

# Automated Trading System Development

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## Interactive Qualifying Project Report

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## **Abstract**

Trading is a business that moves trillions of dollars every day, involving individuals and institutions from all around the world. There are many markets to trade and various ways to do it; this report will explore the different kinds of markets and will more in-depth study the foreign exchange market. This report also covers robot trading, the different aspects to consider when developing an automated trading system, and the process of developing a robust strategy. Finally, the report will show the trading performance of each group member and the overall team results in order to give solid examples of how the research and knowledge acquired during the project was applied and executed.

# Table of Contents

Abstract .....	i
Table of Contents.....	ii
Table of Figures.....	v
Index of Tables.....	vii
1. Introduction.....	1
2. Background Information.....	3
2.1. Details of Various Asset Classes: .....	3
2.1.1. What is a Stock?.....	3
2.1.2. What is a Currency Pair?.....	5
2.2. Sources of Data/Exchanges .....	6
2.2.1. Financial Markets.....	6
2.2.2. Functions of the Financial Markets .....	7
2.2.3. Different Financial Markets .....	9
2.2.4. The History of the Forex Market .....	11
2.2.5. Factors that Affect Forex.....	14
2.3. Trading Platforms.....	17
2.3.1. TradeStation .....	18
2.3.2. MetaTrader4.....	20
2.4. Types of Trading Systems .....	21
2.5. Strategies.....	23
2.5.1. Trend Following.....	23
2.5.2. Volatility Expansion.....	25
2.5.3. Support and Resistance.....	26
2.6. Basic Tools.....	29
2.6.1. Indicators .....	29
2.6.2. Trend Lines.....	65
2.6.3. Candlesticks .....	66
2.6.4. Artificial Intelligence Trading.....	67
2.6.5. Backtesting .....	68
2.6.6. Optimization .....	70
2.6.7. Walk Forward Optimization.....	70

2.6.8. Monte Carlo Analysis.....	71
2.7. Types of Trading Orders.....	72
2.8. Money and Risk Management.....	74
2.8.1. Objectives.....	74
2.8.2. Implementation Costs.....	75
2.8.3. Risk and Reward .....	75
2.8.4. Expectancy.....	75
2.9. System Traits.....	76
2.10. System Components .....	77
2.10.1. Market and Instrument Type.....	77
2.10.2. Instrument Filters.....	77
2.10.3. Setup and Entry .....	77
2.10.4. Position Sizing.....	78
2.10.5. Exit Strategy.....	78
3. Establishing a Trading Company .....	79
3.1. Types of Companies.....	79
3.1.1. Sole Proprietor.....	79
3.1.2. Partnership.....	80
3.1.3. Corporation .....	81
3.1.4. S Corporation.....	81
3.1.5. Limited Liability Company.....	82
3.2. Which Company to Choose? .....	83
3.3. Agencies that Regulate Forex .....	84
3.4. Licenses and Regulations .....	86
3.4.1. Forex Broker License .....	86
4. Methodologies.....	90
4.1. Why Forex?.....	92
5. Trading System Development.....	95
5.1. System's Objectives and Trading Plan .....	95
5.2. Development of the Strategy.....	97
5.2.1. Step by Step Development of the Final Strategy.....	98
5.2.2. Backtesting Performance of Previous Strategies.....	103
5.3. Final Strategy.....	105

5.3.1. Summary of Strategy Conditions.....	105
5.3.2. Final Strategy Components.....	106
5.4. Individual Trading Projects.....	110
5.4.1. Antonio’s Trading Project.....	110
5.4.2. Mauricio’s Trading Project.....	115
5.4.3. Paolo’s Trading Project .....	120
5.4.4. Steven’s Trading Project.....	124
5.5. Walk Forward and Monte Carlo Analysis .....	128
6. Results.....	135
6.1. Antonio’s Trading Results .....	135
6.2. Mauricio’s Trading Results .....	139
6.3. Paolo’s Trading Results.....	143
6.4. Steven’s Trading Results.....	147
6.5. Group Results .....	151
7. Conclusions .....	153
8. Recommendations for Future Projects.....	155
9. References .....	157
Appendix A: List of Trades.....	163
Appendix B: Backtesting Performance Results from Previous Strategies.....	168
Appendix C: EasyLanguage Codes .....	216
Appendix D: Summaries of Articles Relevant to Trading Activity.....	227

## Table of Figures

Figure 1: Caption of TradeStation 9.1 Platform .....	18
Figure 2: MetaTrader4 screen example .....	21
Figure 3: Volatility expansion gaps <sup>44</sup> .....	26
Figure 4: The support in a support and resistance strategy <sup>46</sup> .....	27
Figure 5: The resistance in a support and resistance strategy <sup>46</sup> .....	28
Figure 6: Three Line Moving Average .....	30
Figure 7: The difference between EMA and SMA .....	32
Figure 8: Linear Regression Curve Indicator .....	34
Figure 9: Volatility Indicator.....	36
Figure 10: Correlation between BAC and DJIA.....	39
Figure 11: Price Oscillator Indicator <sup>59</sup> .....	40
Figure 12: Rate of Change Indicator <sup>61</sup> .....	41
Figure 13: Volume Rate of Change <sup>63</sup> .....	43
Figure 14: Relative Strength Index <sup>65</sup> .....	45
Figure 15: DMI Indicator .....	46
Figure 16: Average Directional Index <sup>71</sup> .....	48
Figure 17: TRIX Indicator.....	50
Figure 18: Bollinger Bands Indicator <sup>77</sup> .....	52
Figure 19: Keltner Channel Indicator.....	53
Figure 20: MACD Indicator <sup>82</sup> .....	55
Figure 21: Chaikin Oscillator Indicator <sup>84</sup> .....	57
Figure 22: Stochastic Indicator .....	59
Figure 23: Momentum Indicator .....	61
Figure 24: Parabolic SAR Indicator .....	62
Figure 25: Fibonacci Retracement Indicator.....	64
Figure 26: A sample of a trend line .....	66
Figure 27: Sample Candlesticks.....	67
Figure 28: Backtesting settings from TradeStation.....	69
Figure 29: Rolling Walk-Forward Analysis.....	71
Figure 30: Example of a wrong crossover .....	99
Figure 31: Example of entry at a Lowest-low .....	100
Figure 32: Example of the length of the bar .....	107
Figure 33: Example of the EMAs .....	108
Figure 34: Summary of strategy settings EUR/JPY .....	112
Figure 35: Backtesting equity curve line for EUR/JPY since 01/31/2012 .....	112
Figure 36: Backtesting monthly accumulative net profit for EUR/JPY since 01/31/2012 .....	113
Figure 37: Backtesting performance report for EUR/JPY since 01/31/2012.....	114
Figure 38: Summary of strategy settings EUR/USD.....	117
Figure 39: Backtesting equity curve line for EUR/USD since 01/31/2012 .....	117
Figure 40: Backtesting monthly accumulative net profit for EUR/USD since 01/31/2012.....	118
Figure 41: Backtesting performance report for EUR/USD since 01/31/2012.....	119
Figure 42: Summary of strategy settings AUD/USD .....	121

Figure 43: Backtesting equity curve line for AUD/USD since 01/31/2012.....	122
Figure 44: Backtesting monthly accumulative net profit for AUD/USD since 01/31/2012 .....	122
Figure 45: Backtesting performance report for AUD/USD since 01/31/2012 .....	123
Figure 46: Summary of strategy settings GBP/USD .....	125
Figure 47: Backtesting equity curve line for GBP/USD since 01/31/2012.....	126
Figure 48: Backtesting monthly accumulative net profit for GBP/USD since 01/31/2012.....	126
Figure 49: Backtesting performance report for GBP/USD since 01/31/2012 .....	127
Figure 50: Walk Forward Analysis for EUR/JPY.....	128
Figure 51: Monte Carlo Analysis for EUR/JPY .....	129
Figure 52: Walk Forward Analysis for EUR/USD.....	130
Figure 53: Monte Carlo Analysis for EUR/USD. ....	131
Figure 54: Walk Forward Analysis for AUD/USD .....	132
Figure 55: Monte Carlo Analysis for AUD/USD.....	132
Figure 56: Walk Forward Analysis for GBP/USD .....	133
Figure 57: Monte Carlo Analysis for GBP/USD .....	134
Figure 58: Performance Summary EUR/JPY (02/01/2013-04/03-2013) .....	136
Figure 59: Equity curve line (02/01/2013-04/03/2013) .....	137
Figure 60: Example of the sideways trend of the market and losing trades.....	138
Figure 61: Performance Summary EUR/USD (02/01/2013-04/01-2013) .....	140
Figure 62: Equity curve line (02/01/2013-04/01/2013) .....	141
Figure 63: Example of loss due to news release on 02/07/2013.....	142
Figure 64: Robot malfunction due to internet technical difficulties on 03/22/2013.....	143
Figure 65: Performance Summary AUD/USD (02/01/2013-04/01-2013) .....	144
Figure 66: Equity curve line (02/01/2013-04/01/2013) .....	145
Figure 67: Example of loss due to incomplete position exit (03/13/2013) .....	146
Figure 68: Example of greater position sizing (03/04/2013-03/13/2013) .....	147
Figure 69: Performance Summary GBP/USD (02/01/2013-04/03/2013).....	148
Figure 70: Equity curve line (02/1/2013-04/03/2013) .....	149
Figure 71: Example of platform malfunctioning on 02/27/2013 .....	150

## Index of Tables

Table 1: Comparison between the different types of companies .....	83
Table 2: Backtesting Performance of Strategies for EUR/JPY.....	104
Table 3: Backtesting Performance of Strategies for EUR/USD .....	104
Table 4: Backtesting Performance of Strategies for AUD/USD .....	105
Table 5: Backtesting Performance of Strategies for GBP/USD .....	105
Table 6: Group Performance Report (02/01/2013 - 04/01/2013).....	151

# 1. Introduction

As technology and innovation advance in our modern age, so do the trading platforms and accessibility. Nowadays trading stocks, bonds, foreign exchanges, options, and other securities is easier and more reachable than ever before. Many people can work from home and do a living by investing in these markets with investment capital, research, and dedication. The main focus of this project is how the foreign exchange market can be analyzed with certain tools and techniques to scientifically develop profitable trading systems.

The foreign exchange market, which from this point on will be referred as forex, is a market that trades currencies from different countries. In this market two currencies are traded against each other according to what the market believes to be the relative strength between these two. This market was chosen due to one main reason: it does not require a substantial amount of initial investment capital to be profitable in a practical amount of time, compared to other markets such as the stock or bond market. The expectations for this project were high since the beginning, because after one year of substantial research and practice, this could be applied to manage personal capitals. On the other hand, it is important to take into account that even though the forex market has an advantage in terms of the capital needed compared to other markets, the risks attached to it may be higher as well.

Before starting to trade forex, it is important to acknowledge that the magnitude of analysis needed to understand this market may be considerably greater than other options; forex requires the understanding and analysis of countries' background, current news, and

political and economic situation, plus the influence of the rest of the world's economic environment. Being involved in the forex market allows one to be informed into the world's social, political, and economic situations, making people globalized citizens.

While trading any kind of financial security, it is of extreme importance to have discipline and follow a strict system of parameters that fits one's personality. There are certain important parameters that should be taken into consideration such as position sizing, entry and exit strategies, maximum loss tolerance, return on investment target, and trading time frames. Setting these parameters requires a lot of research, time, and practice to make sure the trader feels comfortable with the procedure and the risk involved.

Trading requires being attentive to a lot of details to make sure one is trading instead of gambling. Investment capital, lots of research, and strong determination are three key elements that allow people to build professional trading strategies that match their personality and have good success potential.

## **2. Background Information**

### **2.1. Details of Various Asset Classes:**

#### **2.1.1. What is a Stock?**

A stock is a share of the ownership of a company. There are many words people use such as shares, equity, or stocks, but basically they all mean the same thing. A stock represents an amount of ownership in a company's assets and earnings. So theoretically, every stockholder of a company is one of the multiple owners –the correct term really is shareholders– of the company and has a claim over everything that company owns, as well as a share of that company's dividends, if any, and any voting rights that are entitled to the stock.

Even though every stockholder is technically one of the owners of the company, there might be many more shareholders that have a considerably larger amount of shares. With this said so, despite the fact that every stockholder may have the right to vote for the board of directors or any other important company decisions, the people who call the shots are stockholders with a large percentage of ownership of the firm. In most cases, one stock entitles to one vote; hence, the more shares someone has, the more powerful the voting impact is.

An attractive aspect of stocks is the limited liability it provides to their owners. This basically means that, in a publicly traded company, shareholders are not personally held accountable for any debt that the company in which they own stock is unable to pay. Even in the extreme case that a company in which one holds stock goes bankrupt, one's personal assets will not be involved.

Stocks are one of the most commonly traded financial instruments. Even though certain companies may not pay out dividends to their stockholders, stocks are still an attractive investment to many people since they believe that the company will increase in value. When someone owns stocks of a company and these stocks gain value, that person makes money whenever he sells his stocks at a higher price than what he bought it.

When a company has needs to raise funds it can either borrow money or sell a part of their company. Publicly selling a part of a company can be referred as “issuing stock”. This is beneficial for a company since it does not involve taking a loan and having to pay back what they borrowed plus interest. As it was previously mentioned, shareholders that buy a company’s stock believe the company will be worth more in the future. The first time a company issues stock is called an Initial Public Offering, often abbreviated as IPO. <sup>1</sup>

There are two main kinds of stocks, common stocks and preferred stocks. Common stocks are the most commonly traded ones. This kind of stock entitles owners to vote at shareholder meetings and receive dividends, if any. On the other hand, preferred stockholders usually have no voting rights; however, they receive dividend payments before common stockholders do. In the event that a company goes bankrupt and its assets are liquidated, preferred stockholders have a priority over common stockholders for these assets. <sup>2</sup>

The value of a publicly traded company is the number of shares multiplied by the current price of what that company’s stock is being traded at. It is important to take into

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<sup>1</sup>“Stock Basics: What are Stocks?” Investopedia, n.d. Web. 3 Dec. 2012.

<<http://www.investopedia.com/university/stocks/stocks1.asp#axzz2E0bh97q5>>

<sup>2</sup>“Stocks.” U.S. Securities and Exchange Commission, n.d. Web. 3 Dec. 2012. <<http://investor.gov/investing-basics/investment-products/stocks>>

consideration that this price may fluctuate considerably over a long or even a short period of time since the price is set to what people speculate and believe the value of one stock is.

### **2.1.2. What is a Currency Pair?**

Currency trading is commonly known as forex, which is the shortened version of Foreign Exchange. In forex, a pair of currencies is being traded against each other's relative strength. For example, if on December 3, 2012 EUR/USD is traded at a rate of 1.3072, it means that the market is paying 1.3072 US Dollars for every Euro. In forex trading, the first currency is known as the base currency and the second currency in the exchange pair is known as the counter or quote currency.

The profit or loss in a forex trade is determined by the difference between the price that was paid in the initial exchange of a currency pair, and the price at which it was later on sold. The term "pip" is commonly used standing for "percentage in points". One pip is the smallest unit of measurement in forex trading. Since currencies have four decimal places for their exchange rates, one pip represents a change of 0.0001 in the market price. The only exception is the Japanese Yen, since it only has two decimal places; one pip in the Japanese Yen is a change of 0.01 in the exchange rate.<sup>3</sup>

One big difference between the stock market and the forex market is the liquidity. This can be simply defined as the ability to convert an asset or security into cash. In other words, assets that can be easily bought or sold are known as liquid assets.<sup>4</sup> The forex market is the most liquid market in the world; every day, over \$1.9 trillion worth of trades take place in

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<sup>3</sup>"Forex- pips, spread, margin, leverage." Learning to Invest, n.d. Web. 4 Dec. 2012. <<http://www.learning-to-invest.com/Forex---pips-spread-margin-leverage--9.html>>

<sup>4</sup>"Liquidity." Investopedia, n.d. Web. 5 Dec. 2012.

<<http://www.investopedia.com/terms/l/liquidity.asp#axzz2E0bh97q5>>

the currency market.<sup>5</sup> From a liquidity stand point, forex is a safer alternative than other markets, since most of the time there is more demand and supply for currencies compared to other financial assets.

In finance, leverage defines the ability of traders to buy more securities than what their actual account balance has, similar to using credit. For instance, the leverage in the forex market can allow traders to control more than 50 times the value in currency pairs than what they actually deposited in their accounts. This is certainly one of the most appealing, and riskier factors of the forex market. For instance, in the stock market, the usual leverage is 2:1. However in forex, the leverage may be up to 50:1. If one invests \$100 margin in stocks with a 2:1 leverage one can buy up to \$200 worth of shares. On the other hand one invests \$100 margin in currencies, at 50:1 leverage, one can buy up to \$5,000 in forex.<sup>6</sup> The term “margin”, also known as minimum security, is the collateral deposit trading providers collect and is intended to cover possible trading losses. It is very important to be aware that while this huge leverage in forex markets may increase potential gains, it may also drastically increase losses.

## **2.2. Sources of Data/Exchanges**

### **2.2.1. Financial Markets**

The term “market” has been around for thousands of years, to represent a structured place where people get together to buy, sell, or exchange their goods. Financial markets come from the same definition; these are places where buyers and sellers trade their financial assets, such as financial securities (stocks and bonds) or commodities (precious metals and

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<sup>5</sup>“Forex.” Investopedia, n.d. Web. 5 Dec. 2013. <<http://www.investopedia.com/terms/f/forex.asp>>

<sup>6</sup>“Forex Overview.” CMSForex, n.d. Web. 5 Dec. 2013.

<<http://www.cmsfx.com/en/forex-education/forex-overview/forex-vs-stocks/us/>>

agricultural goods), for low transaction costs and transparent prices. Financial markets can be found in a various places around the world, differing in size, types of assets traded, and liquidity.<sup>7</sup>

Financial markets have evolved throughout time, the history of these markets dates back to the 13<sup>th</sup> century. The Antwerp Stock Exchange in Belgium is known as the first stock market to be accommodated in an official building.<sup>8</sup> In the United States, the New York Stock Exchange was created in 1792, and it is one of the most important financial markets in the world. It is important to know that technology has influenced the evolution of the financial markets. Formerly, the main way of trading was in the pit; this is where the famous term “out-cry-pit” comes to represent how buyers and sellers made the transactions based on hand signs and shouting.<sup>9</sup> Open outcry trading has been slowly disappearing since nowadays most trading is done electronically, making trading more efficient.

## 2.2.2. Functions of the Financial Markets

### 2.2.2.1. Raising of capital

The amount of supply and demand in a financial market is what makes it liquid. These markets are an important tool for many entities to raise capital through the issuing of shares and bonds. For example, when a company has its initial public offering (IPO), it sells

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<sup>7</sup> "Financial Market." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/f/financial-market.asp>>.

<sup>8</sup> "Economy Watch - Follow The Money." *Oldest Stock Exchange in the World, Oldest Stock Exchange in the World, Stock Market Information*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.economywatch.com/stock-markets-in-world/oldest-stock-exchange.html>>.

<sup>9</sup> "Trading Pit History." *Trading Pit History*. N.p., n.d. Web. 15 Mar. 2013. <<http://tradingpithistory.com/history.html>>.

a portion of the ownership to the open market in exchange of capital. Going public is a common way for many companies to raise capital needed to grow and expand.<sup>10</sup>

#### **2.2.2.2. Risk transfer**

In financial markets the risk transfer is a very important and effective tool. Investors are able to purchase assets and avoid the risk that owning them entails by transferring this risk to a specialized entity. These entities are financial intermediaries, such as banks or insurance companies, who are paid periodically for taking responsibility of managing these assets. These tools allow buyers to have confidence in investing, which keeps the market in continuous movement.<sup>11</sup>

#### **2.2.2.3. International Trade**

International trade consists in the exchange of capital, goods, and services across foreign borders. An important part of this market is the foreign exchange market, which allows currencies to be traded in an easier and more efficient ways. International trade also allows resources from all around the world to be traded thanks to supply and demand.<sup>12</sup> The price competition within markets becomes stronger thanks to the international trade throughout the world, this way consumers are allowed to find better prices in the market.<sup>13</sup>

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<sup>10</sup> "Complete Guide To Corporate Finance." *Introduction To Raising Capital* -. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/walkthrough/corporate-finance/5/raising-capital/introduction.aspx>>.

<sup>11</sup> "Transfer Of Risk." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/t/transferrisk.asp>>.

<sup>12</sup> "What Is International Trade?" *What Is International Trade?* N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/articles/03/112503.asp>>.

<sup>13</sup> "International Trade." *What Is? Definition and Meaning*. BusinessDictionary.com, n.d. Web. 15 Mar. 2013. <<http://www.businessdictionary.com/definition/international-trade.html>>.

## **2.2.3. Different Financial Markets**

### **2.2.3.1. Capital Markets**

Capital Markets are where financial securities are traded. There are two main types of capital markets: primary markets and secondary markets.

Primary markets or new issue markets are where companies obtain funds through debt by issuing securities. These securities are sold and the cash goes straight to the company for operations for expanding purposes. In primary markets, investment banks set the beginning price for the security and then these are sold directly to investors.

Secondary Markets have the price of securities defined by actual supply and demand instead of by investment banks. In these markets, investors trade assets between each other, rather than purchasing securities issued directly by a company. Secondary markets are where the majority of the trading occurs every day.<sup>14</sup>

### **2.2.3.2. Stock Markets**

The stock market is the place where investors trade shares of publicly traded companies. These shares fluctuate in price depending on speculations and the performance of the company. As previously mentioned, the stock market can also be divided into the primary and secondary markets.<sup>15</sup>

### **2.2.3.3. Bond Markets**

Bonds are financial instruments issued by companies and organizations to raise capital. A bond consists in a debt investment in which a company borrows money from investors for

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<sup>14</sup> "Capital Markets." *Enotes.com*. Enotes.com, n.d. Web. 15 Mar. 2013. <<http://www.enotes.com/capital-markets-reference/capital-markets-174144>>.

<sup>15</sup> "Stock Market." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/s/stockmarket.asp>>.

a defined period of time. Investors lend their money with the purpose of getting it back with interests. Bonds are usually traded in capital markets.<sup>16</sup>

#### **2.2.3.4. Money Markets**

Money markets are a segment of the financial market where financial assets with high liquidity are traded. Several of the assets traded are certificates of deposits, banks acceptances, commercial papers, municipal notes, U.S. Treasury bills, repurchase agreements and federal funds. This market is used to borrow and lend assets in short terms of time; assets can be traded within several days or months, just under a year.<sup>17</sup>

#### **2.2.3.5. Derivatives Markets**

Derivatives are financial tools which value is based on one or more underlying assets, such as stocks or bonds. These are known as a contract between two parties setting conditions such as dates, values of underlying parts, and notional amounts, under which payments are supposed to be made between both parties.<sup>18</sup> There are many different types of financial derivatives, but the most common ones are: options, a contract signed by two parties to buy or sell a financial security<sup>19</sup>; futures, a contract obligating a party to buy or sell an asset to another party<sup>20</sup>; swaps, an exchange between securities to modify the maturity<sup>21</sup>, quality of issues or investment objectives of financial securities.<sup>22</sup>

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<sup>16</sup> "Bond Market." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/b/bondmarket.asp>>.

<sup>17</sup> "Money Market." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/m/moneymarket.asp>>.

<sup>18</sup> "Derivative." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/d/derivative.asp>>.

<sup>19</sup> "Option." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/o/option.asp>>.

<sup>20</sup> "Futures." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/f/futures.asp>>.

<sup>21</sup> "Swap." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/s/swap.asp>>.

<sup>22</sup> Smith, Kalen. "What are Financial Derivatives." Money Crashers, n.d. Web. 22 Mar. 2013. <<http://www.moneycrashers.com/what-are-financial-derivatives-trading-examples/>>

### **2.2.3.6. Forex Markets and Interbank Markets**

Forex is the market place where currencies are traded. It is the most liquid and largest market in the world, moving over \$1.9 trillion a day worth of trades. This market is open 24 hours a day, 5 days a week. Through the Internet, any investor can buy and sell currencies in their brokerage accounts. Moreover, the interbank market is the financial system in which banks and financial institutions buy and sell currencies; the interbank market manages around a 50% of the forex market.<sup>23</sup> Banks are capable of changing prices in the markets by making large investments from their own accounts when times of low volume in the market.<sup>24</sup>

### **2.2.4. The History of the Forex Market**

Since early times in history, mankind has developed different methods to trade goods for other valuables. During the European medieval times, a coinage system was developed where coins were made out of different metals and were exchanged depending on their value. On the other hand, paper money was developed in China during the Tang Dynasty (Sixth Century A.D.)<sup>25</sup>. These events marked the beginning of the actual currency model, the banknote system, which consists of coins and paper money to represent different values and accumulation of wealth.

#### **2.2.4.1. The Gold Standard**

The Gold Standard was a monetary system that changed the concept of money; each country that implemented the system established an exchange rate between their currency

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<sup>23</sup> "Interbank Market." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/i/interbankmarket.asp>>.

<sup>24</sup> "The Foreign Exchange Interbank Market." *The Foreign Exchange Interbank Market*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/articles/forex/06/interbank.asp>>.

<sup>25</sup> "Paper Money." *Paper Money*. N.p., n.d. Web. 15 Mar. 2013. <[http://www.chinaculture.org/gb/en\\_madeinchina/2005-06/28/content\\_70185.htm](http://www.chinaculture.org/gb/en_madeinchina/2005-06/28/content_70185.htm)>.

and a certain amount of gold. The purpose of this was for currencies to be backed up by gold.<sup>26</sup> This system made commerce between nations more transparent. The Gold Standard worked from 1871 until 1914 when World War I began; eventually the system broke down because the amount of gold reserves each country needed to back up their currencies were extravagant. Germany was forced to drop the Gold Standard to proceed with their military operations. During the War, the expenses were too large to be backed up by the gold reserves possessed each country had. After the war, many countries abandoned the Gold Standard. Franklin D Roosevelt banned the private ownership of gold in 1933.

