the asset once the price moves above the average of its closing prices from a specified last number of days or months (50 and 200 days being most common), and selling the asset when the price moves below the average to avoid severe market corrections.



SMA 11 strategy applied to gold spot price from 2004 to 2014 as an example of how the strategy works:

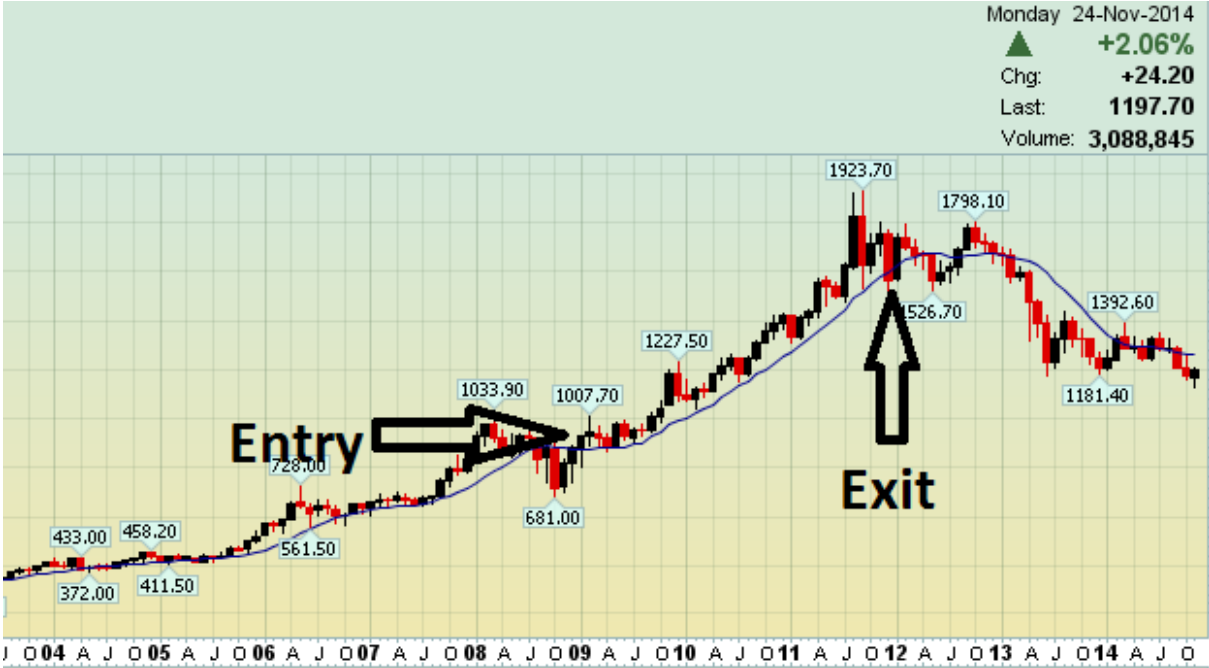


Figure 1: The blue line represent the average of a asset's closing price from the last 220 days of trading, which according to my research is the strategy (SMA 11) that works best for gold.

Each day a new 220 day moving average is calculated. A buy signal is generated when the price moves above the SMA 11 line, or the blue line. A sell signal is generated when the price move below the same line. Note that before the entry point, there where a period of consolidation, where the price moves up and down around the blue SMA 11 line and creates a lot of buy and sell signals, or whipsaw trades which result in high transaction costs.

There have been done many studies on the topic of technical analysis, some only test equity indicies, while others only test if the strategies are valid in currency markets. Kilgallen (2012) did test these strategies on a broad set of assets including commodities, equity indices and currency pairs. However, he did not test the precious metal's when he tested commodities, even though they have intrinsic value and has a history of beeing real money, at least gold and silver. I will test the simple moving average and time-series momentum strategies on precious metal's, some well known equity indices and on currencies as well. When I talk about commoditites in this paper, I'm refering to gold, silver, platinum and palladium.

The main question in this thesis: Is it possible to use technical analysis and strategies to beat the market, that is to trade in and out of an asset according to different trading signal's

generated from past average price's, and to create greater return's than if a trader or investor would just buy and hold the asset?

Two of the shortcomings of this paper is that I only tested the strategies on the precious metal's in the commodity section, and that all research are conducted on in-sample data. As a consequence this paper could be affected by unintentional data maining and are biased leaning towards technical analysis as a tool to use the time-series momentum (MOM) and simple moving average (SMA) rules to improve return's compared to the buy and hold strategy. To further strenghten this research, future paper's should include out- of sample testing. That said, the main strengths of this paper is that I tested the MOM and SMA strategies on the 4 precious metal's, 4 equity indices and on 12 currencies and not just on one asset like an equity index etc.. I tested the robustness of the findings in the precious metal's by dividing the total data set from 1970 to 2012 into three sub sets. I also included the risk measure max drawdown, not only to capture the reward side of the strategy, but to put a light on the risk reducing abilities of technical analysis and active portfolio management, as apposed to the passive buy and hold strategy. Max drawdown is the percentage drop in price between an asset's peak, or an all time high, to a all time low. Faber (2007) was one of the first to outline the risk reducing abilities of technical analysis, and found that the simple moving average strategy would have protected a portfolio from much of the downside volatility in a bear market (declining market).

Faber reports the superior performance of the 10-month SMA rule. This strategy has been confirmed in several published papers like Gwilym et al (2010) and Kilgallen (2012). I found that overall for the MOM strategy tested on all asset's with positive sharp ratio's, that the MOM 10 rule was superior to MOM 11. Contradictive to rescent paper's I found that the SMA 11 beat SMA 10 strategy, but with minimal difference. The precious metal's using the MOM strategy had a 35% less severe drawdown than the buy and hold strategy while the SMA strategy had a 54% less drawdown. Compared to Kilgallen (2012), he found that the maximum drawdown was 28% less severe than the buy-and-hold maximum drawdown for commodities. Again, he did test the strategies on a wider set of commodities than in this paper. For the equity indices the drawdown's were 49% less severe for MOM and 54% for the SMA strategy. For the currencies it was 64% and 66% less severe drawdowns. This coincides with Kilgallen's findings which was 44% less drawdown for equities, and 65% less for currencies. Overall for commodities, equity indices and currencies, the drawdown's were

reduced 46% for the MOM strategy and 57% for the SMA strategy. For all asset's the annual returns increased 100% for both strategies compared to buy and hold. The conclusion is that the technical indicators time-series momentum (MOM) and the simple moving average (SMA) improved the results for all assets, both on a return and risk adjusted basis, and beat the traditional buy and hold strategy.

The rest of the paper is organized as follows. Section 2 gives a literature review. Section 3 describes data and methodology, section 4 discuss the market efficiency theory, while Section 5 outlines the methods used. Section 6 presents a discussion of the empirical results or data analysis. Section 7 concludes the paper.

## **2 Literature Review**

This section gives a brief overview of some previous studies on the topic's of technical analysis, time-series momentum (MOM) and simple moving average (SMA) strategies, to get a clearer view of the effects of technical analysis. Does the strategies really work, or is it only luck? And if the strategies are successful, which of them works best?

Brock et al (1992) states that modern technical analysis probably originated in the work of Charles Dow near the turn of the century. They found that the use of moving averages was discussed by Gartley (1930). There is evidence that technical analysis have been around for a long time, and studies conducted by Sweeney (1986) and Neely et al (1997), document the success of technical rules for forecasting changes in currency exchange rates. Further research done by Bessembinder and Chan (1998), report that the moving average rules are useful for forecasting index returns for a group of Asian stock markets. Okunev and White (2003) tested the performance of momentum trading strategies in foreign exchange markets. They found that momentum strategies was profitable from 1970 through 1990's, which gave further evidence supplementing the previous studies in equity indices. They also found evidence that the strategy worked on currencies as well. Fifield et al (2005) found that using the moving average rules and data for a selection of 11 European stock markets over the 10-year period, January 1991 to December 2000 gave varying results. "While the emerging

markets studied exhibited some degree of predictability in their share returns, the developed markets did not". So the strategies seem to work in some market's at specific times. Faber (2007) tested the simple moving average strategy on monthly observations from 1973 in his paper and found that risk adjusted returns were almost always improved, confirming the results of Bessembinder and Chan (1998) and Brock et al (1992). Faber concluded that by using a simple moving average model, a trader or investor would be able to reduce losses in bear markets, and as he puts it: "Avoiding these massive losses would have resulted in equity-like returns with bond-like volatility and drawdown".

It look like academic's lately are agreeing that market timing strategies reduce the drawdown risk and volatility, but are still uncertain if they are actually profitable, at least in the long run. Gwilym et al (2009) reports that momentum strategies has been profitable using a global portfolio, but that the returns has declined in the last two decades. They conclude that a trend following method reduces the volatility of international equities and provides superior risk adjusted returns compared to a conventional buy and hold strategy, which further strenghten Faber's work.

More recently, researchers have found similar momentum-based investment opportunities across equity indices, currency, commodity and bond futures (see for example Moskowitz et al (2009). Abbey and Doukas (2012) examines whether technical currency trading by individual currency traders is profitable. They found that technical analysis is negatively associated with performance and that retail traders who used well known technical analysis when trading currencies suffered from reduced performance. The research and results are very mixed to say the least.

Kilgallen (2012) tested the simple moving average strategy on commodities, equity indices and currencies, and this thesis is somewhat a replication of his work. The difference beeing, that he tested the strategy on 46 commodities excluding the monetary metal's gold and silver, plus platinum and palladium. My contribution to this research is to test the strategies on the preciou's metals and divide them into sub sets to test the robustness of the strategies.

I want to find out which of the two strategies, simple moving average (SMA) and time-series momentum rules (MOM), that can be expected to perform best. Marshall et al (2013) compare the strategies and found that they are similar with return correlations that are typically in excess of 0.8. They also found that moving average rules exited long positions sooner than the time-series momentum rules, which could reduce the downside risk in market

pullbacks or recessions. Both trading rules perform best outside of large stock series which may explain anomalies in returns for mid- and small-cap stocks. There is lack of supportive evidence on this matter in academic studies, which have focused on indices dominated by large cap stocks.

High transaction costs and bad timing can easily wipe out all the returns that might have been generated using technical analysis in the markets. It is clear that the predictability of technical analysis is hard to prove with varying results and especially after transaction costs are taken into consideration as discussed by Zakamulin (2014). The performance of market timing strategies can be affected by data-mining. Even if there is no obvious data snooping in some studies, the data-mining issue may be relevant as pointed out in the studies by Brock et al. (1992) and Faber (2007). For instance, if a biased researcher wants to prove that technical analysis is superior to a buy and hold strategy, he or she can easily pick a split point for the data sample that result in greater risk adjusted returns when testing the market timing strategies on in-sample data. Further in this thesis, I will explore if the market timing strategies will indeed outperform the buy and hold strategy in precious metal's, equity indices and currencies. If a strategy performs well over a long time frame, it is not certain that the same results are found at different split-points in the data.

Another aspect of technical analysis is the emotional, or human side of trading. The market efficiency theory stands strong in academic works, but still there are some that manage to beat the market indices year after year, while most people lose money. In finance literature there is a growing enthusiasm around the term behavioral finance. Some of the topics discussed in Antonacci's (2013) white paper are anchoring, herding, and the disposition effect built upon research from Kahneman and Tversky (1974). Kahneman and Tversky argue that market participants move money into investments that have recently appreciated, thus causing trends to continue further, which is known as momentum trading. There are anomalies in mid- and small- cap markets that can't be explained by the market efficiency theory, which I will discuss later on in this thesis. Antonacci notes that in anchoring, traders are slow to react to new information, which leads initially to under reaction. In herding, buying begets more buying and causes prices to over react and move beyond fundamental value after the initial under reaction. Through the disposition effect, investors sell winners too soon and hold losers too long. Barberis et al (1998), Daniel et al (1998) and Hong and Stein (1999) further strengthen the theory of behavioral finance and the work of Kahneman et al. Although

technical analysis is very mechanical, the rules can easily be broken by human emotions as shown by the popularity of algorithmic trading. So, why doesn't everybody use technical analysis? There is a lot of irrational trading in the markets, especially in the small cap market. Time and impatience are aspects that make for irrational behaviour, encouraged by greed and fear. A lot of traders are addicts and need to make up for recent losses and don't want to miss out on the next big thing. This is where fundamental and technical analysis easily can be thrown out the window in exchange for a quick fix, and unfortunately a bitter loss. If technical analysis is supposed to work, it depends heavily on the person that uses it. Thinking like a machine, or even program a machine to trade, might not work. Humans often behave irrational, especially when money is involved.

## **3 Data and Methodology**

### **3.1 Data selection**

The data used in this thesis are from 1970 to 2012 for all assets. Most of the data is collected from the Polish site [stooq.com](http://stooq.com). Links are provided in the table at the end of this section. The assets I chose to study are commodities, equity indices and currencies. Other studies like Kilgallen (2012), tested 46 commodities, but excluded the precious metals gold, silver, platinum and palladium. I will divide the total commodity period from 1970-2012 into three sub sets to test the robustness of the data tested. The first set from 1970-1990, the second set 1980-2000 and the third set 1990-2012. The reason for dividing the total set into three sub periods, is to capture the peak of the gold market around 1980 and at the same time include the bottom of the market in early 2000. This way, the results in this thesis might more realistically reflect the effect of the timing strategies with respect to the extraordinary returns from gold investing in the last decade. A weakness in this thesis is that I did not include transaction costs in the testing of the strategies. I also chose to test the strategies on equity indices instead of individual stocks as there are too many stocks to choose from and to avoid a heart attack. I mainly chose large cap indices, but also tested the Russell 2000 small cap index, although the data doesn't start until 1988. For the currencies I chose 12 currencies all paired against the USD. The special drawing rights (SDR) is a basket of currencies from the

International Monetary Fund<sup>1</sup> (IMF). All the data tested are monthly data represented by the average daily closing price for the month. The data starts at the beginning of the calendar year 1970 (when available), and ends at the end of 2012.

## **3.2 Data**

### **3.2.1 Precious metal's**

Prior to 1970 the price of gold was fixed before the Bretton Wood system broke down, so it would be no point implementing this strategies to commodity data starting before 1970. In selecting the commodities gold, silver, platinum and palladium, the thought was that gold and silver especially are viewed upon to be monetary metal's with intrinsic value. Gold silver and platinum are tested on 516 monthly observations between january 1970 and decembe 2012. For palladium there was only data available from 1978 so I tested the strategy on 420 observations.

### **3.2.2 Risk free rate**

The reason for all the data ending in 2012 is that the risk free monthly rate used in the strategy is taken from Amit Goyale's homepage and the data ends december 2012.

### **US government bonds**

Bonds are often used as the risk free asset, as there is historically safer to invest in bonds issued by a country like the US, than to invest in other countries or even corporations. There is a smaller chance of default for a nation or country compared to a company listed on a major stock exchange. The US government issues bonds to finance its debt, which in the time of writing is exceeding <sup>2</sup>17 trillion dollars. This bonds include Treasury bills, treasury notes and treasury bonds.

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<sup>1</sup>The currency value of the SDR is determined by summing the values in U.S. dollars, based on market exchange rates, of a basket of major currencies (the U.S. dollar, Euro, Japanese yen, and pound sterling). The SDR currency value is calculated daily . [http://www.imf.org/external/np/fin/data/rms\\_sdrv.aspx](http://www.imf.org/external/np/fin/data/rms_sdrv.aspx)

<sup>2</sup> <http://www.usdebtclock.org/>

### **3.2.3 Equity Indices data**

I tested the strategies on the Dow Jones Industrial Average (DJIA) index, National Association of Securities Dealers Automatic Quotation System (NASDAQ) composite index, Standard & Poor's 500 (S&P500) index on 516 monthly observations starting from January 1970 and ending December 2012. I also tested the strategy on small cap stocks in the Russell 2000 (\$RUT) index on 301 monthly observations from January 1988 to December 2013.

### **3.2.4 Currency data**

I picked out 12 currency pairs to test the strategies on. Consisting of (all monthly observations and all currencies paired against United States Dollar(USD)): 493 observations of EUR/USD (Euro), 493 observations of NOK/USD (Norwegian Krone), 503 observations of GBP/USD (Great Britain Pound), 503 observations of NZD/USD (New Zealand Dollar), 503 observations of AUD/USD (Australian Dollar), 503 observations of JPY/USD (Japan Yen), 503 observations of CAD/USD (Canadian Dollar), 503 observations of ZAR/USD (South African Rand), 503 observations of CHF/USD (Swiss Franc). All of the above data are from January 1971 through December 2012.

478 observations of INR/USD (Indian Rupee) from January 1973 through December 2012.  
347 observations of CNY/USD (Chinese Yuan) from January 1984 through December 2012.  
264 observations of SDR/USD (Special Drawing Rights) from January 1991 through December 2012.



