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Quantitative Analysis

Quantitative Strategy

Does Technical Analysis Work?

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- **Test of technical signals: Useful in identifying overbought, oversold.**

We test the effectiveness of widely used technical indicators.

Our findings suggest that technical analysis does seem to add value when trading costs are ignored. Specifically, Bollinger Bands, Commodity Channel Index, Nine-Day RSI, and Money Flow seem to identify overbought and oversold stocks. *However, when we factor in trading cost, only Bollinger Bands seem to have statistical significance.*

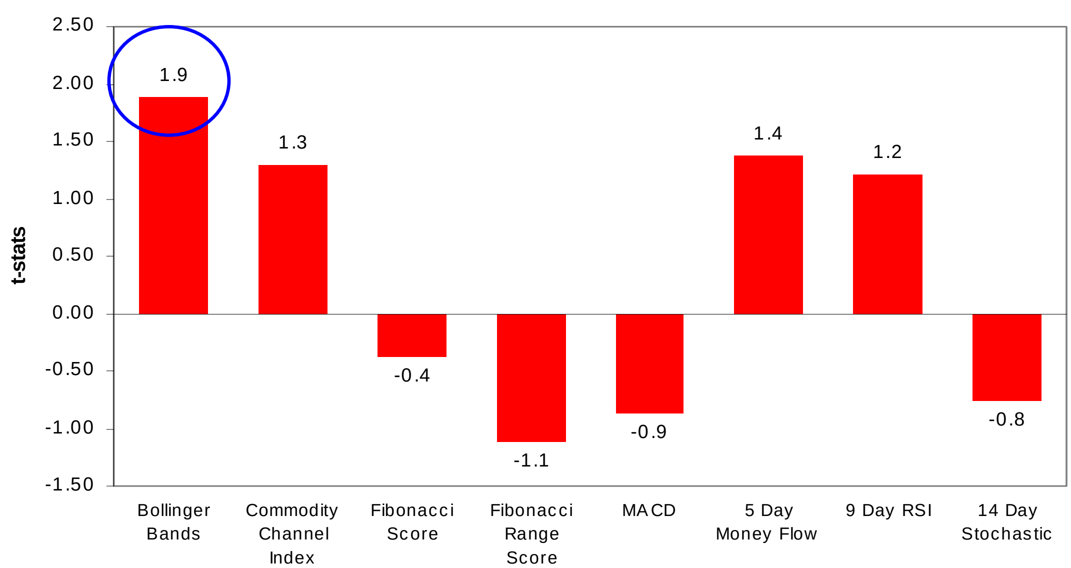
In Exhibit 1, we provide the after-cost effectiveness of various technical indicators.

- **Risk of technical indicators rising.**

We find that the performance of these indicators has become more volatile over the past two years. Hence, the risk of using these indicators has become far more risky now than before.

Exhibit 1: **Significance of Technical Signals after Trading Costs**

performance t-statistics of top and bottom deciles: S&P 500 universe from 1990 to 2002



Source: CSFB Quantitative & Equity Derivatives Strategy.

Does Technical Analysis Work?

Can historical prices predict future returns?

The question of whether technical analysis works has been a topic of contention for over three decades. Can past prices forecast future performance? Can such a strategy be traded profitably in the face of trading costs and slippage?

We test technical indicators

We provide a test of select mechanical technical indicators listed in Exhibit 2. In Appendix B at the end of this report, we further detail these factors. We limit our study to the S&P 500 universe and analyze the relationship between a stock's technical indicators and its subsequent monthly returns. Our test period covers 1990 to the present.

As of each month-end, we segment the universe into deciles using the indicators listed below. Then we select the top and bottom deciles in terms of scores and calculate equal-weighted performance for the subsequent month. We use the performance spread between the top and bottom deciles to measure the effectiveness of these strategies.

Incorporating transaction costs

Once we have our results, we extend our analysis to include transaction costs. We recalculated the return differential between oversold and overbought stocks with a monthly 50-basis-point round-trip trading cost.