#### **2.2.4.2. The Bretton Woods Agreement**

In 1944, the United Nations Monetary and Fiscal Policy Conference took place in Bretton Woods, New Hampshire. In the middle of World War II, delegates from 44 countries came to the United States for this conference; the purpose was to peg all the currencies to the U.S. dollar in a fixed rate, which was pegged to the gold to the fixed price of \$35 per ounce.<sup>27</sup> The conference was called the Bretton Woods Agreement; its biggest accomplishment was the creation of the International Monetary Fund. The Bretton Wood Agreement lasted until 1971 when President Nixon ended the gold standard.<sup>28</sup>

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<sup>26</sup> "Gold Standard." *Definition*. N.p., n.d. Web. 15 Mar. 2013.

<<http://www.investopedia.com/terms/g/goldstandard.asp>>.

<sup>27</sup> "The Bretton Woods System." *About.com Economics*. N.p., n.d. Web. 15 Mar. 2013.

<[http://economics.about.com/od/foreigntrade/a/bretton\\_woods.htm](http://economics.about.com/od/foreigntrade/a/bretton_woods.htm)>.

<sup>28</sup> "Milestones: 1937-1945." U.S. Department of State - Office of the Historian. Web. 13 Mae. 2012.

<<http://history.state.gov/milestones/1937-1945/BrettonWoods>>.

### **2.2.4.3. The Free-Floating System**

Following the Bretton Woods System, in 1978 the International Monetary Fund mandated the Free-Floating System<sup>29</sup>. Currently a free-floating exchange rate is used by most of the world's governments, adopting any of these three systems:

- Dollarization: consists in the adoption of the U.S. dollar as the national coin for any country; for example, Ecuador currently uses this system.<sup>29</sup>
- Pegged Rates: consists in setting a fixed exchange rate between the U.S. dollar and the foreign currency; as adopted by China since 1997 until 2005, when a U.S. dollar was worth 8.28 Yuan.<sup>29</sup>
- Managed Floating Rates: consists in the free-floating value of a country's currency depending on the variation of supply and demand. Within a country there are different market participants that may intervene to manage the currency's value.<sup>29</sup>

### **2.2.4.4. Market Participants**

There are a variety of market participants within economies; among these, the most important ones are governments and central banks, which to some extent control some of the markets by setting interest rates and issuing and buying bonds to stimulate the economy. However, banks also affect the economy in a strong way; besides the individual service they provide to their clients, banks are one of the biggest participants in the forex market. The interbank market is one way in which banks influence the economy; transactions within the banks of the same country influence the value of the currency. Another strong group of participants are speculators; these try to take advantage of the volatility of markets, making money from fluctuating exchange rates. Market participants

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<sup>29</sup> "Forex Tutorial: Forex History and Market Participants." *Investopedia*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/university/forexmarket/forex4.asp>>.

are of big influence to the economies, depending on their behavior within the markets, they can move economies in different directions.

Everyone can be part of currency trading, from small individual investors to powerful central banks. This is made possible through banks, broker-dealers, and online trading platforms.

### **2.2.5. Factors that Affect Forex**

There are certain factors that can change the movement of a currency price in the market. The most common ones are the interest rates, the GDP, the unemployment, and the inflation rate. A good trader should know when the government plans to make announcements about them, since the price of the currency can make violent turns and make the trader's winning trades turn into losing ones.

#### **2.2.5.1. Interest Rates**

Interest rates are controlled by the country's Central Bank. These determine the rate of interest at which banks can borrow from one another. Usually central banks manipulate the interest rate in order to change inflation or to encourage the flow of money in the economy<sup>30</sup>.

Changes in any of the eight global central banks can produce a huge movement in the foreign-exchange market. These changes in the interest rates can be an indirect response to the different economic factors that the governments manage, such as unemployment, inflation, etc. Traders who can anticipate a change in the interest rate can use it as an edge in the market, and make profit from it. Usually traders will look for the higher rate of return

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<sup>30</sup>"Interest Rates." Investopedia. n.d. Web. 15 Mar. 2013.  
<<http://www.investopedia.com/articles/forex/08/interest-rates.asp#axzz2LIGIMzYJ>>.

since it brings a higher profit. The issue here is that the movement of the different currency pairs makes it more complicated than just trading the ones with higher interests.<sup>30</sup>

#### **2.2.5.2. Gross Domestic Product (GDP)**

“The monetary value of all the finished goods and services produced within a country's borders in a specific time period, though GDP is usually calculated on an annual basis. It includes all of private and public consumption, government outlays, investments and exports less imports that occur within a defined territory.”<sup>31</sup>

This definition can be summarized with the following equation:

$$GDP = \text{Consumer Spending (Private Consumption)} + \text{Government Spending} + \text{Business Spending on Capital} + (\text{Total Exports} - \text{Total Imports})^{31}$$

A nation's GDP can be interpreted in many ways, but the most common is of thinking of it as the economic health of a country and its productivity. Usually an economy with a rising GDP is an economy that is being productive, although some other factors, like inflation and debt, have to be considered.

#### **2.2.5.3. Unemployment Rate**

The unemployment rate is “the percentage of the work force that is unemployed at any given date.”<sup>32</sup> A nation with a low unemployment rate usually has a strong economy which offers the country's work force a high amount of jobs. On the other hand, a country with a high unemployment rate usually has a weak economy which does not have the capacity to create enough job opportunities for its work force.

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<sup>31</sup> "GDP" Investopedia. n.d. Web. 15 Mar. 2013.

<<http://www.investopedia.com/terms/g/gdp.asp#axzz2LTx6ks3s>>.

<sup>32</sup> "Unemployment" Princeton: Wordnetweb. n.d. Web. 15 Mar. 2013.

<<http://wordnetweb.princeton.edu/perl/webwn?s=unemployment%20rate>>.

A country which is growing economically usually has a continuously decreasing unemployment rate, since job opportunities should be created as time goes by. A country which is not growing economically, on the other hand, usually presents an increasing unemployment rate. Countries with low unemployment rates are commonly known for having a strong economy and a strong currency, and vice versa.

#### ***2.2.5.4. Inflation***

Inflation can be defined as “a continuing rise in the general price level usually attributed to an increase in the volume of money and credit relative to available goods and services.”<sup>33</sup>

When the inflation has a negative value, it is known as deflation. For a country, it is preferable to have inflation rather than deflation since controlling deflation is way more difficult than controlling inflation. A country would also prefer to have a creeping inflation rather than a higher inflation rate.

A country which is economically growing usually has a creeping inflation, since a creeping value of inflation means that the government is investing money into the economy and there is an ongoing money flow.

#### ***2.2.5.5. How do News Releases Affect Forex?***

When the government releases the monthly, quarterly, or annual reports of the above mentioned factors, there can be an effect on the movement of the currencies in the forex market. Before the government makes the releases, a general expectancy of what the values can be are studied by some institutions which give an expected range in which the value released by the government should be. When the government makes the release and this

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<sup>33</sup> "Inflation" Merriam-Webster. n.d. Web. 15 Mar. 2013. <<http://www.merriam-webster.com/dictionary/inflation>>.

value falls within the expected range, the effect it has in the market is very low, almost nonexistent. On the other hand, when the value released by the government falls outside the expected range, the market gives an unexpected turn, usually catching traders of guard and turning their winning trades into losses.

Many traders think that it is better to stay outside the market when important releases are expected. By doing this, they avoid getting caught by a quick and violent turn of the market. If a trader decides to trade the news, he must be very careful and follow a trading strategy strictly. By following a set of entry and exit rules, he could avoid having a big loss if the market move is in the opposite direction he expects, but he could also make a lot of money by scoring a big win. At the end, it depends on the trader's strategy and his personality to trade or stay away of the market before a news release, although a vast majority of experts recommend avoiding opening positions and entering the market.

### **2.3. Trading Platforms**

Trading Platforms are an alternative to the traditionally used physical brokers. The way that trading platforms work is essentially the same as having a physical broker, receiving the calls and making the transactions. This new trading alternative has some advantages such as increased ability for trading to the open public, and a chance to have live information of the markets. Trading platforms make trading much more user friendly and efficient than traditional broker trading.

The two best trading platforms are MetaTrader4 (MT4) and TradeStation. In this project TradeStation is the platform that will be used. MetaTrader4 has been only considered as a comparative reference.

### 2.3.1. TradeStation

TradeStation's software has many components that help clients complete their trades in a very efficient way. This software offers a lot of independence to users, since its features and parts are based on the client's desire or necessity. This platform also allows traders to create their own strategies and indicators based on EasyLanguage coding. TradeStation is very user friendly, where everything is really visual and all the information is updated live so users can make the right decisions at the right time. An example screenshot of TradeStation is shown on figure 1.



Figure 1: Caption of TradeStation 9.1 Platform

EasyLanguage is the coding language created and developed by TradeStation for their software. This language is very similar to C, which gives simplicity to the code; this allows traders without advanced coding experience to easily learn the coding language. The six types of programs that can be done in EasyLanguage are: Indicator, ShowMe, PaintBar, ActivityBar, ProbabilityMap, and Strategy. Indicators are just signals created to provide

some particular information about the instrument that is being used, these are most likely plots added to the price charts; many traders base their trading decisions on various different indicators. ShowMe is a type of indicator that “plots a dot on the bars in a chart window based on a true/false condition”<sup>34</sup>; this indicator could be used as a guide for the trader for when to take decisions about certain trades. PaintBar is similar to ShowMe, it works on true/false statements and paints the bar completely or partially depending on the Boolean conditions that have been stated before. The way ActivityBars work is allowing the trader to see how the prices changed in a specific bar. This gives the user a more detailed description of the activity of the price and how it changed. ProbabilityMaps are just, as the name states, a probabilistic study of how the price is expected to be moving, based on historical information. Finally, Strategies are the instructions given by the trader to the platform to execute a trade; all these decisions may be done automatically by the platform. Traders create their strategies based on different criteria, depending on the trader’s personality, experience and objectives.

Additionally, TradeStation offers some valuable learning material that can be obtained from their website. They have several written publications, videos, and books on their website that are available for their customers. TradeStation has a special program called “University” where traders, especially new members, can go through a learning experience to get familiar with the software and learn about its features and components. Furthermore, one of the biggest supports for customers is the website forum where users can post their questions and get answers from people that have more experience in the

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<sup>34</sup>“EasyLanguage Essentials – Programmers Guide.” *TradeStation*. 2007. Web. 05 Jan 2013.  
[http://www.tradestation.com/~media/Files/TradeStation/Education/University/School%20of%20EasyLanguage/Books/EL\\_Essentials.ashx](http://www.tradestation.com/~media/Files/TradeStation/Education/University/School%20of%20EasyLanguage/Books/EL_Essentials.ashx).

trading field; these people include TradeStation's analysts and engineers. Finally, TradeStation also has periodic events where they broadcast analysts and important people in the trading business periodically, this to give more help to all the traders using TradeStation.

### **2.3.2. MetaTrader4**

The MetaTrader4 (MT4) platform is a software based application that assists the trader while performing his job. MetaTrader4 offers a wide variety of applications for the user such as opening and closing trades, creating indicators and automated trading strategies.

In order to create all these different applications MetaTrader4 has its own coding language, MetaQuotes Language 4 (MQL4). This language and its structure is based on C, having already some built-in functions that allow the user to combine the trading and financial information with the programming component to create different applications for trading. There are several program applications that can be done in MetaTrader4; these are Expert Advisor, Custom Indicator, Script, Library Included file.<sup>35</sup> These programs have different functionalities and are used for different purposes.

MetaTrader4 programs can be run inside of the platform; this feature gives advantage to the user because it is not necessary to import or export any data, and it can be easily run inside within the same software. Another important feature that MetaTrader4 offers is the ability to edit, compile and run in the platform itself. These two features give the user the ability to utilize information and data from the platform, this means prices, indicators,

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<sup>35</sup> "Documentation." *MQL4*. Web. 05 Jan. 2013. <<http://docs.mql4.com/>>.

session times, and so on. Having the chance to integrate all this information in one strategy is very useful for the trader.

Figure 2 shows an example of a MetaTrader4 screen.



Figure 2: MetaTrader4 screen example<sup>36</sup>

## 2.4. Types of Trading Systems

Trading systems can be divided into two categories:

- Manual or automated.
- Fundamental or technical.

<sup>36</sup> "MetaTrader 5.00 Build 642 / 4.00 Build 419." *Softpedia*. N.p., n.d. Web. 18 Apr. 2013. <<http://www.softpedia.com/get/Others/Finances-Business/MetaTrader.shtml>>.

A manual trading system is a system where the trader decides when to make an entry or an exit for its trades. Nowadays it is common for traders to use computer programs to study the market or to set indicators and screeners that will provide the trader some analytical information. Even though a computer is used for the research, it is still considered manual trading because the trader is the one deciding whether or not to make the trade.<sup>37</sup>

An automated trading system is a system where a computer, previously programmed by the trader with a set of rules for entries, exits and position sizing, executes all the trades. These set of rules can be simple or complex, depending on the strategy the trader wants to follow, or the understanding and knowledge of programming the trader has. Traders who prefer an automated trading system typically use a trading platform, such as TradeStation, where they can program and set up their strategy, and just let the platform do the rest.<sup>38</sup>

Whether to use a manual trading system or an automated trading system depends on the trader itself. Both systems have their pros and cons, and there is not a better one, just one that suits the trader the best. For example, automated systems will carry the set of rules without making mistakes (if programmed correctly), without hesitating. It can also trade for a longer time without getting tired, and it can, at the same time, store and look into more information than a human being. On the other hand, a human being can take into account factors that affect the market, such as natural disasters or wars, and used them to get an edge. A human can also follow his gut and feeling to get into a trade that would generate more profit than an automated one. Finally, a human being can predict that the

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<sup>37</sup> "Manual Trading." Investopedia, n.d. Web. 10 Jan. 2013

<<http://www.investopedia.com/terms/m/manual-trading.asp#axzz2E7tEUA3P>>

<sup>38</sup> "The Pros And Cons Of Automated Trading Systems." Investopedia, n.d. Web. 10 Jan. 2013

<<http://www.investopedia.com/articles/trading/11/automated-trading-systems.asp#axzz2E7tEUA3P>>

market will take an unexpected spin that the computer cannot notice, and pull the trades out.<sup>39</sup> These are just some of the many pros and cons that each of the systems has, and it all depends on the personality and goals of the trader to decide which one to use.

Moreover, a technical trading system is one that uses technical indicators and charting techniques for its research. Technical indicators are usually formulas and graphs that help the trader study the movement of prices and some factors like its trend, or floors and ceilings. The trader would then decide whether to enter or exit a trade based on this information. The trader could use a combination of two or more indicators to make a custom and more personalized indicator that would suit the trader's style.<sup>40</sup>

A fundamental trading system is the one that bases its research in the release of economic reports and their data. The trader would study these reports and then decide to enter or exit a trade depending on what the trader thinks the effect of the reports will have on the market. Some examples of economic reports are nonfarm payrolls, Federal Open Market Committee (FOMC) minutes, and unemployment rates.<sup>40</sup>

## **2.5. Strategies**

### **2.5.1. Trend Following**

Trend following is a widely used trading strategy for various trading asset classes. Trend following can be summarized in four basic steps. The first step in order is to determine the trend of the trading instrument that will be used. For instance, in the forex market, one would first determine in which way a currency pair is trending. After determining the

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<sup>39</sup> Tucci, Nathan. "Manual Trading vs. Automated Trading." Winner's Edge Trading, 1 June 2012. Web. 10 Jan. 2013. <<http://www.winnersedgetrading.com/manual-trading-or-automated-trading/>>

<sup>40</sup> Russell, John. "Two Types of Trading Systems." About, n.d. Web. 10 Jan. 2013. <[http://forextrading.about.com/od/tradingstrategies/a/types2\\_ro.htm](http://forextrading.about.com/od/tradingstrategies/a/types2_ro.htm)>

trend, the second step is deciding the entry point. Depending on the direction of the trend, the trader will chose to either buy long or sell short. Once the trader has entered a position, the next step of this strategy is waiting. This is one of the most difficult steps for many traders since they have to patiently hold their positions as long as the trend keeps turning their positions into profits. Finally, the last step is exiting the trade. The trader needs to exit the trade when he believes the trend is stopping and changing in direction.<sup>41</sup> This final step is challenging for most traders since it is not simple to determine when a trend has changed direction or if it is only going through a temporary drawdown.

If applied correctly and with discipline, trend following can bring profits to many traders; however, a strict set of rules is needed in order to make disciplined trades. Many traders face problems while trading with a trend due to lack of discipline and not sticking to their set of rules. For example, one basic principle of trend following is buying when price is trending up and selling when price is trending down. Even though this principle may seem obvious and simple at first sight, many traders break it on a daily basis. This principle is often broken when traders try to buy at the very bottom and sell at the very top. Winning traders wait until they have confirmed the trend before buying or selling. Another problem traders face due to not following a strict set of rules is predicting. Once traders start to follow a trend, they stop using their set of rules and start predicting how the price is going

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<sup>41</sup> Goodboy, David. "Forex Trend Following." Trading Markets, 8 Apr. 2011. Web. 25 Nov. 2012. <<http://www.tradingmarkets.com/forex/commentary/forex-trend-following-a-profitable-strategy-875103.html>>

to change instead of following what the trend says. This is another commonly made mistake that diminishes the effectiveness of trading with a trend.<sup>42</sup>

To finalize, it is important to make an emphasis that trend following can be a successful part of a set of trading strategies when used with discipline and following a previously defined set of rules that work for one's trading personality. It could be said that trend following can be a successful part of a set of trading strategies, since by itself it can be a weak trading system. If trend following is combined with other trading strategies and applied with discipline, it can create a more robust and profitable trading system.

### **2.5.2. Volatility Expansion**

The volatility expansion trading strategy, as its name suggests, is based on sudden changes of volatility in the price of a trading asset. This strategy usually uses short-term trades. Normally these short-term trades are characterized by a high winning percentage but will provide relatively low profits every trade. Traders that use volatility expansion strategies are out of the market a significant percentage of the time, until they find a rapid change in the volatility.<sup>43</sup>

Volatility expansion often uses gaps. Gaps are the places where there is no continuity in the price of a tradable asset; in other words, it could be said that where the price of one bar is higher than the high or lower than that low of the previous bar. The concept behind volatility expansion is assuming that if there is a gap, a sudden change in volatility, going

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<sup>42</sup> Babcock, Bruce. "How to Trade with the Trend." Reality Based trading Company, 1999. Web. 25 Nov. 2012. <<http://www.rb-trading.com/article9.html>>

<sup>43</sup> "Trending, Sideways and Volatile Markets." TradeStation, n.d. Web. 28 Nov. 2012. <[http://help.tradestation.com/09\\_00/TradeStationHelp/data/trending\\_sideways\\_and\\_volatile\\_markets.htm](http://help.tradestation.com/09_00/TradeStationHelp/data/trending_sideways_and_volatile_markets.htm)>

upwards, the market will continue to go up and if it gaps down the market will continue to go down.<sup>44</sup>



Figure 3: Volatility expansion gaps<sup>44</sup>

There are many different ways to apply volatility expansion strategies to a trading system. Depending on the trading personality, the parameters need to be set in order to determine the entry and exit points. In volatility expansion systems, the gaps determine the entry points. The timeframe of the gap periods as well as the exits need to be defined by the trader according to his objectives. Since this strategy has a high percentage of winning trades but the profits are usually low per every trade, this trading strategy can be more profitable when combined with other strategies to obtain a stronger trading system.

### 2.5.3. Support and Resistance

This is a widely used strategy for trading various kinds of financial instruments such as currency pairs and stocks. The support and resistance points are defined by the highs and

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<sup>44</sup> "Markets, Strategies, and Time Frames." Elite Trader, n.d. Web. 28 Nov. 2012. <<http://www.elitetrader.com/tr/index.cfm?s=17&t=74&p=5>>

lows of a certain financial instrument over a specific period of time; during this period, the trader can see how the price is bouncing back and forth between these points until the price breaks through either benchmark.<sup>45</sup>

This strategy is also known as floors and ceilings. The floors or the support levels are made of repetitive lows. Support is a price level in which there is a strong enough demand that prevents the price from going down further.<sup>46</sup> For instance, in a candlestick chart, the support level would be set when there is a relatively straight line for the lows in which no other low outbreaks the line.



Figure 4: The support in a support and resistance strategy<sup>46</sup>

On the other hand, there are ceilings or resistance levels. These resistance levels are made of repetitive highs in which no other high outbreaks the price in a certain period of time. The logic behind this is that it is a price level at which there is a strong level of supply that prevents the price from rising.<sup>46</sup>

<sup>45</sup> "Support and Resistance Trading Strategy." Earn Forex, n.d. Web. 28 Nov. 2012.

<<http://www.earnforex.com/forex-strategy/support-resistance-strategy>>

<sup>46</sup> "Support and Resistance." Stock Charts, n.d. Web. 28 Nov. 2012.

<[http://stockcharts.com/help/doku.php?id=chart\\_school:chart\\_analysis:support\\_and\\_resistan](http://stockcharts.com/help/doku.php?id=chart_school:chart_analysis:support_and_resistan)>



Figure 5: The resistance in a support and resistance strategy<sup>46</sup>

There is a curious phenomenon that occurs with floors and ceilings in which they switch roles. This means that when a ceiling is breached by the price, that value that used to be ceiling, could eventually turn into a floor. Same with floors that, once breached, they can end up switching their role and acting as ceilings. This phenomenon is something traders could take into account when trading with this strategy.

The support and resistance strategies are based on the principles of demand and supply, which controls the fluctuations of the prices of financial instruments. It is important to take into account that since this is a very commonly used strategy, it is very weak if used by itself to trade. This is due to the fact that many large institutions know that many people use support and resistance and it is very easy for these institutions to manipulate and push prices just a little bit beyond the support or resistance levels to trick people and wipe them out.

## 2.6. Basic Tools

### 2.6.1. Indicators

In the following section, some of the most commonly used indicators will be presented. Even though one's strategy may not necessarily include all of them, it is important to understand them since they could be used for future strategy development to make a system more robust.

#### *2.6.1.1. Simple Moving Average Indicator*

##### Definition

The simple moving average is one of the most widely used indicators. This is a very basic indicator that basically plots an average of prices according to the number of bars specified in the input length. The three most common moving average indicators are: one line moving average, two lines moving average, and three lines moving average. These three are very similar in the sense that they are all calculating the same arithmetic average using the same formula, what differs is the number of lines they plot and the different time periods they use to calculate the averages.

One line moving average: plots one moving average line. In TradeStation the default length to calculate the average is nine bars.

Two line moving average: plots two moving average lines. Usually one is called the fast average, which has a shorter length, and the slow average, which has a longer length. In TradeStation the default lengths normally are nine bars for the fast line and eighteen bars for the slow line.

Three line moving average: plots three moving average lines. Usually one is called the faster average, having the shortest length, the other is called the fast average, having a short length, and the slow average, having the longest length. In TradeStation the default lengths normally are four bars for the fastest, nine bars for the fast, and eighteen bars for the slow moving average.<sup>47</sup>

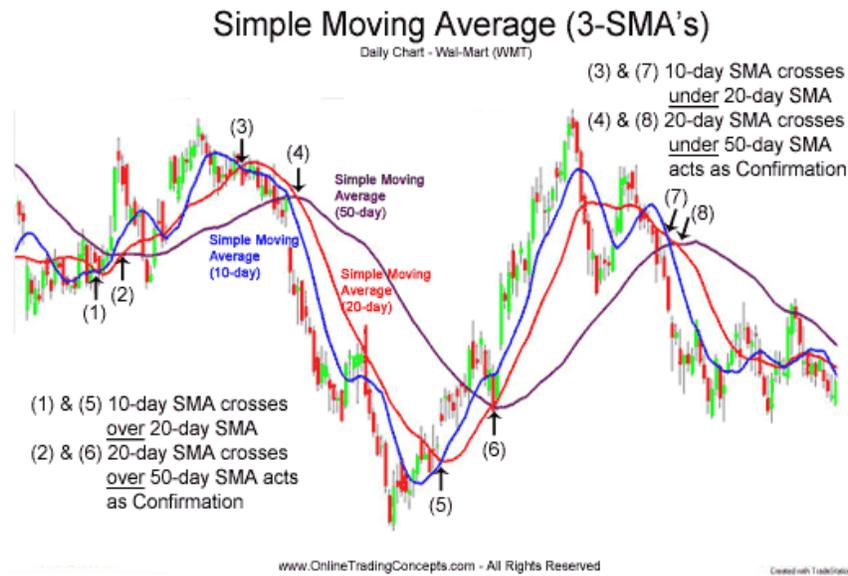


Figure 6: Three Line Moving Average<sup>48</sup>

### Formula

The formula for the one line moving average would be the sum of the number of closing prices that are being analyzed, divided by the same number of closing prices.<sup>49</sup> This is the formula for the simple moving average:

$$\frac{\sum_{i=1}^k Price(i)}{i}$$

<sup>47</sup> "Mov Avg 1 Line (Indicator)." TradeStation Help, n.d. Web. 8 Dec. 2012.

<sup>48</sup> "Moving Average Crossovers." Online Trading Concepts, n.d. Web. 31 Mar. 2013.

<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/MASimple2.html>>

<sup>49</sup> "Moving Averages - Simple and Exponential." n.d. Web. 8 Dec. 2012.

<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:moving\\_averages](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:moving_averages)>

## Use

This indicator's main use is to identify a trend in the movement of the price for a given time period. For instance, when the average values are going upward, means that the prices are going above the moving average, and this shows an uptrend. If prices are constantly lower than the average, the moving average indicator would show a down trend.

## Possible Application

The moving average indicator is helpful to identify a general trend in the price duration of a certain trading instrument. This could be used to get a broad idea of what is the direction that a certain security is following. However, it is important to be aware that this is a very simple indicator and widely used by many people, so if used by itself it may not be a robust strategy.