### Data info and reference links:

Asset	Start year	End year	Monthly obs	Reference data links
Gold	1970	2012	516	<a href="http://stooq.com/q/d/?s=xauusd&amp;c=0&amp;d1=19680501&amp;d2=20140815">http://stooq.com/q/d/?s=xauusd&amp;c=0&amp;d1=19680501&amp;d2=20140815</a>
Silver	1970	2012	516	<a href="http://stooq.com/q/d/?s=xagusd&amp;c=0&amp;d1=19680501&amp;d2=20140815">http://stooq.com/q/d/?s=xagusd&amp;c=0&amp;d1=19680501&amp;d2=20140815</a>
Platinum	1970	2012	516	<a href="http://stooq.com/q/d/?s=xptusd&amp;c=0&amp;d1=19680501&amp;d2=20140815">http://stooq.com/q/d/?s=xptusd&amp;c=0&amp;d1=19680501&amp;d2=20140815</a>
Palladium	1978	2012	420	<a href="http://stooq.com/q/d/?s=xpdusd&amp;c=0&amp;d1=19680501&amp;d2=20140815">http://stooq.com/q/d/?s=xpdusd&amp;c=0&amp;d1=19680501&amp;d2=20140815</a>
DJIA	1970	2012	516	<a href="http://stooq.com/q/d/?s=%5Edji&amp;c=0&amp;d1=19680501&amp;d2=20140814">http://stooq.com/q/d/?s=%5Edji&amp;c=0&amp;d1=19680501&amp;d2=20140814</a>
NASDAQ	1971	2012	493	<a href="http://stooq.com/q/d/?s=%5Endq&amp;i=d&amp;d1=19680103&amp;d2=20141114&amp;i=295">http://stooq.com/q/d/?s=%5Endq&amp;i=d&amp;d1=19680103&amp;d2=20141114&amp;i=295</a>
S&P500	1970	2012	516	<a href="http://stooq.com/q/d/?s=%5Espx&amp;c=0&amp;d1=19680501&amp;d2=20140814">http://stooq.com/q/d/?s=%5Espx&amp;c=0&amp;d1=19680501&amp;d2=20140814</a>
Russel 2000	1988	2013	301	<a href="http://finance.yahoo.com/q/hp?s=%5ERUT&amp;a=0&amp;b=10&amp;c=1968&amp;d=10&amp;e=17&amp;f=2014&amp;g=d&amp;z=66&amp;y=6798">http://finance.yahoo.com/q/hp?s=%5ERUT&amp;a=0&amp;b=10&amp;c=1968&amp;d=10&amp;e=17&amp;f=2014&amp;g=d&amp;z=66&amp;y=6798</a>
EUR/USD	1971	2012	493	<a href="http://stooq.com/q/d/?s=eurusd">http://stooq.com/q/d/?s=eurusd</a>
NOK/USD	1971	2012	493	<a href="http://stooq.com/q/d/?s=nokusd&amp;c=0&amp;i=m">http://stooq.com/q/d/?s=nokusd&amp;c=0&amp;i=m</a>
SDR/USD	1991	2012	264	<a href="http://stooq.com/q/d/?s=xdrusd">http://stooq.com/q/d/?s=xdrusd</a>
GBP/USD	1971	2012	503	<a href="http://stooq.com/q/d/?s=gbpusd&amp;c=0&amp;d1=19000301&amp;d2=20140911&amp;i=m">http://stooq.com/q/d/?s=gbpusd&amp;c=0&amp;d1=19000301&amp;d2=20140911&amp;i=m</a>
NZD/USD	1971	2012	503	<a href="http://stooq.com/q/d/?s=nzdusd&amp;c=0&amp;i=m">http://stooq.com/q/d/?s=nzdusd&amp;c=0&amp;i=m</a>
CNY/USD	1984	2012	347	<a href="http://stooq.com/q/d/?s=cnyusd">http://stooq.com/q/d/?s=cnyusd</a>
AUD/USD	1971	2012	503	<a href="http://stooq.com/q/d/?s=audusd">http://stooq.com/q/d/?s=audusd</a>
JPY/USD	1971	2012	503	<a href="http://stooq.com/q/d/?s=jpyusd&amp;c=0&amp;i=m">http://stooq.com/q/d/?s=jpyusd&amp;c=0&amp;i=m</a>
CAD/USD	1984	2012	347	<a href="http://stooq.com/q/d/?s=cadusd">http://stooq.com/q/d/?s=cadusd</a>
INR/USD	1973	2012	478	<a href="http://stooq.com/q/d/?s=usdinr">http://stooq.com/q/d/?s=usdinr</a>
ZAR/USD	1984	2012	347	<a href="http://stooq.com/q/d/?s=zarusd&amp;i=m&amp;d1=19680109&amp;d2=20141217&amp;i=10">http://stooq.com/q/d/?s=zarusd&amp;i=m&amp;d1=19680109&amp;d2=20141217&amp;i=10</a>

Table 1: Assets data presented with start year, end year, number of observations and link to homepage which data was collected from.

## 3.3 Methodology

Market timing is an active strategy that attempts to outperform the passive buy-and-hold strategy by anticipating the future direction of a financial market using signals generated from past prices. In practical trading the most common Moving Average (MA) strategies to use are the 50 day and 200 day moving average, the simple moving average (SMA) being the most commonly used strategy. Another strategy I will be testing is the time-series momentum rule (MOM) further discussed later in this section. These strategies take advantage of the momentum and trend in the market. When the stock price is increasing and the price action is trading above the SMA line, the trade is in play until the price declines below the SMA line, if the initial position is long (make money on increasing share price's). The same is true for the MOM strategy. When a buy signal is generated from the average price's, a trader allocate a portion of the capital into the risky asset. When a sell signal is generated, the trader liquidate the position and move the capital into a risk free asset.

To be long a stock is the same as buying a stock bid, that is what the market maker asks of in \$ terms to sell me the stock. I only make money in a long position if the stock price increases above my initial entry price.

To short a stock is the opposite of going long a stock. Instead of buying the stock, I borrow the stock from a broker or other traders through my broker and sell the stocks I borrowed at the current/desired market price. Since I have borrowed the shares, I will have to return them to the lender at some time in the future. I would only want to short a stock if I believe that the stock price will decline. Maybe there is some bad company news coming out? If the stock price declines below my initial entry price, I will make money on the transaction. If the price increases above my entry price I will lose money. Example: If I sell short share XYZ at 10\$ in the market and the price decreases to 9\$, I have made 1\$ profit because I deliver back the 10\$ stock at a cost of 9\$. If the stock price would instead increase to 11\$, I will lose 1\$ because I have to pay 11\$ to make delivery for the 10\$ stock I borrowed. The short seller is also obligated to pay cash dividends on the borrowed stock to the lender (if any dividend).

### **Assumptions:**

- Entry and exit prices are assumed to be at the close of business on the last trading day of the month.
- Taxes, slippage related to bid–ask spread, and trading commission costs are excluded from return calculations.
- Asset return computations are done using the capital appreciation returns (CAR) instead of total returns. By using CAR the dividends and interest income is excluded.

### 3.3.1 The simple moving average (SMA)

This strategy, involves buying a security once it starts to trade above the average of its closing prices from a specified last number of days or months and selling the security when its price falls below that same average. In other words, an individual using these strategies can outperform a buy-and-hold strategy without the trader taking on additional volatility or risk, and even reduce the risk. Simple moving average uses an equally weighted moving average and the current price trading rules:

$$SMA_t(k) = \frac{1}{k} \sum_{j=0}^{k-1} P_{t-j}$$

For a general moving average strategy the signals for time t+1 are:

Buy:

$$P_t > SMA_t(k)$$

Sell:

$$P_t < SMA_t(k)$$

The most popular of the moving average strategies is the simple moving average, or SMA. In the SMA strategy all of the security prices in the lookback period are weighted equally. If the lookback period is too short there are many whipsaw trades, market noise and high transaction costs that wipe out the potential gains as there would be too many trades involved. One way to get around this problem in practice, is to use a shorter time frame when trading. If the lookback period is too long, the signal's created would lag the market and reacts too slow. It is better to use longer time frames when analyzing the indices.

### 3.3.2 Time-series momentum rule (MOM)

Let  $(P_1, P_2, \dots, P_T)$  be the observations of the monthly closing prices of an asset. In the momentum rule a buy signal is generated when a k-month momentum is positive. Otherwise, a sell signal is generated. A k-month momentum at month-end t is computed as:

$$MOM_t(k) = P_t - P_{t-k}$$

The trading signal for month  $t + 1$  is generated according to the following rules:

Buy:

$$MOM_t(k) > 0$$

Sell:

$$MOM_t(k) < 0$$

When a Buy signal is generated, money is allocated to the asset. In contrast, when a Sell signal is generated, money is allocated to T Bills.

### **3.3.3 In-sample strategy testing**

The markets are open 5 days a week, Monday through Friday and there are 20 trading days during a month. This means that the 50 day MA equals 2.5 months and the 200 day MA is equal to 10 months. I will mainly use the 7, 10, 11 and 13 month average of prices as a reference when testing the strategies. Then I will find the strategy with the highest Sharpe Ratio and test the months around that strategy. As an example, if the 10 month strategy from the testing results reveals the highest SR, then I will test the 9 month and 11 month strategy to see if they have superior SR compared to the 10 month to make sure I find the strategy with the highest reward vs. risk. All my research is tested on in-sample data from the stock market using the close price of the day to compute monthly returns.

An in-sample test is done by implementing the market timing strategies, in this case the SMA and MOM strategies, on the returns computed from past market data to obtain the superior strategy. Then the strategies are back tested on the same data. This method is perfect to measure past performance, but the question is still if the strategies will continue to work in the future. Markets are rapidly changing and there is no guarantee that the markets will continue to behave like it did in the past. This thesis could be affected by data mining since the strategies are not tested on out-of sample data, where the choice of look back period is constantly tested and changed, and is not influenced directly by previous work of other authors. For the precious metals I performed an in-sample strategy test, where I divided the

total historical data set from 1970 to 2012, into three sub set period's to test the robustness of the strategies.

### 3.3.4 Performance measures

#### Sharpe ratio

A ratio developed by Nobel laureate William F. Sharpe to measure risk-adjusted performance. The Sharpe ratio is computed by subtracting the risk free rate from the expected portfolio return, and then divide the answer with the portfolio standard deviation used as the risk measure. The Sharpe ratio formula is:

$$S R_p = \frac{r_p - r_f}{\sigma_p}$$

Where  $S R_p$  = Sharpe ratio portfolio,  $r_p$  = expected portfolio return and  $\sigma_p$  = portfolio standard deviation

The Sharpe ratio tells us whether a portfolio's returns are due to smart investment decisions or a result of excess risk. In finance the ratio is the most used optimization criterion for finding the best trading rule. The greater a portfolio's Sharpe ratio, the better its risk-adjusted performance has been. A negative Sharpe ratio indicates that a risk-less asset would perform better than the security being analyzed. There have been proposed many alternatives to the Sharpe ratio. In most of these alternative reward-to-risk ratios the standard deviation is replaced by another risk measure that takes into account only the downside risk.

#### Maximum drawdown

Maximum drawdown is an indicator of the risk of a portfolio chosen based on a certain strategy. It measures the largest single drop from peak to bottom in the value of a portfolio (before a new peak is achieved).

Max Drawdown = (Peak value before largest drop - lowest value before new high established)/(peak value before largest drop).

Gold SMA 11 portfolio drawdown vs. buy and hold drawdown.

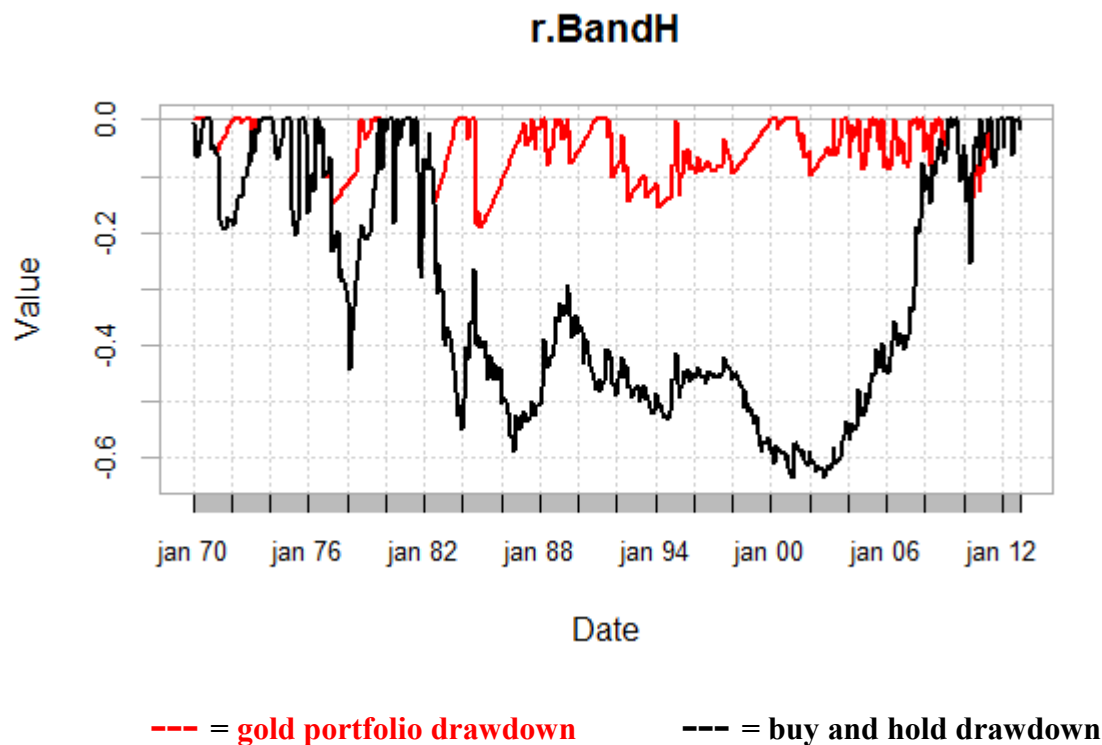


Figure 2: shows max drawdown between 1970 and 2012. Note that in the period between 1982 and 2002, the drawdown for the buy and hold strategy was in the 40-60% range while the portfolio drawdown has been more stable in the 10-20% range for the period tested.

### ACF (auto correlation function)

<sup>3</sup>Autocorrelation is a mathematical representation of the degree of similarity between a given time series and a lagged version of itself over successive time intervals. It is the same as calculating the correlation between two different time series, except that the same time series is used twice, once in its original form and once lagged one or more time periods. The term can also be referred to as "lagged correlation" or "serial correlation". For monthly time series it is important with lags 12 and 24. In finance literature, a version of the capital asset pricing

<sup>3</sup> <http://www.investopedia.com/terms/a/autocorrelation.asp>

model (CAPM) theory is that  $\{x_t\}$  is not predictable and should have no autocorrelations. (See the efficient market hypothesis section later for theory on the CAPM model). Testing for autocorrelations have been used as a tool to check for efficient market hypothesis. However, the way of which stock prices are determined and index returns are calculated might introduce autocorrelations in the observed return series. For example, if you know a stock historically has a high positive autocorrelation value and you witnessed the stock making solid gains over the past several days, you might reasonably expect the movements over the upcoming several days (the leading time series) to match those of the lagging time series and to move upwards.

When computed, the resulting number can range from +1 to -1. An autocorrelation of +1 represents perfect positive correlation (i.e. an increase seen in one time series will lead to a proportionate increase in the other time series), while a value of -1 represents perfect negative correlation (i.e. an increase seen in one time series results in a proportionate decrease in the other timeseries).

### **Simple autoregressive models (AR)**

<sup>4</sup>Autoregressive processes are used by investors in technical analysis. A stochastic process used in statistical calculations in which future values are estimated based on a weighted sum of past values. An autoregressive process operates under the premise that past values have an effect on current values. A process considered AR(1) is the first order process, meaning that the current value is based on the immediately preceding value. An AR(2) process has the current value based on the previous two values. One drawback to this type of analysis is that past prices won't always be the best predictor of future movements, especially if the underlying fundamentals of a company have changed.

#### Simple autoregressive model

When  $x_t$  has a statistical significant lag-1 autocorrelation, the lagged value  $x_{t-1}$  might be useful in predicting  $x_t$ .

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<sup>4</sup> <http://www.investopedia.com/terms/a/autoregressive.asp>

$x_t = \phi_0 + \phi_1 x_{t-1} + a_t$ , where  $\{a_t\}$  is assumed to be white noise series with mean 0 and variance  $\sigma_a^2$ .  $X_t$  is the dependant variable and  $x_{t-1}$  is the explanatory variable. This model is known as an autoregressive model of order 1, or AR(1)

Consider the time series process  $x_t$ , where  $t$  is the time index. The time series process follows the Auto-Regressive process of order 1 (AR(1) process) and we can write it as:

$x_t = a + \phi x_{t-1} + \varepsilon_t$ , where  $\phi$  is some constant such that  $|\phi| < 1$ . A random variable is unpredictable in the sense that it has no predictors. The best possible predictor is only the mean value of the process. In contrast, if a random variable follows the AR(1) process, there is some degree of predictability. The past value of the process serves as a predictor for the future value.

The AR(1) process can be easily generalized to AR( $n$ ) process:

$$x_t = a + \phi_1 x_{t-1} + \phi_2 x_{t-2} + \dots + \sum_{i=1}^n \phi_i x_{t-i} + \varepsilon_t$$

### 3.3.6 Financial time series and their characteristics

Time independency of returns:

To some extent, an implication of the efficient market hypothesis (EMH). EMH only imposes unpredictability of returns

#### Returns as a random variable

Assume that the random variable  $X$  (i.e., log-return) has the following cumulative distribution function (CDF) which can be used to compute p-values of a test statistics:

$$F_x(x) = P(X \leq x; \theta)$$



The mean (expected value) of X and the first central moment measure the central location of the distribution:  $f(x)$  = probability distribution function (PDF) of X

$$\hat{\mu}_x = \frac{1}{T} \sum_{t=1}^T x_t$$

For an asset we can use hypothesis testing to test if the mean return of the asset is zero which if true would be a bad trade or investment.

$$H_0: \mu_x = 0$$

$$H_1: \mu_x \neq 0$$

The variance of X is the second moment and measures the variability of X. The positive square root of variance is the standard deviation, denoted  $\sigma$ . For asset returns, variance or standard deviation is a measure of uncertainty and is often used to measure risk:

$$\hat{\sigma}_x^2 = \frac{1}{T-1} \sum_{t=1}^T (x_t - \hat{\mu}_x)^2$$

The third central moment measures the skewness of the distribution, that is measuring the symmetry of X w.r.t. its mean :

$$\hat{S}(x) = \frac{1}{(T-1)\hat{\sigma}_x^3} \sum_{t=1}^T (x_t - \hat{\mu}_x)^3$$

Skewness measures the degree of asymmetry in the return distribution. Positive skewness indicates that more of the returns are positive, negative skewness indicates that more of the returns are negative. An investor should in most cases prefer a positively skewed asset to a similar (style, industry, region) asset that has a negative skewness. When  $\hat{S}(x)$  is negative, large realizations of X are more often negative than positive (i.e., crashes are more likely than booms).

For normal distribution  $\hat{g}(x) = 0$

If  $\hat{g}(x) < 0$ , the distribution is skewed to the left

If  $\hat{g}(x) > 0$ , the distribution is skewed to the right

The fourth central moment measures kurtosis which is the tail heaviness of the distribution:

$$\bar{K}(x) = \frac{1}{(T-1)\hat{\sigma}_x^4} \sum_{t=1}^T (x_t - \hat{\mu}_x)^4$$

Kurtosis measures the concentration of the returns in any given part of the distribution. The kurtosis function will by default return what is referred to as “excess kurtosis”, where 0 is a normal distribution, other methods of calculating kurtosis than method= "excess" will set the normal distribution at a value of 3. In general a rational investor should prefer an asset with a low to negative excess kurtosis, as this will indicate more predictable returns (the major exception is generally a combination of high positive skewness and high excess kurtosis)

A distribution with positive excess kurtosis is said to have heavy tails and the distribution puts more mass on the tails of it's support than a normal distribution does. This means that such a distribution tends to contain more extreme values and is said to be leptokurtic. Negative excess kurtosis is said to be platykurtic. In finance the first four moments of a random variable is used to describe the behaviour of asset returns.