Exhibit 2: List of Widely Followed Technical Indicators

Name	Category	Interpretation	Note
Bollinger Band	Trend Reversal	Reversal when trade beyond the bands	Best used in conjunction with other indicators
Commodity Channel Index	Price Momentum	100 is overbought and -100 is oversold	
Fibonacci Retracement	Price Momentum	Reversal when retracement levels are reached: 0%, 23.6%, 38.2%, 50%, 61.8%, 76.4%, 100%	
MACD Signal	Price Momentum	When MACD crosses signal moving up is a bullish trend and vice versa	
5 Day Money Flow	Price Momentum	Represents market interest / activities	
9 Day RSI	Trend Reversal	70 is overbought and 30 is oversold	
Stochastics	Trend Reversal	70 is overbought and 30 is oversold	Interaction between %K and %D identifies trends

Source: CSFB Quantitative & Equity Derivatives Strategy.

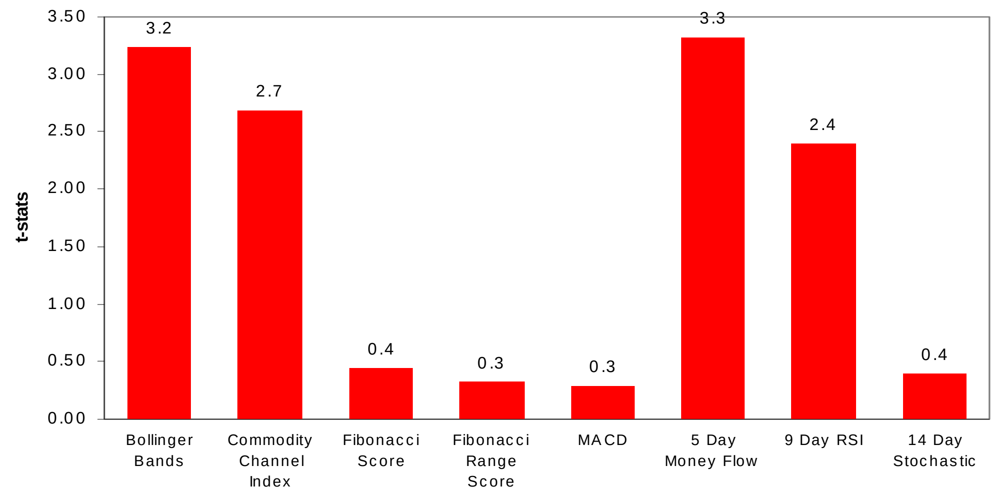
Results of Technical Strategies

Without trading cost, technical analysis adds value on average

We find that historical prices seem to add value in forecasting future performances. In Exhibit 3, we show how well each technical indicator forecasts future returns. Bollinger Bands, Commodity Channel Index, Money Flow, and RSI were significant.

Exhibit 3: Significance of Technical Signals

performance t-statistics of top and bottom deciles: S&P 500 universe from 1990 to 2002



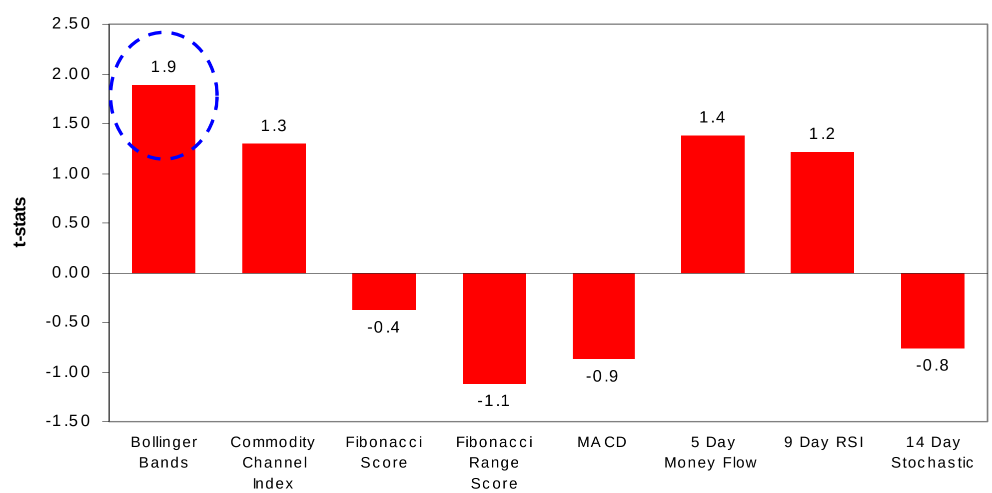
Source: CSFB Quantitative & Equity Derivatives Strategy.