### *2.6.1.2. Exponential Moving Average Indicator*

#### Definition

The exponential moving average (EMA) is another very widely used trend indicator similar to the simple moving average (SMA) previously described. The difference from the (SMA) is it gives a greater weight to the market's most recent prices and a reduced weight to older prices. The exponential moving average values are calculated using the number of bars back specified by the user in the length parameter of the indicator. The default length in TradeStation is nine bars.<sup>50</sup> Figure 7 shows a visual representation of the difference between the EMA and the SMA; as it can be seen, the EMA follow more closely the actual prices.

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<sup>50</sup> "Mov Avg Exponential (Indicator)." TradeStation Help, n.d. Web. 8 Dec. 2012.



Figure 7: The difference between EMA and SMA<sup>51</sup>

### Formula

In order to calculate the exponential moving average first the simple moving average needs to be calculated –since the EMA needs to start somewhere and the SMA is used as the first calculation. The second step is calculating the weighting multiplier. Finally, the last step is calculating the exponential moving averages.<sup>51</sup>

$$\text{SMA: } \frac{\sum_{i=1}^k \text{Price}(i)}{i}$$

$$\text{Multiplier: } (2 / (\text{lenght} + 1))$$

$$\text{EMA: } (\text{Price} - \text{EMA}(\text{previous day})) * \text{Multiplier} + \text{EMA}(\text{previous day})$$

### Use

This indicator is used to identify the trend of a financial instrument. It can be used to identify long trends or short trends and changes of momentum, according to what the

<sup>51</sup>“Moving Averages – Simple and Exponential.” n.d. Web. 8 Dec. 2012.  
<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:moving\\_averages](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:moving_averages)>

trader sets the length to be. Many traders use various EMAs of different lengths in order to be able to track the different price movements and changes of momentum.

#### Possible Application

This indicator may be used in the same way that the simple moving average indicator, to identify the general trend of a financial asset. Furthermore, another use of this indicator can be to identify changes of momentum. For instance, if using two EMAs, one fast (shorter length) and one slow (longer length), one can see the sudden changes of momentum in a certain instrument when the two EMAs cross. This changes of momentum can help a trader determine when to enter or exit a position.

#### *2.6.1.3. Linear Regression Curve Indicator*

##### Definition

The linear regression curve indicator is a common tool to predict the future values of a trading security relative to its past performance. This indicator plots a curve through price activity. The curve is obtained by plotting a line through each end point of the invisible linear regression trend lines. These invisible trend lines are calculated by plotting the minimal distance between closing prices, using the least squares method, over the number of bars defined in the input length. The default input length in TradeStation is nine bars.<sup>52</sup>

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<sup>52</sup> "Linear Reg Curve (Indicator)" TradeStation Help, n.d. Web. 8 Dec. 2012.

## Linear Regression Curve

Daily Chart - E-mini S&P 500 Future (ES)



Figure 8: Linear Regression Curve Indicator<sup>53</sup>

### Formula

The regression line is calculated by using the formula:  $\hat{Y} = a + bX$ . Where  $a$  and  $b$  are constants,  $\hat{Y}$  is the predicted value of  $Y$ , which in this case is price, and  $X$  is the number of bars that are moving. Then the least squares function is used to find the invisible linear regression trend lines to plot the minimal distance between closing prices<sup>54</sup>:

$$\sum (Y - \hat{Y})^2$$

### Use

Linear regression curves help to predict where the price of the market will be in the near future. When prices are trending up, this indicator tries to determine what the upward bias of the price may be; likewise for when prices are trending down. Some people use this

<sup>53</sup> "Linear Regression Curve." Online Trading Concepts, n.d. Web. 31 Mar. 2013. <<http://www.onlinetradingconcepts.com/TechnicalAnalysis/LinRegCurve.html> >

<sup>54</sup> Price, Ian. "Least-squares regression line." n.d. Web. 8 Dec. 2012. <[http://www.une.edu.au/WebStat/unit\\_materials/c4\\_descriptive\\_statistics/least\\_squares\\_regress.html](http://www.une.edu.au/WebStat/unit_materials/c4_descriptive_statistics/least_squares_regress.html)>

indicator to determine if prices are overextended. If they see that prices rise above or fall below the regression curve, they believe that it suggests that the price is overextended and will eventually move back towards the line.

#### Possible Application

This indicator can be used to monitor a change in price direction. By analyzing the trend of the curves and how are prices moving compared to the curve one can obtain a general idea of overvalued prices that might eventually move back or undervalued prices that might eventually move higher.

#### *2.6.1.4. Volatility Indicator*

##### Definition

This indicator plots a smoothed average of the “True Range”. This range measures the normal range of a bar, but first checks the previous bar’s closing price to check if it is outside the current bar’s range; if it is outside, the closing price is used instead of the high or low. In this way, the previous close is considered in the current range in order to solve for gaps between bars.<sup>55</sup>

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<sup>55</sup> “Volatility (Indicator).” TradeStation Help, n.d. Web. 8 Dec. 2012.

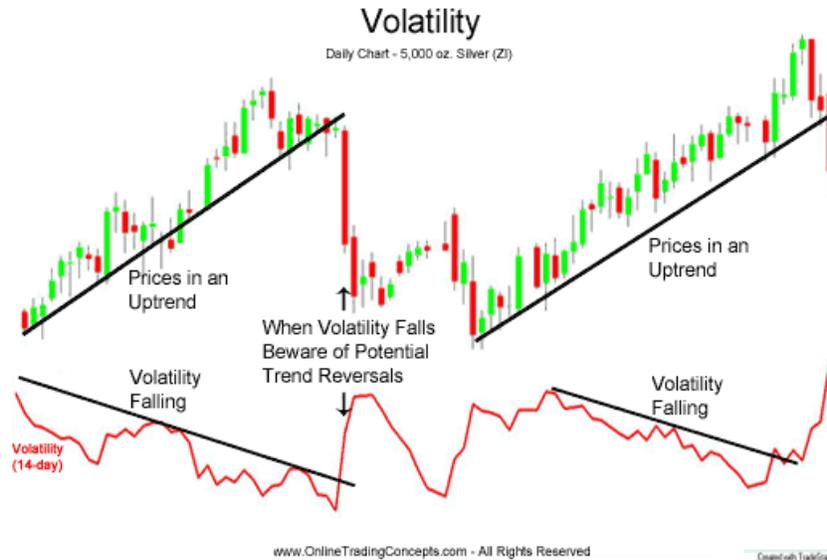


Figure 9: Volatility Indicator<sup>56</sup>

### Formula

Volatility is basically the standard deviation on the market price studied over a certain period of time. The formula for standard deviation is:

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

### Use

As its name implies, the volatility indicator is used for measuring the market's volatility based on the price ranges. This indicator helps the analyst to see extreme changes in volatility related to changes in the character and speculation of a given market.

### Possible Application

This indicator can help the trader be aware of how volatile a specific market of trading securities is and determine if it fits its trading personality and strategy. Furthermore, the

<sup>56</sup> "Volatility." Online Trading Concepts, n.d. Web. 31 Mar. 2013.  
<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/Volatility.html>>

volatility indicator is also useful to monitor sudden changes in volatility and to be aware of this fact can be crucial for a successful trading system.

### 2.6.1.5. Correlation Indicator

#### Definition

The correlation indicator calculates how frequent the price of two markets moves in the same direction or in an opposite direction during a specified input length, number of bars. These values are plotted as values with a range of -1 to 1. In the end, the correlation indicator, just as its name says, measures the correlation of prices between two markets; better said, their tendency to move in the same direction.

A positive correlation value indicates that the two markets tend to move in the same direction. A negative correlation value indicates a strong tendency for the two markets to move in opposite directions. A correlation value of near zero indicates there is very little correlation between the two markets.

#### Formula

The formula to calculate the r=correlation coefficient is:

$$r = \frac{1}{n - 1} \sum \frac{x - \bar{x}}{s(x)} * \frac{y - \bar{y}}{s(y)}$$

Given a set of observations (x1, y1), (x2,y2),...(xn,yn),

In the formula x would be market 1 and y market 2. s(x) is standard deviation of x and s(y) is standard deviation of y. <sup>57</sup>

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<sup>57</sup> Yale University. "Correlation." n.d. Web. 9 Dec. 2012.  
<<http://www.stat.yale.edu/Courses/1997-98/101/correl.htm>>

## Use

This indicator is used to find if there is any correlation between two markets and if there is, how the information of a certain market and its fluctuations can help one take better decisions regarding the other market. A positive correlation means that the two markets tend to move in the same direction, and a negative correlation means a tendency to move in opposite directions. The closest the values are to the poles means the stronger the correlation is. If the values are close to zero, this indicates that there is not a lot of correlation.<sup>58</sup>

## Possible Application

This indicator can help one base its system on information not only relying in the market that is being traded, but also on a market which one finds to have a strong correlation. For instance, if one finds that the market of interest has a strong correlation to a market which has a lot of information, one can also use the information of that other market as part of its system. For example, if one finds a stock that is strongly negatively correlated with the Dow Jones Industrial Average, one would assume that most of the time when the Dow goes down, the stock price will go up, so one could base a portion of its strategy with the fluctuations of the Dow.

Figure 10 shows an example of correlation between Bank of America, BAC, and Dow Jones Industrial Average, DJIA: Here it can be seen how there is a positive correlation and a strong positive correlation a lot of times between the movement of the price of the Bank of America Stocks and the Dow Jones Industrial Average.

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<sup>58</sup> "Correlation (Indicator)." TradeStation Help, n.d. Web. 8 Dec. 2012.



Figure 10: Correlation between BAC and DJIA

### 2.6.1.6. Price Oscillator

#### Definition

The Price Oscillator moving average is an investment indicator that compares two moving averages, in which one is larger than the other. The indicator can vary in different ways; it can vary in the measurements of the averages, technique that allows one to use points or percentages.<sup>59</sup> It is mostly used with percentages, called Percentage Price Oscillator (PPO), because the measurements allows one to know when there is a shift from a positive to a negative side of the zero line. The price oscillator also varies in the length of the moving averages, using the length of one that doubles the length of the other, makes the reading of the chart easier; the moving averages are also used with a smaller difference in the case of more experienced investors.<sup>60</sup>

#### Formula

- Price oscillator using points

$$\text{Shorter Moving Average} - \text{Longer Moving Average}$$

<sup>59</sup> "Price Oscillator." - *Technical Analysis*. N.p., n.d. Web. 15 Mar. 2013.

<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/PriceOscillator.html>>.

<sup>60</sup> "Price Oscillator â Technical Indicator." *Tradingsim Online Trading Simulator*. N.p., n.d. Web. 15 Mar. 2013.

<<http://tradingsim.com/blog/price-oscillator/>>.

- Percentage Price Oscillator

$$100 * ((\text{Shorter Moving Average} - \text{Longer Moving Average}) / \text{Longer Moving Average})$$

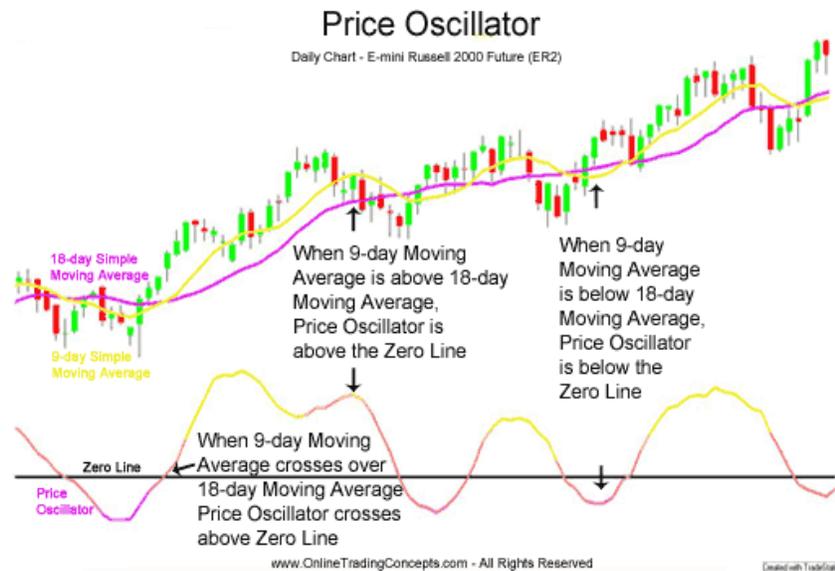


Figure 11: Price Oscillator Indicator<sup>59</sup>

### Use

When the shorter moving average line crosses above the longer moving average line, the PPO is crossing above the zero line. The same happens when the longer moving average line crosses below the shorter moving average line, the PPO is crossing below the zero line.

When an asset is overbought, the oscillator is moving down towards the zero line after hitting a ceiling. At this point one should look for selling short. After it crosses the zero line, one can review the candlesticks and the regular moving averages for the asset to sell short due to bearish behavior.

When an asset is oversold, the oscillator is moving upwards towards the zero line after hitting a bottom. At this point one should look for buying. After it crosses the zero line, one can review the candlesticks and the regular moving averages to buy due to bull behavior.

## Possible Application

The price oscillator is a very useful indicator which can be used to evaluate when it is the best moment to buy or sell assets; evaluations of the bullish and bearish conducts are visible with the indicator. This way one could take advantage from the price movement to gain profit.

### 2.6.1.7. Rate of Change

#### Definition

The rate of change indicator is a technique applied to observe price movement and detectable divergence of prices. It consists in a comparison of the percentage of a current price with the price of the previous period; this period of time is usually of 14 days<sup>61</sup>.

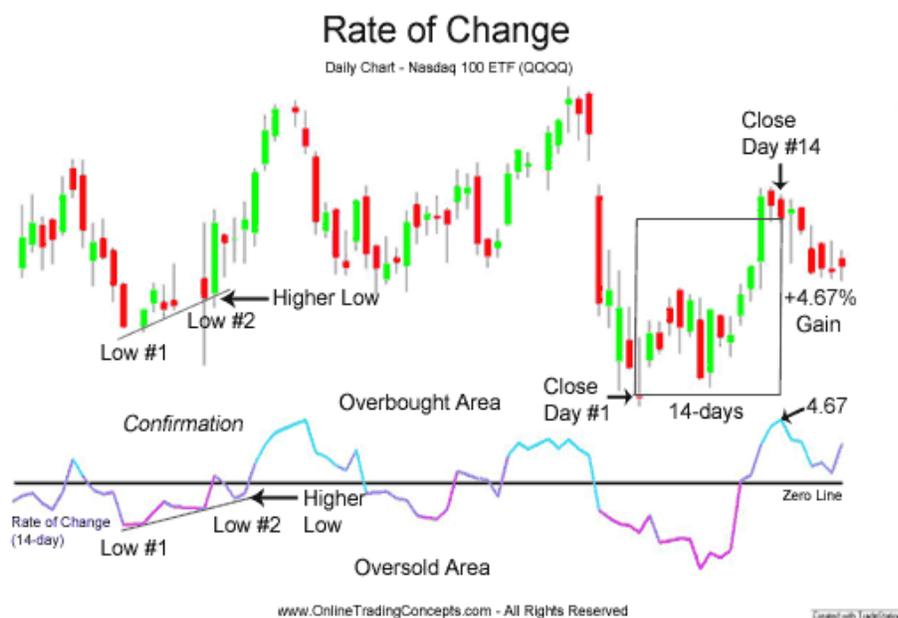


Figure 12: Rate of Change Indicator<sup>61</sup>

This technique helps confirm prices and view the divergence between them.

<sup>61</sup> "Rate of Change (ROC)." Online Trading Concepts. n.d. Web. 15 Mar. 2013.  
<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/RateofChange.html>>.

Oscillations that indicate upward trend are composed by a high and a low where the peak in the trend should always be higher than the previous period peak, and the low in the period should be higher than the previous period low. A common situation of a rally is the higher low shown in figure 12. Oscillations that indicate a down trend, are composed by a low and a high where the low in the trend should be lower than the previous low, and the peak in the current period must be lower than the peak in the previous period, for example the lower high in figure 12.<sup>61</sup>

Formula

### **ROC in points**

$$ROC^{62} = \frac{\text{Closing price today} - \text{Closing periods "n" days ago}}{\text{Closing price "n" periods ago}}$$

### **ROC in percentage**

$$ROC = \frac{\text{Closing price today} - \text{Closing periods "n" days ago}}{\text{Closing price "n" periods ago}} \times 100$$

Use

Two very common situations are possible: when the prices are in an overbought area, where the trader is advised to sell to make profits because of the huge demand for the asset with a small supply. The other situation is when the prices are in an oversold area; where there is low demand and excessive supply and the best thing to do is to buy cheap because the prices will go up.

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<sup>62</sup> "Price Rate Of Change - ROC." *Investopedia*, n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/p/pricerateofchange.asp>>.

## Possible Application

This technique could be used to anticipate the movement of the market and make profit out of it. Most of the people guide themselves through common analysis techniques and news making prices move excessively.

### 2.6.1.8. Volume Rate of Change

#### Definition

The volume rate of change indicator is a technique used to measure the volume of trades within bars, It compares the current volume of trades with a previous volume of trades measured certain amount of periods ago. The difference of periods used for the comparison of volume is usually of 14 periods.



Figure 13: Volume Rate of Change<sup>63</sup>

#### Formula

$$\left( \frac{\text{Current volume}}{\text{Volume "n" periods ago}} - 1 \right) \times 100 \quad 63$$

<sup>63</sup> "Rate of Change (ROC)." *Rate of Change*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.onlinetradingconcepts.com/TechnicalAnalysis/RateofChange.html>>.

## Use

The volume rate of change analysis technique is of great use because it helps understand the strength of the price movements. It has the purpose of showing the amount of trades made within a bar to show how strong the price movement was. It is often used to detect price divergence or confirm price moves.<sup>64</sup>

## Possible Application

This indicator applied along with a trending indicator, such as moving averages or a linear regression curve, could be useful to observe the trend of a market as well as how sustained the current trend is. It would help avoid making decision when price changes are weak, and it would show when a strong price movement takes place to take advantage of it.

### 2.6.1.9. *Relative Strength Index (RSI)*

#### Definition

The RSI is an indicator that measures changing prices during specific periods of time. The shorter these periods are, the fluctuation will be more noticeable. To measure the strength, the indicator uses the average of trades done in a period of time to show a difference between positive and negative trades. If a larger number of periods are used, the oscillation of the curve will be much less aggressive. One can see the difference in the curves in figure 14. The top red curve is a 5 period curve, and the bottom blue curve is a 55 period curve.<sup>65</sup>

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<sup>64</sup> "Volume Rate of Change." - *Technical Analysis*. N.p., n.d. Web. 15 Mar. 2013.

<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/VolumeRateofChange.html>>.

<sup>65</sup> "How to Trade with RSI in the FX Market." *Forex Trading News, Charts, Signals, Strategy, Analysis @ DailyFX*. N.p., n.d. Web. 15 Mar. 2013.

<[http://www.dailyfx.com/forex/education/trading\\_tips/daily\\_trading\\_lesson/2012/08/07/Trading\\_with\\_RSI.html](http://www.dailyfx.com/forex/education/trading_tips/daily_trading_lesson/2012/08/07/Trading_with_RSI.html)>.



Figure 14: Relative Strength Index<sup>65</sup>

### Formula

$$RSI = 100 - \frac{100}{1 + RS}$$

$$RS = \frac{\text{Average Gain}}{\text{Average Loss}} \quad ^{66}$$

### Use

Using the top and bottom 30% lines of the graph, the RSI shows the overbought and oversold areas through previous performance. Looking at the situation when prices are overbought, or over the 70% line, traders use their bear spirits to invest in this kind of setting. When prices are in the oversold area or under the 30% line, traders use their bull spirits to take advantage of this situation.<sup>67</sup>

<sup>66</sup> "Relative Strength Index (RSI) - ChartSchool - StockCharts.com." *Relative Strength Index (RSI) - ChartSchool - StockCharts.com*. N.p., n.d. Web. 15 Mar. 2013.

<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:relative\\_strength\\_index\\_rsi](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:relative_strength_index_rsi)>.

<sup>67</sup> "Relative Strength Index - RSI." *Relative Strength Index (RSI) Definition*. N.p., n.d. Web. 15 Mar. 2013.

<<http://www.investopedia.com/terms/r/rsi.asp>>.

## Possible Application

This analysis technique could be used to take advantage of the overbought and oversold situations to trade appropriately; understanding the changes in momentum will allow one to trade in a more efficient way taking advantage of the strong ups and downs of the prices.

### 2.6.1.10. DMI

#### Definition

The Directional Movement Indicator (DMI) is an indicator created for assessing price direction and strength. There are two main components on the DMI: the positive DMI that measures the strength of the price moving upwards, and the negative DMI which measures the strength of the price moving downwards. This is an indicator that works on the strength of the bulls compared to the bears. This indicator plots three different lines, the +DMI, the -DMI and the difference (ADX).<sup>68</sup>

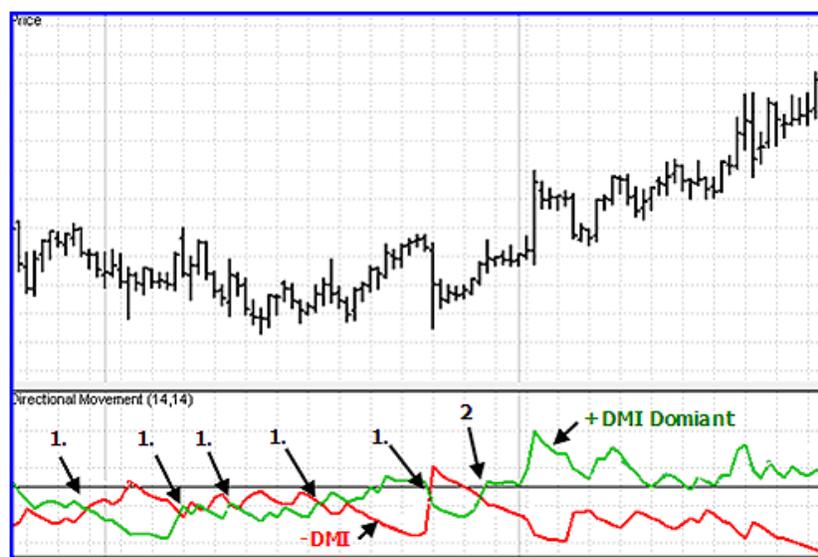


Figure 15: DMI Indicator<sup>69</sup>

<sup>68</sup> "DMI (Indicator)." TradeStation Help. TradeStation. n.d. Web. 12 Dec. 2012.

<sup>69</sup> "DMI Points the Way to Profits." *Investopedia*. n.p., n.d. Web. 15 Mar. 2013.  
<<http://www.investopedia.com/articles/technical/02/050602.asp>>

## Formula

The following formulas show how the DMI is calculated.<sup>70</sup>

$$U = H_n - (H_n - 1)$$

$$D = (L_n - 1) - L_n$$

$$TR = (H_n - L_n) | H_n - (C_n - 1) | ((C_n - 1) - L_n)$$

$$EMAUP = (EMAUn - 1) + \left(\frac{2}{n+1}\right)(Un - (EMAUn - 1))$$

$$EMADOWN = (EMADn - 1) + \left(\frac{2}{n+1}\right)(Dn - (EMADn - 1))$$

$$EMATR = (EMATRn - 1) + \left(\frac{2}{n+1}\right)(TRn - (EMATRn - 1))$$

$$+DI = \frac{EMAUP}{EMATR}$$

$$-DI = \frac{EMADOWN}{EMATR}$$

## Use

The DMI indicator is used to determine the strength of a trending market. The ADX plot is really helpful to realize and prove if a market is actually trending and it is not just a small change. This also helps to understand the strength of the market.

## Possible Application

This indicator can be used to reinforce a system about going on trending markets. It can also be used with other strength indicators to develop a strong system that will trade successfully in trending markets.

### 2.6.1.11. Average Directional Index (ADX)

#### Definition

The ADX indicator is a trend strength indicator that does not show trend direction, it specifically bases on showing the strength of the current trend. It is usually plotted together with the +DMI (positive directional movement indicator) and the -DMI (negative

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<sup>70</sup> Milton, Adam. "Directional Movement Index (DMI)." About.com Day Trading. N.p., n.d. Web. 12 Dec. 2012.

directional movement indicator), which add trend direction to the plot. The indicator consists in a moving average of the time range during a certain period of time, which is plotted with one line within a range of 100.<sup>71</sup>



Figure 16: Average Directional Index<sup>71</sup>

Calculating the AXD with Wilder's indicators<sup>72</sup>

High, low, and closing of the time period

$$UpMove = today's\ high - yesterday's\ low$$

$$DownMove = yesterday's\ low - today's\ low$$

<sup>71</sup>"ADX: The Trend Strength Indicator." *Investopedia*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/articles/trading/07/adx-trend-indicator.asp>>

<sup>72</sup> Kotak Securities. "Average Directional Moving Index." *Average Directional Moving Index*. Slideshare, n.d. Web. 15 Mar. 2013. <<http://www.slideshare.net/KotakSecurities/average-directional-moving-index-10932152>>.

## Formula

$$ADX = \frac{100 \times EMA(|+DI| + |-DI|)}{(+DI) + (-DI)} \quad 72$$

## Use

Applied together with the directional movement indicators, when the +DMI is above the -DMI, means that prices are moving up; when the -DMI is over the +DMI, means that prices are moving down. After noticing the direction of the trend, it is important to focus on the ADX line for the strength of the trend; when the ADX is between 0 and 25 it is weak, from 25 to 50 it marks a strong trend, from 50 to 75 a very strong trend, and from 75 to 100 an extremely strong trend. Trends over 60 are very unusual.

## Possible Application

Through the ADX one can evaluate the strength of a trend. Focusing on this one could avoid a misdirection that the price trend might show. Predicting trend reversals, is one of the most useful features this indicator shows, which one could use to anticipate changes in prices.