Large  $\hat{K}(x)$  implies that large realizations (positive or negative) are more likely to occur

For normal distribution  $\hat{K}(x) = 3$

Define excess kurtosis as  $\hat{K}(x) - 3$

If  $\hat{K}(x) < 3$ , the distribution has thinner tails than normal

If  $\hat{K}(x) > 3$ , the distribution has thicker tails than normal

### Weights of asset vs. weights of T-bills

$$r_{p,t} = w_{A,t} r_{A,t} + w_{T,t} r_{T,t}$$

where  $r_{A,t}$  and  $r_{T,t}$  are the returns on an asset and T-bill at time  $t$  respectively, and  $w_A$ , and  $w_T$  are the weights of an asset and T-bill respectively such that:

$$w_A + w_T = 1$$

In this strategy we trade between going long 100% a asset and 100% T-bills

$0 \leq w_A \leq 1, 0 \leq w_T \leq 1$  so that

$$w_A + 0 w_T = 1 \text{ and } 0 w_A + w_T = 1$$

## 4 The efficient market hypothesis

### 4.1 A random walk

The conclusion amongst academics have long been that it is impossible to predict future stock prices based on past performance and patterns, that technical analysis is a useless tool and that the price moves like a random walk that can't be predicted. If we look at the performance of the mutual funds, this assumption seems reasonable. Grøtte (2006) writes that several university studies from the 1970's show that: There was no positive correlation between returns and the velocity of the portfolio, in fact the study showed that greater velocity resulted in weaker returns. There was no correlation between returns and the mutual funds fees. Adjusted for risk the returns got worse compared to the indexes.

The conclusion was that mutual funds did not give any excess return compared to the indexes. Fama (1970) from the university of Chicago was the first to point this out in the famous Efficient Market Hypothesis. The basic idea is that in the perfect efficient market all information is released to all traders and investors at the exact same time, the stock is correctly priced and it is therefore impossible to beat the market by analyzing a company to find the «right» value. New information like a quarterly report and EPS is quickly priced into the stock price according to the theory. Fama categorized three levels of efficiency:

- 1) Weak market efficiency – the daily stock price consists of all the information from past price action. Technical analysis is useless. The stock market doesn't have a memory. If a stock is up a lot lately, it is no guarantee that it will continue. The efficient market moves like a random walk.
- 2) Semi strong market efficiency – the stock price today reflects all public available information. It is useless to analyse yearly 10K reports because the market have already priced in the information. The only way to receive excess return is to get access to and trade on information that is not yet publically known, known as insider trading which is illegal.
- 3) Strong market efficiency – the stock price today is reflecting all relevant information, even insider information. Nobody can beat the market.

Fama's depressive conclusion: "On average stock prices adjust quickly to information about investment decisions, dividend changes, changes in capital structure and corporate-control transactions".

One advantage with the B&H strategy is that a trader that holds a position more than 1 year pays less tax and also don't pay taxes until the position is realized. During the months of september and october alot of traders realize losses to get tax advantages, as they can deduct the losses from their positions from their taxes.

## 4.2 Efficient markets

Markowitz (1952) used statistical methods to define risk and reward. According to Markowitz a rational investor is risk averse, that is he or she will not accept any higher risk without the reward beeing greater. He defined risk as price fluctuations , the greater the volatility measured by the std., the greater the portfolio risk is. To reduce the risk the portfolio have to consist of stocks with low correlation. To use Markowitz's theories in practise, the expected return, volatility and correlation between the stocks have to be calculated. From these estimates we can construct the optimal portfolio according to modern portfolio theory (MPT). An efficient portfolio will give the highest returns for a given level of risk. The MPT model have later been extended using another risk measure than the std., and which also include a equilibrium condition.

The Capital Asset Pricing Model (CAPM) is a model that uses beta as a way to measure risk. If beta is equal to 1, then the stock beeing analyzed moves exactly like a index like S&P500. If the beta is -1 the stock moves in the opposite direction of the market. The model is assuming that the market is efficient. The <sup>5</sup>CAPM model:

$$r_a = r_f + \beta_a (r_m - r_f)$$

Where  $r_a$  = expected market return,  $r_f$  = risk free rate and  $\beta_a$  = beta of security

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<sup>5</sup> <http://www.investopedia.com/terms/c/capm.asp>

The time value of money is represented by the risk-free (rf) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time and to the market premium ( $R_m - r_f$ ).

The CAPM says that the expected return of a security or a portfolio equals the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat the required return, then the investment should not be undertaken. The security market line plots the results of the CAPM for all different risks (betas).

The CAPM divides risk into two parts:

Unsystematic risk or specific risk – risk that is tied to factors in the company or that has to do with the stock itself. More micro events like earnings, lay-offs, acquisitions etc.

Systematic risk – risk tied to macro events and the markets as a whole, like recessions, wars, catastrophes etc.

In a well diversified portfolio the unsystematic risk will be more or less eliminated, so the only risk left is the systematic risk.

## **5 Method**

### **5.1. Hypothesis testing**

A hypothesis is something that has not yet been proven to be true. The meaning of this notion is close to the meanings of: assumption, conjecture, guess, etc. The first step in a hypothesis test is to formalize it by specifying the null hypothesis. A null hypothesis is an assertion about the value of a population parameter. It is an assertion that we hold true (do not reject) unless we have sufficient statistical confidence to conclude otherwise. An alternative hypothesis is the negation (refusal) of the null hypothesis. Mean return =  $\mu$  and standard deviation =  $\sigma$ .

In all tests we need to specify the significance level  $\alpha$ . I use a 5% significance level, that is to claim that the results from the observations in the dataset with 95% certainty lies inside the boundaries of a normal probability distribution. In this hypotheses we want to see if the returns on the asset portfolio is greater than 0.

## 5.2 T-test

20) For each Sharpe ratio I report the p-value of testing the null hypothesis that it is equal to the Sharpe ratio of the market portfolio. For this purpose I apply the Jobson and Korkie [1981] test with the Memmel [2003] correction. Specifically, given two portfolios 1 and 2, with  $SR_1$ ,  $SR_2$ , as their estimated Sharpe ratios and correlation coefficient over a sample of size  $T$ , the test of the null hypothesis:

$$H_0: SR_1 - SR_2 \leq 0$$

$$H_1: SR_1 - SR_2 \geq 0$$

is obtained via the test statistic:

$$z = \frac{SR_1 - SR_2}{\frac{\sqrt{1}}{T} \left[ 2(1 - p^2) + \frac{1}{2} (SR_1^2 + SR_2^2 - 2SR_1 * SR_2 p^2) \right]}$$

which is asymptotically distributed as a standard normal.

## 6 Data analysis

In this section I will first analyze the precious metal's and rank the strategies based on the highest Sharpe ratio's as shown in table 2. Table 3, 4 and 5 shows the data set divided into sub sets or periods. The first sub set is from 1970 to 1990, the second set is from 1980 to 2000 and the third sub set is from 1990 to 2012. I will only perform this task on the commodities, as there are countless other studies conducted on equity indices and currencies. The reason for dividing the data, is to see if the results vary much from the total data set and if they are robust. Even though I test sub sets of the data, one weakness as a reminder, is that the strategies are only tested on in-sample data and could therefore be affected by data-mining. Further research should investigate if the results in this thesis are replicable on out-of-sample data. Table 6 shows the same analysis made on the equity indices and table 7 shows the ranking on the different currency pairs. Table 8 provides a summary of all the strategies tested on the different asset classes. I added the p-value to test if the hypothesis, that the Sharpe ratio generated by trading the active portfolio, is statistically equal to or better than the Sharpe ratio from the B&H strategy. That is, if the p-value is less than 5%, I reject the null hypothesis and conclude that the returns from the active portfolio is superior to the B&H returns. Table 9 shows the AR(1) summary results to check if the findings are consistent with the market efficiency theory. Figure 3 shows the growth of 1\$ invested in the active portfolio for the entire period vs. The traditional B&H strategy.



## 6.1 Precious metal's

### 6.1.1 Total precious metal's 1970-2012 performance:

Asset	Gold	Silver	Platinum	Palladium
Technical strategy	<b>MOM 9</b>	MOM 10	MOM 2	<b>MOM 7</b>
Sharp ratio portfolio	<b>0,49</b>	<b>0,30</b>	<b>0,28</b>	<b>0,49</b>
Sharp ratio B&H	0,24	0,18	0,11	0,20
maxDrawdown B&H	0,64	<b>0,90</b>	0,73	0,85
maxDrawdown portfolio	<b>0,31</b>	0,64	0,44	<b>0,47</b>
Z test statistics	<b>3,05</b>	1,44	1,79	<b>2,83</b>
p - value	<b>0,0023</b>	0,1506	0,0734	<b>0,0046</b>
Technical strategy	<b>SMA 11</b>	SMA 10	<b>SMA 16</b>	<b>SMA 8</b>
Sharp ratio portfolio	<b>0,52</b>	<b>0,27</b>	<b>0,30</b>	<b>0,53</b>
Sharp ratio B&H	0,24	0,18	0,11	0,20
maxDrawdown portfolio	<b>0,28</b>	0,53	0,38	0,35
Z test statistics	<b>3,28</b>	0,97	2,12	3,27
p - value	<b>0,0011</b>	0,3313	0,0344	0,001

Table 2: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for commodities

By calculating the average of all the months tested, the SMA 11 strategy returned a SR of 0.44 and the MOM 9 strategy a SR of 0.43. The risk of trading the MOM 9 portfolio is reduced 52% measured by max drawdown and the returns increased 67% while the SR increased 100% compared to the B&H strategy. All the returns are positively skewed around 1.4 which indicates that more of the returns are positive than negative. The kurtosis is fairly high around 8 and a rational investor should prefer an asset with a low to negative excess kurtosis, as this will indicate more predictable returns. For the precious metal's, the return for gold using the MOM 9 and SMA 11 gives a statistical significant result at the 5% level, and I conclude that the returns from the gold portfolio outperforms the returns from the B&H strategy.

Silver returns on the other hand, reveals high p-values and I can not reject H0. That is, I can't conclude that the silver returns from the silver portfolio will outperform the B&H returns measured by the Sharpe ratio. The risk of trading the silver MOM 10 portfolio is reduced 29% and the SMA 10 portfolio is reduced 41% measured by max drawdown, the returns increased 100% and the SR increased 67% for MOM 10 and 50% for SMA 10 compared to the B&H strategy.

For the platinum portfolio the Sharpe ratio from the SMA 16 strategy is statistical

significant at the 5% level, while the MOM 2 strategy is not. I conclude that the returns from the SMA 16 strategy outperforms the returns from the B&H strategy. The risk of trading the platinum MOM 2 portfolio is reduced 48% and the SMA 16 portfolio is reduced 40% measured by max drawdown, the returns increased 150% and the SR increased 109% for MOM 2 and 173% for SMA 16 compared to the B&H strategy.

The returns for palladium using the MOM 7 and SMA 8 are statistical significant at the 5% level, and I conclude that the returns from the palladium portfolio outperforms the returns from the B&H strategy. The risk of trading the palladium MOM 7 portfolio is reduced 59% and the SMA 8 portfolio is reduced 45% measured by max drawdown, the returns increased 186% and 229% and the SR increased 145% for MOM 7 and 165% for SMA 8 compared to the B&H strategy.

## 6.2 Dividing the precious metal's into sub sets

### 6.2.1 Precious metal's 1970-1990 performance:

Asset	Gold	Silver	Platinum	Palladium
Technical strategy	<b>MOM 9</b>	MOM 9	MOM 11	<b>MOM 10</b>
Sharp ratio portfolio	<b>0,64</b>	0,32	0,27	<b>0,36</b>
Sharp ratio B&H	<b>0,29</b>	0,12	0,07	<b>0,09</b>
maxDrawdown B&H	<b>64%</b>	90%	73%	<b>85%</b>
maxDrawdown portfolio	<b>28%</b>	64%	47%	<b>46%</b>
Z test statistics	<b>2,99</b>	1,74	1,48	<b>1,98</b>
p - value	<b>0,0027</b>	0,0811	0,1387	<b>0,0473</b>
Technical strategy	<b>SMA 11</b>	<b>SMA 10</b>	<b>SMA 13</b>	<b>SMA 13</b>
Sharp ratio portfolio	<b>0,66</b>	<b>0,38</b>	<b>0,35</b>	<b>0,42</b>
Sharp ratio B&H	<b>0,29</b>	<b>0,12</b>	<b>0,07</b>	<b>0,09</b>
maxDrawdown portfolio	<b>28%</b>	<b>48%</b>	<b>38%</b>	<b>46%</b>
Z test statistics	<b>3,23</b>	<b>2</b>	<b>2,2</b>	<b>2,4</b>
p - value	<b>0,0013</b>	<b>0,0452</b>	<b>0,0274</b>	<b>0,0163</b>

Table 3: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for a sub set of commodities

Testing the strategies on a shorter timeframe gave strong results. The period from 1970 to 1990 for gold gave a Sharpe ratio was 0,64 for MOM 9 and 0.66 for SMA 11 with drawdown of 28% for both strategies. The B&H strategy had a SR of 0.29 with a drawdown of 64% making the portfolio strategy over 100% better than the passive buy and hold strategy with

respect to risk and reward. Annual std. for the active strategies is 22% with annual returns of 21% compared to 20% and 8% for B&H.

Silver gave a Sharpe ratio of 0.32 for MOM 9 and 0.38 for SMA 10 with drawdown of 64% and 48%. The B&H strategy had a SR of 0.12 with a drawdown of 90% . Annual std. for the active strategies is 22% with annual returns of 21% compared to 20% and 8% for B&H. The gold portfolio is less risky than the silver portfolio.

Platinum gave a Sharpe ratio of 0.27 for MOM 11 and 0.35 for SMA 13 with drawdown of 47% and 38%. The B&H strategy had a SR of 0.07 with a drawdown of 73% . Annual std. for the active strategies is 28% with annual returns of 12% and 14% compared to 27% and 4% for B&H.

Palladium gave a Sharpe ratio of 0.36 for MOM 10 and 0.42 for SMA 13 with drawdown of 46% for both strategies. The B&H strategy had a SR of 0.09 with a drawdown of 85% . Annual std. for the active strategies is 27% with annual returns of 14% and 16% compared to 36% and 7% for B&H.

#### 6.2.2 Precious metal's 1980-2000 performance:

Asset	Gold	Silver	Platinum	Palladium
Technical strategy	<b>MOM 9</b>	MOM 9	MOM 3	<b>MOM 10</b>
Sharp ratio portfolio	-0,07	-0,13	-0,03	0,43
Sharp ratio B&H	-0,45	-0,33	-0,20	0,05
maxDrawdown B&H	<b>64%</b>	64%	64%	<b>64%</b>
maxDrawdown portfolio	<b>26%</b>	48%	43%	<b>47%</b>
Z test statistics	2,17	1,14	1,19	2,91
p - value	0,0300	0,2555	0,2341	0,0036
Technical strategy	<b>SMA 7</b>	SMA 11	SMA 3	<b>SMA 13</b>
Sharp ratio portfolio	-0,15	-0,13	-0,02	0,45
Sharp ratio B&H	-0,45	-0,33	-0,20	0,05
maxDrawdown portfolio	<b>31%</b>	48%	43%	<b>33%</b>
Z test statistics	1,81	1,13	1,17	2,84
p - value	0,0709	0,2587	0,2405	0,0046

Table 4: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for a sub set of commodities

For the period from 1980 to 2000 the Sharpe ratio's were negative for all metal's except palladium. Gold had a Sharpe ratio of -0.07 for MOM 9 and -0.15 for SMA 7 with drawdown of 26% and 31%. The B&H strategy had a SR of -0.45 with a drawdown of 64%. Although

the Sharpe ratio is negative for both strategies, trading the portfolio greatly improves the results compared to the passive buy and hold strategy with respect to risk and reward. Annual std. for the active strategies is 13% with annual returns of 5% and 4% compared to 20% and 8% for B&H.

Silver gave a Sharpe ratio of -0.13 for MOM 9 and -0.13 for SMA 11 with drawdown of 48%. The B&H strategy had a SR of -0.33 with a drawdown of 64%. Annual std. for the active strategies is 22% with annual returns of 1.2% compared to 20% and 8% for B&H.

Platinum portfolio gave a Sharpe ratio of -0.03 for MOM 3 and -0.02 for SMA 3 with drawdown of 43%. The B&H strategy had a SR of -0.20 with a drawdown of 64%. Annual std. for the active strategies is 20% with annual returns of 4% and 5% compared to 20% and 8% for B&H.

For the period from 1980 to 2000 for palladium gave a Sharpe ratio of 0.43 for MOM 10 and 0.45 for SMA 13 with drawdown of 47% and 33%. The B&H strategy had a SR of 0.05 with a drawdown of 64%. Annual std. for the active strategies is 29% and 28% with annual returns of 17% compared to 20% and 8% for B&H.

### 6.2.3 Precious metal's 1990-2012 performance:

Asset	Gold	Silver	Platinum	Palladium
Technical strategy	<b>MOM 9</b>	<b>MOM 9</b>	MOM 11	<b>MOM 10</b>
Sharp ratio portfolio	<b>0,57</b>	<b>0,31</b>	0,22	<b>0,44</b>
Sharp ratio B&H	<b>0,22</b>	<b>0,06</b>	0,04	<b>0,19</b>
maxDrawdown B&H	<b>64%</b>	<b>90%</b>	73%	<b>85%</b>
maxDrawdown portfolio	<b>28%</b>	<b>64%</b>	47%	<b>46%</b>
Z test statistics	<b>3,16</b>	<b>2,18</b>	1,48	<b>2,1</b>
p - value	<b>0,0016</b>	<b>0,0289</b>	0,1398	<b>0,0361</b>
Technical strategy	<b>SMA 11</b>	<b>SMA 10</b>	<b>SMA 13</b>	<b>SMA 13</b>
Sharp ratio portfolio	<b>0,6</b>	<b>0,34</b>	<b>0,3</b>	<b>0,5</b>
Sharp ratio B&H	<b>0,22</b>	<b>0,06</b>	<b>0,04</b>	<b>0,19</b>
maxDrawdown portfolio	<b>28%</b>	<b>48%</b>	<b>38%</b>	<b>46%</b>
Z test statistics	<b>3,4</b>	<b>2,26</b>	<b>2,21</b>	<b>2,51</b>
p - value	<b>0,0006</b>	<b>0,0236</b>	<b>0,0271</b>	<b>0,0122</b>

Table 5: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for a sub set of commodities

The period from 1990 to 2012 turned out to be the strongest with high Sharpe ratio's. Gold

gave a Sharpe ratio of 0.57 for MOM 9 and 0.60 for SMA 11 with drawdown of 28% for both strategies. The B&H strategy had a SR of 0.22 with a drawdown of 64% making the portfolio strategy over 100% better than the passive buy and hold strategy with respect to risk and reward. Annual std. for the active strategies is 21% with annual returns of 19% compared to 20% and 8% for B&H.

Silver gave a Sharpe ratio of 0.31 for MOM 9 and 0.34 for SMA 10 with drawdown of 64% and 48%. The B&H strategy had a SR of 0.06 with a drawdown of 90% making the portfolio strategies outperform B&H 500% with respect to Sharpe ratio. Annual std. for the active strategies is 31% with annual returns of 13% and 14% compared to 33% and 4% for B&H.