After incorporating trading costs, Bollinger Bands is still statistically significant

In the face of trading costs, technical analysis is far less effective. In Exhibit 4, we show that after incorporating trading costs, only Bollinger Bands is significant in forecasting future returns.

Exhibit 4: Significance of Technical Signals after Trading Costs

performance t-statistics of top and bottom deciles: S&P 500 universe from 1990 to 2002



Source: CSFB Quantitative & Equity Derivatives Strategy.

Volatility of Technical Performance

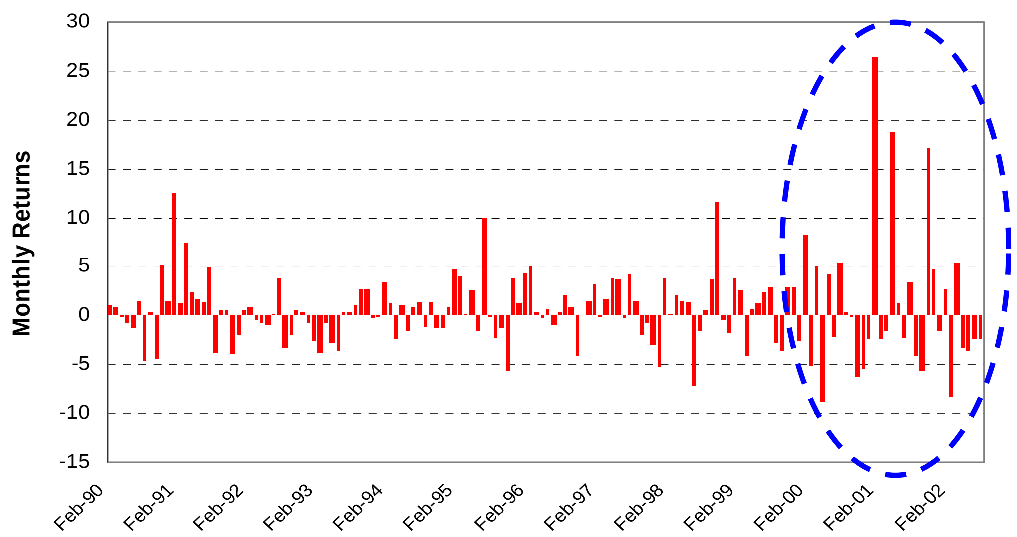
Results of technical analysis getting more volatile

Recent technical indicator results appear to be more volatile than historical levels. The volatility of these strategies surged after the technology bubble burst in March 2000. We are concerned with using the technical strategy as a stand-alone investment strategy owing to diminishing stability.

In Appendix A on the following page, we provide monthly top-bottom decile performance spread of each of the strategies we tested.

Exhibit 5: Backtest of Bollinger Bands

S&P 500 universe from 1990 to 2002—top versus bottom decile performance spread



Source: CSFB Quantitative & Equity Derivatives Strategy.

Appendix A: Historical Performance

Historical top-bottom spreads of technical indicators

In this section, we provide historical top-bottom decile spreads of technical indicators from 1990 to 2002. Our testing universe is the S&P 500. The details of the testing methodology are explained on page 2 of this report.