### 2.6.1.12. *TRIX Indicator*

#### Definition

TRIX is a momentum oscillator which displays the rate of change of a triple exponentially smoothed moving average<sup>73</sup>. It calculates the logarithm of the price input over the period of time by the length input of the bar<sup>74</sup>.

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<sup>73</sup> "Trix." Stockcharts, n.d. Web. 15 Dec. 2012.

<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:trix](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:trix)>

<sup>74</sup> "Trix (indicator)". TradeStation Help, n.d. Web. 15 Dec. 2012.



Figure 17: TRIX Indicator<sup>75</sup>

## Formula

$$\text{Triple } EMA_0 = (1 - f)^3(p_0 + 3fp_1 + 6f^2p_2 + 10f^3p_3 + \dots)$$

The easiest way to understand and calculate TRIX is to apply the exponential moving average three times to create the triple smoothed series. In the formula, the P's represent the prices (Po today's close, P1 yesterday's, etc.) and the "f" can be found with  $f = 1 -$

$$\frac{2}{N+1} = \frac{N-1}{N+1} \text{ where } N \text{ is the number of days used for the calculation.}^{76}$$

<sup>75</sup> "Trading FOREX With The TRIX Indicator". Indicator Forex, 15 Aug. 2009. Web. 31 Mar. 2013.

<<http://www.indicatorforex.com/content/trading-forex-trix-indicator>>

<sup>76</sup> "Trix (technical analysis)". Wikipedia, n.d. Web. 15 Dec. 2012.

<[http://en.wikipedia.org/wiki/Trix\\_\(technical\\_analysis\)](http://en.wikipedia.org/wiki/Trix_(technical_analysis))>

## Use

TRIX is commonly used to determine if a market is overbought or oversold and to determine if the market has a positive momentum or a negative momentum. Many believe that a TRIX crossing above the zero line is a buy sign and a cross below the line is a sell sign. It is also helpful to determine turning points in the market when it diverges from the price. The two main advantages of TRIX are that it leads rather than lag, and that it acts as an excellent filter which gets rid of almost all the noise.

## Possible Application

TRIX can be applied in a trading system to check if one is getting into an overbought or oversold market. TRIX would be useful to avoid making trades that would end up being losing trades because the market is close to changing its trend. It should be used with other indicators that measure volatility or moving trends.

### ***2.6.1.13. Bollinger Bands***

#### Definition

Bollinger Bands is an indicator which shows three lines, a moving average and two standard deviations placed above and below the moving average. The standard deviation lines represent volatility. These bands narrow when volatility decreases and widen when it increases. It also shows M Tops and W Lows which are good indicators of up and down breakouts.<sup>77</sup>

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<sup>77</sup> "Bollinger Bands." Stockcharts, n.d. Web. 15 Dec. 2012.  
<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:bollinger\\_bands](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:bollinger_bands)>



Figure 18: Bollinger Bands Indicator<sup>77</sup>

### Formula

Moving Average Formula:  $MA = \frac{\sum_{i=1}^n y_i}{n}$

Upper Band:  $UpperBB = MA + D \sqrt{\frac{\sum_{i=1}^n (y_i - MA)^2}{n}}$

Lower Band:  $LowerBB = MA - D \sqrt{\frac{\sum_{i=1}^n (y_i - MA)^2}{n}}$

In all of the above,  $y_i$  represents the price,  $n$  the number of bars, and  $D$  the number of standard deviations applied.<sup>78</sup>

### Use

As mentioned before, the Bollinger Bands can be used to predict breakouts with the M Tops and the W Lows. They are also used to determine if prices are too high or too low, but determining this doesn't mean a "bull market" or a "bear market", because there might be other factors affecting prices.<sup>77</sup>

<sup>78</sup> "Bollinger Bands Formula." Dundas Chart, n.d. Web. 15 Dec. 2012.  
 <<http://support2.dundas.com/onlinedocumentation/webchart2005/Bollinger.html>>

## Possible Application

The Bollinger Bands could be used in a trading system to determine breakouts that would result in big wins. It would be better to use other indicators as well to check if the right trade is being made. Other useful indicators to combine with Bollinger Bands could be momentum indicators.

### 2.6.1.14. Keltner Channel

#### Definition

Similar to the Bollinger Bands, the Keltner Channel indicator shows three lines, an exponential moving average and two average true range lines which are located below and above the moving average. This indicator is a trend following indicator which is helpful to determine or identify reversals when channel breakouts occur.<sup>79</sup>

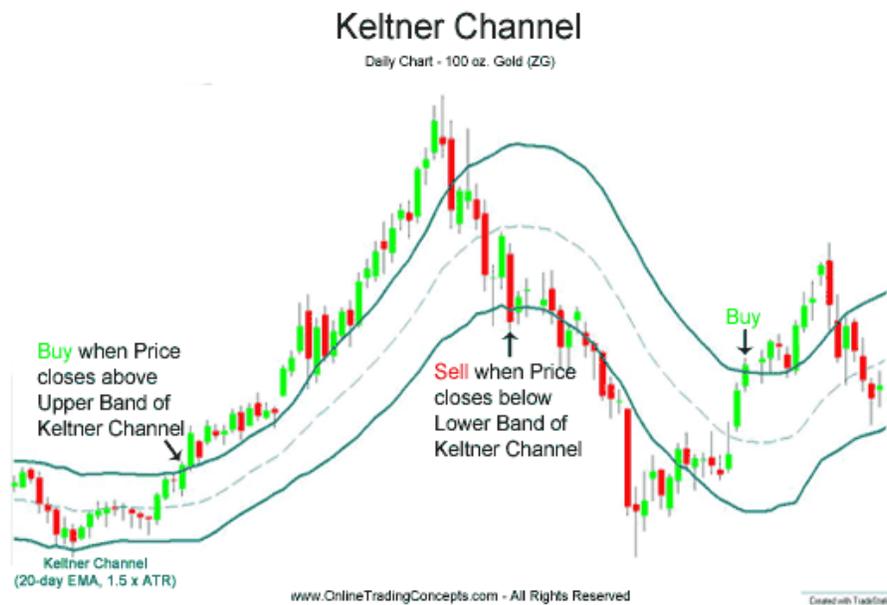


Figure 19: Keltner Channel Indicator<sup>80</sup>

<sup>79</sup> "Keltner Channels." Stockcharts, n.d. Web. 15 Dec. 2012.

<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:keltner\\_channels](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:keltner_channels)>

<sup>80</sup> "Keltner Channel" Online Trading Concepts, n.d. Web. 15 Mar. 2013.

<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/KeltnerChannel.html>>

## Formula

$$\text{Middle Band} = \text{Average Price} = \frac{\text{High} + \text{Low} + \text{Close}}{3}$$

$$\text{Upper Band} = \text{Middle Moving Average} + \text{Band Moving Average}$$

$$\text{Lower Band} = \text{Middle Moving Average} - \text{Band Moving Average}$$

Where:

$$\text{Middle Moving Average} = \text{Simple Moving Average}_n \text{ of Middle Band}$$

$$\text{Bando Moving Average} = \text{Simple Moving Average}_n \text{ of (High - Low)}$$

$$n = \text{number of periods}^{81}$$

## Use

The Keltner Channel is used for trend identification and trend following. For this aspect, it is better than the Bollinger Bands because its width is more constant.<sup>81</sup>

## Possible Application

The Keltner Channel, being a trend following indicator, can be used with momentum indicators to find an appropriate or trending markets and follow their trend, buying long or selling short. MACD would be a good choice for the momentum indicator.

### 2.6.1.15. MACD

#### Definition

The MACD turns two trend-following indicators, in this case two moving averages, into a momentum oscillator. This is done by subtracting the longer moving average from the shorter. The MACD is commonly used because it works both as a trend following indicator

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<sup>81</sup> Keltner Channels (KC).” Prosticks, n.d. Web. 15 Dec. 2012.  
<<http://www.prosticks.com/education/indicators/loadContent.php?sid=d4ce8d58dbccac2aec2197cb4ddafa01&page=kc>>

and as a momentum indicator. This indicator is not useful for identifying overbought or oversold markets because it is unbounded.<sup>82</sup>



Figure 20: MACD Indicator<sup>82</sup>

### Formula

$$MACD = Exp. Moving Average [Price, (smaller number of bars)] - Exponential$$

$$Moving Average [Price, (larger number of bars)]$$

$$signal = Exp. Moving Average [Price, (Number of bars)]$$

The smaller number of bars is commonly set to 12, the larger number of bars to 26, and the bars for the MACD EMA is commonly set to 9.<sup>83</sup>

<sup>82</sup> "Moving Average Convergence-Divergence (MACD)." Stockcharts, n.d. Web. 15 Dec. 2012. <[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:moving\\_average\\_conve](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:moving_average_conve)>

<sup>83</sup> "MACD." Wikipedia, n.d. Web. 15 Dec. 2012. <<http://en.wikipedia.org/wiki/MACD>>

## Use

As mentioned before, the MACD can be used to identify momentum. If the MACD shows a centerline crossover, it shows a momentum to the direction of the crossover. Also, a signal line crossover can determine if a bullish or a bearish market is present, this depending on the direction the signal is going at the moment of the crossover.<sup>82</sup>

## Possible Application

Since the MACD is a momentum indicator, it would be a good application to combine it with a trend following indicator to search and find a suitable market to trade. As mentioned before, applying it with Keltner Channel might be a good option.

### *2.6.1.16. Chaikin Oscillator*

#### Definition

The Chaikin Oscillator uses the MACD formula to measure the momentum of the accumulation distribution line. It is the difference between the 3-day exponential moving average of the accumulation distribution line and the 10-day accumulation distribution line. As a momentum indicator, it works to anticipate or determine a change in momentum of the Accumulation Distribution Line which can lead into a trend change. It is considered an indicator of an indicator<sup>84</sup>.

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<sup>84</sup> "Chaikin Oscillator." Stockcharts, n.d. Web. 15 Dec. 2012.  
<[http://stockcharts.com/school/doku.php?id=chart\\_school:technical\\_indicators:chaikin\\_oscillator](http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:chaikin_oscillator)>



Figure 21: Chaikin Oscillator Indicator<sup>84</sup>

Formula

$$\text{Money Flow Multiplier} = \frac{[(\text{Close} - \text{Low}) - (\text{High} - \text{Close})]}{(\text{High} - \text{Low})}$$

$$\text{Money Flow Volume} = \text{Money Flow Multiplier} * \text{Volume for the Period}$$

$$\text{ADL} = \text{Previous ADL} + \text{Current Period's Money Flow Volume}$$

$$\text{Chaikin Oscillator} = (\text{3Day EMA of ADL}) - (\text{10Day EMA of ADL})$$

ADL stands for Accumulation Distribution Line.<sup>84</sup>

Use

The Chaikin Oscillator can be used to measure the momentum behind the buying and selling pressure. When it moves into a positive value, it is indicating that the accumulation

distribution line is rising and there is a buying pressure prevailing. When it moves into a negative value, it is indicating that the accumulation distribution line is falling and there is a selling pressure prevailing. This can help determine appearances of bullish and bearish markets.<sup>84</sup>

#### Possible Application

Since the Chaikin Oscillator is an indicator derived from another indicator (the accumulative distribution line), it would be a good choice to combine it with a trend following indicator, such as the Keltner Channel, and another indicator such as the Bollinger Bands to look for breakouts which can lead to profitable big trades.

#### *2.6.1.17. Stochastic Indicator*

##### Definition

The stochastic indicator shows the relationship between the current prices to its range over a period of time. This indicator uses support and resistance levels to make all the calculations. The stochastic indicator is based on percentages. The strength of the stochastic indicator works as a confirmation for the price movement. Stochastic indicator prevents one from following false breakouts and also helps to identify overbought or oversold conditions. This indicator plots 4 lines, FastK which is the simple calculation of the stochastic, FastD is the same stochastic calculation but in a smoothed shape, OverBought and OverSold are just the floors and ceilings of the instrument.



Figure 22: Stochastic Indicator<sup>85</sup>

### Formula

The formula for the Stochastic Indicator is just a percentage calculation of the difference between the closing price and the lowest price divided by the difference of the highest and the lowest.

$$\%K = 100 \frac{(C - L)}{(H - L)}^{86}$$

Where:

L = Lowest Low

H = Highest High

C = Current bar Close

<sup>85</sup> "Trading With Stochastic Oscillator". Indicator Forex, 24 Jun. 2009. Web. 31 Mar. 2013.

<<http://www.indicatorforex.com/content/trading-stochastic-oscillator> >

<sup>86</sup> "Stochastic (Indicator and Function)." TradeStation Help. TradeStation. n.d. Web. 12 Dec. 2012.

## Use

The indicator is mostly used to identify the strength on the trends, and to prove that the instrument is actually trending the way it is going. This indicator also helps significantly when one is trying to look for instruments that are overbought or oversold, and in this way it prevents doing a risky trade.

## Possible Application

This indicator can help to make the correct decisions, especially for those moments when the change of prices on a specific instrument is very unstable, making the user think that there are enough conditions to realize that there is a change in the market price; most of the time these changes are just speculations or small insignificant movements. Also, this indicator prevents the system to run into overbought or oversold instruments. The Stochastic indicator plots can be used to make decisions depending on the objective.

### ***2.6.1.18. Momentum Indicator***

#### Definition

The Momentum indicator is a comparison between the current price and the price of the instrument during a specific number of bars. The default setting of the momentum indicator is set as the closing price. This indicator plots the rate of change in points between the current price and a previous bar's price and also a line at zero to identify if the subtraction is positive or negative.<sup>87</sup>

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<sup>87</sup> "Momentum (*Indicator and Function*)."  
TradeStation Help. TradeStation. n.d. Web. 12 Dec. 2012.



Figure 23: Momentum Indicator<sup>88</sup>

### Formula

There is no formal formula for this indicator since it is only a comparison between two prices.

$$\text{Momentum} = \text{Current Price} - \text{Determined price}$$

### Use

This popular indicator is similar to the stochastic indicator and helps identify trends on instruments since it is just a comparison between the actual price and a previous price. Also, it helps identifying overbought and oversold conditions for a determined instrument.

### Possible Application

This indicator can be applied to determine the change of the price of an instrument; showing how the instrument and its tendency are going. The momentum indicator can

<sup>88</sup> "Momentum Indicator" I Trading Shares. 18 Feb. 2013. Web. 31 Mar. 2013. <<http://www.itradingshares.com/momentum-indicator/>>

reinforce the decisions that are going to be made. This indicator is really good for identifying overbought and oversold conditions for the instrument and it is one of the strongest measurements for determining if the instrument is weak or strong.

### 2.6.1.19. Parabolic SAR

#### Definition

The Parabolic SAR (stop and reverse) indicator is based on the price and time the market has. This indicator is based on Welles Wilder's Parabolic Time/Price Strategy. Parabolic SAR is mostly used in trending markets and its principle is to be always in the market. The indicator is very good for determining time or price-based stops. The Parabolic SAR gives also good directions on trending markets, where the parabola below is generally bullish, and the parabola above is generally bearish.<sup>89</sup>



Figure 24: Parabolic SAR Indicator<sup>90</sup>

<sup>89</sup>"Parabolic SAR (*Indicator*)." TradeStation Help. TradeStation. n.d. Web. 12 Dec. 2012.

<sup>90</sup>"Parabolic SAR" Online Trading Concepts, n.d. Web. 15 Mar. 2013.

<<http://www.onlinetradingconcepts.com/TechnicalAnalysis/ParabolicSAR.html>>

### Formula

The formula for the parabolic SAR indicator is based on previous information, and gets built with the change of every bar.

$$SAR_{n+1} = SAR_n + \alpha(EP - SAR_n)$$

Where:

EP is the extreme point.

$\alpha$  is the acceleration factor of the parabola.

### Use

Traders that usually stay in the market all the time mostly use this indicator. When the current value reaches the Parabolic SAR, the position is exited and a new position in the opposite direction is taken. This indicator is based on the bull and bear market conditions, and also a time-price relationship.

### Possible Application

The Parabolic SAR indicator can be used to see how strong a market is and to reinforce the trading decision made in a trending market. This indicator will also help when one does not have enough time to be taking decisions.

#### ***2.6.1.20. Fibonacci Retracement***

##### Definition

The Fibonacci retracement is an indicator that attempts to predict the future price of a currency. This indicator uses the basic concept of the mathematical expression that Leonardo Fibonacci discovered. The Fibonacci Retracement is applied to trading by first tracing a line from the top to the bottom of large price movements. From here, it traces the

38.2%, 50%, 61.8%, and 78.6% retracements of the price movement, which are the most commonly used percentages.<sup>91</sup>



Figure 25: Fibonacci Retracement Indicator<sup>92</sup>

### Formula

There is no actual formula for the Fibonacci indicator. The way it works is on the retracement for 38.2%, 50%, 61.8%, and 78.6% retracements of price movements.

### Use

Fibonacci indicators are used to reinforce the decisions based on trends, where the system based on this indicator can go back on the retracement to keep going on the actual trend.

This indicator can also be used to predict support and resistance lines, preventing the instrument to continue with the trend.

<sup>91</sup> "How to Trade Reversals With Fibonacci Retracements." *Tradingmarkets.com*. N.p., n.d. Web. 12 Dec. 2012. <[http://www.tradingmarkets.com/.site/forex/how\\_to/articles/how-to-trade-reversals-with-fibonacci-retracements-81252.cfm](http://www.tradingmarkets.com/.site/forex/how_to/articles/how-to-trade-reversals-with-fibonacci-retracements-81252.cfm)>.

<sup>92</sup> "Fibonacci Retracement" *Stockcharts*, n.d. Web. 31 Mar. 2013. <[http://stockcharts.com/school/doku.php?id=chart\\_school:chart\\_analysis:fibonacci\\_retracemen](http://stockcharts.com/school/doku.php?id=chart_school:chart_analysis:fibonacci_retracemen)>

### Possible Application

The Fibonacci indicator can be used in one's support and resistance theory system, since it is one of the strengths of this indicator. Fibonacci projections can also be used as a leading indicator because of its certainty in predicting the market's direction. Also, this indicator has constant values for which the retracement needs to be done; this is easier than other indicator because of its simplicity for the calculation.

### 2.6.2. Trend Lines

Trend Lines are used as technical analysis techniques to help the decision making process about entries and exits, in other words, when and how the market should be entered and exited. Trend lines are based on historical information; they depend on what the user considers to be the most appropriate timeframe and the information that they will be based on. Short term data is generally based on linear approximation trend lines, while long term data is more likely to be a logarithmic approximation. Trend lines, as the name indicates, show how a determined instrument is trending and what the trader should expect.<sup>93</sup>

The use of trend lines becomes certainly essential when the decision making process takes place. Depending on the floor and ceiling values that the user has set, his participation in the market will differ.

The two main components of the trend lines are support trend line and resistance trend line. Support trend line is the minimum price that the instrument can take before it becomes risky for the user. Support trend lines are plotted by taking into consideration

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<sup>93</sup> Milton, Adam. "Trend Lines." About.com Day Trading. About.com, n.d. Web. 24 Feb. 2013. <<http://daytrading.about.com/od/indicators/a/TrendLineHub.htm>>.

historical information, followed by a linear approximation which gives the trend of the instrument. On the other hand, Resistance trend line is the top or maximum value that an instrument takes before it becomes risky, based on historical data and the trend that the instrument seems to be taking.<sup>94</sup>



Figure 26: A sample of a trend line<sup>95</sup>

### 2.6.3. Candlesticks

Candlesticks are an important component of chart analysis. They are a way of representation historical data on a plot. The candlesticks are very useful to understand the real behavior of a determined instrument in a certain period, because of its simple structure.

<sup>94</sup> "Support and Resistance." StockCharts.com, n.d. Web. 24 Feb. 2013.  
<[http://stockcharts.com/help/doku.php?id=chart\\_school:chart\\_analysis:support\\_and\\_resistan](http://stockcharts.com/help/doku.php?id=chart_school:chart_analysis:support_and_resistan)>.

<sup>95</sup> "Trend Line Trading." DailyFx.com, n.d. Web. 24 Feb. 2013.  
<<http://forexforums.dailyfx.com/attachments/trading-strategies/26626d1237392454t-trend-line-trading-gbpusd-h1.jpg>>.

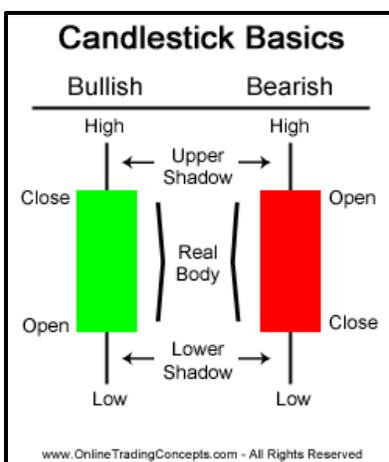


Figure 27: Sample Candlesticks.<sup>96</sup>

As shown in figure 27, there are two main components on a candlestick: the body and the shadows. The body indicates the realistic values, prices, of the instrument, because it has on top the close (for positive trending) or open (for negative trending) and the open and close values in the bottom, respectively. The other main component of candlesticks is the shadows, which are the highest and lowest prices for that bar. The combination of these two elements gives a better picture of how the market is trending and the behavior of the instrument in a predefined period of time. Candlesticks also indicate how people act in the market, which is very useful to identify human manipulation. Another important concept that can be deduced from candlesticks is the speculation happening on the price of an instrument.<sup>97</sup>

#### 2.6.4. Artificial Intelligence Trading

Artificial Intelligence Trading, also known as Automated Trading, is an option that has been available for a relative short time to people. It has made trading a more accessible activity

<sup>96</sup> "Candlestick Basics." Candlestick Charts and Patterns. OnlineTradingConcepts.com, n.d. Web. 24 Feb. 2013. <<http://www.onlinetradingconcepts.com/TechnicalAnalysis/Candlesticks/CandlestickBasics.html>>.

<sup>97</sup> StockCharts.com. "Introduction to Candlesticks." StockCharts.com, n.d. Web. 24 Feb. 2013. <[http://stockcharts.com/school/doku.php?id=chart\\_school:chart\\_analysis:introduction\\_to\\_candlesticks](http://stockcharts.com/school/doku.php?id=chart_school:chart_analysis:introduction_to_candlesticks)>.

since now there is an option for people that are better at programming than economics and finances. The way automated trading executes and takes decisions is based on the code that its strategy has. This code is based primarily on indicators, and the execution is just the software following the instructions that were provided. The fact of having an automation in the trading process avoids human mistakes in the decision making process, since now the computer software just executes what the code states.

A trading strategy can be fully or partially automated. This means that the code could just include some of the decision making process, like entering or exiting the market, and having the user to take the rest of the decisions, or just giving some signals to the user to take all the decisions. The other one is fully automated trading strategy in which, as the name indicates, the code states everything and the software is in charge of taking all the decisions.

#### **2.6.5. Backtesting**

Backtesting is a technique used to examine a strategy to see how it would have performed the past, based on historical data. This operation is done by applying the strategy in a determined period of time decided by the user. Then the software and/or platform chosen by the trader will evaluate the trades done by the strategy in the selected period of time.

Backtesting a strategy helps the trader detect the strengths and weaknesses of its strategy and from there analyze the different trades made to draw some conclusions and see where improvement is needed. This also helps to see if the strategy is doing what is supposed to do, because often the code written for a strategy does not do exactly what the user wants it to do.

This is one of the most important steps in the process of creating a robust strategy because situations that happened in the past could repeat themselves exactly the same, or at least similarly, in the future.

Backtesting has a close relationship with Optimization, because they are subsequent steps. After Optimization is done and applied to a strategy, the results of this optimization are shown backtesting the strategy.

To backtest a strategy it is necessary to set the parameters that are going to be used for these tests. Some of these parameters are the initial capital, bar length, time period, commission and position slippage per trade, interest rate, and position sizing. These parameters depend on the software or platform used by the trader; the parameters described above correspond to TradeStation. The menu where these parameters can be set in TradeStation is shown in figure 28.

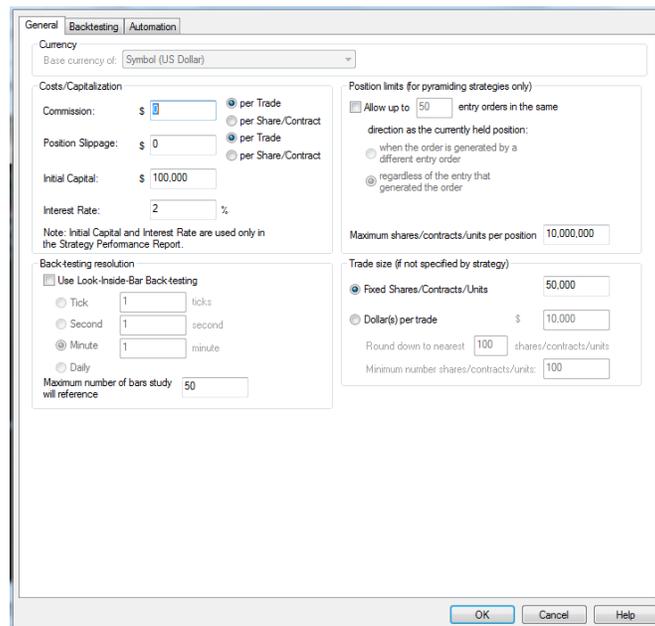


Figure 28: Backtesting settings from TradeStation.

### **2.6.6. Optimization**

Optimization is a software based operation that considers a range of values for each parameter of a strategy to be tested, and from there obtain the best results depending on the user's need. Optimization is basically the best result out of all the possible combinations depending on the ranges and settings preset before.

This operation is very useful and almost an essential part on the process of making a robust and profitable strategy, since it is going to provide the best values for it. A good optimization should include as many options as possible, but the trader should keep in mind that this process takes a significant amount of time. For this reason, the best approach is to do it in ranges to see where the optimal values are, and then do an optimization with a smaller range of values close to the ideal ones to get a more efficient result.