Platinum gave a Sharpe ratio of 0.23 for MOM 11 and 0.30 for SMA 13 with drawdown of 47% and 38%. Testing the strategies on this time frame reduced the drawdown 10 percent points compared to the 1970 to 1990 period. The B&H strategy had a SR of 0.04 with a drawdown of 73% making the portfolio strategies outperform B&H 500% with respect to Sharpe ratio. Annual std. for the active strategies is 28% with annual returns of 10% and 13% compared to 27% and 4% for B&H.

Palladium gave a Sharpe ratio of 0.44 for MOM 10 and 0.50 for SMA 13 with drawdown of 46% for both strategies. The B&H strategy had a SR of 0.19 with a drawdown of 85%. Annual std. for the active strategies is 29% with annual returns of 17% and 19% compared to 36% and 7% for B&H.

## 6.3 Equity indices

### 6.3.1 Total equities 1970-2012 performance:

Asset	DJIA	NASDAQ	S&P500	Russel 2000
Technical strategy	MOM 9	MOM 6	MOM 9	MOM 1
SR portfolio	<b>0,24</b>	<b>0,40</b>	<b>0,32</b>	<b>0,31</b>
SR B&H	0,12	0,24	0,11	0,13
maxDrawdown B&H	<b>0,64</b>	0,75	0,53	0,54
maxDrawdown portfolio	<b>0,31</b>	0,35	0,30	0,19
Z test statistics	1,18	1,40	1,80	1,10
p - value	0,2364	0,1612	<b>0,0715</b>	0,2721
Technical strategy	SMA 8	<b>SMA 12</b>	<b>SMA 11</b>	SMA 1
SR portfolio	<b>0,19</b>	<b>0,44</b>	<b>0,34</b>	<b>0,39</b>
SR B&H	0,12	<b>0,24</b>	<b>0,11</b>	0,13
maxDrawdown portfolio	0,27	<b>0,30</b>	<b>0,24</b>	0,20
Z test statistics	0,69	<b>1,99</b>	<b>2,20</b>	1,57
p - value	0,4929	<b>0,0465</b>	<b>0,0277</b>	0,1157

Table 6: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for equities

For the equity indices, the return results for DJIA index using MOM 9 and SMA 8 strategies are not statistical significant and I can't conclude that the SR of the portfolio's are superior to that of B&H.

Testing the strategies on the DJIA gave a Sharpe ratio of 0.24 for MOM 9 and 0.19 for SMA 8 with drawdown's of 31% and 27%. The B&H strategy had a SR of 0.12 with a drawdown of 64%.

Annual std. for the active strategies is 11% and 12% with annual returns of 8% and 7% compared to 20% and 8% for B&H.

Testing the strategies on the NASDAQ gave a Sharpe ratio of 0.40 for MOM 6 and 0.44 for SMA 12 with drawdown's of 35% and 30%. SMA 12 is also the only strategy, besides SMA 1 which gave a SR of 0.58, that is statistical significant at the 95% confidence interval level. The B&H strategy had a SR of 0.24 with a drawdown of 75%. Annual std. for the active strategies is 16% with annual return's of 11% and 12% compared to 21% and 9% for B&H. The returns are negatively skewed at -0.5 and has kurtosis of 6.16, so there is high volatility and downside risk.

Testing the strategies on the S&P500 gave a Sharpe ratio of 0.32 for MOM 9 and 0.34

for SMA 11 with drawdown's of 30% and 24%. The B&H strategy had a SR of 0.11 with a drawdown of 53%. Annual std. for the active strategies is 11% with annual return's of 9% compared to 21% and 9% for B&H. Trading the portfolios compared to B&H will not increase the returns but reduce the risk substantially. The S&P500 is significant at the 5% level when using the SMA 11 strategy with a SR of 0.34, a 200% higher SR than B&H. Max drawdown is 24%, reduced by 55% from the Drawdown for the B&H strategy of 53%. The annual std. is 11% and the annual return is 9% with -0.69 skewness and kurtosis of 6.42.

Timing is essential when using technical indicators in trading. As an example the return from buying an asset right before a financial crisis is devastating, compared to buying the same asset at the bottom before the price start increasing again. There are a lot of studies on mean reversion where an undervalued asset revert to the mean and often over reacts the other way before returning to the mean. The opposite is true for an overvalued asset.

Faber (2007) found that commodities, REITs, and foreign stock indices all suffered losses over 35%. The S&P500 topped out in late 2007 at 1576\$ and declined 58% to 666\$ in the beginning of 2009. My research shows a max drawdown of 53% for the B&H strategy in the S&P500 from 1970 to 2012. At the same time DJIA declined 54% from 14198\$ to 6470\$. The max drawdown were 64% for the B&H strategy for the Dow. The NASDAQ declined from 2861\$ to 1265\$, a 56% drop. The max drawdown were 75% for the B&H strategy in the NASDAQ which occurred in 2000 and the price declined from 5132\$ and bottomed out at 1108\$ in late 2002, a 78% drop. The normal benefits of diversification disappeared as many non-correlated asset classes experienced large declines simultaneously.

Testing the strategies on the Russel 2000 gave a Sharpe ratio of 0.31 for MOM 1 and 0.39 for SMA 1 with drawdown's of 19% and 20%. The B&H strategy had a SR of 0.13 with a drawdown of 54%.

Annual std. for the active strategies is 12% and 13% with annual return's of 11% and 12% compared to 19% and 9% for B&H.

## 6.4 Currencies

### 6.4.1 Total currencies 1970-2012 performance:

Asset	EUR/USD	NOK/USD	SDR/USD	GBP/USD	NZD/USD	CNY/USD
Technical strategy	<b>MOM 2</b>	<b>MOM 1</b>	<b>MOM 1</b>	<b>MOM 7</b>	<b>MOM 10</b>	<b>MOM 10</b>
SR portfolio	0,15	-0,13	-0,68	-0,44	0,01	-1,34
SR B&H	-0,26	-0,44	-1,26	-0,27	-0,49	-1,47
maxDrawdown B&H	0,48	0,51	0,21	0,83	0,73	0,58
maxDrawdown portfolio	0,12	0,15	0,08	0,61	0,16	0,04
Z test statistics	3,44	2,91	3,36		3,75	
p - value	0,0005	0,0036	0,0007		0,0001	
Technical strategy	<b>SMA 2</b>	<b>SMA 1</b>	<b>SMA 1</b>	<b>SMA 13</b>	<b>SMA 13</b>	<b>SMA 7</b>
SR portfolio	0,18	-0,13	-0,57	-0,52	0,01	-0,89
SR B&H	-0,26	-0,44	-1,26	-0,27	-0,49	-1,47
maxDrawdown portfolio	0,12	0,20	0,06	0,76	0,16	0,21
Z test statistics	3,88	2,54	3,99		3,86	4,25
p - value	0,0001	0,0111	0,00E+000		0,0001	0,00E+000

Asset	AUD/USD	JPY/USD	CAD/USD	INR/USD	ZAR/USD	CHF/USD
Technical strategy	<b>MOM 10</b>	<b>MOM 2</b>	<b>MOM 1</b>	<b>MOM 1</b>	<b>MOM 1</b>	<b>MOM 1</b>
SR portfolio	-0,07	0,14	-0,56	0,32	0,49	-0,15
SR B&H	-0,47	-0,15	-1,17	-0,14	0,08	-0,88
maxDrawdown B&H	0,67	0,42	0,40	0,20	0,51	0,82
maxDrawdown portfolio	0,15	0,10	0,06	0,06	0,14	0,08
Z test statistics	2,98	2,66	5,33	5,98	4,46	5,27
p - value	0,0028	0,0077	0,00E+000	0,00E+000	0,00E+000	0,00E+000
Technical strategy	<b>SMA 11</b>	<b>SMA 1</b>	<b>SMA 1</b>	<b>SMA 2</b>	<b>SMA 1</b>	<b>SMA 1</b>
SR portfolio	-0,10	0,10	-0,40	0,40	0,55	-0,15
SR B&H	-0,47	-0,15	-1,17	-0,14	0,08	-0,88
maxDrawdown portfolio	0,14	0,24	0,03	0,06	0,13	0,08
Z test statistics	2,72	2,23	6,04	6,74	5,11	7,32
p - value	0,0065	0,0257	0,00E+000	0,00E+000	0,00E+000	0,00E+000

Table 7: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for currencies

For most of the currencies the strategies performed poorly, with some exceptions. The only currency pair that was not statistically significant testing the Sharpe ratio on the 5% level was GBP/USD using the MOM 2.5 strategy. Testing the strategies on the EUR/USD gave a Sharpe ratio of 0.15 for MOM 2 and 0.39 for SMA 2 with drawdown's of 12%. The B&H strategy



had a SR of -0.26 with a drawdown of 48%.

Annual std. for the active strategies is 8% with annual return's of 7% compared to 11% and 2% for B&H. Trading the portfolio's reduces the downside risk and increases the return's compared to B&H, but using MOM 2 or SMA 2 will result in many trades and high transaction costs. The returns are slightly positively skewed and has a kurtosis of 4.7.

Testing the strategies on the NZD/USD gave a Sharpe ratio of 0.01 for MOM 10 and 0.01 for SMA 13 with drawdown's of 16%. The B&H strategy had a SR of -0.49 with a drawdown of 73%.

Annual std. for the active strategies is 7.5% with annual return's of 6% compared to 12% and -0.7% for B&H. The portfolio is negatively skewed at -0.42 and has a kurtosis of 8.2.

Testing the strategies on the JPY/USD gave a Sharpe ratio of 0.14 for MOM 2 and 0.10 for SMA 1 with drawdown's of 10% and 24%. The B&H strategy had a SR of -0.15 with a drawdown of 42%. Annual std. for the active strategies is 8% with annual return's of 7% compared to 11% and 3% for B&H. The portfolio is positively skewed at 1.1 with a kurtosis of 7.9. Even though the SMA 1 portfolio has the highest SR, it is also the portfolio with the highest drawdown. To reduce this risk, a trader could use the MOM 11 portfolio or SMA 4 with SR's of 0.10 and 0.09. The risk measured by std. is only 1% point higher while the annual return's are 1% point lower for both strategies.

Testing the strategies on the INR/USD gave a Sharpe ratio of 0.32 for MOM 1 and 0.4 for SMA 2 with drawdown's of 6%. The B&H strategy had a SR of -0.19 with a drawdown of 20%.

Annual std. for the active strategies is 6% with annual return's of 8% compared to 6% and 5% for B&H. Notice that all the strategies used on INR/USD returned significant, positive and high SR's. The returns are positively skewed at 5.4 and the kurtosis is over 60 and very high, which implies that the returns are unstable. For longer time frames and to avoid transaction costs, a trader could use the MOM 10 or SMA 10 which have a SR of 0.22 and 0.24. The max drawdown is 2% point's lower than MOM 1 and SMA 2, the std. is the same and the returns are 1% point lower if a trader chose the later strategies.

Testing the strategies on the ZAR/USD gave a Sharpe ratio of 0.49 for MOM 1 and 0.55 for SMA 1 with drawdown's of 14% and 13%. The B&H strategy had a SR of 0.08 with a drawdown of 51%.

Annual std. for the active strategies is 10% with annual return's of 10% and 11% compared to

12% and 6% for B&H. Note that ZAR/USD gave superior results to the other currency pairs with a SR of 0.55 using the SMA 1 strategy. It is also the only currency pair with a positive SR for the B&H strategy with a SR of 0.08. On average the SR for ZAR/USD is 0.39 using from 1, 2, 2.5, 7, 10, 11 and 13 months in the computation. (All the strategies tested was statistical significant at the 5% level except the SMA 2.5 strategy). However, looking at the graph it is clear that had a INRestor bought ZAR/USD in 1999 and just hold, he would be worse off today. Using SMA 1 would result in the strategy beeing very close to the price and would give many buy or sell signals leading to high transaction costs. A investor or trader would be better off using SMA 10 with a SR of 0.38 and which would have saved them a lot of capital in the period from 1999 to 2002. The annual std. was 10% and the annual return was 9% for this strategy. The drawdown for SMA 10 is 28% and more volatile than the 13% drawdown for SMA 1. One strategy would be to short the ZAR/USD once the price breaks through the SMA 10 line from above and to the downside. The rest of the currency pairs resulted in negative Sharpe ratios and won't be further commented, although the results from the portfolio's outperformed the B&H strategy.

## 6.5 Total assets

### 6.5.1 Total strategy across asset classes 1970-2012 performance:

	<b>Commodities</b>	<b>Equity indexes</b>	<b>Currencies</b>	<b>All assets</b>
	Average B&H	Average B&H	Average B&H	Average B&H
Sharp ratio B&H	0,18	0,15	-0,58	<b>-0,08</b>
Min B&H	-0,36	-0,23	-0,14	<b>-0,24</b>
Max B&H	0,46	0,17	0,17	<b>0,26</b>
Skewness B&H	0,68	-0,52	-0,09	<b>0,02</b>
Kurtosis B&H	4,48	1,76	15,00	<b>7,08</b>
maxDrawdown B&H	0,78	0,59	0,53	<b>0,63</b>
Annual Std. B&H	0,29	0,18	0,10	<b>0,19</b>
Annual return B&H	0,06	0,08	0,01	<b>0,05</b>
Mean excess return B&H	0,00	0,00	0,00	<b>0,00</b>
Strategy	Average MOM	Average MOM	Average MOM	Average MOM
Sharp ratio portfolio	0,39	0,22	-0,28	<b>0,11</b>
Min portfolio	-0,24	-0,20	-0,12	<b>-0,19</b>
Max portfolio	0,49	0,16	0,12	<b>0,26</b>
Skewness portfolio	1,37	-0,50	-0,34	<b>0,18</b>
Kurtosis portfolio	9,05	4,76	22,65	<b>12,16</b>
maxDrawdown portfolio	0,51	0,30	0,19	<b>0,34</b>
Annual Std. Portfolio	0,31	0,13	0,07	<b>0,17</b>
Annual return portfolio	0,16	0,09	0,05	<b>0,10</b>
Mean excess return portfolio	0,01	0,00	0,00	<b>0,00</b>
Strategy	Average SMA	Average SMA	Average SMA	Average SMA
Sharp ratio portfolio	0,45	0,24	-0,25	<b>0,15</b>
Min portfolio	-0,24	-0,19	-0,11	<b>-0,18</b>
Max portfolio	0,49	0,16	0,13	<b>0,26</b>
Skewness portfolio	1,52	-0,39	-0,01	<b>0,37</b>
Kurtosis portfolio	9,64	4,57	20,47	<b>11,56</b>
maxDrawdown portfolio	0,36	0,27	0,18	<b>0,27</b>
Annual Std. Portfolio	0,30	0,13	0,07	<b>0,17</b>
Annual return portfolio	0,18	0,09	0,05	<b>0,10</b>
Mean excess return portfolio	0,01	0,00	0,00	<b>0,01</b>

Table 8: Sharpe ratio, max drawdown and test statistics between the active portfolio and the B&H strategy for all assets

The MOM strategy returned the highest Sharpe ratio of 0.39 for commodities, 0.22 for equities and -0.28 for the currency pairs. The returns were only positively skewed for commodities. However, the commodities max drawdown is 51%, 30% for equities and 19%

for currencies. The same can be observed looking at the annual std. as a risk measure with a std. of 31% for commodities, 13% for equities and 7% for currencies. The annual returns are highest for commodities with an annual return of 16%, 9% for equities and 5% return for the currencies using the MOM strategy.

The SMA strategy returned the highest Sharpe ratio of 0.45 for commodities, 0.24 for equities and -0.25 for the currency pairs. The returns were only positively skewed for commodities. However, the commodities max drawdown is 36%, 27% for equities and 18% for currencies. The same can be observed looking at the annual std. as a risk measure with a std. of 30% for commodities, 13% for equities and 7% for currencies. The annual returns are highest for commodities with an annual return of 18%, 9% for equities and 5% return for the currencies using the SMA strategy.

The B&H strategy returned the highest Sharpe ratio of 0.18 for commodities, 0.15 for equities and -0.58 for the currency pairs. The returns were only positively skewed for commodities. However, the commodities max drawdown is 78%, around 25% higher than for the other assets tested. The same can be observed looking at the annual std. as a risk measure with a std. of 29% for commodities, 18% for equities and 10% for currencies. The annual returns are highest for equities with a return of 8%, 6% for commodities and a poorly 1% return for the currencies.

Overall, the B&H for all the assets combined returns a slightly negativ SR of -0.08. The SMA strategy have a SR of 0.15 and beats the MOM strategy which have a SR of 0.11. The returns is positively skewed for all the strategies. The kurtosis for the portfolio's is almost double that of B&H and indicates that the results from the portfolio performance is less stable than the returns from the B&H strategy. On average the B&H strategy had a drawdown of 63% while the SMA strategy had a drawdown of 27% and MOM 34%. If a trader use the SMA or MOM strategy apposed to the traditional B&H strategy, a trader would reduce the portfolio risk. The annual std. for B&H is 19% and 17% for the strategies. The annual return for B&H is 5% and over 10% using the SMA or MOM strategy. This shows that the SMA strategy on average slightly outperformed the MOM starategy with respect to Sharpe ratio and returns, and increased the return 100% vs. B&H. Note that the SMA strategy is slightly riskier than the MOM starategy when looking at max drawdown and std.

However, since I only tested the strategies on in-sample data, there is a chance that

these results would be different had I tested the strategies on out-of-sample data. Another weakness with my thesis is that I only tested 4 commodities, 4 stock indices and 12 currencies. The results might have been worse if I had tested more asset classes. The SMA and MOM strategies worked well on commodities and equities. Although using the strategies on currencies resulted in negative Sharpe ratio and low return's, the strategies outperformed the B&H strategy.

6.6 AR(1) autocorrelation across assets:

AR(1)	1971-2012		1971-1990		1980-2000		1990-2012	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Gold	0,09	<b>0,04</b>	0,15	<b>0,02</b>	-0,06	0,31	-0,13	<b>0,03</b>
Silver	0,03	0,48	0,12	0,07	0,00	0,94	-0,10	0,09
Platinum	-0,02	0,73	-0,06	0,31	-0,12	<b>0,05</b>	0,11	0,07
Palladium (1978)	0,02	0,73	0,02	0,83	-0,03	0,66	0,02	0,77
DJIA	0,02	0,60	0,04	0,53	-0,03	0,60	0,01	0,82
NASDAQ	0,13	<b>0,00</b>	0,18	<b>0,01</b>	0,09	0,18	0,11	0,08
S&P500	0,04	0,38	0,02	0,75	-0,03	0,62	0,06	0,30
Russel 2000 (1988)	0,11	0,36	0,24	0,18	0,07	0,35	-0,14	0,32
EUR/USD	0,01	0,76	0,00	0,94	0,05	0,45	0,05	0,45
JPY/USD	0,04	0,42	0,06	0,34	0,03	0,68	0,02	0,78
INR/USD	0,27	<b>0,00</b>	0,22	<b>0,00</b>	0,21	<b>0,00</b>	0,33	<b>0,00</b>
ZAR/USD	0,33	<b>0,00</b>	0,35	<b>0,00</b>	0,34	<b>0,00</b>	0,32	<b>0,00</b>

Table 9: Shows the autocorrelation for all the different assets represented by the lagging coefficient and the following p-value

The autocorrelation is positive but weak overall, and is statistical significant at the 5% level for gold, NASDAQ, INR/USD and ZAR/USD for the total data set tested from 1970 to 2012. The lagging effect is minimal for gold with positive lag for the entire period, positive lag in the 1971-1990 period and with negative autocorrelation for the period 1990-2012. This doesn't make much sense when comparing the lag to the actual price action, which have been very bullish the last decade. The NASDAQ have positive lags for all periods but the autocorrelation is only statistical significant for the entire period and from 1971-1990. The INR and ZAR have stronger coefficients, while below 0,5 they have stayed positive throughout all the time periods tested. They tend to have a slightly bullish tendency when looking at the lagging effect. This analysis did not shed much light on the time-series and have weak predictive lags for further price direction.