Exhibit 6: Bollinger Band

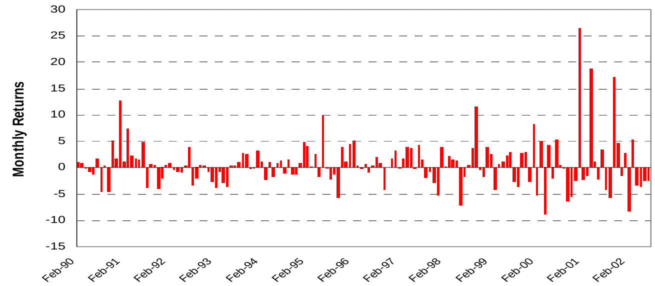


Exhibit 7: Commodity Channel

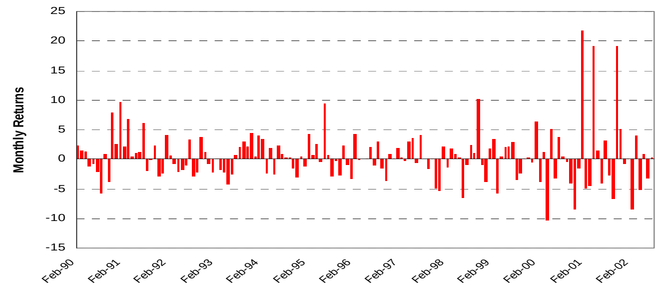


Exhibit 8: Fibonacci Score

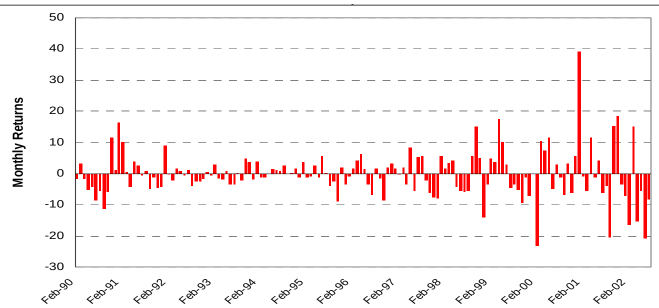


Exhibit 9: Fibonacci Range

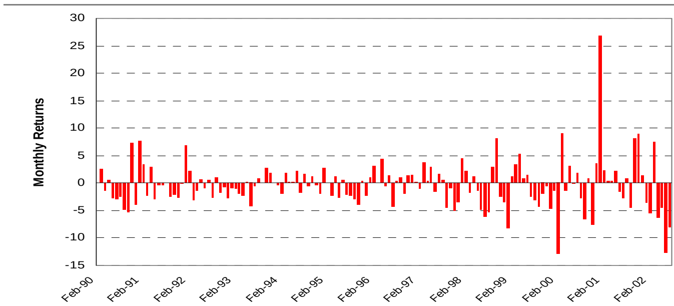


Exhibit 10: MACD

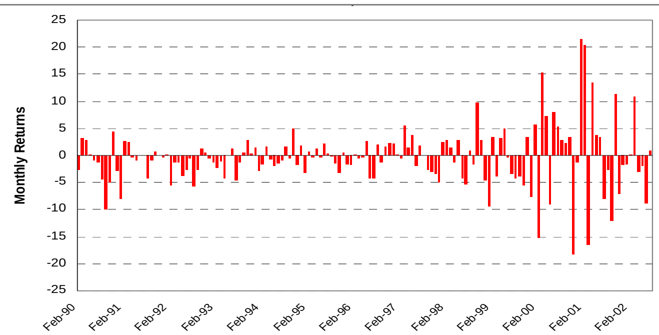


Exhibit 11: 5D Money Flow

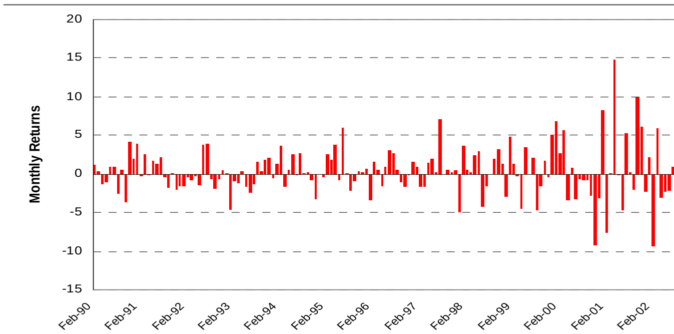


Exhibit 12: 9 Day RSI

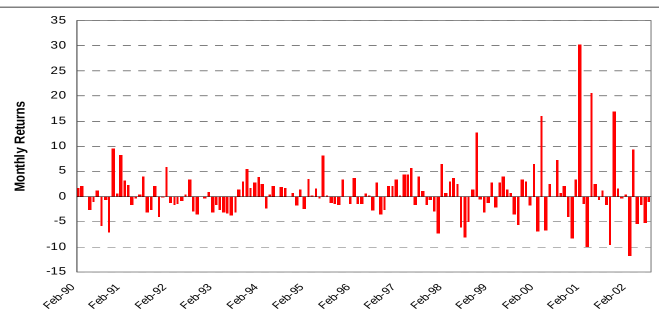
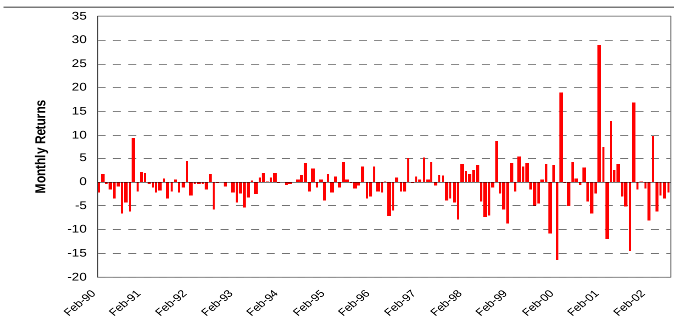


Exhibit 13: 14D Stochastic



Appendix B: Methodology

Bollinger Band

Bollinger Band examines the stock's price relative to its 20-day moving average. Oversold stocks tend to trade two standard deviations below its 20-day moving average and vice versa. We rank companies by looking at the number of standard deviation between the current stock price and its 20-day moving average.

Commodity Channel

Commodity Channel Index is a standardized score that calculates price movements from the average price as a statistical variation. We rank companies by its Commodity Channel Index score and assume stocks with the highest momentum will underperform in direction and vice versa.

Fibonnacci Retracement

Fibonacci Retracement examines the stock price relative to historical highs and lows. Studies show that stock prices tend to reverse in direction as it approaches certain trenches. We approached Fibonacci Retracement using two methods:

- *Fibonacci Raw Score.* We looked at the stock price relative to its three-year high and three-year low. We rank companies by this relation and assume stocks trading close to its three year high will decline and vice versa.
- *Fibonacci Range Score*. We looked at the stock price relative to the closest trenches. We assume that if the closest trench is below the current price, the price will increase and vice versa.

MACD

Moving Average Convergence Divergence (MACD) Signal is a price momentum indicator that measures the difference between two exponential moving averages. We rank companies by this indicator and assume stocks with the highest momentum will decline and vice versa.

Money Flow

Five-Day Money Flow incorporates the volume with the direction of the trade. A high value indicates large volume on up-ticks and vice-versa. We rank companies by this indicator and assume stocks with the most up-tick volume will decline and vice versa.

RSI

Nine-Day RSI measures price momentum based on the changes in prices. It is commonly used as a reversal indicator where companies with a RSI greater than 70 are labeled as overbought and less than 30 as oversold. We ranked companies by this indicator and assume stocks with the highest RSI score will decline and vice versa

Stochastics

Fourteen-Day Stochastics measures price velocity. Stochastic generate a buy signal when it goes below 30 and a sell signal when it goes above 70. We rank companies by this indicator and assume stocks with the highest stochastic score will underperform and vice versa.

Reference

Robert W. Colby, Thomas A. Meyers, *The Encyclopedia of Technical Indicators*, McGraw-Hill, 1988.

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