### **2.6.7. Walk Forward Optimization**

It was discussed that optimization is very useful and important, but there is another optimization process that can be applied to the strategy to assure its efficiency. This process is walk forward optimization. The basic concept behind walk forward is the application of the strategy in smaller periods of time from the total frame that has to be tested on.



Figure 29: Rolling Walk-Forward Analysis.<sup>98</sup>

Figure 29, obtained from TradeStation, shows a better explanation of the walk-forward process. It shows how the strategy gets tested over a smaller amount of time, but keeps going forward until the full period of tests is completed.

This is a more complete optimization process, since it provides better solutions or results for the values that should be used as the strategy's parameters by considering smaller periods of time and testing the strategy over and over again.

### 2.6.8. Monte Carlo Analysis

This is a built in function provided by TradeStation in the Walk-Forward analysis. Monte Carlo analysis is a good technique to test and see the strategy's robustness. The main concept behind Monte Carlo analysis is the application of different a range of values to

<sup>98</sup> "Walk-Forward-Optimizer." *TradeStation*. TradeStation, n.d. Web. 10 Jan. 2013. <<https://www.tradestation.com/trading-technology/tradestation-platform/analyze/walk-forward-optimizer>>.

different variables over and over again, “each time using different set of values from the probability functions”<sup>99</sup>. After this process is done all the possible outcomes associated with these values come out, the outcome results depend on the parameters and needs set by the trader. The outcomes then are entered in a probabilistic graph, which depends on the user preferred probability distributions. These graph gives the trader an idea of how profitable and robust the strategy is because of the randomness of the values applied to the strategy; but not only that, it also provides a good idea on how the strategy would perform in the future having a different environment as it had when it was created.

Monte Carlo analysis is commonly used to perform risk analysis calculations, based on random situations that can go from the best possible option to the worst extreme case. This is what makes this analysis technique such a useful tool to determine the robustness of a strategy.

## 2.7. Types of Trading Orders

When trading, there are two simple actions to take, entering the trade and exiting it. The simplest way to do this is issuing a “buy” or “sell” order. For example, the trader could issue a “buy” order to begin the trade and then a “sell” order to exit it if he expects the price to go up. On the other hand, if the trader expects the price to go down, he can issue a “sell” order first, and then exits the trade by issuing a “buy” order; this is called “selling short”.<sup>100</sup>

Buying and selling can be performed by using one of the three following order types: market orders (MKT), limit orders (LMT), and stop orders (STP).

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<sup>99</sup> "Monte Carlo Simulation: What Is It and How Does It Work? - Palisade." *Monte Carlo Simulation: What Is It and How Does It Work? - Palisade*. N.p., n.d. Web. 17 Apr. 2013.

<sup>100</sup> Milton, Adam. "Trading Order Types." About, n.d. Web. 14 Jan. 2013.  
<<http://daytrading.about.com/od/daytradingbasics/a/OrderTypes.htm>>

### **2.7.1. Market order**

This will issue a buy or sell order at the best price available at the current time. This price might not be the same that the trader wanted because other orders might get processed first, changing the price and generating a slight difference. Issuing a market order means that the trader wants to buy or sell at all costs and he is willing to risk getting a different price than the one he wanted at the moment the order was issued.<sup>100</sup>

### **2.7.2. Limit orders**

Orders issued by the trader when he is willing to buy or sell a contract at a specified price or at a better one. These orders are not always filled because the market price can move away from the price desired by the trader. If the price falls within the trader's desires, then the order gets filled and the trader enters the trade<sup>100</sup>. For buy limit orders, the market must be trading at the specified price or at a lower one for the position to be entered. For a sell limit order, the market must be trading at the specified price or at a higher one for the position to be entered.<sup>101</sup> For example, if the trader issues a buy limit order with a limit price of \$3.30, the market price must be \$3.30 or lower to buy a security. On the other hand, if the trader issues a sell limit order with a limit price of \$3.30, the market price must be at \$3.30 or higher to sell a security.

### **2.7.3. Stop orders**

Also known as stop market orders, stop orders are issued by the trader when he wants to enter a trade only if it trades at a specified price or at a higher or lower one, depending on the type of stop order. The specified price in this case is known as "the stop". If the market is trading at the stop price or at a better one, a market order would then be filled at the best

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<sup>101</sup> Fontanills, George A. "Trading Order Types." Dummies, n.d. Web. 14 Jan. 2013. <<http://www.dummies.com/how-to/content/trading-order-types.html>>

price available at that time<sup>101</sup>. For buy stop orders, the market must be trading at the stop price or at a higher one to leave the market. For a sell stop order, the market must be trading at the stop price or at a lower one to exit the market. For example, if the trader issues a buy stop order with a stop price of \$3.30, the market price must be \$3.30 or higher for the buy market order to be filled. If the trader issues a sell stop order with a stop price of \$3.30, the market price must be \$3.30 or lower for the sell market order to be filled. Sell stop orders are a good way to minimize losses when exiting a position and is very appealing for risk management.<sup>101</sup>

## **2.8. Money and Risk Management**

Trading systems require of a lot of organization; ideas, analysis techniques, and strategies must be arranged to comfort the trader's personality. Money and risk management in a trading system are essential to control loss and avoid chance to get on the way of professional trading; no system is perfect, meaning potential loss is a concern that should be managed working with the appropriate account size and trading the proper dimension of capital. Trading systems have been stratified into objectives, traits, and components.

### **2.8.1. Objectives**

There are three objectives to keep in mind when setting a trading system: implementation costs, risk and reward, and expectancy. It is important to define these to have a more specific idea of how one wants to trade. This helps the trader identify what the cost for trading will be, how much money he needs to make profit, and the profit expected from the trading system.<sup>102</sup> The objectives are the following:

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<sup>102</sup> King, Paul M. *The Complete Guide to Building a Successful Trading Business*. Middlebury, VT: PMKing Trading, 2007. 46-51. Print.

### 2.8.2. Implementation Costs

Trading requires different expenses, which should be minimized to achieve a greater profit.

The most important expenses are the following:

- Commission is what brokers charge to buy or sell something. Different brokers have different commission charges and offer different services. Choosing a specific broker depends on what is more convenient for the trader.
- The spread<sup>103</sup> is the difference in pips between the buy and sell price for a given commodity.
- The slippage<sup>104</sup> is the difference between the actual price and the expected price. These last two can be minimized by trading in high liquidity markets.
- Interests and carrying costs are other important expenses that affect the total profit.<sup>105</sup>

### 2.8.3. Risk and Reward

Two words that are important to have in mind before trading are risk and reward; the amount of capital one is willing to risk affects the amount of profit one desires to make. Risk is an element that needs moderation because it must comfort the trader's personality.

### 2.8.4. Expectancy

Through a specialized strategy traders have an expectancy of what they want their profit target to be; the expectancy depends on the risk of capital made when trading. Expectancy

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<sup>103</sup> "Spread." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/s/spread.asp>>.

<sup>104</sup> "Slippage." *Definition*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.investopedia.com/terms/s/slippage.asp>>.

<sup>105</sup> "Spreads and Slippage: Real Costs to Trading." *EToro Blog Spreads and Slippage Real Costs to Trading Comments*. N.p., n.d. Web. 15 Mar. 2013. <<http://www.etoro.com/blog/markets/28092012/spreads-and-slippage-real-costs-to-trading/>>.

is the average reward for the trades made by a system. It is important to have good exit strategies to be able to generate profit using a proper position sizing and the right amount of risk.

## 2.9. System Traits

When creating a system, it is important to understand the different elements that vary depending on the strategy. These elements called system traits mostly depend on the trader's personality. Many of these traits depend on the market, the account settings, the strategy settings, and many other elements of the system.<sup>106</sup>

Understanding the following traits is essential to make the system work towards one's preferences. Commissions affect the system depending on what the broker charges for transaction. The slippage depends on the liquidity of the instrument traded within a market; depending on the amount of trades there is a bigger demand and supply for the asset in a wider range of prices. Trading frequency is a characteristic that varies depending on the settings of the account, the time within a bar, and the entry and exit strategies. The main objective of a trading system is to generate profits; position sizing is one of the key factors that determine the magnitude of the profits. A counterpart of making profit is the risk of ruin; in order to make money in trading, taking some risk is always needed. Positions sizing is also used to moderate and balance risk, keeping the business away from ruin. Winning percentage, average winning trades, and average losing trades are different characteristics that depend on the market you are trading, especially in its volatility. The

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<sup>106</sup> King, Paul M. *The Complete Guide to Building a Successful Trading Business*. Middlebury, VT: PMKing Trading, 2007. 53-55. Print.

trade duration is other trading behavior that can be managed by the strategy settings depending on the position sizing and the amount of money desired.

## **2.10. System Components**

These elements allow the trader to design the system and arrange the objectives and traits to match his own personality<sup>107</sup>. The following components are to be chosen considering the studied traits that will direct the system towards its main objectives:

### **2.10.1. Market and Instrument Type**

Defining the type of assets and where to trade them is important, this way focusing on choosing the best set up to trade the specific asset. Different brokers offer a variety of options depending on the market being traded. A good strategy should work on any market if the correct measures and instruments are applied.

### **2.10.2. Instrument Filters**

Liquidity is an important characteristic when choosing the instrument to be traded; within markets the instruments with most liquidity avoid spread and slippage. Trading within the correct time frames and bar lengths helps one take advantage of liquidity.

### **2.10.3. Setup and Entry**

A good pattern to enter a trade is essential; this can be made through different analysis techniques that show trend direction and strength. A strategy with a good directional indicator and strength indicator improves the entry technique avoiding weak market movements.

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<sup>107</sup> King, Paul M. *The Complete Guide to Building a Successful Trading Business*. Middlebury, VT: PMKing Trading, 2007. 55-56. Print.

#### **2.10.4. Position Sizing**

Having in mind the expectancy of a trade, the position sizing takes an important role.

Having the right amount of money in each trade is important; this amount is usually standardized to keep the system within the same amount of risk per trade. Position sizing avoids human impulses and a mistake that may take traders to greater losses.

#### **2.10.5. Exit Strategy**

Exits are believed to be the most important element of a trading system; these specify the amount of profit that could be gained by each trade. A proper exit strategy prevents trades from unexpected movements of the markets, which could drain a whole account. A good exit strategy exits positions with a suitable amount of profit, sometimes a good exit strategy does not achieve the greatest profit, but it avoids the risk a larger profit may take.

## 3. Establishing a Trading Company

To establish any kind of business one needs to carefully analyze the different options to legally settle it. There are many kinds of ways to register a company, each with different regulations, liabilities, and tax implications. In the following section, different types of companies will be analyzed in order to determine which the best fit for this group is.

### 3.1. Types of Companies

#### 3.1.1. Sole Proprietor

A sole proprietorship is the most common and easiest way to set up a business. This kind of business is owned and operated by one person, and there is no distinction between the business and the owner. Even though this is the most common and easiest way to start a business, just as the owner is entitled to all profits, he is also responsible for all debts; a sole proprietorship does not protect the owner of the losses and liability of the business.<sup>108</sup>

Trading as a sole proprietor is mostly an accounting decision since no separate legal entity is created. The main advantage for traders setting their business as a sole proprietorship is that they can deduct some trading-related expenses before calculating taxes. As previously mentioned, this kind of business does not offer the owner any kind of liability protection for his personal assets and it does not give any flexibility to the treatment of the trading profits, they are simply part of the personal tax return as income. In a sole proprietorship the death of the owner would terminate the sole proprietorship.<sup>109</sup>

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<sup>108</sup> "Sole Proprietorship." U.S. Small Business Administration, n.d. Web. 11 Jan. 2013. <<http://www.sba.gov/content/sole-proprietorship-0>>

<sup>109</sup> King, Paul M. *The Complete Guide to Building a Successful Trading Business*. Middlebury, VT: PMKing Trading, 2007. 27. Print.

### **3.1.2. Partnership**

This is a single business where two or more persons share ownership. Each partner contributes to the aspects of the business and in return they share the profits and losses of their business. The main advantage of this kind of business is that it allows more than one person to own, make decisions, and share any profits of losses.<sup>110</sup>

There are three types of partnerships: general partnership, limited partnership and limited liability partnership.

#### ***3.1.2.1. General Partnership (GP):***

In this kind of partnership it is assumed that all profits, liability, and duties are divided equally between all partners. If partners decide to have a different distribution it needs to be documented in the partnership agreement. Similar to a sole proprietorship, a general partnership is not a separate legal entity and it does not protect partners from debts and liabilities. This kind of business is dissolved on the death of a partner.<sup>109</sup>

#### ***3.1.2.2. Limited Partnership:***

This partnership is more complex than a general partnership and it allows partners to have limited liability and limited input with management decisions. The limits on this partnership depend on each partner's percentage of ownership. A limited partnership is a separate legal entity; however, the general partners still have unlimited liability.<sup>109</sup>

#### ***3.1.2.3. Limited Liability Partnership:***

In a limited liability partnership, general partners are protected of liability, but the partnership is dissolved when a partner leaves (not only if he dies).<sup>109</sup>

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<sup>110</sup> "Partnership." U.S. Small Business Administration, n.d. Web. 11 Jan. 2013  
<<http://www.sba.gov/content/partnership>>

### 3.1.3. Corporation

A corporation, also known as a C corporation, is a separate legal entity which is owned by shareholders. In this kind of business the corporation is held responsible for liability and debts, not its shareholders. Corporations are much more complex than other business structures and they normally have higher administrative fees and more complicated tax and legal requirements. Most of the time, a corporation structure is suggested for large business organizations.<sup>111</sup>

The main disadvantage of a corporation is the double taxation. In corporations the net income is taxed at the corporate level and taxed again when it is paid to the shareholders. Because of the double taxation, a corporation is not normally recommended for a trading legal entity.<sup>112</sup>

### 3.1.4. S Corporation

An S corporation has similar legal and paperwork burden than a regular corporation, but its main advantage is that it has a different tax regulation of income. In an S corporation, only the income that is paid as a salary to the owner is subject to employment taxes. All other income that is not paid as salary is treated as a distribution to the owner, and is not subject to corporate or employment taxes.<sup>112</sup>

The main disadvantage of an S corporation is that it has many restrictions in the way it operates such as:

- It cannot have more than 75 owners.

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<sup>111</sup> "Corporation." U.S. Small Business Administration, n.d. Web. 11 Jan. 2013  
<<http://www.sba.gov/content/corporation>>

<sup>112</sup> King, Paul M. *The Complete Guide to Building a Successful Trading Business*. Middlebury, VT: PMKing Trading, 2007. 28-20. Print.

- Owners cannot be non-resident aliens or other business entities.
- Any salaries paid to owners must be a “fair salary”.
- Distribution of net income must be in proportion to ownership.

### **3.1.5. Limited Liability Company**

A limited liability company (LLC) is a separate legal entity with features similar to a corporation and a partnership combined. It offers the limited liability benefits of a corporation and the tax efficiencies and operational flexibility of a partnership for the owners, which are referred as members. Unlike a corporation, LLC's are not taxed as a separate business entity; all the profits and losses of an LLC are distributed accordingly to each member and the members are responsible for reporting these profits or losses on their personal tax returns, just as the owners of a partnership would.<sup>113</sup>

An LLC is much simpler than a corporation; no board of directors is required and a simple filing to maintain status is enough to keep the LLC active. An LLC can have an unlimited number of owners, and its owners can be non-resident aliens or other business entities. The main disadvantage of this type of business is that all net income is liable to employment taxes. However, the advantage is that members have total flexibility on how much and when to pay themselves. An LLC is a superior legal entity, except when you have very high profits compared to the salary you want to pay yourself, in this particular case an S corporation would be the best fit.<sup>113</sup>

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<sup>113</sup> “Limited Liability Company.” U.S. Small Business Administration, n.d. Web. 11 Jan. 2013  
<<http://www.sba.gov/content/limited-liability-company-llc>>

### 3.2. Which Company to Choose?

<b>Entity Type</b>	<b>Setup &amp; Management</b>	<b>Liability Protection</b>	<b>Tax Treatment</b>	<b>Income Flexibility</b>
Individual	None	None	Cannot deduct expenses	None
Sole Proprietor	Simple	None	Can deduct expenses	None
General Partnership	Simple	None	Can deduct expenses	Some
Limited Partnership	Moderate	None (for the general partner)	Can deduct expenses	Some
Limited Liability Partnership	Moderate	Maximum	Can deduct expenses	Some
C Corporation	Most Complicated	If status maintained	Double Taxation	Maximum
S Corporation	Most Complicated	If status maintained	Most preferential	Some Restrictions
Limited Liability Company	Moderate	Maximum	Most flexible	No Restrictions

Table 1: Comparison between the different types of companies<sup>114</sup>

After evaluating all the different options to set the company, it was decided that, for our case, the best choice would be to form a Limited Liability Company (LLC). The main reason behind this decision is that the LLC can have an unlimited number of owners, which can be non-resident aliens. This suits the group members perfectly if they plan on starting a company since two members come from Ecuador and two members from Venezuela. Another great advantage to having a LLC is that no board of directors is required, and maintaining status is really simple, since only a simple filing of tax returns is needed in order to keep the company active.<sup>114</sup>

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<sup>114</sup> King, Paul M. "The Complete Guide to Building a Successful Trading Business." Middlebury, VT: PMKing Trading, 2007. 26-31. Print.

With an LLC the owners get a higher flexibility to decide how much they are going to pay themselves a distribution of the company and in what percentages. They also have the freedom to decide when they are going to make these payments. These all add up to give them the total flexibility to decide to do distributions whenever they want to. Finally, in a LLC the accounting is done in a yearly basis, instead of the burden of doing it in a periodic payroll.<sup>114</sup>

In other words, a Limited Liability Company would be the best choice of a legal structure for our case since it protects the owners' personal assets and allows any number of owners in the firm. Furthermore, an LLC allows owners to be non-resident aliens of the country the company is planned on being set on and also gives them the flexibility of deciding how much and when to pay themselves the company's distributions.<sup>114</sup>

### **3.3. Agencies that Regulate Forex**

In the United States all the trading markets are regulated by some commissions. This commissions help traders avoid being scammed by brokers. Each commission has its own set of regulations and divisions which control different markets. In the next section, the three commissions that control forex will be discussed, along with the division which actually regulates the forex market.

#### ***3.3.1. Securities and Exchange Commission***

The Securities and Exchange Commission, SEC, was created in 1934 by the US Government to protect investors by regulating the trading markets. This commission is composed of five commissioners, one of them, the agency's chief executive, being chosen by the president

himself. All of these commissioners cannot belong to the same political party to avoid partisanship. The SEC is divided into five divisions and 23 Offices<sup>115</sup>.

The SEC has the responsibility of enforcing federal securities laws, overseeing the inspection of brokers, investment advisers, securities firms, and ratings fields, and checking the rules and making amends to them or issuing new ones. One of its Divisions, the Division of Trading and Markets, checks that all the markets, including forex, are working within their parameters and regulations<sup>115</sup>. This Division also oversees the Securities Investor Protection Corporation (SIPC) which helps investors in case that their brokers or brokerage firms fails, and end up owing their customers money. It is important to note that not every investor is protected by the SIPC, but 99% of those who are have received their investments back.<sup>116</sup>

### ***3.3.2. Commodities and Futures Trading Commission***

The Commodities and Futures Trading Commission, CFTC, was created by the US Congress in 1974 to regulate options and commodity futures markets<sup>117</sup>. The goal of this Commission is mainly the same as the SEC; protect users from fraud and manipulation, but from only the commodity futures and options market. In order to achieve it, the CFTC checks and investigates commodities fraud by checking foreign currency schemes, hedge fund fraud, and others. This Commission also works with other state and federal agencies and commissions in order to protect the investors<sup>118</sup>.

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<sup>115</sup> <http://www.sec.gov/about/whatwedo.shtml>

<sup>116</sup> [http://www.sipc.org/Portals/0/PDF/HSPY\\_English\\_2011.pdf](http://www.sipc.org/Portals/0/PDF/HSPY_English_2011.pdf)

<sup>117</sup> <http://www.cftc.gov/About/MissionResponsibilities/index.htm>

<sup>118</sup> <http://www.usa.gov/directory/federal/us-commodity-futures-trading-commission.shtml>

Both of these Commissions also work to educate people, especially investors, to help them know the risks present in trading markets, and the ways to avoid or detect them. They also try to make investors understand that these Commissions support them in case of fraud or scams.

### **3.4. Licenses and Regulations**

A forex license gives the company the ability to legally offer forex trading. This is the main reason why forex licenses are such an important component in the process of forming a company. The regulations and licensing depend on the country where the company is going to be doing business, not where the company is located or where the clients are from, and because of this regulations and rules vary from country to country. Depending on the licensing there are also different requirements and application processes that need to be done by the company or the individuals to be legally operating.

#### **3.4.1. Forex Broker License**

The process of getting a broker license in the United States is long and complicated because it includes several steps that have to be followed and some paperwork that needs to be filled in. The reason why the license process in the United States was chosen was because the trading that the group did was in this country, but it has to be kept in mind that some of these rules and conditions may not apply in other countries where there could be some additional rules that are applied. The normal application process for a broker license has to be done through the U.S. Commodity Futures Trading Commission (CFTC) and the U.S. Security and Exchange Commission (SEC). The application requires some information from the applicant like bank account where all the clients' funds are going to be collected, "dealing manuals & agreements, anti-money laundering policies, conflict of interest

policies". As the process continues there will be some background investigation and also some examinations of security principles and state laws that the applicant needs to pass in forward to get this license.<sup>119</sup>

#### **3.4.1.1. Series 3 License**

Series 3 License is "a securities license entitling the holder to sell commodities or futures contracts"<sup>120</sup>. There is an exam that gives the certification of the Series 3, so there are some concepts that this test covers. The Series 3 examination is required by the National Futures Association (NFA) and the Commodities Futures Trading Commission (CFTC) to be a certified broker. It has to be clarified that the Series 3 license applies to commodities and futures trading. The Series 3 examination is made of two parts: market knowledge and regulatory knowledge<sup>121</sup>. The minimum percentage needed to pass this test is 70%. Some of the main topics covered in this test are<sup>122</sup>:

- Futures Trading Theory
- Margins, Limits, Settlements
- Orders, Accounts, Analysis
- Basic Hedging
- Financial Hedging
- Spreads
- General Speculation

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<sup>119</sup> "How to Become a Forex Broker." *How to Become a Forex Broker*. N.p., n.d. Web. 13 Mar. 2013. <<http://www.100forexbrokers.com/how-to-become-a-forex-broker>>.

<sup>120</sup> "Series 3." *Definition*. N.p., n.d. Web. 13 Mar. 2013. <<http://www.investopedia.com/terms/s/series3.asp>>.

<sup>121</sup> "The Series 3 Exam: Creating A Career With Commodities." *The Series 3 Exam: Creating A Career With Commodities*. N.p., n.d. Web. 13 Mar. 2013. <<http://www.investopedia.com/articles/professionaleducation/08/series-3-commodities.asp>>.

<sup>122</sup> "SERIES 3 EXAM PRODUCTS." *Series 3*. N.p., n.d. Web. 13 Mar. 2013. <<http://securitiesexam.com/products/series3.html>>.

- Financial Speculation
- Options
- Regulations

#### **3.4.1.2. Series 34 License**

The definition of the Series 34 License is “an exam required for individuals seeking to engage in off-exchange forex transactions with retail customers”<sup>123</sup>. This means that this license is the one that forex professional traders are interested in. Similarly to the Series 3 license, this license covers different topics that will guaranty that the individual is capable of doing forex trading business. The main topics this exam covers are<sup>124</sup>:

- Definitions and Terminology
- Forex Trading Calculations
- Risks Associated with Forex Trading
- Forex Market – Concepts, Theories, Economic Factors and Indicators, Participants
- Forex Regulatory Requirements

#### **3.4.1.3. Series 65 License**

The Series 65 license is “a securities license required by most U.S. states for individuals who act as investment advisors”<sup>125</sup>. This license is different than the previous ones because it is not fully about trading but it is more about being an investment advisor, as the definition says, that will have more to do with laws, regulations and portfolio management.

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<sup>123</sup> "Series 34." *Definition*. N.p., n.d. Web. 13 Mar. 2013. <<http://www.investopedia.com/terms/s/series-34.asp>>.

<sup>124</sup> "SERIES 34 EXAM PRODUCTS." *Series 34 Exam Study Materials: Retail Off-Exchange Forex Examination*. N.p., n.d. Web. 13 Mar. 2013. <<http://securitiesexam.com/products/series34.html>>.

<sup>125</sup> "Series 65." *Definition*. N.p., n.d. Web. 13 Mar. 2013. <<http://www.investopedia.com/terms/s/series65.asp>>.

Similarly to the other licenses this one has an exam that has to be approved by the individual in forward to achieve this license. The topics covered by this license are<sup>126</sup>:

- Economic Factors & Business Information
- Client Investment Recommendations and Strategies
- Investment Vehicles Characteristics
- Laws, Regulations and Guidelines including Prohibition on Unethical Business Practices

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<sup>126</sup> "SERIES 65 EXAM PRODUCTS." *Series 65 Exam*. N.p., n.d. Web. 13 Mar. 2013. <<http://securitiesexam.com/products/series65.html>>.

## 4. Methodologies

In order to create a robust and profitable trading strategy, one has to understand many aspects. The trader must first know everything there is to know about the market and the instrument he is trading. When trading forex, the trader must understand the following:

- Different factors that make the forex market different from other markets, such as trading times, leverage, liquidity, etc.
- Political and economic situations ongoing in the countries which currencies are being traded.

After the trader understands the market he is trading, he needs to create his trading strategy. For this, the trader must understand many factors that make up the strategy. He needs to understand and decide the following:

- Everything there is to know about money and risk management, factors such as amount of capital, maximum drawdown, desired profit, setup costs, and expectancy.
- All the system components, such as position sizing, profit and stop loss amounts, and desired trading time.