## 7 Conclusion

The SMA strategy beat the MOM strategy for all precious metal's except from silver when looking at the Sharpe ratio for the period 1970-2012. Gold have the highest score of 0.24 when looking at the buy and hold strategy, with palladium having the next best score at 0.20. Note that when trading the active portfolio, palladium slightly outperformed gold using SMA 8 for palladium vs. SMA 11 for gold, while the MOM strategy gave the same results for both metal's judging by the Sharpe ratio. The max drawdown is higher for palladium and thus making this portfolio more risky than the gold portfolio. Silver is by far the most risky portfolio amongst the precious metal's and even though the Sharpe ratio was very high compared to the buy and hold strategy for silver alongside platinum, both gold and palladium greatly outperformed them, especially when using the SMA strategy. The annual return's for palladium was over 20%, 13% for gold and around 10% for silver and platinum, making palladium SMA 8 strategy the best performer when looking at the entire data set from 1970 to 2012.

When testing the sub period 1970-1990, the SMA strategy is superior to the MOM strategy for all the precious metal's. Gold greatly outperformed the other metal's with respect to Sharpe ratio for the portfolio's MOM 9 and SMA 11 as well as for the buy and hold strategy. The drawdown for gold were superior to the other assets with much lower risk. Annual return for both gold and silver was extraordinary and around 20%.

From 1980 to 2000 all the metal's returned negative Sharpe ratios except for palladium, which had high positive ratio for the portfolio's and a slightly positive Sharpe ratio for the buy and hold strategy. The drawdown in the period was smallest for the gold portfolio's. In this period a trader would be better off buying and holding gold, silver or platinum compared to trading the portfolio's which had much lower annual returns with only slightly more risk for gold and silver measured by standard deviation. If a trader bought and held platinum in this period, the annual return would be about 100% higher than trading the portfolio's with equal risk. Also the transaction costs would have been much lower. It was surprising to observe the extraordinary performance of the palladium portfolio's.

In the last sub set from 1990 to 2012 the SMA outperformed the MOM strategy. Gold performed best with palladium following close behind. The same goes for the buy and hold strategy. The gold portfolio's have lowest risk according to the max drawdown. Both gold and

palladium had high annual return's of 19% for the portfolio's, while silver and platinum return's were around 10-13%.

For the equity indices from 1970 to 2012 the SMA strategy outperformed the MOM strategy in the NASDAQ, S&P500 and Russel 2000 indices, the only exception was DJIA where the MOM 9 portfolio was superior. The NASDAQ SMA 12 portfolio has the highest Sharpe ratio of the indices, SMA 11 was the best strategy for the S&P500, while SMA 8 worked best on the DJIA. The max drawdown for the period was highest for DJIA and NASDAQ. Minimum drawdown for the indices using the buy and hold strategy is greater than 50%, while actively trading the portfolio's will reduce the drawdown risk about 50%. The NASDAQ and Russel 2000 had higher annual return's using the strategies compared to buy and hold, the S&P500 and DJIA gave same return's for the portfolio as the buy and hold strategy. The results from testing the small cap index Russel 2000 is insignificant and have too few observations to give any meaningful results. Notice how small cap and technology stocks outperform using shorter timeframes in the strategy, compared to the DJIA and S&P500. This could be as a result of more active trading and rapidly sector changes and higher volatility.

Across the entire data set from 1970 to 2012 testing the strategies on the different asset classes, the buy and hold strategy performs best on precious metal's and equity indices. For currencies the strategies performed poorly with high risk and low annual return's. Overall for all asset classes, the buy and hold strategy have a slightly negative Sharpe ratio with high risk and low return. For the active strategies, the SMA strategy outperformed the MOM strategy across all asset's with the highest Sharpe ratio. The precious metal's outperformed the other assets when looking at Sharpe ratio. This confirms earlier studies that conclude that higher return's can only be achieved by taking on additional risk. The drawdown and std. for the metal's combined are much higher on average, than the other asset's. As stated above, the return's are superior. The conclusion is that the SMA and MOM strategy perform's well on many different asset's on in-sample data, and that the SMA strategy outperformed the MOM strategy. These observations are not new. What might not have been documented before, is how well the strategies performed on the precious metal's and even that the results, especially for palladium was quite robust. Further research should again test these strategies on out-of sample data to deal with data-mining issues and the fact that this study was conducted on data

consisting of a relatively short time frame. 40 years of data might not be sufficient to determine if this strategy works well, and there is no guarantee that what might have worked in the past, will work in the future. Only time will tell.

Wealth of 1\$ invested in the portfolio vs. Buy and hold (precious metal's):

Figure 1: The wealth of 1\$ invested in the SMA 11 gold portfolio vs B&H

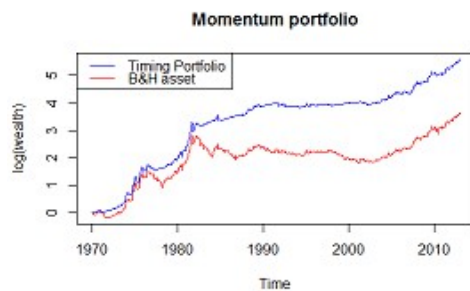


Figure 2: The wealth of 1\$ invested in the MOM 10 silver portfolio vs B&H

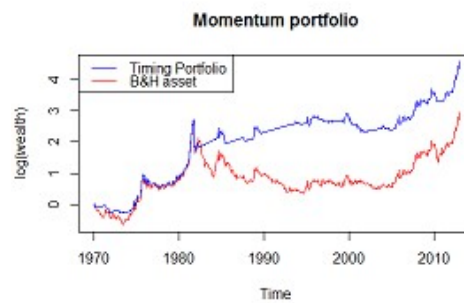


Figure 3: The wealth of 1\$ invested in the SMA 16 platinum portfolio vs B&H

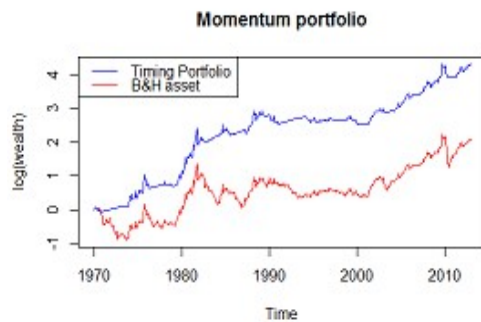


Figure 4: The wealth of 1\$ invested in the SMA 8 palladium portfolio vs B&H

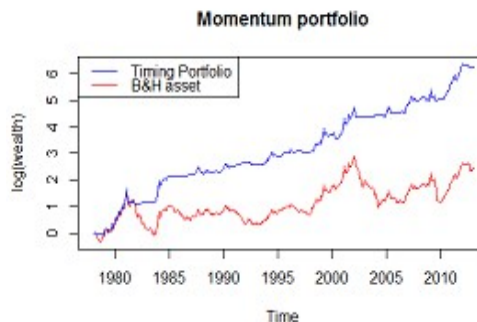


Figure 3: Shows how a portfolio ( blue line) performed in the period from 1970 to 2012 for the precious metal's compared to a the buy and hold strategy (red line)

The precious metal's portfolio's greatly outperformed the buy and hold strategy for the three decades of data tested. When dividing the total data set into sub sets, the period from 1980 to 2000 returned negative Sharpe ratio's except for palladium. The point being, that even though the performance of actively trading the portfolio's for the entire data set would have been very successful, the performance would have been much worse if the portfolio had only been traded in the period 1980-2000.



## Best strategies

BEST Strategy	MOM	SMA
Gold	9	11
Silver	10	<b>10</b>
Platinum	2	16
Palladium	7	8
DJIA	9	8
NASDAQ	6	12
S&P500	9	11
Russel 2000	<b>1</b>	1
EUR/USD	2	<b>2</b>
NZD/USD	10	<b>13</b>
JPY/USD	2	<b>1</b>
INR/USD	<b>1</b>	<b>2</b>
ZAR/USD	<b>1</b>	<b>1</b>

1970-1990		
Gold	9	11
Silver	9	10
Platinum	11	13
Palladium	10	13
1980-2000		
Gold	9	7
Silver	9	11
Platinum	3	3
Palladium	10	13
1990-2012		
Gold	9	11
Silver	9	10
Platinum	11	13
Palladium	10	13

Table 10: Summary best performing strategies on different assets

## 8 Appendix

Index/FX/ComrGold									
Start date	1970,1								
end date	2012,12								
n	516								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15		1
SR B&H	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24
Min B&H	-0,19	-0,19	-0,19	-0,19	-0,19	-0,19	-0,19	-0,19	-0,19
Max B&H	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30
Mean return B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
UCL mean B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Std B&H	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Skewness B&H	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97
Kurtosis B&H	4,22	4,22	4,22	4,22	4,22	4,22	4,22	4,22	4,22
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	9	10	11	13	15	
SR portfolio	0,30	0,40	0,48	<b>0,49</b>	0,47	0,43	0,39	0,47	0,43
Min portfolio	-0,19	-0,19	-0,19	<b>-0,19</b>	-0,19	-0,19	-0,19	-0,19	-0,19
Max portfolio	0,30	0,30	0,30	<b>0,30</b>	0,30	0,30	0,30	0,30	0,30
Mean return portfolio	0,01	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01	0,01	0,01
LCL mean portfolio	0,00	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01	0,01	0,01
UCL mean portfolio	0,01	0,01	0,02	<b>0,02</b>	0,02	0,02	0,01	0,02	0,02
Std portfolio	0,05	0,05	0,05	<b>0,05</b>	0,05	0,05	0,05	0,05	0,05
Skewness portfolio	1,69	1,71	1,52	<b>1,47</b>	1,35	1,25	1,29	1,30	1,45
Kurtosis portfolio	9,89	11,33	8,87	<b>8,79</b>	8,15	7,86	7,95	7,79	8,83
maxDrawdown portfolio	0,32	0,31	0,28	<b>0,32</b>	0,29	0,31	0,31	0,31	0,30
Annual Std. Portfolio	0,17	0,16	0,17	<b>0,17</b>	0,18	0,18	0,18	0,18	0,17
Annual return portfolio	0,10	0,11	0,13	<b>0,13</b>	0,13	0,12	0,12	0,13	0,12
Mean excess return portfolio	0,00	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01	0,01	0,01

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	9	10	11	12	15	
SR portfolio	0,32	0,33	0,47	0,50	<b>0,52</b>	0,48	0,46	0,44
Min portfolio	-0,19	-0,19	-0,19	-0,19	<b>-0,19</b>	-0,19	-0,19	-0,19
Max portfolio	0,30	0,30	0,30	0,30	<b>0,30</b>	0,30	0,30	0,30
Mean return portfolio	0,01	0,01	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01
LCL mean portfolio	0,00	0,01	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01
UCL mean portfolio	0,01	0,01	0,02	0,02	<b>0,02</b>	0,02	0,02	0,02
Std portfolio	0,05	0,05	0,05	0,05	<b>0,05</b>	0,05	0,05	0,05
Skewness portfolio	1,90	1,68	1,63	1,57	<b>1,57</b>	1,43	1,33	1,59
Kurtosis portfolio	10,93	10,60	9,76	9,16	<b>8,82</b>	8,54	8,19	9,43
maxDrawdown portfolio	0,34	0,32	0,28	0,28	<b>0,28</b>	0,29	0,28	0,30
Annual Std. Portfolio	0,16	0,17	0,17	0,17	<b>0,17</b>	0,17	0,18	0,17
Annual return portfolio	0,10	0,10	0,13	0,13	<b>0,14</b>	0,13	0,13	0,12
Mean excess return portfolio	0,00	0,00	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01

Table 11: Gold performance 1970-2012

Index/FX/Comm Gold								
Start date	1970,1							
end date	1990							
n	229							
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13		1
SR B&H	0,29	0,29	0,29	0,29	0,29	0,29	0,29	0,29
Skewness B&H	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94
Kurtosis B&H	2,81	2,81	2,81	2,81	2,81	2,81	2,81	2,81
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	0,49	0,48	0,61	<b>0,64</b>	0,57	0,47	0,43	0,53
Skewness portfolio	1,49	1,48	1,31	<b>1,41</b>	1,30	1,19	1,23	1,34
Kurtosis portfolio	6,59	7,37	5,80	<b>6,00</b>	5,53	5,12	5,23	5,95
maxDrawdown portfolio	0,32	0,31	0,28	<b>0,28</b>	0,28	0,31	0,31	0,30
Annual Std. Portfolio	0,21	0,21	0,22	<b>0,22</b>	0,22	0,23	0,23	0,22
Annual return portfolio	0,17	0,16	0,20	<b>0,21</b>	0,19	0,17	0,16	0,18
z	1,62	1,42	2,88	<b>3,00</b>	2,53	1,71	1,31	2,07
P-value	0,11	0,16	0,00	<b>0,00</b>	0,01	0,09	0,19	0,08

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	0,53	0,40	0,61	0,61	0,64	<b>0,66</b>	0,64	0,58
Skewness portfolio	1,85	1,45	1,48	1,48	1,41	<b>1,39</b>	1,38	1,49
Kurtosis portfolio	7,72	6,94	6,75	6,90	6,34	<b>5,98</b>	5,88	6,64
maxDrawdown portfolio	0,27	0,32	0,28	0,28	<b>0,28</b>	<b>0,28</b>	0,28	0,28
Annual Std. Portfolio	0,21	0,21	0,21	0,21	0,21	<b>0,22</b>	0,22	0,21
Annual return portfolio	0,18	0,15	0,20	0,20	0,21	<b>0,21</b>	0,21	0,19
z	1,74	0,81	2,54	2,52	2,92	<b>3,23</b>	3,08	2,40
P-value	0,08	0,42	0,01	0,01	0,00	<b>0,00</b>	0,00	0,08

Table 12: Gold performance 1970-1990

Indicator	Gold	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Start date	1980	1	2,5	9	10	11	13		1
Lookback period	2000								
end date	241								
SR B&H		-0,45	-0,45	-0,45	-0,45	-0,45	-0,45	-0,45	-0,45
Skewness B&H		0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97
Kurtosis B&H		5,67	5,67	5,67	5,67	5,67	5,67	5,67	5,67
maxDrawdown B&H		0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H		0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H		0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	-0,26	-0,26	-0,19	<b>-0,07</b>	-0,12	-0,19	-0,22	-0,19
Skewness portfolio	1,36	1,14	1,13	<b>1,45</b>	1,31	1,04	1,09	1,22
Kurtosis portfolio	14,77	22,24	19,43	<b>21,66</b>	19,47	18,41	19,07	19,29
maxDrawdown portfolio	0,32	0,29	0,26	<b>0,26</b>	0,26	0,34	0,31	0,29
Annual Std. Portfolio	0,15	0,13	0,14	<b>0,13</b>	0,13	0,14	0,14	0,14
Annual return portfolio	0,02	0,03	0,03	<b>0,05</b>	0,04	0,03	0,03	0,03
z	1,26	1,09	1,54	<b>2,17</b>	1,97	1,57	1,39	1,57
P-value	0,21	0,28	0,12	<b>0,03</b>	0,05	0,12	0,16	0,14

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	-0,22	-0,42	<b>-0,15</b>	-0,22	-0,20	-0,19	-0,21	-0,23
Skewness portfolio	1,09	1,20	<b>1,32</b>	1,20	1,19	1,18	1,15	1,19
Kurtosis portfolio	19,07	22,26	<b>18,39</b>	23,57	23,45	23,28	22,60	21,80
maxDrawdown portfolio	0,31	0,29	<b>0,31</b>	0,31	0,31	0,31	0,31	0,31
Annual Std. Portfolio	0,14	0,13	<b>0,14</b>	0,13	0,13	0,13	0,13	0,13
Annual return portfolio	0,02	0,01	<b>0,04</b>	0,03	0,04	0,04	0,03	0,03
z	1,39	0,16	<b>1,81</b>	1,26	1,37	1,45	1,37	1,26
P-value	0,16	0,87	<b>0,07</b>	0,21	0,17	0,15	0,17	0,26

Table 13: Gold performance 1980-2000

Index/FX/ComrGold									
Start date	1990								
end date	2012								
n	265								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13			1
SR B&H	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,2152	0,2152
Skewness B&H	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,9836	0,9836
Kurtosis B&H	3,07	3,07	3,07	3,07	3,07	3,07	3,07	3,0705	3,0705
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,6367	0,6367
Annual Std. B&H	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2033	0,2033
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,078	0,078
Indicator	MOM	MOM	MOM	<b>MOM</b>	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	<b>9</b>	10	11	13		
SR portfolio	0,41	0,43	0,55	<b>0,57</b>	0,51	0,41	0,3994	0,46875	
Skewness portfolio	1,52	1,55	1,39	<b>1,49</b>	1,39	1,28	1,3267	1,42145	
Kurtosis portfolio	6,96	8,23	6,52	<b>6,74</b>	6,25	5,83	6,0734	6,65792	
maxDrawdown portfolio	0,32	0,31	0,28	<b>0,28</b>	0,28	0,31	0,3089	0,29725	
Annual Std. Portfolio	0,21	0,2	0,21	<b>0,21</b>	0,21	0,22	0,2152	0,21017	
Annual return portfolio	0,15	0,15	0,18	<b>0,19</b>	0,17	0,15	0,1474	0,16307	
z	1,71	1,7	3,05	<b>3,16</b>	2,73	1,95	1,7797	2,29476	
P-value	0,09	0,09	0	<b>0</b>	0,01	0,05	0,0751	0,04485	
Indicator	SMA	SMA	SMA	SMA	SMA	<b>SMA</b>	SMA	Average	
Lookback period	1	2,5	7	9	10	<b>11</b>	13		
SR portfolio	0,49	0,33	0,56	0,55	0,58	<b>0,6</b>	0,5812	0,52772	
Skewness portfolio	1,93	1,52	1,54	1,56	1,49	<b>1,47</b>	1,4633	1,56855	
Kurtosis portfolio	8,42	7,68	7,35	7,71	7,11	<b>6,72</b>	6,6197	7,37354	
maxDrawdown portfolio	0,27	0,32	0,28	0,28	0,28	<b>0,28</b>	0,2798	0,2831	
Annual Std. Portfolio	0,2	0,2	0,2	0,2	0,21	<b>0,21</b>	0,2086	0,2045	
Annual return portfolio	0,16	0,13	0,18	0,18	0,19	<b>0,19</b>	0,1899	0,17557	
z	2,11	0,96	2,94	2,72	3,11	<b>3,41</b>	3,269	2,64283	
P-value	0,04	0,34	0	0,01	0	<b>0</b>	0,0011	0,05524	

Table 14: Gold performance 1990-2012

Index/FX/ComrSilver									
Start date	1970,1								
end date	2012,12								
n	516								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15		1
SR B&H	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18
Min B&H	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48
Max B&H	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58
Mean return B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
UCL mean B&H	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Std B&H	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09
Skewness B&H	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
Kurtosis B&H	6,06	6,06	6,06	6,06	6,06	6,06	6,06	6,06	6,06
maxDrawdown B&H	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90
Annual Std. B&H	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
Annual return B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	9	10	11	13	15	
SR portfolio	0,18	0,27	0,26	0,29	0,30	0,26	0,25	0,24	0,26
Min portfolio	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48
Max portfolio	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58	0,58
Mean return portfolio	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
UCL mean portfolio	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Std portfolio	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Skewness portfolio	1,46	1,23	1,13	1,13	1,10	1,08	1,06	1,07	1,16
Kurtosis portfolio	14,88	13,12	13,64	13,44	13,16	12,50	12,75	12,19	13,21
maxDrawdown portfolio	0,58	0,70	0,72	0,64	0,64	0,64	0,64	0,64	0,65
Annual Std. Portfolio	0,27	0,28	0,27	0,28	0,28	0,28	0,28	0,28	0,28
Annual return portfolio	0,07	0,10	0,09	0,10	0,11	0,10	0,09	0,09	0,09
Mean excess return portfolio	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	9	10	11	15	
SR portfolio	0,15	0,17	0,25	0,27	0,26	0,19	0,21
Min portfolio	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48	-0,48
Max portfolio	0,58	0,58	0,58	0,58	0,58	0,58	0,58
Mean return portfolio	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00
UCL mean portfolio	0,01	0,02	0,02	0,02	0,02	0,02	0,02
Std portfolio	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Skewness portfolio	1,48	1,24	1,34	1,38	1,18	1,13	1,29
Kurtosis portfolio	14,23	14,49	13,51	13,94	13,30	12,96	13,74
maxDrawdown portfolio	0,62	0,66	0,53	0,53	0,66	0,70	0,62
Annual Std. Portfolio	0,27	0,27	0,27	0,27	0,28	0,28	0,27
Annual return portfolio	0,06	0,07	0,09	0,10	0,09	0,07	0,08
Mean excess return portfolio	0,00	0,00	0,01	0,01	0,01	0,00	0,01

Table 15: Silver performance 1970-2012

Index/FX/ComrSilver									
Start date	1970,1								
end date	1990								
n									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13			1
SR B&H	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12
Skewness B&H	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,91
Kurtosis B&H	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99
maxDrawdown B&H	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90
Annual Std. B&H	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
Annual return B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Indicator	MOM	MOM	MOM	<b>MOM</b>	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	<b>9</b>	10	11	13		
SR portfolio	0,29	0,23	0,25	<b>0,32</b>	0,29	0,26	0,25	0,27	
Skewness portfolio	1,77	1,41	1,34	<b>1,27</b>	1,28	1,23	1,21	1,36	
	15,0	12,4	13,0	<b>12,4</b>	12,4	11,2			
Kurtosis portfolio	4	8	2	<b>4</b>	1	4	11,99	12,66	
maxDrawdown portfolio	0,53	0,70	0,72	<b>0,64</b>	0,64	0,64	0,64	0,65	
Annual Std. Portfolio	0,31	0,33	0,33	<b>0,33</b>	0,33	0,34	0,33	0,33	
Annual return portfolio	0,13	0,10	0,11	<b>0,14</b>	0,12	0,11	0,11	0,12	
z	1,26	0,96	1,05	<b>1,74</b>	1,42	1,27	1,13	1,26	
P-value	0,21	0,34	0,30	<b>0,08</b>	0,16	0,20	0,26	0,22	
Indicator	SMA	SMA	SMA	SMA	<b>SMA</b>	SMA	SMA	Average	
Lookback period	1	2,5	7	9	<b>10</b>	11	13		
SR portfolio	0,20	0,20	0,32	0,34	<b>0,38</b>	0,32	0,36	0,30	
Skewness portfolio	1,57	1,36	1,56	1,56	<b>1,63</b>	1,37	1,34	1,49	
	11,7	13,7	13,0	13,1	<b>13,7</b>	12,8			
Kurtosis portfolio	7	7	7	2	<b>9</b>	7	12,69	13,01	
maxDrawdown portfolio	0,54	0,64	0,58	0,53	<b>0,48</b>	0,66	0,66	0,58	
Annual Std. Portfolio	0,33	0,32	0,32	0,32	<b>0,32</b>	0,33	0,33	0,32	
Annual return portfolio	0,09	0,09	0,14	0,14	<b>0,16</b>	0,13	0,15	0,13	

Table 16: Silver performance 1970-1990

Index/FX/ComrSilver								
Start date	1980,1							
end date	2000							
n	241							
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13		1
SR B&H	-0,33	-0,33	-0,33	-0,33	-0,33	-0,33	-0,33	-0,33
Skewness B&H	-0,31	-0,31	-0,31	-0,31	-0,31	-0,31	-0,31	-0,31
Kurtosis B&H	4,21	4,21	4,21	4,21	4,21	4,21	4,21	4,21
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	-0,21	-0,21	-0,23	<b>-0,13</b>	-0,16	-0,22	-0,27	-0,20
Skewness portfolio	-0,75	-0,75	-1,34	<b>-1,42</b>	-1,37	-1,44	-1,89	-1,28
Kurtosis portfolio	14,23	14,23	17,26	<b>18,56</b>	17,73	18,73	19,28	17,15
maxDrawdown portfolio	0,54	0,54	0,61	<b>0,48</b>	0,48	0,48	0,48	0,51
Annual Std. Portfolio	0,23	0,23	0,22	<b>0,22</b>	0,22	0,22	0,21	0,22
Annual return portfolio	-0,01	-0,01	-0,01	<b>0,01</b>	0,01	-0,01	-0,01	0,00
z	0,72	0,72	0,57	<b>1,14</b>	0,98	0,63	0,31	0,72
P-value	0,47	0,47	0,57	<b>0,26</b>	0,33	0,53	0,75	0,48
Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	-0,19	-0,27	-0,26	-0,20	-0,15	<b>-0,13</b>	-0,13	-0,19
Skewness portfolio	-0,46	-1,44	-1,02	-1,04	-1,05	<b>-1,05</b>	-1,05	-1,02
Kurtosis portfolio	13,51	14,04	16,24	16,88	17,86	<b>17,69</b>	17,74	16,28
maxDrawdown portfolio	0,59	0,67	0,58	0,54	0,49	<b>0,48</b>	0,48	0,54
Annual Std. Portfolio	0,24	0,24	0,23	0,22	0,22	<b>0,22</b>	0,22	0,23
Annual return portfolio	-0,01	-0,03	-0,02	0,00	0,01	<b>0,01</b>	0,01	0,00
z	0,87	0,36	0,38	0,78	1,00	<b>1,13</b>	1,14	0,81
P-value	0,39	0,72	0,71	0,44	0,32	<b>0,26</b>	0,25	0,44

Table 17: Silver performance 1980-2000



Index/FX/ComrSilver									
Start date	1990								
end date	2012								
n	265								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13			1
SR B&H	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Skewness B&H	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
Kurtosis B&H	6,65	6,65	6,65	6,65	6,65	6,65	6,65	6,65	6,65
maxDrawdown B&H	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90
Annual Std. B&H	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
Annual return B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Indicator	MOM	MOM	MOM	<b>MOM</b>	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	<b>9</b>	10	11	13		
SR portfolio	0,25	0,22	0,23	<b>0,31</b>	0,27	0,25	0,24	0,25	
Skewness portfolio	1,86	1,48	1,42	<b>1,36</b>	1,36	1,31	1,29	1,44	
Kurtosis portfolio	16,42	13,76	14,64	<b>14,01</b>	13,97	12,69	13,51	14,14	
maxDrawdown portfolio	0,53	0,70	0,72	<b>0,64</b>	0,64	0,64	0,64	0,65	
Annual Std. Portfolio	0,30	0,32	0,31	<b>0,31</b>	0,31	0,32	0,32	0,31	
Annual return portfolio	0,11	0,10	0,10	<b>0,13</b>	0,12	0,11	0,11	0,11	
z	1,49	1,41	1,46	<b>2,18</b>	1,87	1,75	1,58	1,68	
P-value	0,14	0,16	0,15	<b>0,03</b>	0,06	0,08	0,11	0,10	
Indicator	SMA	SMA	SMA	SMA	<b>SMA</b>	SMA	SMA	Average	
Lookback period	1	2,5	7	9	<b>10</b>	11	13		
SR portfolio	0,16	0,18	0,28	0,30	<b>0,34</b>	0,29	0,33	0,27	
Skewness portfolio	1,67	1,43	1,66	1,66	<b>1,73</b>	1,46	1,43	1,58	
Kurtosis portfolio	13,12	15,11	14,46	14,61	<b>15,33</b>	14,34	14,14	14,44	
maxDrawdown portfolio	0,56	0,64	0,58	0,53	<b>0,48</b>	0,66	0,66	0,59	
Annual Std. Portfolio	0,32	0,31	0,31	0,31	<b>0,30</b>	0,31	0,31	0,31	
Annual return portfolio	0,08	0,09	0,12	0,13	<b>0,14</b>	0,12	0,14	0,12	

Table 18: Silver performance 1990-2012

Index/FX/ComrPlatinum										
Start date	1970,1									
end date	2012,12									
n	516									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Min B&H	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37
Max B&H	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45
Mean return B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
UCL mean B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Std B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Skewness B&H	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54
Kurtosis B&H	4,64	4,64	4,64	4,64	4,64	4,64	4,64	4,64	4,64	4,64
maxDrawdown B&H	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73
Annual Std. B&H	0,27	0,27	0,27	0,27	0,27	0,27	0,27	0,27	0,27	0,27
Annual return B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2	2,5	3	7	9	10	11	13	15	
SR portfolio	0,19	<b>0,28</b>	0,26	0,27	0,19	0,23	0,25	0,21	0,19	0,17	0,22
Min portfolio	-0,37	<b>-0,37</b>	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37
Max portfolio	0,45	<b>0,45</b>	0,34	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,44
Mean return portfolio	0,01	<b>0,01</b>	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean portfolio	0,00	<b>0,00</b>	0,00	0,00	0,00	0,00	<b>0,00</b>	0,00	0,00	0,00	0,00
UCL mean portfolio	0,01	<b>0,02</b>	0,01	0,02	0,01	0,01	0,02	0,01	0,01	0,01	0,01
Std portfolio	0,06	<b>0,06</b>	0,06	0,06	0,07	0,07	0,07	0,07	0,07	0,07	0,06
Skewness portfolio	1,33	<b>1,22</b>	0,81	1,41	1,06	0,94	0,91	0,92	0,84	0,93	1,04
					10,4	11,3	10,6				
Kurtosis portfolio	11,59	<b>11,23</b>	9,68	11,57	5	8	5	10,62	10,65	10,96	10,88
maxDrawdown portfolio	0,40	<b>0,44</b>	0,46	0,42	0,47	0,53	0,53	0,53	0,53	0,53	0,48
Annual Std. Portfolio	0,22	<b>0,22</b>	0,20	0,22	0,23	0,23	0,23	0,23	0,23	0,23	0,22
Annual return portfolio	0,08	<b>0,10</b>	0,09	0,09	0,08	0,08	0,09	0,08	0,07	0,07	0,08
Mean excess return portfolio	0,00	<b>0,01</b>	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	9	10	11	15	<b>16</b>	17	20		
SR portfolio	0,11	0,24	0,21	0,23	0,28	0,30	<b>0,30</b>	0,30	0,26	0,25	
Min portfolio	-0,37	-0,37	-0,37	-0,37	-0,37	-0,37	<b>-0,37</b>	-0,37	-0,37	-0,37	
Max portfolio	0,44	0,44	0,44	0,44	0,44	0,44	<b>0,44</b>	0,44	0,44	0,44	
Mean return portfolio	0,01	0,01	0,01	0,01	0,01	0,01	<b>0,01</b>	0,01	0,01	0,01	
LCL mean portfolio	0,00	0,00	0,00	0,00	0,00	0,00	<b>0,00</b>	0,00	0,00	0,00	
UCL mean portfolio	0,01	0,01	0,01	0,01	0,02	0,02	<b>0,02</b>	0,02	0,02	0,02	
Std portfolio	0,08	0,06	0,06	0,06	0,07	0,07	<b>0,06</b>	0,06	0,07	0,07	
Skewness portfolio	0,54	1,09	1,40	1,42	1,32	1,33	<b>1,33</b>	1,33	1,17	1,22	
					11,0	10,9	<b>10,9</b>				
Kurtosis portfolio	4,64	12,68	11,57	12,01	1	0	<b>9</b>	10,97	10,53	10,59	
maxDrawdown portfolio	0,60	0,42	0,54	0,46	0,38	0,38	<b>0,38</b>	0,38	0,50	0,45	
Annual Std. Portfolio	0,22	0,21	0,22	0,22	0,23	0,23	<b>0,23</b>	0,23	0,23	0,22	
Annual return portfolio	0,06	0,09	0,08	0,09	0,10	0,10	<b>0,10</b>	0,10	0,09	0,09	
Mean excess return portfolio	0,00	0,00	0,00	0,00	0,01	0,01	<b>0,01</b>	0,01	0,01	0,00	

Table 19: Platinum performance 1970-2012

Index/FX/ComrPlatinum									
Start date	1970								
end date	1990								
n	241								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA	
Lookback period	1	2,5	9	10	11	13		1	
SR B&H	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	
Skewness B&H	0,72	0,72	0,72	0,72	0,72	0,72	0,72	0,72	
Kurtosis B&H	2,86	2,86	2,86	2,86	2,86	2,86	2,86	2,86	
maxDrawdown B&H	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73	
Annual Std. B&H	0,27	0,27	0,27	0,27	0,27	0,27	0,27	0,27	
Annual return B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	
Indicator	MOM	MOM	MOM	MOM	MOM	<b>MOM</b>	MOM	Average	
Lookback period	1	2,5	7	9	10	<b>11</b>	13		
SR portfolio	0,18	0,22	0,15	0,22	0,23	<b>0,27</b>	0,24	0,22	
Skewness portfolio	1,20	0,77	1,01	1,21	1,15	<b>1,16</b>	1,06	1,08	
Kurtosis portfolio	7,63	6,96	7,07	8,18	7,38	<b>7,49</b>	7,21	7,42	
maxDrawdown portfolio	0,39	0,46	0,47	0,38	0,45	<b>0,47</b>	0,51	0,45	
Annual Std. Portfolio	0,28	0,26	0,29	0,28	0,28	<b>0,28</b>	0,29	0,28	
Annual return portfolio	0,09	0,10	0,08	0,10	0,11	<b>0,12</b>	0,11	0,10	
z	0,78	0,89	0,63	1,04	1,20	<b>1,48</b>	1,30	1,05	
P-value	0,44	0,37	0,53	0,30	0,23	<b>0,14</b>	0,19	0,31	
Indicator	SMA	SMA	SMA	SMA	SMA	SMA	<b>SMA</b>	Average	
Lookback period	1	2,5	7	9	10	11	<b>13</b>		
SR portfolio	0,15	0,19	0,21	0,25	0,25	0,33	<b>0,35</b>	0,25	
Skewness portfolio	1,24	1,17	1,29	1,22	1,25	1,19	<b>1,18</b>	1,22	
Kurtosis portfolio	7,94	10,02	7,95	7,30	7,66	7,15	<b>7,05</b>	7,87	
maxDrawdown portfolio	0,47	0,42	0,45	0,43	0,42	0,38	<b>0,38</b>	0,42	
Annual Std. Portfolio	0,29	0,26	0,28	0,29	0,29	0,29	<b>0,29</b>	0,28	
Annual return portfolio	0,08	0,09	0,10	0,11	0,11	0,14	<b>0,14</b>	0,11	
z	0,57	0,72	1,04	1,41	1,36	1,99	<b>2,20</b>	1,33	

Table 20: Platinum performance 1970-1990

Index/FX/ComrPlatinum								
Start date	1980							
end date	2000							
n	241							
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13		1
SR B&H	-0,20	-0,20	-0,20	-0,20	-0,20	-0,20	-0,20	-0,20
Skewness B&H	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17
Kurtosis B&H	4,45	4,45	4,45	4,45	4,45	4,45	4,45	4,45
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	-0,05	<b>-0,03</b>	-0,16	-0,06	-0,04	-0,15	-0,16	-0,09
Skewness portfolio	0,39	<b>0,10</b>	-0,32	-0,06	-0,05	-0,05	-0,58	-0,08
Kurtosis portfolio	12,49	<b>12,94</b>	13,76	16,58	15,77	14,68	17,89	14,87
maxDrawdown portfolio	0,41	<b>0,43</b>	0,55	0,44	0,44	0,45	0,44	0,45
Annual Std. Portfolio	0,21	<b>0,20</b>	0,20	0,19	0,19	0,20	0,18	0,20
Annual return portfolio	0,04	<b>0,04</b>	0,01	0,04	0,04	0,02	0,02	0,03
z	1,03	<b>1,19</b>	0,24	0,85	1,02	0,30	0,23	0,70
P-value	0,30	<b>0,23</b>	0,81	0,40	0,31	0,76	0,81	0,52

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	-0,17	<b>-0,02</b>	-0,11	-0,10	-0,11	-0,07	-0,06	-0,09
Skewness portfolio	0,20	<b>0,12</b>	0,09	0,02	-0,07	-0,06	-0,09	0,03
Kurtosis portfolio	13,15	<b>14,65</b>	14,27	15,90	17,70	16,82	15,93	15,49
maxDrawdown portfolio	0,60	<b>0,43</b>	0,50	0,55	0,47	0,39	0,39	0,48
Annual Std. Portfolio	0,20	<b>0,20</b>	0,20	0,19	0,19	0,19	0,19	0,19
Annual return portfolio	0,01	<b>0,05</b>	0,03	0,03	0,03	0,04	0,04	0,03
z	0,18	<b>1,17</b>	0,55	0,60	0,56	0,80	0,88	0,68
P-value	0,86	<b>0,24</b>	0,58	0,55	0,58	0,42	0,38	0,52