Once the trader has decided the important parameters of the strategy to make it suit his personality, he must get into the technical and analytical part of the trading system. Here, the trader must decide which mathematical or statistical approach he will use to determine when to enter and exit trades or if he wants to use only news releases and government actions in order to decide when to trade.

- If the trader decides to use a technical approach, he must understand the different technical indicators that could help him identify when it is time to enter the market or when he should exit his trade. Some of these indicators are simple and exponential moving averages, DMI, MACD, Parabolic SAR, and others. The trader should understand the mathematical explanation and the use each of these indicators have in order to develop a robust strategy. These indicators can be found by the trader in trading platforms or in some internet charts.
- If the trader decides to base his trading actions in news releases and government actions, he must understand the different releases that could suddenly change the markets trend and the way to analyze them to use them to his advantage. Some releases are unemployment rates, GDP value, interest rates, and others.

Another aspect that has to be chosen, is if the trading is going to be done using a computer based platform or with a broker or brokerage company. The trader must understand the different costs each of the options have, as the advantages one could have over the other. By using a broker, the trader could minimize his implementation cost, but having to tell the broker every time to get into the trade or exit could make the trader lose some of the profit that could have been done by entering the market right away. Deciding to use a platform means having a membership cost which is added to the implementation costs, but the live charts and market activity could give the trader an edge over others.

If the trader decides to use a platform, he also needs to understand the different features offered by it, as the different elements needed to use it effectively. In order for the trader to

create, modify or understand the built-in indicators and strategies, he must understand and know how to use the programming code used by the platform.

Another useful aspect the trader could use for his advantage is optimization. The trader must understand how to optimize his strategy in order to obtain the best set of parameters that will suit the trader's desires. The trader must understand how the backtesting and the walk forward optimizations work. He must also know the different parameters these optimizations take into account in order to generate the results.

Finally, the trader could run some tests to check how his strategy is working or how it could have worked if different scenarios occurred. These tests are the Monte Carlo Simulation and the Walk Forward Analysis, which give the trader a different analysis of the trades made. The trader must understand these tests to gain advantage and make final changes to his trading system to make it a more robust one.

#### **4.1. Why Forex?**

It was decided to trade forex because it is one of the most practical and best markets to start in the trading business. The first advantage of forex is that one does not need too much initial capital to start trading. After this project is finished, there is a big chance that the members of the team may want to put to practice and apply all the knowledge and skills acquired in this IQP to manage personal funds. Taking into account the fact that the members of this project are college students, there may not be a lot of personal investment capital available to start trading, so forex is a good fit. As it was previously explained in the forex market description, in forex one can use leverage up to 50:1. For example if one wants to invest \$1,000 of one's own money, leverage could be used to invest up to \$50,000

worth of currency pairs. However, it is important to take into account that using leverage may magnify your profits, but at the same time it magnifies losses and risk. That is the main reason why for this project leverage will not be used; however, after the project is finished and the group has more knowledge, understanding, and experience in the forex market, leverage could be used to manage one's personal funds.

Another attractive of the forex market is the fact that it is the largest, most liquid market in the world, with an average traded volume of more than \$1.9 trillion per day<sup>127</sup>. This is attractive because a market with high liquidity is more secure to trade in the sense that most certainly, whenever one wants to enter or exit a position, this can be done easily because there is enough liquidity in the market. On the other hand, trading in markets with low liquidity may become a problem to traders facing no movement in prices, or not being able to either buy or sell their positions due to a lack of liquidity.

Finally, one last factor that led to the decision to choose forex instead of any other financial instrument is the fact that forex is related to almost everything happening around the different countries in the world, specifically in the ones of the currency pairs that are being traded. For instance, if one trades stocks, one needs to be informed about important factors of a company such as their next release of a product, their financial statements, their legal problems, and any other factors that may influence a change in their stock price. However, to trade forex one needs a much more globalized scope of the economy and be aware of what is going on in the countries in which one is trading their currency, plus other countries that might also affect a change in this currency's strength. For instance, to trade

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<sup>127</sup> "Forex." Investopedia, n.d. Web. 11 Mar. 2013.  
<http://www.investopedia.com/terms/f/forex.asp#axzz2NMYNRQ5z>>

forex one needs to perform a thorough research of the economic conditions of the two countries of the currency pair. To find information about the economic strength of a certain country it is important to be aware of current events happening such as elections, fiscal changes, and domestic and foreign problems, as well as indicators. Some important indicators of the strength of a country's economy are unemployment rate, interest rates, GDP growth, debt, and balance of trade. It was decided that it was more interesting to invest all the time required for this project on something that would give one a better understanding of the global economy rather than a better understanding on the performance of certain firms. With this said so, it was decided to trade forex for this Interactive Qualifying Project.

## **5. Trading System Development**

The following section describes the main objectives, the trading plan, and the scientific journey that was taken to develop the final version of the automated trading system. In order to develop a robust trading strategy it is necessary to have a detailed background information and investigation that will support this strategy. For this project specifically, the detailed background information is described in a previous section. The final strategy can be a compilation of different strategies that have been done separately or a simple strategy that has been developed according to the necessities and requirements of the trader. The final strategy in this section started as a simple strategy and has been modified to make it more robust, always keeping in mind the aspects of the group's trading plan. The changes made to the original strategy have been done to fix issues the strategy presented during the trading experience.

### **5.1. System's Objectives and Trading Plan**

The first step that was taken to start developing the trading system was defining its objectives and goals. It was decided to set up a goal that was challenging but realistic, one that would be attractive to potential clients and investors. For this project, it was defined that an appealing annual rate of return would be 8%. With this said, the goal of each member of the group would be to generate a monthly return of 0.67%. Each group member received a TradeStation simulated account with \$100,000 of initial investment capital; so each person should focus on having a monthly net income of \$670.

The group had a total initial investment capital of \$400,000, and the goal was to generate eight percent return per year, which is \$2,680 per month as a group. One crucial factor to determine the profit or losses of a system is position sizing. As a group it was decided not

to use leverage for this project. Even though with the use of leverage, at a 50:1 ratio, each person in the group would have the ability to invest up to \$5 million in the forex market, just as the potential profits would be heavily increased, the chances of getting wiped out severely increased as well. Since it was the first time most members of the group were trading, using leverage meant a potential hazard. It was decided to be a little conservative and every individual would use a fixed position size of \$50,000 per trade, fifty percent of the of the initial investment capital of each member.

An important part of the objectives of a trading system is defining the maximum drawdown. One of the goals of the strategy was to have a low drawdown. Many customers get scared away with strategies that have a high draw-down tolerance, so it was decided to set the maximum monthly drawdown to \$1,000 per account (one percent of initial capital); in this way, reducing the risks of getting wiped-out.

It is crucial for any person attempting to trade to realize that it is a very time consuming business. In order to create a system that fits one's trading personality, it is important to realize how much time one has available for trading. As college students, it should be considered that the time availability for trading may be low. With this said, this trading system was designed for a low time commitment. Even though it is an automated trading system, this does not mean that one can simply activate it and expect to come back after one month and see everything working perfectly with huge profits. With an automated trading system one still needs to be attentive to everything going on in the news, especially when there is an open position, since the robot computes exactly what the code states, without knowing if any important events occur or if there are news releases that may

severely affect these positions. Robot trading requires the trader to be monitoring the trades and making sure everything is running correctly. The objective of the system was to have a low time commitment, making between two to four trades per week, and hold positions for only about one day. In this way, the trader does not have to be every day, all day in front of the computer, but only a couple of times per day whenever there is a position open, monitoring how the system is performing.

As it was previously mentioned, each person had \$100,000 of initial investment capital in their account, and it was decided that each individual should trade a different currency pair. The distribution of currency pairs are as follows: Antonio EUR/JPY, Mauricio EUR/USD, Paolo AUD/USD, and Steven GBP/USD. The reason that these four currency pairs were chosen is that they have volatility and a huge volume of trades. This is important since one needs the market to be in motion in order to be able to make profits. Each member of the team will use the same automated trading system; however, the parameters that will be used are different, according to what fits best for the specific currency pair that was assigned.

## **5.2. Development of the Strategy**

In order to develop an automated trading strategy, one has to start from a basic automated strategy and take several steps to make it more robust and profitable. In each of these steps, one needs to identify what are the strategy's strengths, weaknesses, and needs, and with this information, add new or modify existing features to make it stronger. In the following section, the scientific journey that was taken to develop the final trading strategy will be described step by step. It is important to know that all the strategies shown below

have the same bar length (60 minute bars) and they all entered the trades with a fixed position sizing of \$ 50,000.

### **5.2.1. Step by Step Development of the Final Strategy**

Listed below are the strategies that were constantly optimized and modified in order to reach the final strategy that fitted the group's objectives. The processes of developing the final strategy consisted on starting from a very basic strategy and with small steps make it more complex and robust.

#### ***5.2.1.1. Double EMA Cross I (entries and exits at market price)***

As the name indicates, this strategy is based on the crossing of two exponential moving averages (EMAs). The values for these EMAs were determined with optimization feature in TradeStation according to what was best for each currency pair. For the fast EMA, the range of values that were optimized was between 2 and 12 bars. For the slow EMA, the range of values that were optimized was between 12 and 30 bars. There was not a constant value for these EMAs because every currency pair had better results using different values. They way this strategy worked was, every time there was a cross between these two EMAs a fixed \$50,000 position was entered. If the fast EMA crossed over the slow EMA, the strategy had to buy long at the market price at the next bar; on the other hand, if the fast EMA crossed under the slow EMA, the strategy had to sell short at the market price at the next bar. This strategy was a "Stop and Reverse" because it never exited the market; every time the two EMAs crossed the strategy entered the market, and when the EMAs crossed in the opposite direction, the strategy exited the positions and immediately entered the market in the opposite direction. This strategy had a high drawdown and low profits because it was not able to identify the wrong crossovers. The wrong crossovers are the

ones that, as shown in figure 30, signal the robot that it is time to enter a position in a specific direction, but suddenly after a few bars, another crossover occurs in the opposite direction.



Figure 30: Example of a wrong crossover

#### ***5.2.1.2. Double EMA Cross II (entries and exits at highest-highs and lowest-lows of previous bars)***

This strategy was based on the previous basic strategy. However, in this strategy an extra condition to enter or exit a position was included. In order to enter or exit the market, this robot was required to only enter or exit the market when the EMAs crossed and the price reached the highest high or lowest low price, respectively, of a predefined number of bars back. In more detail, for buying long it had to buy it at a higher price compared to the highest high from a predetermined number of previous bars; for selling short it had to sell it at a lower price than the lowest low from a specific number of previous bars. These conditions helped the strategy to enter a position one bar after the EMAs crossed, and trying to only enter the position if the market was still going in the same direction.



Figure 31: Example of entry at a Lowest-low

Figure 31 shows how the crossover and the lowest-low conditions are met, meaning that a position would have been entered, and in this case, selling short. This strategy was still stop and reverse since the entry parameters were the same as the exit parameters.

***5.2.1.3. Double EMA Cross III (entries and exits at highest-highs and lowest-lows of previous bars, exits when profit target and maximum loss stops)***

This strategy is based on the previous strategy and adds two extra conditions for the exits: a profit target and a stop loss. This means that when the strategy opens a position based on the EMA cross and highest-highs or lowest-lows conditions, it is going to close this position when one of these conditions is first met: there is a cross in the opposite direction, the profit target has been reached, or the maximum loss condition has been met. Adding these two conditions to exit a position gives the strategy more concise conditions to exit a

position, doing it after reaching the desired profit or a maximum loss. With these conditions, the back-tested equity curve became smoother, avoiding the huge losses and also getting out of the market when a profit target that is defined by the trader is met. This strategy helps reduce the risk of getting wiped out or losing clients due to large drawdowns. Each trader in the team optimized the profit target and stop loss values according to what fitted best with the specific currency pair; the optimization ranges were between \$100 to \$1,000 for profit target and \$100 to \$500 for stop loss amount.

#### ***5.2.1.4. Double EMA Cross IV (entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops)***

This strategy replaces the profit target component of the previous strategy with a trailing stop profit target. A trailing stop is simply a stop order that is generated when the position reaches a predefined profit value, and the exit will execute after the market price reaches a trailing percentage below the target price. If the profit keeps incrementing, so does the price for the exit, which always stays the determined percentage below the highest profit after reaching the initial target. Using this condition to exit the market helps to keep a position open for some time after the profit target is reached only if the price is going in a profitable direction, the position is exited the price begins to go in the opposite direction to prevent a potential loss. The decision for the final strategy was made between percentage trailing stops, and profit targets. Trailing stops showed to be more profitable according to back-testing results.

***5.2.1.5. Double EMA Cross V (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA, exits with trailing stops and maximum loss stops)***

The results obtained by the previous strategy were very concise and met to objectives that the strategy was set to. Despite the results of this strategy, it was necessary to add an extra condition to the strategy to make it more robust. Exiting the positions were not an issue anymore with the trailing stops for profit target and the maximum loss stop. The problem at this point was how the entries were made. The approach taken to overcome this challenge was to add a condition, now in order to enter a market the price had to be greater (to buy long) or smaller (to sell short) than the EMA50. The EMA50 by itself is a good long term trend indicator, and this compared to the market price helps to prevent entering the market in the wrong direction. By adding this condition the results showed a more robust strategy that entered the market in the right moments, but it had less profit than the previous ones. Here there is a tradeoff, even though total profit is reduced, the percentage of winning trades versus losing trades is considerably higher and the strategy is more protected against entering a position against the long term trend.

***5.2.1.6. Double EMA Cross VI (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA and slope, exits with trailing stops and maximum loss stops)***

This strategy adds an extra entry condition to the previous strategy. The robot only enters a trade if the EMAs cross in the same direction as the slope of the 50 EMA. The addition of the slope of the EMA50 makes more concise entry decisions, this because a position will be opened only if the trend of the market is going in the same direction of the EMA50. This may sound very trivial, but having support from the EMA50 to enter the market makes difference. The EMA50 means that the exponential moving average is applied to 50 bars

back, so having the EMA50 trending in the same direction of the other two EMAs is a signal that the trending is strong enough to enter the market. The inclusion of the slope of the EMA50 was done as a separate condition from the other two EMAs because this is a very slow EMA that shows a long period of time trend, on the other hand the other EMAs show short time changes in momentum.

***5.2.1.7. Additional Strategy (Double EMA Cross, entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops, and extra entries at big momentum changes determined by opening and closing price changes)***

This strategy was not used by all the members of the group, since it was only an experimental strategy. When the strategy was not in the market, waiting for another cross to happen, there were big momentum changes that were missed because the two EMAs did not cross due to the fact that price was only going in one direction. To see what happened when the strategy took advantage of these chances this new condition was included, to enter the market if the pip difference in the previous three bars was big enough to do so. This strategy had a great profit, but it was in the market almost all the time and also had some big losses because of entering too much to the market. The reason why this strategy was not considered for the development of the final strategy was because the number of trades that this strategy was doing and the risk involved in it did not fit the group's objectives.

**5.2.2. Backtesting Performance of Previous Strategies**

The following section shows four tables that illustrate the performance of each of the old strategies that were developed in the process of arriving to the final robot applied. This results show the performance of each strategy applied to the specific currency pair of each

trader in the team. All of these strategies were backtested since February 1, 2012, in order to obtain a significant comparison of the performance of each. It is important to notice how in most of the cases the total profit, profit factor, and the percent of profitable trades increased as one goes from a simpler strategy to a more complex one; on the other hand, the total number of trades gets smaller as the strategies get more sophisticated, getting closer to the objectives of the group. For a more detailed report on the performance, the equity curves, and parameters of each strategy see Appendix B.

Trader	Antonio Puzzi (EUR/JPY)						
Strategy	Strategy I	Strategy II	Strategy III	Strategy IV	Strategy V	Strategy VI	Final Strategy
Total Net Profit	\$20,696.92	\$21,214.97	\$16,337.49	\$24,462.29	\$18,783.30	\$19,810.07	\$20,008.24
Gross Profit	\$64,387.48	\$43,914.29	\$39,791.42	\$56,528.95	\$37,680.80	\$38,170.71	\$36,829.10
Gross Loss	\$43,690.57	\$22,699.32	\$23,453.93	\$32,066.67	\$18,897.50	\$18,360.64	\$16,820.86
Profit Factor	1.47	1.93	1.7	1.76	1.99	2.08	2.19
Total Number of Trades	589	191	209	382	180	186	165
Percent Profitable	31.92%	43.98%	48.80%	50.00%	50.00%	47.31%	50.91%

Table 2: Backtesting Performance of Strategies for EUR/JPY

Trader	Mauricio Ledesma (EUR/USD)						
Strategy	Strategy I	Strategy II	Strategy III	Strategy IV	Strategy V	Strategy VI	Final Strategy
Total Net Profit	\$3,684.40	\$6,767.08	\$10,317.94	\$14,931.82	\$11,874.23	\$12,145.77	\$13,579.29
Gross Profit	\$35,395.43	\$21,580.75	\$26,017.37	\$29,752.26	\$25,984.78	\$25,166.61	\$24,937.97
Gross Loss	\$(31,711.03)	\$(14,813.67)	\$(15,699.44)	\$(14,820.44)	\$(14,110.55)	\$(13,020.83)	\$(11,358.68)
Profit Factor	1.12	1.46	1.66	2.01	1.84	1.93	2.2
Total Number of Trades	606	142	201	205	190	172	157
Percent Profitable	29.54%	43.66%	52.74%	57.07%	48.42%	51.16%	55.41%

Table 3: Backtesting Performance of Strategies for EUR/USD

Trader	Paolo Colella (AUD/USD)						
Strategy	Strategy I	Strategy II	Strategy III	Strategy IV	Strategy V	Strategy VI	Final Strategy
Total Net Profit	\$2,572.11	\$11,092.93	\$6,576.94	\$9,226.54	\$8,914.50	\$8,972.80	\$9,339.55
Gross Profit	\$27,019.40	\$22,315.89	\$28,818.60	\$31,468.19	\$24,957.90	\$22,643.95	\$22,905.94
Gross Loss	\$(24,447.29)	\$(11,222.96)	\$(22,241.65)	\$(22,241.65)	\$(16,043.40)	\$(13,671.15)	\$(13,566.39)
Profit Factor	1.11	1.99	1.3	1.41	1.56	1.66	1.69
Total Number of Trades	288	126	227	227	183	159	157
Percent Profitable	34.38%	45.24%	42.49%	42.29%	44.26%	45.91%	45.22%

Table 4: Backtesting Performance of Strategies for AUD/USD

Trader	Steven Guayaquil (GBP/USD)						
Strategy	Strategy I	Strategy II	Strategy III	Strategy IV	Strategy V	Strategy VI	Final Strategy
Total Net Profit	\$5,755.69	\$9,176.14	\$10,200.74	\$11,714.48	\$10,549.50	\$10,514.17	\$9,337.64
Gross Profit	\$26,973.23	\$14,754.62	\$18,599.55	\$19,031.22	\$17,710.87	\$17,059.75	\$18,119.68
Gross Loss	\$(21,217.54)	\$(5,578.49)	\$(8,398.81)	\$(7,316.74)	\$(7,161.37)	\$(7,076.58)	\$(8,782.04)
Profit Factor	1.27	2.64	2.21	2.6	2.47	2.49	2.06
Total Number of Trades	402	86	122	137	110	113	128
Percent Profitable	33.08%	44.19%	46.72%	57.66%	54.55%	59.29%	53.91%

Table 5: Backtesting Performance of Strategies for GBP/USD

## 5.3. Final Strategy

The development of the final strategy was done as it was demonstrated in the previous section. All the step by step additions of components and tests helped the strategy to become more robust and trustful.

### 5.3.1. Summary of Strategy Conditions

Entry Rules:

All of the following conditions must be satisfied for the system to enter the market.

- Fast EMA crosses over (for long entry) or under (for short entry) Slow EMA.
- Price must be above (for long entry) or below (for short entry) the EMA 50.

- The slope of the EMA 50 must be positive (for long entry) or negative (for short entry).
- If all of the previous conditions are met the system enters the market in the next bar when the price reaches the highest high (for long entry) or lowest low (for short entry) of the previously defined number of bars back.
- The system always enters the market with a fixed position sizing equivalent to %50,000.

#### Exit Rules:

Whenever one of the following conditions is met the system exits the market.

- Fast EMA crosses the Slow EMA in the opposite direction than when the system entered the market. In this case, the system sells in the next bar at the highest high or lowest low price of the previously defined number of bars back for each.
- The opened position reaches the stop loss amount.
- The opened position reaches the profit target trailing amount and then the price falls back the specified percentage that activates the stop.

Two EMAs, fast and slow, have to cross each other to enter and exit the market.

### 5.3.2. Final Strategy Components

In the following section, the components of the final strategy will be explained in detail.

#### Bar Length

The final strategy, as well as all the previous strategies, uses 60 minute bars. There were several factors that were involved when choosing this length for the bar. The most important one was because with 60 minute bars the markets do not oscillate as much as they do in the smaller lengths bars. Bars with smaller lengths show too much noise in the

market, making excessive oscillations provoking frequent entries and exits which make the system less profitable. Figure 32 shows the length of the bar that is being used for the Final Strategy.

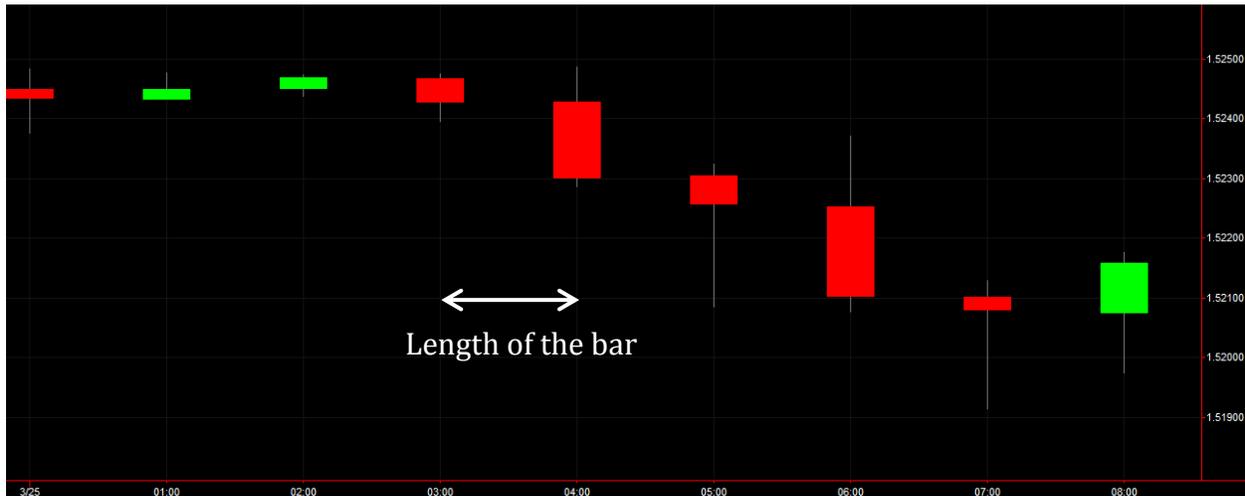


Figure 32: Example of the length of the bar

### Fast and Slow Exponential Moving Averages

The most important indicator used for this strategy was the Exponential Moving Average (EMA), because the decisions to enter the market are made by the crossing of a fast and a slow EMA which show changes in momentum. EMAs are good indicators of long term trend and changes in momentum that help to notice when the trend of a market is finishing and when there is another trend starting in different direction. In this strategy, the fast and the slow EMAs need to cross in order to enter a market.



Figure 33: Example of the EMAs

Figure 33 shows the three EMAs used for this strategy. The fast and the slow EMA are used to detect changes in momentum with their crosses. The use of the EMA 50 will be explained in the EMA 50 and Slope section.

### Trigger Lengths

The trigger lengths are the numbers of bars back considered for any condition. In this particular case, the trigger lengths define the number of bars back taken in account for the highest-high or lowest-low prices required to enter or exit a market. The strategy only buys or sells the next bar after an EMA cross, only if the market price arrives to the highest high (for long entry) or lowest low (for short entry) of a predefined number of bars back; this helps to prevent the robot from entering a position after a cross when the market is immediately going in the opposite direction. For a better performance, these lengths have been separated as individual variables, meaning that there will be trigger length for long entry, short entry, and a trigger to exit a long position, and another to exit a short position. The variables were made this way because the results obtained by using different variables

compared to using single variables, trigger length for long and trigger length for short, were significantly better and also gave the trader more control over this condition.

#### Trailing Stops and Maximum Loss Stop Amount

As it was discussed in the previous section, stop loss helps to have control over the maximum loss that the trader is willing to accept before closing a position. The trailing stops in this strategy work similar to a profit target; when the price reaches the profit target specified by the “floor amount” it activates a trailing stop using a predefined percentage so that if the price keeps on going in a profitable direction, the strategy holds the position, but if the price goes in a negative direction for a value higher than the “trailing percentage” it closes the position. The variables that have to be chosen for these conditions are: floor amount and trailing percentage, for trailing stop.

#### EMA50 and Slope

The EMA50 and slope are two conditions that were added to the strategy to make it more robust. The EMA 50 is a good benchmark to compare with the market price; if the trend is going up and the market price is higher than the 50 EMA it is a good sign to go long, if the trend is going down and the market price is below the 50 EMA it is a good sign to go short. In order to enter a market, the two EMAs have to cross each other and also the price has to be higher (for long entry) or lower (for short entry) than the EMA 50 and the slope of the EMA 50 has to be positive or negative, respectively. The addition of the EMA 50 and the slope conditions was made to make the entries be executed only when the changes in momentum are in the same direction as the long term trend.

The slope that is used in the strategy is based on a linear regression applied to the EMA50. This slope works as a condition to enter the market; this means that if the slope is positive,

the position opened should be long, and if the slope is negative, the position should be short. This is just a trend confirmation condition because it helps to prevent entering the market against the trend, which will most likely lead to losses. The only variable for this condition is the number of bars considered to do the linear regression.

## **5.4. Individual Trading Projects**

Each member of the group traded a different currency pair using the automated strategy that was developed for the project. Most of the parameters of the strategy changed for every group member, according to what fitted best for the specific currency pair that was traded. In the following section, the individual trading projects will be explained for each member of this project; these descriptions will include what currency was traded, the different parameters used, and the backtesting performance.

### **5.4.1. Antonio's Trading Project**

The currency pair chosen by this team member to trade was the EUR/JPY. After several optimizations and changes to the strategy, the final values obtained were the following:

#### **Bar Length**

After evaluating the options discussed with the group, the 60 minute bar was the best option to trade. This amount of time suited the trader perfectly since it gave him the liberty of trading some hours a day. This choice also gave a good amount of trades and profit after the backtesting was applied.

#### **Exponential Moving Averages**

The values for the three EMA's were 5 for the fast length, 15 for the slow length, and 50 for the slower one. The values for the fast and the slow lengths were obtained after optimizing

the strategy several times while the value for the slower EMA (50) was chosen by the group after discussing various options.

### Long Trend Slope

The value obtained for the long trend slope was 3. This means that the linear regression for the slope of the EMA50 is going to be calculated based on the previous 3 bars. This value was determined after optimizing using a range from 2 through 10 in intervals of 1.

### Trigger Lengths

For this strategy, the group decided to have different triggers for the different actions the system was taking. The strategy ended up having triggers for long entry, short entry, and two other triggers, one for exiting a long position and one to exit a short position. The values were the following:

- Long Entry: 1
- Short Entry: 1
- Long Exit: 2
- Short Exit: 5

### Trailing Stop and Stop Loss Amount

It was decided to have a Stop Loss Amount of 400 for every strategy and an optimized value for the trailing stops. After optimizing this strategy several times, the best value for the Percent Trailing Floor Amount was 500, while the value for the Percent Trailing Percent was 5.

## Summary of Strategy Settings

TradeStation Strategy Inputs	
Description	Value
Final Strategy - Price	Close
Final Strategy - EMA_Fast	5
Final Strategy - EMA_Slow	15
Final Strategy - LengthSlope	3
Final Strategy - Trigger_Length_Long_Entry	1
Final Strategy - Trigger_Length_Short_Entry	1
Final Strategy - Trigger_Length_Long_Exit	2
Final Strategy - Trigger_Length_Short_Exit	5
Final Strategy - ShareOrPosition	2
Final Strategy - ProfitTargetAmt	0
Final Strategy - StopLossAmt	400
Final Strategy - BreakevenFloorAmt	0
Final Strategy - DollarTrailingAmt	0
Final Strategy - PctTrailingFloorAmt	500
Final Strategy - PctTrailingPct	5
Final Strategy - ExitOnClose	false

Figure 34: Summary of strategy settings EUR/JPY

## Backtesting Performance Summary

The following section shows the performance summary of the automated strategy using the previously mentioned parameters since July 31, 2012.

### Equity Curve Line

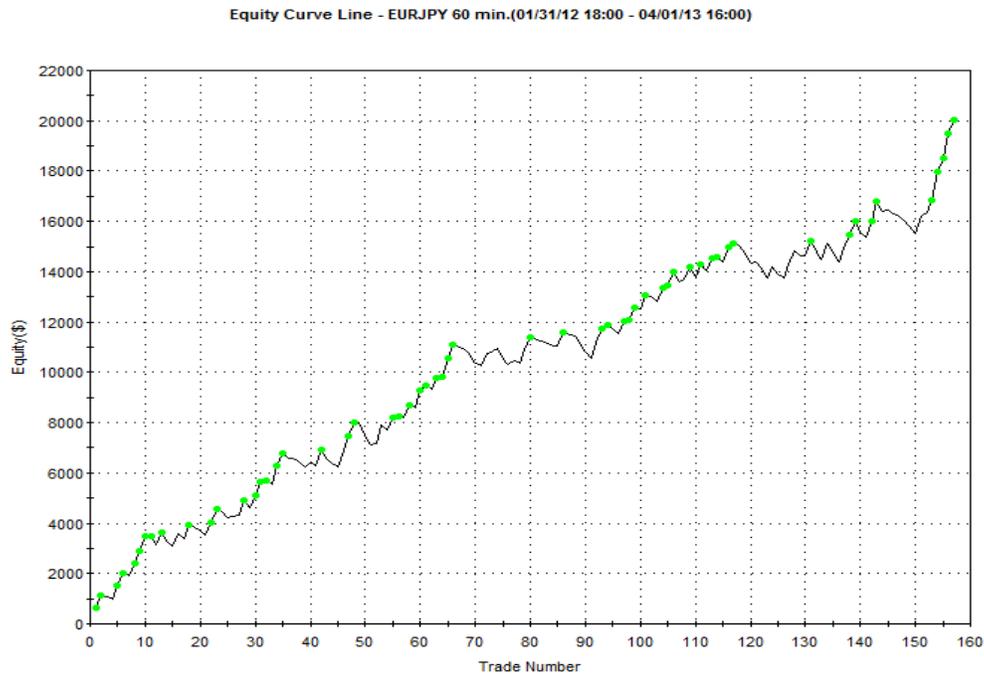


Figure 35: Backtesting equity curve line for EUR/JPY since 01/31/2012

## Monthly Accumulative Net Profit

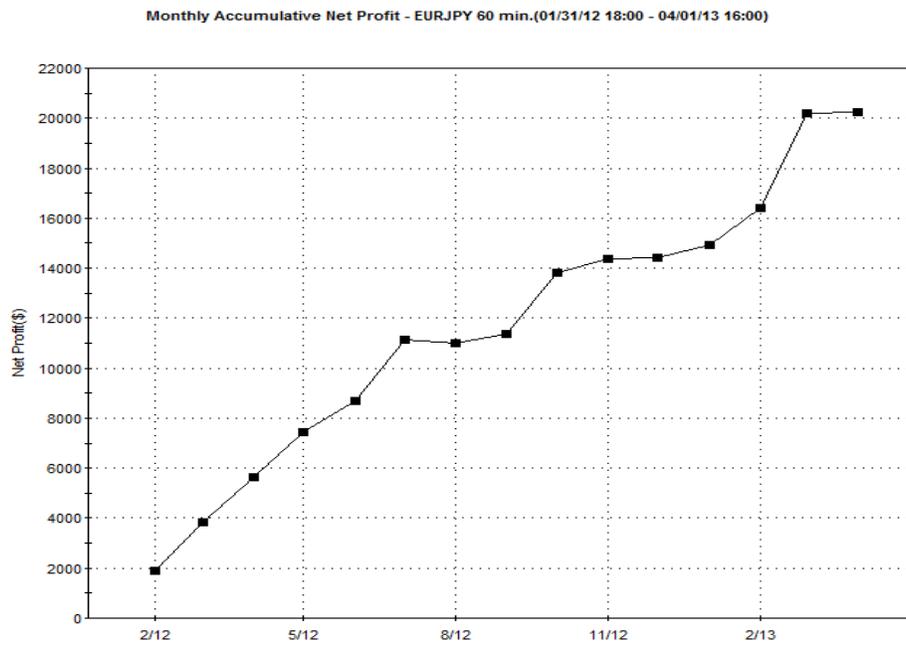


Figure 36: Backtesting monthly accumulative net profit for EUR/JPY since 01/31/2012

## Performance Report

TradeStation Performance Summary <span style="float: right;">Collapse ▲</span>			
	All Trades	Long Trades	Short Trades
Total Net Profit	\$20,024.19	\$10,474.13	\$9,550.06
Gross Profit	\$35,520.69	\$17,460.21	\$18,060.48
Gross Loss	(\$15,496.50)	(\$6,986.08)	(\$8,510.42)
Profit Factor	2.29	2.50	2.12
Roll Over Credit	(\$51.99)	(\$26.34)	(\$25.65)
Open Position P/L	\$207.65	\$0.00	\$207.65
Select Total Net Profit	\$20,024.19	\$10,474.13	\$9,550.06
Select Gross Profit	\$35,520.69	\$17,460.21	\$18,060.48
Select Gross Loss	(\$15,496.50)	(\$6,986.08)	(\$8,510.42)
Select Profit Factor	2.29	2.50	2.12
Adjusted Total Net Profit	\$14,299.87	\$6,615.61	\$5,312.45
Adjusted Gross Profit	\$31,573.94	\$14,766.04	\$15,168.49
Adjusted Gross Loss	(\$17,274.07)	(\$8,150.43)	(\$9,856.04)
Adjusted Profit Factor	1.83	1.81	1.54
Total Number of Trades	157	78	79
Percent Profitable	51.59%	53.85%	49.37%
Winning Trades	81	42	39
Losing Trades	76	36	40
Even Trades	0	0	0
Avg. Trade Net Profit	\$127.54	\$134.28	\$120.89
Avg. Winning Trade	\$438.53	\$415.72	\$463.09
Avg. Losing Trade	(\$203.90)	(\$194.06)	(\$212.76)
Ratio Avg. Win:Avg. Loss	2.15	2.14	2.18
Largest Winning Trade	\$1,157.98	\$708.73	\$1,157.98
Largest Losing Trade	(\$401.46)	(\$401.46)	(\$400.36)
Largest Winner as % of Gross Profit	3.26%	4.06%	6.41%
Largest Loser as % of Gross Loss	2.59%	5.75%	4.70%
Net Profit as % of Largest Loss	4987.83%	2609.00%	2385.39%
Select Net Profit as % of Largest Loss	4987.83%	2609.00%	2385.39%
Adjusted Net Profit as % of Largest Loss	3561.96%	1647.88%	1326.93%
Max. Consecutive Winning Trades	7	7	8
Max. Consecutive Losing Trades	5	5	7
Avg. Bars in Total Trades	21.35	22.78	19.94
Avg. Bars in Winning Trades	27.00	29.29	24.54
Avg. Bars in Losing Trades	15.33	15.19	15.45
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41200	41200
Total Shares/Contracts Held	6122000	3016000	3106000
Account Size Required	\$1,392.80	\$904.21	\$1,948.51
Total Slippage	\$0.000	\$0.000	\$0.000
Total Commission	\$0.000	\$0.000	\$0.000
Return on Initial Capital	20.02%		
Annual Rate of Return	15.73%		
Buy & Hold Return	19.24%		
Return on Account	1437.70%		
Avg. Monthly Return	\$1,348.68		
Std. Deviation of Monthly Return	\$1,119.22		
Return Retracement Ratio	1.33		
RINA Index	282.84		
Sharpe Ratio	n/a		
K-Ratio	n/a		
Trading Period	1 Yr, 1 Mth, 26 Dys, 20 Hrs		
Percent of Time in the Market	45.05%		
Time in the Market	6 Mths, 7 Dys, 22 Hrs, 4 Mins		
Longest Flat Period	11 Dys, 5 Hrs, 59 Mins		
Max. Equity Run-up	\$20,498.85		
Date of Max. Equity Run-up	04/01/13 04:00		
Max. Equity Run-up as % of Initial Capital	20.50%		

Figure 37: Backtesting performance report for EUR/JPY since 01/31/2012

### 5.4.2. Mauricio's Trading Project

This member of the group traded EUR/USD. The following parameters for this specific trading project were obtained with careful analysis of the market, TradeStation's optimization feature, and backtesting.

#### Bar Length

For this particular currency pair, the best length for each bar was 60 minutes. This choice was made as a group in order to suit the trader's availability and avoid spending many hours a day trading. After backtesting the strategy several times, the results presented a reasonable amount of trades and desired values for trading times, profit factor and winning trades.

#### Exponential Moving Averages

In order to arrive at the best length values to use for the fast and slow EMAs, the optimization feature in TradeStation was used with historical data to arrive at the best parameters. The fast EMA was usually optimized between two bars and up to twelve bars; the slow EMA was usually optimized from twelve bars to twenty six bars in length. Finally, the best values for these two parameters were 6 bars for the fast EMA and 16 bars for the slow EMA.

#### Trend Slope

The linear regression formula calculates the slope of the EMA 50 line. To obtain the best value for the number of bars back that the linear regression uses to calculate the slope, the optimization feature was used. The best value, for total profit, was two bars back. It is important to notice that the linear regression formula is calculating the slope for the EMA50, not for the actual price; so even though in this case it only uses two bars back for

the regression, it is using the information of fifty bars back of the exponential moving average to determine a long trend.

### Trigger Lengths

The trigger lengths in the automated strategy define that a position will be entered, once all of the conditions for buying long or selling short are met, at the highest high or the lowest low of a certain number of bars back. The strategy has four trigger lengths, two triggers for long and short entries, and two triggers to exit a long or a short trade. The best parameters for this currency pair were the following:

- Long Entry: 2
- Short Entry: 5
- Long Exit: 6
- Short Exit: 1

### Trailing Stop and Stop Loss Amount

The parameters set for the trailing stops for EUR/USD with the automated strategy were set to a floor amount of \$250 with a 1% trailing parameter. This was one of the most important parts deciding the strategy and needed to be thoroughly optimized and carefully analyzed. On the other hand, the stop loss was set to \$400 to prevent any larger drawdowns.

## Summary of Strategy Settings

TradeStation Strategy Inputs	
Description	Value
*Final Strategy ML - Price	Close
*Final Strategy ML - EMA_Fast	6
*Final Strategy ML - EMA_Slow	16
*Final Strategy ML - LengthSlope	2
*Final Strategy ML - Trigger_Length_Long_Entry	2
*Final Strategy ML - Trigger_Length_Short_Entry	5
*Final Strategy ML - Trigger_Length_Long_Exit	6
*Final Strategy ML - Trigger_Length_Short_Exit	1
*Final Strategy ML - ShareOrPosition	2
*Final Strategy ML - ProfitTargetAmt	0
*Final Strategy ML - StopLossAmt	400
*Final Strategy ML - BreakevenFloorAmt	0
*Final Strategy ML - DollarTrailingAmt	0
*Final Strategy ML - PctTrailingFloorAmt	250
*Final Strategy ML - PctTrailingPct	1
*Final Strategy ML - ExitOnClose	false

Figure 38: Summary of strategy settings EUR/USD

## Backtesting Performance Summary

The following section shows the performance summary of the automated strategy using the previously mentioned parameters since July 31, 2012.

### Equity Curve Line

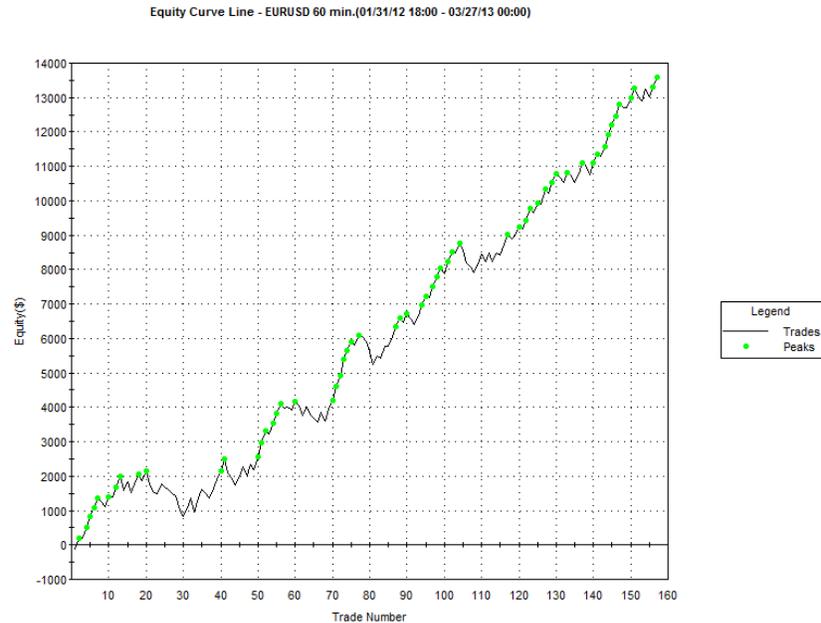


Figure 39: Backtesting equity curve line for EUR/USD since 01/31/2012

## Monthly Accumulative Net Profit

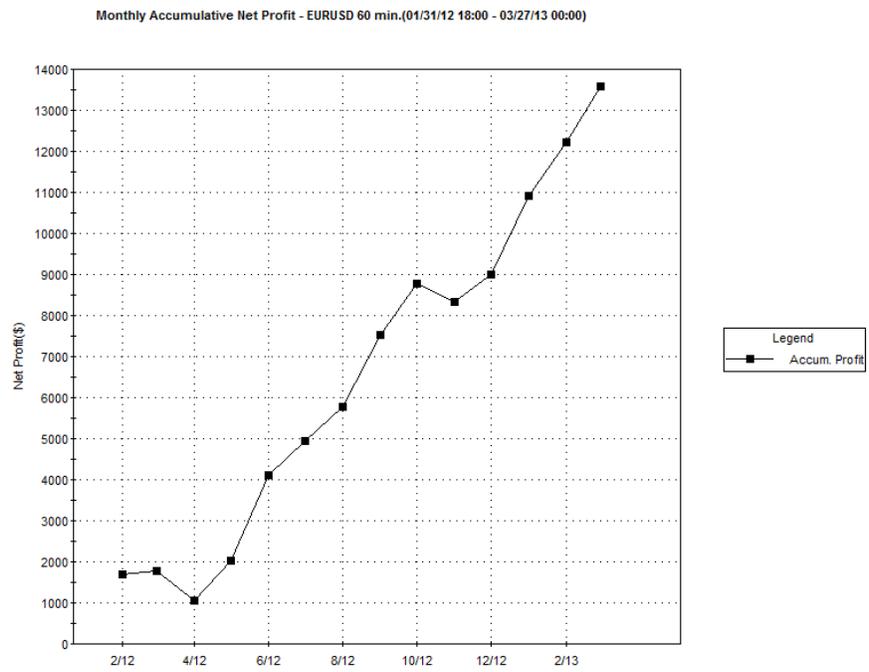


Figure 40: Backtesting monthly accumulative net profit for EUR/USD since 01/31/2012

## Performance Report

TradeStation Performance Summary		Collapse ▲		
	All Trades	Long Trades	Short Trades	
Total Net Profit	\$13,579.29	\$8,094.32	\$5,484.98	
Gross Profit	\$24,937.97	\$12,570.48	\$12,367.49	
Gross Loss	(\$11,358.68)	(\$4,476.16)	(\$6,882.52)	
Profit Factor	2.20	2.81	1.80	
Roll Over Credit	(\$22.61)	(\$42.67)	\$20.05	
Open Position P/L	\$0.00	\$0.00	\$0.00	
Select Total Net Profit	\$13,579.29	\$8,094.32	\$5,484.98	
Select Gross Profit	\$24,937.97	\$12,570.48	\$12,367.49	
Select Gross Loss	(\$11,358.68)	(\$4,476.16)	(\$6,882.52)	
Select Profit Factor	2.20	2.81	1.80	
Adjusted Total Net Profit	\$9,548.04	\$5,373.39	\$2,518.42	
Adjusted Gross Profit	\$22,264.34	\$10,653.50	\$10,503.02	
Adjusted Gross Loss	(\$12,716.31)	(\$5,280.11)	(\$7,984.60)	
Adjusted Profit Factor	1.75	2.02	1.32	
Total Number of Trades	157	74	83	
Percent Profitable	55.41%	58.11%	53.01%	
Winning Trades	87	43	44	
Losing Trades	70	31	39	
Even Trades	0	0	0	
Avg. Trade Net Profit	\$86.49	\$109.38	\$66.08	
Avg. Winning Trade	\$286.64	\$292.34	\$281.08	
Avg. Losing Trade	(\$162.27)	(\$144.39)	(\$176.47)	
Ratio Avg. Win:Avg. Loss	1.77	2.02	1.59	
Largest Winning Trade	\$460.12	\$460.12	\$425.18	
Largest Losing Trade	(\$400.24)	(\$400.18)	(\$400.24)	
Largest Winner as % of Gross Profit	1.85%	3.66%	3.44%	
Largest Loser as % of Gross Loss	3.52%	8.94%	5.82%	
Net Profit as % of Largest Loss	3392.81%	2022.67%	1370.43%	
Select Net Profit as % of Largest Loss	3392.81%	2022.67%	1370.43%	
Adjusted Net Profit as % of Largest Loss	2385.60%	1342.74%	629.23%	
Max. Consecutive Winning Trades	7	5	5	
Max. Consecutive Losing Trades	6	5	8	
Avg. Bars in Total Trades	18.49	17.23	19.61	
Avg. Bars in Winning Trades	18.78	20.35	17.25	
Avg. Bars in Losing Trades	18.13	12.90	22.28	
Avg. Bars in Even Trades	0.00	0.00	0.00	
Max. Shares/Contracts Held	41300	41200	41300	
Total Shares/Contracts Held	6076500	2857000	3219500	
Account Size Required	\$1,314.55	\$730.64	\$1,794.32	
Total Slippage	\$0.00000	\$0.00000	\$0.00000	
Total Commission	\$0.00000	\$0.00000	\$0.00000	
Return on Initial Capital	13.58%			
Annual Rate of Return	11.12%			
Buy & Hold Return	(2.26%)			
Return on Account	1033.00%			
Avg. Monthly Return	\$969.94			
Std. Deviation of Monthly Return	\$846.67			
Return Retracement Ratio	1.29			
RINA Index	297.50			
Sharpe Ratio	n/a			
K-Ratio	n/a			
Trading Period	1 Yr, 1 Mth, 21 Dys, 4 Hrs			
Percent of Time in the Market	35.52%			
Time in the Market	4 Mths, 26 Dys, 13 Hrs, 1 Min			
Longest Flat Period	13 Dys, 7 Hrs			
Max. Equity Run-up	\$13,871.89			
Date of Max. Equity Run-up	03/25/13 11:00			
Max. Equity Run-up as % of Initial Capital	13.87%			

Figure 41: Backtesting performance report for EUR/USD since 01/31/2012

### 5.4.3. Paolo's Trading Project

This member of the group decided to trade the AUD/USD currency pair. The values and parameters obtained in this strategy after various steps of optimization were the following:

#### Bar Length

After checking other options, the 60 minute bar length was the best choice for the strategy. The 60 minute bars are appropriate since they do not get much noise like shorter length bars do, and it suits the team member perfectly, since the trading is less stressful and time consuming.

#### Exponential Moving Averages

The strategy uses three EMA's. The values for the fast and the slow lengths were obtained after optimizing the strategy several times. These values were 6 for the fast one, and 17 for the slow one. The value for the slower EMA was chosen by the group to be 50. This value was decided after discussing options we had and analyzing them with our parameters for money and risk management.

#### Long Trend Slope

The value for this variable was determined after the optimization done from 2 to 7, to obtain a correct linear regression for the slope of the EMA50. The long trend slope for this currency pair is 2, which means that the linear regression is going to be done based on the previous 2 bars.

#### Trigger Lengths

There are four trigger lengths that have been optimized for this strategy, trigger length for long entry, short entry, and trigger length to exit a long position and another to exit a short position; this because individual trigger length values give better results for the strategy.

The values were:

- Long Entry: 4
- Short Entry: 1
- Long Exit: 7
- Short Exit: 4

### Trailing Stop and Stop Loss Amount

The trailing stop values that best suited this strategy were 300 for the Percent Trailing Floor Amount and 2 for the Percent Trailing Percent. The value for the Stop Loss Amount was decided by the group members after various risk management analysis to be 400.

### Summary of Strategy Settings

TradeStation Strategy Inputs	
Description	Value
*Final Strategy PC - Price	Close
*Final Strategy PC - EMA_Fast	6
*Final Strategy PC - EMA_Slow	17
*Final Strategy PC - LengthSlope	3
*Final Strategy PC - Trigger_Length_Long_Entry	4
*Final Strategy PC - Trigger_Length_Short_Entry	1
*Final Strategy PC - Trigger_Length_Long_Exit	7
*Final Strategy PC - Trigger_Length_Short_Exit	4
*Final Strategy PC - ShareOrPosition	2
*Final Strategy PC - ProfitTargetAmt	0
*Final Strategy PC - StopLossAmt	400
*Final Strategy PC - BreakevenFloorAmt	0
*Final Strategy PC - DollarTrailingAmt	0
*Final Strategy PC - PctTrailingFloorAmt	300
*Final Strategy PC - PctTrailingPct	2
*Final Strategy PC - ExitOnClose	false

Figure 42: Summary of strategy settings AUD/USD

### Backtesting Performance Summary

The following section shows the performance summary of the automated strategy using the previously mentioned parameters since July 31, 2012.