Table 21: Platinum performance 1980-2000

Index/FX/ComrPlatinum									
Start date	1990								
end date	2012								
n	241								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA	
Lookback period	1	2,5	9	10	11	13			1
SR B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Skewness B&H	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73
Kurtosis B&H	3,13	3,13	3,13	3,13	3,13	3,13	3,13	3,13	3,13
maxDrawdown B&H	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73	0,73
Annual Std. B&H	0,27	0,27	0,27	0,27	0,27	0,27	0,27	0,27	0,27
Annual return B&H	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	9	10	11	13		
SR portfolio	0,12	0,14	0,11	0,17	0,21	<b>0,22</b>	0,18	0,17	0,17
Skewness portfolio	1,22	0,78	1,01	1,22	1,16	<b>1,17</b>	1,10	1,10	1,10
Kurtosis portfolio	8,13	7,40	7,43	8,77	8,02	<b>8,02</b>	7,92	7,95	7,95
maxDrawdown portfolio	0,39	0,46	0,47	0,38	0,45	<b>0,47</b>	0,51	0,45	0,45
Annual Std. Portfolio	0,28	0,25	0,28	0,27	0,27	<b>0,27</b>	0,28	0,27	0,27
Annual return portfolio	0,07	0,08	0,07	0,09	0,10	<b>0,10</b>	0,09	0,09	0,09
z	0,68	0,67	0,63	1,00	1,38	<b>1,48</b>	1,15	1,00	1,00
P-value	0,49	0,51	0,53	0,32	0,17	<b>0,14</b>	0,25	0,34	0,34
Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average	
Lookback period	1	2,5	7	9	10	11	13		
SR portfolio	0,09	0,12	0,15	0,19	0,19	0,26	<b>0,30</b>	0,18	0,18
Skewness portfolio	1,26	1,17	1,31	1,25	1,28	1,22	<b>1,21</b>	1,24	1,24
Kurtosis portfolio	8,44	7,40	7,43	8,77	8,19	7,66	<b>7,65</b>	7,92	7,95
maxDrawdown portfolio	0,47	0,42	0,45	0,43	0,42	0,38	<b>0,38</b>	0,51	0,45
Annual Std. Portfolio	0,28	0,25	0,27	0,28	0,28	0,28	<b>0,28</b>	0,28	0,27
Annual return portfolio	0,06	0,08	0,08	0,09	0,09	0,11	<b>0,13</b>	0,09	0,09
z	0,40	0,56	0,86	1,26	1,20	1,82	<b>2,21</b>	1,15	1,00

Table 22: Platinum performance 1990-2012

Index/FX/ComrPalladium										
Start date	1978,1									
end date	2012,12									
n	420									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Min B&H	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41
Max B&H	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49
Mean return B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
UCL mean B&H	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Std B&H	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Skewness B&H	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44
Kurtosis B&H	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
maxDrawdown B&H	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85
Annual Std. B&H	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36
Annual return B&H	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07
Mean excess return B&H	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	6	7	8	9	10	11	13		
SR portfolio	0,31	0,36	0,41	0,49	0,46	0,41	0,43	0,37	0,30		0,39
Min portfolio	-0,26	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24
Max portfolio	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49
Mean return portfolio	0,01	0,01	0,01	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01
LCL mean portfolio	0,00	0,00	0,01	0,01	0,01	0,00	0,01	0,00	0,00	0,00	0,01
UCL mean portfolio	0,02	0,02	0,02	0,03	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Std portfolio	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Skewness portfolio	1,41	1,49	1,45	1,38	1,31	1,37	1,38	1,35	1,20		1,37
Kurtosis portfolio	9,52	11,27	8,74	8,48	8,29	8,72	8,72	9,17	8,56		9,05
maxDrawdown portfolio	0,57	0,43	0,47	0,47	0,47	0,47	0,49	0,59	0,68		0,51
Annual Std. Portfolio	0,31	0,29	0,31	0,31	0,31	0,31	0,31	0,31	0,31		0,31
Annual return portfolio	0,15	0,14	0,18	0,23	0,19	0,15	0,17	0,14	0,13		0,16
Mean excess return portfolio	0,01	0,01	0,01	0,02	0,01	0,01	0,01	0,01	0,01		0,01

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	6	7	8	9	10	11		
SR portfolio	0,35	0,32	0,46	0,49	0,53	0,48	0,47	0,47		0,45
Min portfolio	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24	-0,24
Max portfolio	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49
Mean return portfolio	0,01	0,01	0,01	0,01	0,02	0,01	0,01	0,01	0,01	0,01
LCL mean portfolio	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
UCL mean portfolio	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Std portfolio	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Skewness portfolio	1,78	1,24	1,57	1,64	1,60	1,45	1,44	1,46		1,52
Kurtosis portfolio	10,89	9,50	9,22	9,65	9,79	9,31	9,23	9,54		9,64
maxDrawdown portfolio	0,38	0,33	0,45	0,35	0,35	0,35	0,35	0,35		0,36
Annual Std. Portfolio	0,29	0,28	0,31	0,30	0,30	0,31	0,31	0,30		0,30
Annual return portfolio	0,17	0,12	0,17	0,19	0,20	0,19	0,19	0,19		0,18
Mean excess return portfolio	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01		0,01

Table 23: Palladium performance 1978-2012

Index/FX/ComrPalladium									
Start date	1978								
end date	1990								
n	241								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA	
Lookback period	1	2,5	9	10	11	13		1	
SR B&H	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	
Skewness B&H	0,42	0,42	0,42	0,42	0,42	0,42	0,42	0,42	
Kurtosis B&H	3,08	3,08	3,08	3,08	3,08	3,08	3,08	3,08	
maxDrawdown B&H	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	
Annual Std. B&H	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	
Annual return B&H	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	

Indicator	MOM	MOM	MOM	MOM	<b>MOM</b>	MOM	MOM	Average
Lookback period	1	2,5	7	9	<b>10</b>	11	13	
SR portfolio	0,17	0,24	0,34	0,34	<b>0,36</b>	0,34	0,22	0,29
Skewness portfolio	0,74	0,56	0,72	0,72	<b>0,70</b>	0,62	0,45	0,64
Kurtosis portfolio	10,15	8,91	7,89	7,89	<b>7,95</b>	7,72	7,06	8,22
maxDrawdown portfolio	0,54	0,63	0,46	0,46	<b>0,46</b>	0,52	0,65	0,53
Annual Std. Portfolio	0,25	0,27	0,27	0,27	<b>0,27</b>	0,27	0,28	0,27
Annual return portfolio	0,09	0,11	0,14	0,14	<b>0,14</b>	0,14	0,10	0,12
z	0,55	1,01	1,82	1,82	<b>1,98</b>	1,89	1,06	1,45
P-value	0,58	0,31	0,07	0,07	<b>0,05</b>	0,06	0,29	0,20

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	<b>SMA</b>	Average
Lookback period	1	2,5	7	9	10	11	<b>13</b>	
SR portfolio	0,21	0,21	0,40	0,38	0,37	0,37	<b>0,42</b>	0,34
Skewness portfolio	0,72	0,67	0,97	0,80	0,80	0,79	<b>0,77</b>	0,79
Kurtosis portfolio	8,17	10,67	7,94	8,67	8,51	8,35	<b>8,18</b>	8,64
maxDrawdown portfolio	0,67	0,58	0,49	0,43	0,46	0,46	<b>0,46</b>	0,51
Annual Std. Portfolio	0,27	0,25	0,28	0,27	0,27	0,27	<b>0,27</b>	0,27
Annual return portfolio	0,10	0,10	0,16	0,15	0,15	0,15	<b>0,16</b>	0,14
z	0,87	0,75	2,36	2,07	1,97	1,99	<b>2,40</b>	1,77
P-value	0,39	0,45	0,02	0,04	0,05	0,05	<b>0,02</b>	0,14

Table 24: Palladium performance 1978-1990

Index/FX/ComrPalladium									
Start date	1980								
end date	2000								
n	241								
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13			1
SR B&H	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
Skewness B&H	0,69	0,69	0,69	0,69	0,69	0,69	0,69	0,69	0,69
Kurtosis B&H	4,04	4,04	4,04	4,04	4,04	4,04	4,04	4,04	4,04
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	9	10	11	13		
SR portfolio	0,26	0,26	<b>0,43</b>	0,33	0,36	0,27	0,23	0,31	
Skewness portfolio	1,62	1,75	<b>1,49</b>	1,58	1,61	1,57	1,39	1,57	
		12,0							
Kurtosis portfolio	9,94	2	<b>8,61</b>	9,29	9,28	9,74	9,01	9,70	
maxDrawdown portfolio	0,57	0,42	<b>0,47</b>	0,47	0,49	0,59	0,68	0,53	
Annual Std. Portfolio	0,29	0,27	<b>0,29</b>	0,29	0,29	0,29	0,29	0,29	
Annual return portfolio	0,11	0,11	<b>0,17</b>	0,13	0,14	0,11	0,10	0,12	
z	1,51	1,35	<b>2,91</b>	2,02	2,26	1,58	1,35	1,85	
P-value	0,13	0,18	<b>0,00</b>	0,04	0,02	0,11	0,18	0,10	
Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average	
Lookback period	1	2,5	7	9	10	11	13		
SR portfolio	0,27	0,30	0,34	0,39	0,37	0,37	<b>0,45</b>	0,35	
Skewness portfolio	1,94	1,42	1,70	1,70	1,70	1,71	<b>1,66</b>	1,69	
Kurtosis portfolio	11,38	9,82	9,48	10,02	9,94	10,25	<b>9,79</b>	10,10	
maxDrawdown portfolio	0,38	0,58	0,35	0,35	0,35	0,35	<b>0,33</b>	0,39	
Annual Std. Portfolio	0,28	0,29	0,29	0,28	0,28	0,28	<b>0,28</b>	0,28	
Annual return portfolio	0,11	0,12	0,13	0,15	0,15	0,15	<b>0,17</b>	0,14	

Table 25: Palladium performance 1980-2000



Index/FX/ComrPalladium								
Start date	1990							
end date	2012							
n	265							
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	2,5	9	10	11	13		1
SR B&H	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19
Skewness B&H	0,47	0,47	0,47	0,47	0,47	0,47	0,47	0,47
Kurtosis B&H	2,94	2,94	2,94	2,94	2,94	2,94	2,94	2,94
maxDrawdown B&H	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85
Annual Std. B&H	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36
Annual return B&H	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	0,25	0,31	0,39	0,42	<b>0,44</b>	0,43	0,32	0,37
Skewness portfolio	0,86	0,67	0,62	0,78	<b>0,76</b>	0,69	0,55	0,70
Kurtosis portfolio	8,67	7,87	7,27	6,75	<b>6,80</b>	6,64	6,15	7,16
maxDrawdown portfolio	0,54	0,63	0,51	0,46	<b>0,46</b>	0,52	0,65	0,54
Annual Std. Portfolio	0,27	0,28	0,28	0,29	<b>0,29</b>	0,29	0,30	0,28
Annual return portfolio	0,11	0,13	0,15	0,17	<b>0,17</b>	0,17	0,13	0,15
z	0,42	0,94	1,55	1,94	<b>2,10</b>	2,01	1,18	1,45
P-value	0,68	0,35	0,12	0,05	<b>0,04</b>	0,04	0,24	0,22

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	7	9	10	11	13	
SR portfolio	0,22	0,33	0,45	0,44	0,42	0,42	<b>0,50</b>	0,40
Skewness portfolio	0,83	0,81	0,97	0,85	0,85	0,84	<b>0,81</b>	0,85
Kurtosis portfolio	7,75	8,99	7,10	7,67	7,54	7,42	<b>6,96</b>	7,63
maxDrawdown portfolio	0,67	0,58	0,49	0,43	0,46	0,46	<b>0,46</b>	0,51
Annual Std. Portfolio	0,28	0,27	0,29	0,28	0,28	0,28	<b>0,28</b>	0,28
Annual return portfolio	0,10	0,14	0,18	0,17	0,17	0,17	<b>0,19</b>	0,16
z	0,27	1,00	2,18	1,92	1,81	1,83	<b>2,51</b>	1,64
P-value	0,79	0,32	0,03	0,05	0,07	0,07	<b>0,01</b>	0,19

Table 26: Palladium performance 1990-2012

Index/FX/Comm DJIA										
Start date	1970,1									
end date	2012,12									
n	516									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12
Min B&H	-0,23	-0,23	-0,23	-0,23	-0,23	-0,23	-0,23	-0,23	-0,23	-0,23
Max B&H	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14
Skewness B&H	-0,46	-0,46	-0,46	-0,46	-0,46	-0,46	-0,46	-0,46	-0,46	-0,46
Kurtosis B&H	2,03	2,03	2,03	2,03	2,03	2,03	2,03	2,03	2,03	2,03
maxDrawdown B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Annual Std. B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Annual return B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Indicator	MOM	MOM	MOM	MOM	<b>MOM</b>	MOM	MOM	MOM	Average	
Lookback period	1	2,5	7	8	<b>9</b>	10	11	13		
SR portfolio	0,11	0,15	0,13	0,21	<b>0,24</b>	0,24	0,14	0,10	0,17	
Min portfolio	-0,23	-0,23	-0,23	0,23	<b>-0,23</b>	-0,23	-0,23	-0,23	-0,23	
Max portfolio	0,14	0,14	0,14	0,14	<b>0,14</b>	0,14	0,14	0,14	0,14	
Skewness portfolio	-0,64	-0,79	-0,78	0,70	<b>-0,62</b>	-0,59	-0,67	-0,64	-0,68	
Kurtosis portfolio	7,43	7,24	7,04	7,48	<b>6,77</b>	6,41	6,15	5,93	6,81	
maxDrawdown portfolio	0,26	0,31	0,36	0,25	<b>0,31</b>	0,31	0,31	0,31	0,30	
Annual Std. Portfolio	<b>0,11</b>	0,12	0,12	0,11	<b>0,12</b>	0,12	0,12	0,12	0,12	

Table 27: DJIA performance 1970-2012

Index/FX/Comm NASDAQ										
Start date	1971,1									
end date	2012,12									
n	493									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24
Min B&H	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27
Max B&H	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22
Skewness B&H	-0,49	-0,49	-0,49	-0,49	-0,49	-0,49	-0,49	-0,49	-0,49	-0,49
Kurtosis B&H	1,76	1,76	1,76	1,76	1,76	1,76	1,76	1,76	1,76	1,76
maxDrawdown B&H	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
Annual Std. B&H	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
Annual return B&H	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	5	6	7	8	9	10	11	13		
SR portfolio	0,35	0,15	0,34	<b>0,40</b>	0,36	0,40	0,36	0,34	0,37	0,35		0,34
Min portfolio	-0,27	-0,27	-0,27	<b>-0,27</b>	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27		-0,27
Max portfolio	0,22	0,22	0,22	<b>0,22</b>	0,22	0,22	0,22	0,22	0,22	0,22		0,22
Skewness portfolio	-0,72	-0,63	-0,60	<b>-0,54</b>	-0,57	-0,53	-0,50	-0,69	-0,64	-0,62		-0,60
Kurtosis portfolio	6,65	6,25	5,92	<b>6,25</b>	6,08	6,20	5,29	5,89	5,49	5,29		5,93
maxDrawdown portfolio	0,46	0,46	0,35	<b>0,35</b>	0,33	0,29	0,32	0,45	0,47	0,45		0,39
Annual Std. Portfolio	0,16	0,16	0,16	<b>0,16</b>	0,16	0,16	0,16	0,16	0,17	0,17		0,16
Annual return portfolio	0,10	0,07	0,10	<b>0,11</b>	0,10	0,11	0,11	0,10	0,11	0,10		0,10
Mean excess return portfolio	0,00	0,00	0,00	<b>0,01</b>	0,00	0,01	0,01	0,00	0,01	0,01		0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2	2,5	3	7	9	10	11	12	13	14	15		
SR portfolio	0,58	0,47	0,18	0,41	0,31	0,37	0,41	0,42	0,44	0,42	0,43	0,36		0,40
Min portfolio	-0,22	-0,22	-0,27	-0,27	-0,27	-0,27	-0,27	-0,27	<b>-0,27</b>	-0,27	-0,27	-0,27		-0,26
Max portfolio	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	<b>0,22</b>	0,22	0,22	0,22		0,22
Skewness portfolio	0,11	-0,39	-0,53	-0,55	-0,70	-0,60	-0,59	-0,57	-0,50	-0,48	-0,49	-0,51		-0,48
Kurtosis portfolio	4,92	5,23	5,31	6,53	6,09	6,28	6,07	6,04	6,16	5,73	5,60	5,52		5,81
maxDrawdown portfolio	0,40	0,41	0,62	0,31	0,50	0,43	0,37	0,33	0,30	0,32	0,32	0,32		0,39
Annual Std. Portfolio	0,14	0,15	0,17	0,15	0,16	0,15	0,16	0,16	0,16	0,16	0,16	0,16		0,16
Annual return portfolio	0,13	0,12	0,07	0,11	0,10	0,11	0,11	<b>0,11</b>	0,12	0,12	0,12	0,10		0,11
Mean excess return portfolio	0,01	0,01	0,00	0,01	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,00		0,01

Table 28: NASDAQ performance 1971-2012

Index/FX/Comm S&P500										
Start date	1970,1									
end date	2012,12									
n	516									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Min B&H	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22
Max B&H	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
Skewness B&H	-0,44	-0,44	-0,44	-0,44	-0,44	-0,44	-0,44	-0,44	-0,44	-0,44
Kurtosis B&H	1,74	1,74	1,74	1,74	1,74	1,74	1,74	1,74	1,74	1,74
maxDrawdown B&H	0,75	0,53	0,53	0,53	0,53	0,53	0,53	0,53	0,53	0,53
Annual Std. B&H	0,21	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
Annual return B&H	0,09	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2,5	7	8	9	10	11	13	
SR portfolio	0,01	0,07	0,25	0,29	0,32	0,28	0,29	0,23	0,22
Min portfolio	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22
Max portfolio	0,12	0,12	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Skewness portfolio	-0,92	-0,86	-0,80	-0,74	-0,67	-0,70	-0,58	-0,61	-0,73
Kurtosis portfolio	6,48	6,56	6,43	6,13	5,69	5,35	5,13	5,34	5,89
maxDrawdown portfolio	0,28	0,31	0,24	0,24	0,30	0,30	0,30	0,24	0,28
Annual Std. Portfolio	0,11	0,11	0,11	0,11	0,11	0,12	0,12	0,12	0,11
Annual return portfolio	0,05	0,06	0,08	0,08	0,09	0,08	0,09	0,08	0,08
Mean excess return portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2,5	7	10	11	12	13	
SR portfolio	0,19	0,14	0,26	0,30	0,34	0,33	0,30	0,27
Min portfolio	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22	-0,22
Max portfolio	0,16	0,13	0,12	0,13	0,13	0,13	0,13	0,13
Skewness portfolio	-0,44	-0,85	-0,96	-0,77	-0,69	-0,69	-0,69	-0,73
Kurtosis portfolio	1,74	7,08	7,08	6,66	6,42	6,29	5,90	5,88
maxDrawdown portfolio	0,25	0,31	0,24	0,24	0,24	0,24	0,24	0,25
Annual Std. Portfolio	0,10	0,12	0,11	0,11	0,11	0,11	0,11	0,11
Annual return portfolio	0,07	0,07	0,08	0,09	0,09	0,09	0,09	0,08
Mean excess return portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 29: S&P500 performance 1970-2012

Index/FX/Comm Russel 2000										
Start date	1988,1									
end date	2013,12									
n	301									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Averag	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Min B&H	-0,21	-0,21	-0,21	-0,21	-0,21	-0,21	-0,21	-0,21	-0,21	-0,21
Max B&H	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
		-	-							
Skewness B&H	-0,52	0,52	0,52	-0,52	-0,52	-0,52	0,52	0,52	0,52	-0,52
Kurtosis B&H	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
maxDrawdown B&H	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54
Annual Std. B&H	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19
Annual return B&H	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2	2,5	3	5	7	8	9	10	11	13	
SR portfolio	0,31	0,17	0,03	0,20	0,09	0,08	0,14	0,22	0,12	0,11	0,06	0,13
Min portfolio	-0,09	-0,14	0,15	-0,09	-0,14	-0,15	-0,15	-0,11	-0,11	-0,19	-0,19	-0,14
Max portfolio	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
			-									
Skewness portfolio	0,18	0,03	0,30	0,19	-0,03	-0,13	-0,25	-0,02	-0,12	-0,44	-0,35	-0,11
Kurtosis portfolio	1,63	1,76	2,53	1,57	1,32	1,66	1,78	1,45	1,31	2,81	2,47	1,84
maxDrawdown portfolio	0,19	0,32	0,35	0,22	0,27	0,32	0,45	0,26	0,26	0,30	0,30	0,29
Annual Std. Portfolio	0,12	0,13	0,13	0,12	0,14	0,13	0,14	0,13	0,13	0,14	0,14	0,13
Annual return portfolio	0,11	0,09	0,06	0,09	0,08	0,08	0,09	0,10	0,08	0,08	0,07	0,08
Mean excess return portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2	2,5	3	5	7	8	9	10	11	13	
SR portfolio	0,39	0,34	0,09	0,30	0,17	0,09	0,10	0,09	0,01	0,04	0,08	0,15
Min portfolio	-0,11	-0,09	-0,21	-0,08	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	-0,10
Max portfolio	0,15	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
Skewness portfolio	0,08	0,34	-0,49	0,25	0,18	0,14	0,13	0,09	0,01	0,01	-0,02	0,07
Kurtosis portfolio	1,61	2,12	4,03	1,57	1,61	1,19	1,04	1,13	1,10	1,14	0,97	1,59
maxDrawdown portfolio	0,20	0,19	0,35	0,19	0,22	0,24	0,30	0,30	0,27	0,21	0,21	0,24
Annual Std. Portfolio	0,13	0,13	0,14	0,12	0,12	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Annual return portfolio	0,12	0,11	0,08	0,11	0,09	0,08	0,08	0,08	0,07	0,07	0,08	0,09
Mean excess return portfolio	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 30: Russel 2000 performance 1988-2012

Index/FX/Comm EUR/USD										
Start date	1971,1									
end date	2012,12									
n	493									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	-	-	-	-	-	-	-	-	-	-
Min B&H	0,26	-0,26	-0,26	-0,26	-0,26	0,26	0,26	-0,26	-0,26	-0,26
Max B&H	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Skewness B&H	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
Kurtosis B&H	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
maxDrawdown B&H	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48
Annual Std. B&H	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Annual return B&H	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2	2,5	3	7	10	11	13	
SR portfolio	0,08	<b>0,15</b>	-0,08	0,07	-0,06	0,00	-0,05	-0,09	0,00
Min portfolio	0,09	<b>-0,09</b>	-0,10	-0,09	-0,10	-0,10	-0,10	-0,10	-0,10
Max portfolio	0,11	<b>0,11</b>	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Skewness portfolio	0,10	<b>0,31</b>	-0,01	0,19	-0,12	-0,15	-0,19	-0,30	-0,02
Kurtosis portfolio	4,02	<b>4,50</b>	5,07	5,02	4,26	4,63	7,13	16,62	4,75
maxDrawdown portfolio	0,15	<b>0,12</b>	0,20	0,12	0,19	0,18	0,24	0,30	0,19
Annual Std. Portfolio	0,08	<b>0,08</b>	0,08	0,08	0,09	0,08	0,08	0,09	0,08
Annual return portfolio	0,06	<b>0,07</b>	0,05	0,06	0,05	0,06	0,05	0,05	0,06
Mean excess return portfolio	0,00	<b>0,00</b>	0,00	0,00	4,46e-06	0,00	9,98e-05	0,00	0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2	2,5	3	7	10	11	13	
SR portfolio	0,13	<b>0,18</b>	-0,01	0,16	-0,01	0,03	0,03	0,04	0,07
Min portfolio	-0,09	<b>-0,09</b>	-0,10	-0,09	-0,10	-0,10	-0,10	-0,10	-0,10
Max portfolio	0,11	<b>0,11</b>	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Skewness portfolio	0,22	<b>0,14</b>	-0,28	0,13	-0,04	-0,07	-0,10	-0,16	-0,02
Kurtosis portfolio	4,54	<b>4,68</b>	4,40	4,59	4,45	4,52	4,55	4,84	4,57
maxDrawdown portfolio	0,12	<b>0,12</b>	0,21	0,12	0,18	0,13	0,14	0,15	0,15
Annual Std. Portfolio	0,08	<b>0,08</b>	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Annual return portfolio	0,07	<b>0,07</b>	0,06	0,07	0,06	0,06	0,06	0,06	0,06
Mean excess return portfolio	0,00	<b>0,00</b>	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 31: EUR/USD performance 1971-2012

Index/FX/Comm JPY/USD										
Start date	1971,1									
end date	2012,12									
n	503									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Averag	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	-	-	-	-	-	-	-	-	-	-
	0,15	-0,15	0,15	0,15	0,15	0,15	0,15	-0,15	0,15	-0,15
Min B&H	-	-	-	-	-	-	-	-	-	-
	0,10	-0,10	0,10	0,10	0,10	0,10	0,10	-0,10	0,10	-0,10
Max B&H	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18
Skewness B&H	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Kurtosis B&H	2,33	2,33	2,33	2,33	2,33	2,33	2,33	2,33	2,33	2,33
maxDrawdown B&H	0,42	0,42	0,42	0,42	0,42	0,42	0,42	0,42	0,42	0,42
Annual Std. B&H	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Annual return B&H	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2	2,5	3	7	10	11	12	13		
SR portfolio	0,09	<b>0,14</b>	-0,14	0,07	-0,04	0,07	0,10	0,03	0,03		0,04
Min portfolio	0,10	<b>-0,10</b>	-0,10	-0,10	-0,10	-0,10	-0,10	-0,10	-0,10		-0,10
Max portfolio	0,18	<b>0,18</b>	0,10	0,18	0,13	0,13	0,13	0,13	0,13		0,15
Skewness portfolio	0,99	<b>1,10</b>	0,08	1,06	0,50	0,44	0,44	0,42	0,30		0,59
Kurtosis portfolio	8,18	<b>7,91</b>	4,37	8,04	4,62	3,93	3,76	3,87	3,86		5,39
maxDrawdown portfolio	0,14	<b>0,10</b>	0,16	0,11	0,16	0,20	0,19	0,21	0,27		0,17
Annual Std. Portfolio	0,08	<b>0,08</b>	0,08	0,08	0,09	0,09	0,09	0,09	0,09		0,09
Annual return portfolio	0,06	<b>0,07</b>	0,05	0,06	0,05	0,06	0,06	0,06	0,06		0,06
Mean excess return portfolio	0,00	<b>0,00</b>	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2	2,5	3	4	7	10	11	13		
SR portfolio	<b>0,10</b>	0,08	-0,02	0,07	0,09	-0,05	0,07	0,07	0,05		0,05
Min portfolio	<b>-0,10</b>	-0,10	-0,10	-0,10	-0,10	-0,10	-0,10	-0,10	-0,10		-0,10
Max portfolio	<b>0,18</b>	0,18	0,18	0,18	0,18	0,12	0,13	0,13	0,13		0,16
Skewness portfolio	<b>1,06</b>	1,00	1,02	0,99	1,03	0,30	0,52	0,50	0,50		0,77
Kurtosis portfolio	<b>8,70</b>	8,22	9,26	7,51	8,07	4,50	4,24	4,17	4,05		6,52
maxDrawdown portfolio	<b>0,24</b>	0,15	0,13	0,15	0,15	0,14	0,14	0,14	0,17		0,16
Annual Std. Portfolio	<b>0,08</b>	0,08	0,08	0,09	0,08	0,08	0,09	0,09	0,09		0,08
Annual return portfolio	<b>0,07</b>	0,06	0,06	0,06	0,06	0,05	0,06	0,06	0,06		0,06
Mean excess return portfolio	<b>0,00</b>	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00

Table 32: JPY/USD performance 1971-2012

Index/FX/Comm INR/USD											
Start date	1973,1										
end date	2012,12										
n	478										
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA	
Lookback period	1	7	9	10	11	13	15			1	
SR B&H	-0,14	0,14	0,14	0,14	0,14	-0,14	0,14	-	-0,14	-0,14	
Min B&H	-0,06	0,06	0,06	0,06	0,06	-0,06	0,06	-	-0,06	-0,06	
Max B&H	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	
Skewness B&H	3,41	3,41	3,41	3,41	3,41	3,41	3,41	3,41	3,41	3,41	
Kurtosis B&H	34,51	34,5	34,5	34,5	34,5	34,5	34,5	34,5	34,51	34,51	
maxDrawdown B&H	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	
Annual Std. B&H	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	
Annual return B&H	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2	2,5	7	10	11	13	
SR portfolio	0,32	0,30	0,11	0,19	0,22	0,17	0,14	0,21
Min portfolio	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06
Max portfolio	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22
Skewness portfolio	5,10	5,00	4,94	3,41	5,43	5,27	5,34	4,93
Kurtosis portfolio	59,10	57,73	57,29	34,51	65,04	62,72	63,50	57,13
maxDrawdown portfolio	0,06	0,08	0,11	0,08	0,08	0,09	0,09	0,08
Annual Std. Portfolio	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Annual return portfolio	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,07
Mean excess return portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2	2,5	3	7	10	11	13	
SR portfolio	0,38	0,40	0,18	0,30	0,24	0,24	0,21	0,20	0,27
Min portfolio	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06	-0,06
Max portfolio	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22
Skewness portfolio	5,66	5,42	5,05	5,09	5,17	5,01	5,02	5,04	5,18
Kurtosis portfolio	66,58	62,90	59,87	59,02	59,61	57,32	57,25	58,34	60,11
maxDrawdown portfolio	0,06	0,06	0,11	0,08	0,07	0,08	0,08	0,09	0,08
Annual Std. Portfolio	0,05	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Annual return portfolio	0,08	0,08	0,07	0,08	0,07	0,07	0,07	0,07	0,07
Mean excess return portfolio	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 33: INR/USD performance 1973-2012



Index/FX/Comm ZAR/USD										
Start date	1971,1									
end date	2012,12									
n	503									
Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average	SMA
Lookback period	1	7	9	10	11	13	15			1
SR B&H	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Min B&H	-0,13	-0,13	-0,13	-0,13	0,13	-0,13	-0,13	-0,13	-0,13	-0,13
Max B&H	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
Skewness B&H	1,41	1,41	1,41	1,41	1,41	1,41	1,41	1,41	1,41	1,41
Kurtosis B&H	8,24	8,24	8,24	8,24	8,24	8,24	8,24	8,24	8,24	8,24
maxDrawdown B&H	0,51	0,51	0,51	0,51	0,51	0,51	0,51	0,51	0,51	0,51
Annual Std. B&H	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12
Annual return B&H	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Mean excess return B&H	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Indicator	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	MOM	Average
Lookback period	1	2	2,5	3	7	10	11	13		
SR portfolio	<b>0,49</b>	<b>0,47</b>	<b>0,22</b>	<b>0,42</b>	<b>0,32</b>	<b>0,31</b>	<b>0,29</b>	<b>0,29</b>		0,35
Min portfolio	<b>-0,13</b>	-0,13	-0,13	-0,13	-0,13	-0,13	-0,13	-0,13		-0,13
Max portfolio	<b>0,21</b>	0,21	0,21	0,21	0,21	0,21	0,21	0,21		0,21
Skewness portfolio	<b>1,41</b>	<b>2,22</b>	<b>1,78</b>	<b>2,23</b>	<b>2,06</b>	<b>1,89</b>	<b>1,86</b>	<b>1,76</b>		1,90
Kurtosis portfolio	<b>8,24</b>	<b>14,32</b>	<b>14,69</b>	<b>16,44</b>	<b>15,18</b>	<b>13,83</b>	<b>13,64</b>	<b>12,54</b>		13,61
maxDrawdown portfolio	<b>0,14</b>	<b>0,16</b>	<b>0,29</b>	<b>0,20</b>	<b>0,26</b>	<b>0,24</b>	<b>0,26</b>	<b>0,26</b>		0,23
Annual Std. Portfolio	<b>0,10</b>	<b>0,11</b>	<b>0,10</b>	<b>0,10</b>	<b>0,10</b>	<b>0,11</b>	<b>0,11</b>	<b>0,11</b>		0,10
Annual return portfolio	<b>0,10</b>	<b>0,11</b>	<b>0,08</b>	<b>0,10</b>	<b>0,09</b>	<b>0,09</b>	<b>0,08</b>	<b>0,08</b>		0,09
Mean excess return portfolio	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>		0,00

Indicator	SMA	SMA	SMA	SMA	SMA	SMA	SMA	Average
Lookback period	1	2	2,5	7	10	11	13	
SR portfolio	<b>0,55</b>	0,51	0,20	0,37	0,38	0,37	0,35	0,39
Min portfolio	<b>-0,13</b>	-0,13	-0,13	-0,13	-0,13	-0,13	-0,13	-0,13
Max portfolio	<b>0,21</b>	0,21	0,20	0,21	0,21	0,21	0,21	0,21
Skewness portfolio	<b>2,29</b>	2,19	1,61	1,91	1,95	1,90	1,85	1,96
Kurtosis portfolio	<b>15,38</b>	15,69	14,72	14,64	15,49	15,17	14,54	15,09
maxDrawdown portfolio	<b>0,13</b>	0,14	0,29	0,20	0,28	0,28	0,28	0,23
Annual Std. Portfolio	<b>0,10</b>	0,10	0,10	0,10	0,10	0,10	0,10	0,10
Annual return portfolio	<b>0,11</b>	0,11	0,08	0,09	0,09	0,09	0,09	0,09
Mean excess return portfolio	<b>0,00</b>	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 34: ZAR/USD performance 1971-2012

Sharpe ratio	MOM	MOM	MOM
	1	10	11
Gold	0,30	0,47	0,43
Silver	0,18	<b>0,30</b>	0,26
Platinum	0,19	0,25	0,21
Palladium	0,31	0,43	0,37
DJIA	0,11	0,24	0,14
NASDAQ	0,35	0,34	0,37
S&P500	<b>0,01</b>	0,28	0,29
Russel 2000	<b>0,31</b>	0,12	<b>0,11</b>
EUR/USD	0,08	<b>0,00</b>	-0,05
NZD/USD	-0,13	<b>0,01</b>	-0,09
JPY/USD	0,09	0,07	0,10
INR/USD	<b>0,32</b>	0,22	0,17
ZAR/USD	<b>0,49</b>	0,31	0,29
Average	0,20	0,23	0,20
Rank	3	1	2

Sharpe ratio	SMA	SMA	SMA
	1	10	11
Gold	0,32	0,50	<b>0,52</b>
Silver	0,15	<b>0,27</b>	0,26
Platinum	0,11	0,23	0,28
Palladium	0,35	0,47	0,47
DJIA	0,06	0,16	0,14
NASDAQ	0,58	0,41	0,42
S&P500	0,19	0,30	<b>0,34</b>
Russel 2000	<b>0,39</b>	0,01	0,04
EUR/USD	0,13	0,03	0,03
NZD/USD	-0,04	-0,03	-0,03
JPY/USD	<b>0,10</b>	0,07	0,07
INR/USD	0,38	0,24	0,21
ZAR/USD	<b>0,55</b>	0,38	0,37
Average	<b>0,25</b>	<b>0,23</b>	<b>0,24</b>
Rank	1	3	2

Table 35: Sharpe ratio ranking for MOM and SMA

MOM			
1970-1990			
Gold	0,49	0,57	0,47
Silver	0,29	0,29	0,26
Platinum	0,18	0,23	<b>0,27</b>
Palladium	0,17	<b>0,36</b>	0,34
Average	0,28	0,36	0,33
1980-2000			
Gold	-0,26	-0,12	-0,19
Silver	-0,21	-0,16	-0,22
Platinum	-0,05	-0,04	-0,15
Palladium	0,26	0,36	0,27
Average	-0,07	0,01	-0,07
1990-2012			
Gold	0,41	0,51	0,41
Silver	0,25	0,27	0,25
Platinum	0,12	0,21	<b>0,22</b>
Palladium	0,25	<b>0,44</b>	0,43
Average	0,26	0,36	0,33
Total average MOM			
	0,16	0,24	0,20
Rank			
	3	1	2
SMA			
1970-1990			
Gold	0,53	0,64	<b>0,66</b>
Silver	0,20	<b>0,38</b>	0,32
Platinum	0,15	0,25	0,33
Palladium	0,21	0,37	0,37
Average	0,27	0,41	0,42
1980-2000			
Gold	-0,22	-0,20	-0,19
Silver	-0,19	-0,15	<b>-0,13</b>
Platinum	-0,17	-0,11	-0,07
Palladium	0,27	0,37	0,37
Average	-0,08	-0,02	0,00
1990-2012			
Gold	0,49	0,58	<b>0,60</b>
Silver	0,16	<b>0,34</b>	0,29
Platinum	0,09	0,19	0,26
Palladium	0,22	0,42	0,42
Average	0,24	0,38	0,39
Total average SMA			
	0,18	0,29	0,31
Rank			
	3	2	1
Overall average MOM			
	0,17	0,24	0,20
Overall rank MOM			
	3	1	2
Overall average SMA			
	0,17	0,25	0,26
Overall rank SMA			
	3	2	1

Table 36: Sharpe ratio ranking for MOM and SMA sub sets

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