## Equity Curve

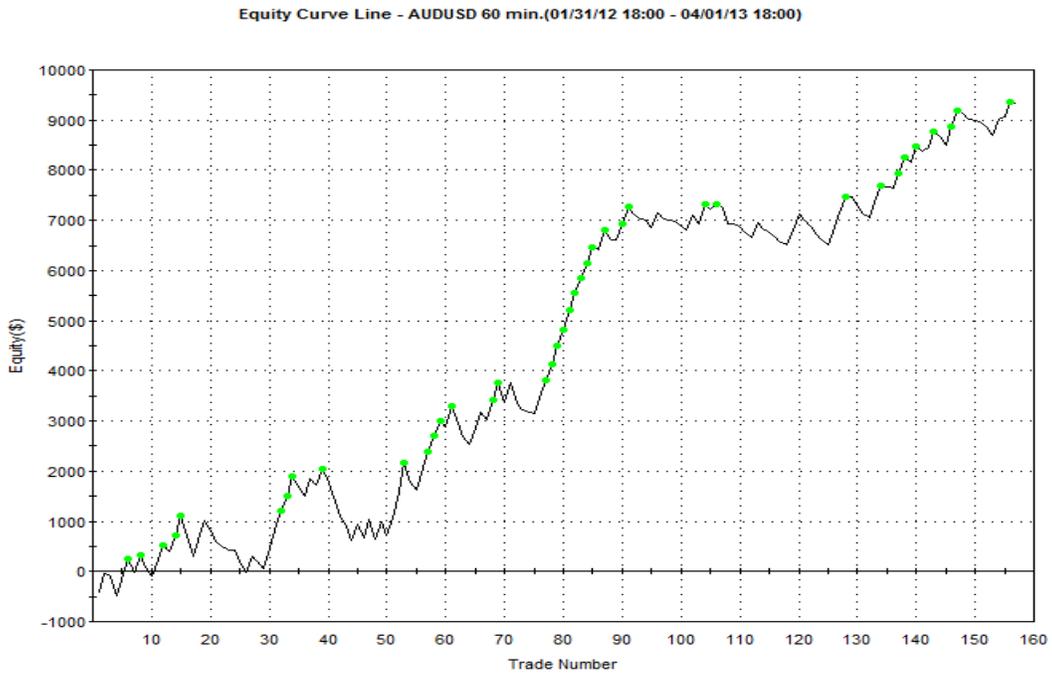


Figure 43: Backtesting equity curve line for AUD/USD since 01/31/2012

## Monthly Accumulative Net Profit

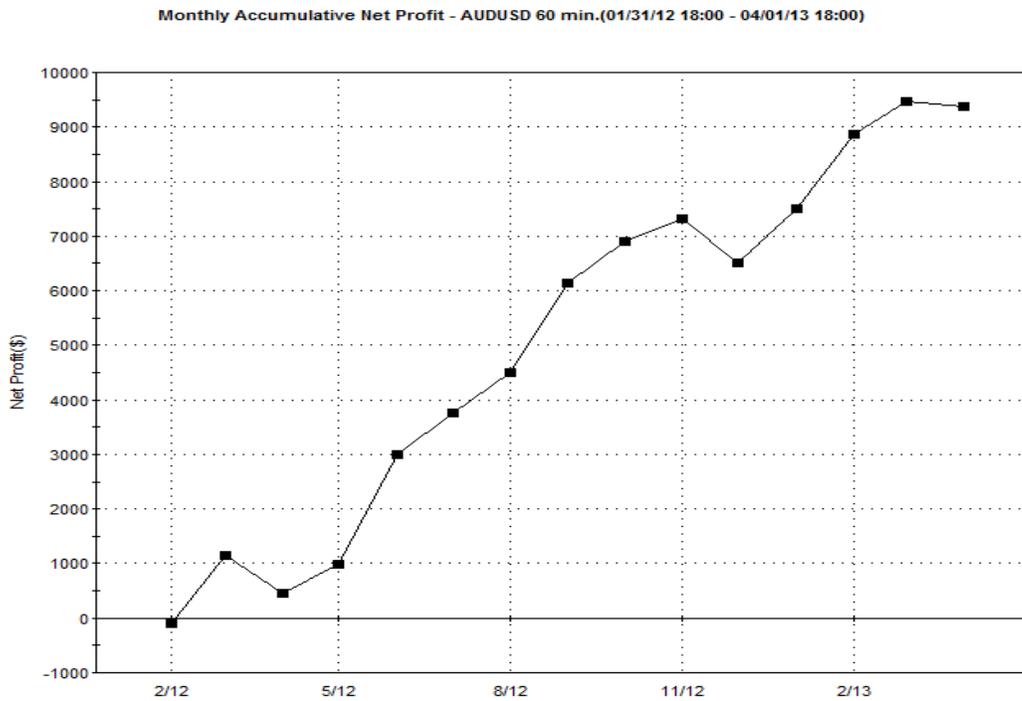


Figure 44: Backtesting monthly accumulative net profit for AUD/USD since 01/31/2012

## Performance Report

TradeStation Performance Summary		Collapse 		
	All Trades	Long Trades	Short Trades	
Total Net Profit	\$9,339.55	\$4,959.72	\$4,379.83	
Gross Profit	\$22,905.94	\$10,320.13	\$12,585.81	
Gross Loss	(\$13,566.39)	(\$5,360.41)	(\$8,205.98)	
Profit Factor	1.69	1.93	1.53	
Roll Over Credit	(\$343.99)	\$290.01	(\$634.00)	
Open Position P/L	\$36.00	\$36.00	\$0.00	
Select Total Net Profit	\$9,339.55	\$4,959.72	\$4,379.83	
Select Gross Profit	\$22,905.94	\$10,320.13	\$12,585.81	
Select Gross Loss	(\$13,566.39)	(\$5,360.41)	(\$8,205.98)	
Select Profit Factor	1.69	1.93	1.53	
Adjusted Total Net Profit	\$5,158.21	\$2,269.01	\$1,166.57	
Adjusted Gross Profit	\$20,187.51	\$8,466.58	\$10,595.82	
Adjusted Gross Loss	(\$15,029.30)	(\$6,197.57)	(\$9,429.26)	
Adjusted Profit Factor	1.34	1.37	1.12	
Total Number of Trades	157	72	85	
Percent Profitable	45.22%	43.06%	47.06%	
Winning Trades	71	31	40	
Losing Trades	86	41	45	
Even Trades	0	0	0	
Avg. Trade Net Profit	\$59.49	\$68.88	\$51.53	
Avg. Winning Trade	\$322.62	\$332.91	\$314.65	
Avg. Losing Trade	(\$157.75)	(\$130.74)	(\$182.36)	
Ratio Avg. Win:Avg. Loss	2.05	2.55	1.73	
Largest Winning Trade	\$580.75	\$580.75	\$439.94	
Largest Losing Trade	(\$400.42)	(\$400.16)	(\$400.42)	
Largest Winner as % of Gross Profit	2.54%	5.63%	3.50%	
Largest Loser as % of Gross Loss	2.95%	7.47%	4.88%	
Net Profit as % of Largest Loss	2332.46%	1239.44%	1093.82%	
Select Net Profit as % of Largest Loss	2332.46%	1239.44%	1093.82%	
Adjusted Net Profit as % of Largest Loss	1288.21%	567.03%	291.34%	
Max. Consecutive Winning Trades	10	3	8	
Max. Consecutive Losing Trades	6	5	5	
Avg. Bars in Total Trades	20.47	20.00	20.87	
Avg. Bars in Winning Trades	23.31	23.81	22.93	
Avg. Bars in Losing Trades	18.13	17.12	19.04	
Avg. Bars in Even Trades	0.00	0.00	0.00	
Max. Shares/Contracts Held	51800	51500	51800	
Total Shares/Contracts Held	7652000	3530100	4121900	
Account Size Required	\$1,438.71	\$530.83	\$1,418.49	
Total Slippage	\$0.00000	\$0.00000	\$0.00000	
Total Commission	\$0.00000	\$0.00000	\$0.00000	
Return on Initial Capital	9.34%			
Annual Rate of Return	7.69%			
Buy & Hold Return	(2.75%)			
Return on Account	649.16%			
Avg. Monthly Return	\$624.52			
Std. Deviation of Monthly Return	\$797.56			
Return Retracement Ratio	1.02			
RINA Index	163.82			
Sharpe Ratio	n/a			
K-Ratio	n/a			
Trading Period	1 Yr, 1 Mth, 26 Dys, 22 Hrs			
Percent of Time in the Market	41.74%			
Time in the Market	5 Mths, 23 Dys, 23 Hrs			
Longest Flat Period	12 Dys, 1 Hr			
Max. Equity Run-up	\$10,039.56			
Date of Max. Equity Run-up	03/31/13 22:00			
Max. Equity Run-up as % of Initial Capital	10.04%			

Figure 45: Backtesting performance report for AUD/USD since 01/31/2012

#### 5.4.4. Steven's Trading Project

This member of the group traded GBP/USD. The values obtained after several optimizations applied to the final, and the previous strategies are:

##### Bar Length

The best length bar for this particular currency is 60 minutes bar, considering the time frame determined by the group previously. This length of bar is appropriate to this currency pair because, as it was mentioned in an earlier section, does not get as much noise as the 5 minute bar gets, but it is still a relative short time frame where to trade. This bar length was decided because of the time commitment that was available to trade.

##### Exponential Moving Averages

The strategy uses three exponential moving average plots as indicators, two of them are variable since one of them is set constant to 50 bars. The values obtained for the other two EMAs are: 7, for the fast, and 30, for the slow. These values were obtained by applying the optimization to the strategy. The range of values for the fast EMA were from 2 to 12, and for the slow EMA were from 15 to 30; these were the values defined by the group when the strategy was finalized.

##### Long Trend Slope

The value for this variable was determined after the optimization done from 2 to 7, to obtain a correct linear regression for the slope of the EMA50. The long trend slope for this currency pair is 2, which means that the linear regression is going to be done based on the previous 2 bars.

##### Trigger Lengths

There are four trigger lengths that have been optimized for this strategy, trigger length for long entry, short entry, and triggers to exit a long position and another to exit a short

position; this because individual trigger length values give better results for the strategy.

The values were:

- Long Entry: 4
- Short Entry: 1
- Long Exit: 1
- Short Exit: 5

#### Trailing Stop and Stop Loss Amount

The best parameters for trailing stop and stop loss amount were \$250 and 2%, respectively. These values were optimized with the strategy to obtain the best values for this currency pair.

#### Summary of Strategy Settings

TradeStation Strategy Inputs	
Description	Value
Final Strategy - Price	Close
Final Strategy - EMA_Fast	7
Final Strategy - EMA_Slow	30
Final Strategy - LengthSlope	2
Final Strategy - Trigger_Length_Long_Entry	4
Final Strategy - Trigger_Length_Short_Entry	1
Final Strategy - Trigger_Length_Long_Exit	1
Final Strategy - Trigger_Length_Short_Exit	5
Final Strategy - ShareOrPosition	2
Final Strategy - ProfitTargetAmt	0
Final Strategy - StopLossAmt	400
Final Strategy - BreakevenFloorAmt	0
Final Strategy - DollarTrailingAmt	0
Final Strategy - PctTrailingFloorAmt	250
Final Strategy - PctTrailingPct	2
Final Strategy - ExitOnClose	false

Figure 46: Summary of strategy settings GBP/USD

#### Backtesting Performance Summary

The backtested results show the expected performance of the strategy based on historical information from January 31, 2012.

## Equity Curve Line

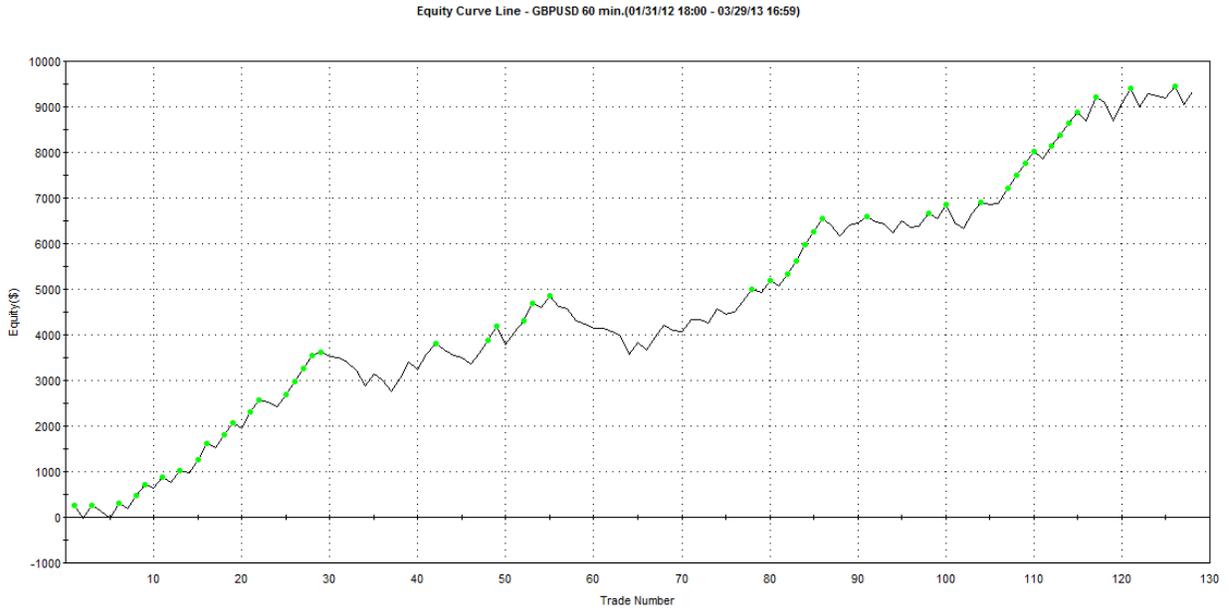


Figure 47: Backtesting equity curve line for GBP/USD since 01/31/2012

## Monthly Accumulative Net Profit

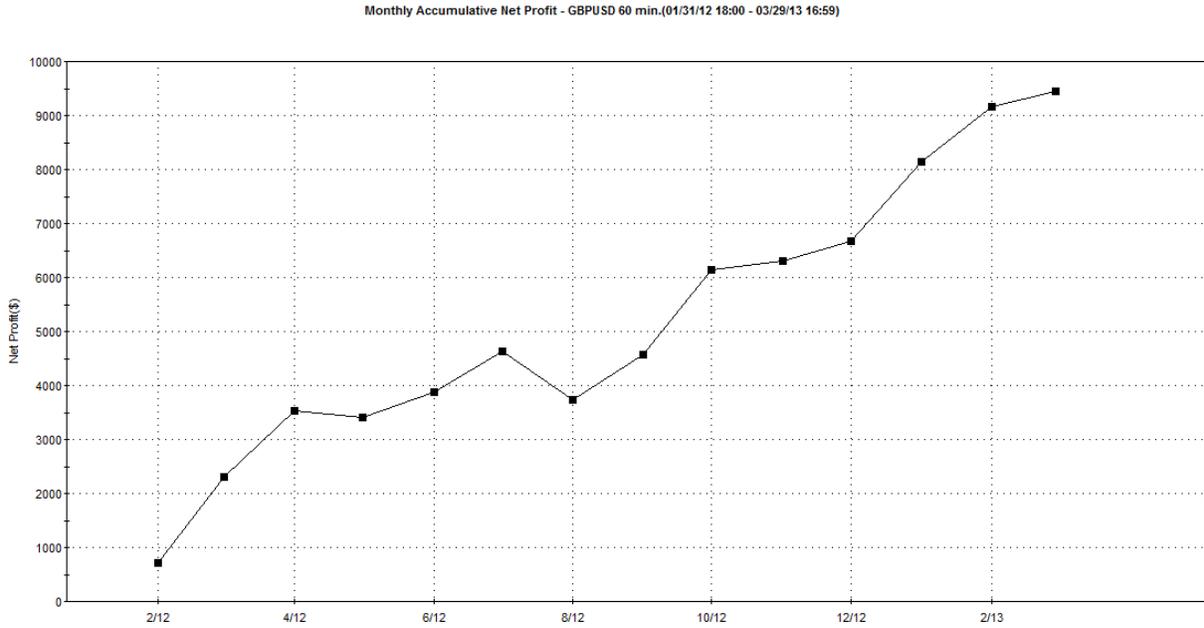


Figure 48: Backtesting monthly accumulative net profit for GBP/USD since 01/31/2012

## Performance Report

TradeStation Performance Summary				Collapse 
	All Trades	Long Trades	Short Trades	
Total Net Profit	\$9,337.64	\$4,150.09	\$5,187.54	
Gross Profit	\$18,119.68	\$8,643.04	\$9,476.64	
Gross Loss	(\$8,782.04)	(\$4,492.95)	(\$4,289.09)	
Profit Factor	2.06	1.92	2.21	
Roll Over Credit	(\$48.09)	\$6.19	(\$54.27)	
Open Position P/L	\$118.87	\$118.87	\$0.00	
Select Total Net Profit	\$8,808.79	\$4,150.09	\$4,658.69	
Select Gross Profit	\$17,590.83	\$8,643.04	\$8,947.79	
Select Gross Loss	(\$8,782.04)	(\$4,492.95)	(\$4,289.09)	
Select Profit Factor	2.00	1.92	2.09	
Adjusted Total Net Profit	\$6,012.96	\$1,751.80	\$2,873.60	
Adjusted Gross Profit	\$15,938.33	\$7,065.05	\$7,959.16	
Adjusted Gross Loss	(\$9,925.37)	(\$5,313.24)	(\$5,085.56)	
Adjusted Profit Factor	1.61	1.33	1.57	
Total Number of Trades	128	60	68	
Percent Profitable	53.91%	50.00%	57.35%	
Winning Trades	69	30	39	
Losing Trades	59	30	29	
Even Trades	0	0	0	
Avg. Trade Net Profit	\$72.95	\$69.17	\$76.29	
Avg. Winning Trade	\$262.60	\$288.10	\$242.99	
Avg. Losing Trade	(\$148.85)	(\$149.76)	(\$147.90)	
Ratio Avg. Win:Avg. Loss	1.76	1.92	1.64	
Largest Winning Trade	\$528.85	\$381.76	\$528.85	
Largest Losing Trade	(\$400.32)	(\$400.32)	(\$400.08)	
Largest Winner as % of Gross Profit	2.92%	4.42%	5.58%	
Largest Loser as % of Gross Loss	4.56%	8.91%	9.33%	
Net Profit as % of Largest Loss	2332.53%	1036.69%	1296.63%	
Select Net Profit as % of Largest Loss	2200.42%	1036.69%	1164.44%	
Adjusted Net Profit as % of Largest Loss	1502.03%	437.60%	718.26%	
Max. Consecutive Winning Trades	5	3	5	
Max. Consecutive Losing Trades	9	5	5	
Avg. Bars in Total Trades	27.44	30.90	24.38	
Avg. Bars in Winning Trades	31.67	36.70	27.79	
Avg. Bars in Losing Trades	22.49	25.10	19.79	
Avg. Bars in Even Trades	0.00	0.00	0.00	
Max. Shares/Contracts Held	33400	33400	33100	
Total Shares/Contracts Held	4075600	1927500	2148100	
Account Size Required	\$1,271.20	\$812.65	\$1,040.47	
Total Slippage	\$0.00000	\$0.00000	\$0.00000	
Total Commission	\$0.00000	\$0.00000	\$0.00000	
Return on Initial Capital	9.34%			
Annual Rate of Return	7.75%			
Buy & Hold Return	(3.88%)			
Return on Account	734.55%			
Avg. Monthly Return	\$675.35			
Std. Deviation of Monthly Return	\$704.18			
Return Retracement Ratio	1.32			
RINA Index	174.39			
Sharpe Ratio	n/a			
K-Ratio	n/a			
Trading Period	1 Yr, 1 Mth, 23 Dys, 20 Hrs, 59 Mins			
Percent of Time in the Market	43.88%			
Time in the Market	6 Mths, 1 Dy, 16 Hrs			
Longest Flat Period	12 Dys			
Max. Equity Run-up	\$9,824.86			
Date of Max. Equity Run-up	03/28/13 21:00			
Max. Equity Run-up as % of Initial Capital	9.82%			

Figure 49: Backtesting performance report for GBP/USD since 01/31/2012

## 5.5. Walk Forward and Monte Carlo Analysis

In the following section, the Walk Forward and Monte Carlo analysis are going to be applied to the strategy and each currency pair in order to check the strategy's robustness. These tests will show the performance of the strategy on randomized situations to see if the strategy is robust enough to undergo different scenarios in which losses could be large enough to wipe out the accounts.

### 5.5.1. Antonio's Trading System Walk Forward Analysis

As it can be seen in figure 50 shown below, the Walk Forward Analysis for the final strategy trading EUR/JPY was successful. Out of the 30 simulations done, only one did not pass the test. The different simulations were done using a walk forward optimization applying the genetic approach, due to huge number of tests that resulted from the large ranges selected to optimize the strategy input values.

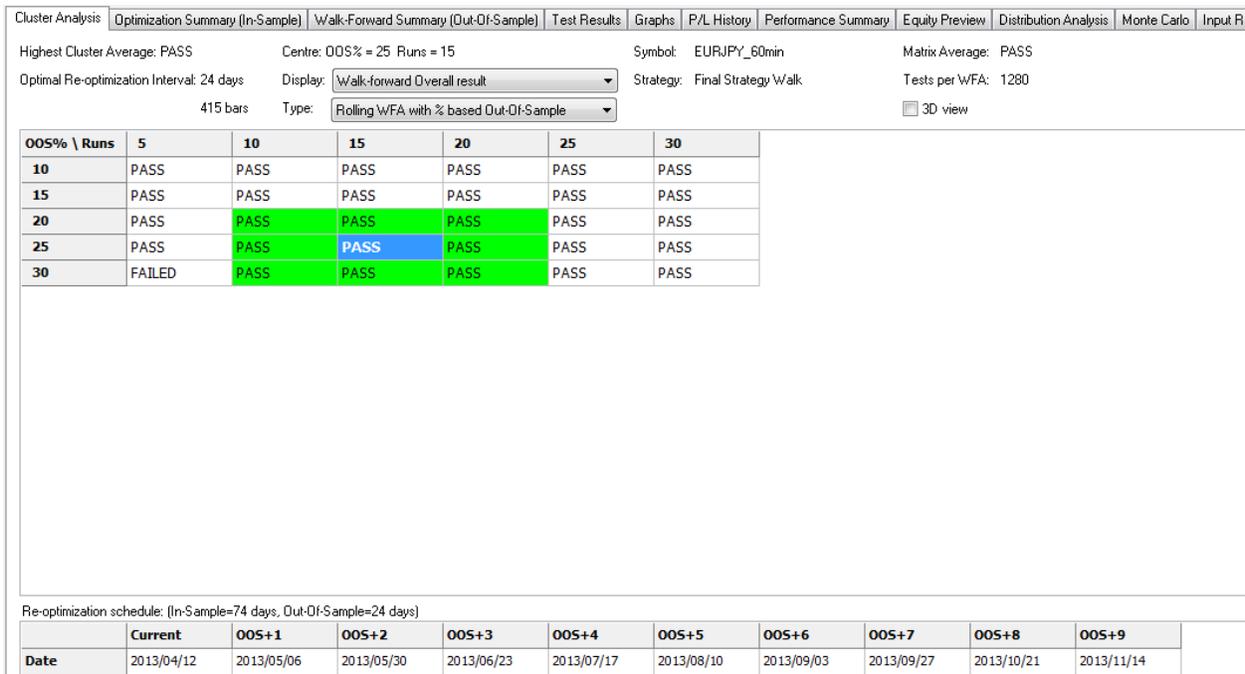


Figure 50: Walk Forward Analysis for EUR/JPY

### 5.5.2. Antonio's Trading System Monte Carlo Analysis

As shown in figure 51 below, the Monte Carlo analysis using the final strategy with the EUR/JPY currency pair gave positive results. The graph below shows that the system is surely going to make 14% of the whole invested capital. It can also be seen that there is a high probability of raising this return to 15%, and that in some circumstances it could even reach the 16% and 17% of total return. Taking into account that the team's objective was to have an annual return of 8%, having 14% of return in almost 14 months of simulation should be considered as an excellent result for this simulation, thus considering this a good strategy to use with the EUR/JPY pair.

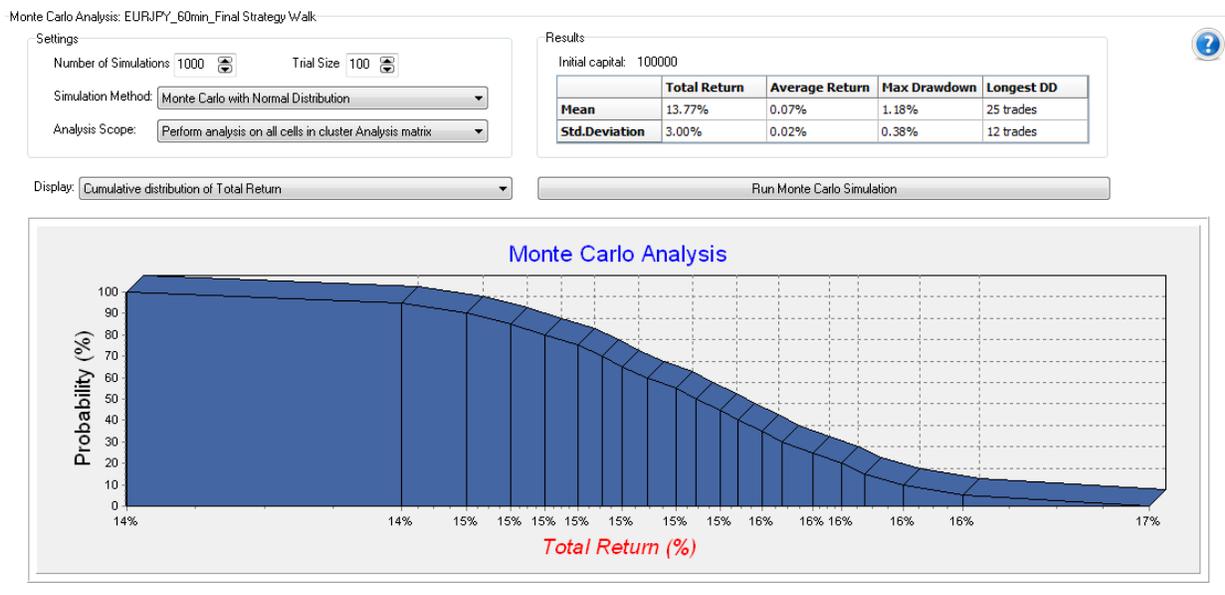


Figure 51: Monte Carlo Analysis for EUR/JPY

### 5.5.3. Mauricio's Trading System Walk Forward Analysis

Figure 52 shows the Walk Forward analysis results for the EUR/USD robot. The overall results of the analysis were positive since there are twenty-six simulations that passed out of the thirty that were performed. These results demonstrate that the system is expected to be profitable and robust to a confident level. The fact that the overall performance of the

robot in the Walk Forward analysis is positive brings up more confidence for the system than only by using backtesting results.

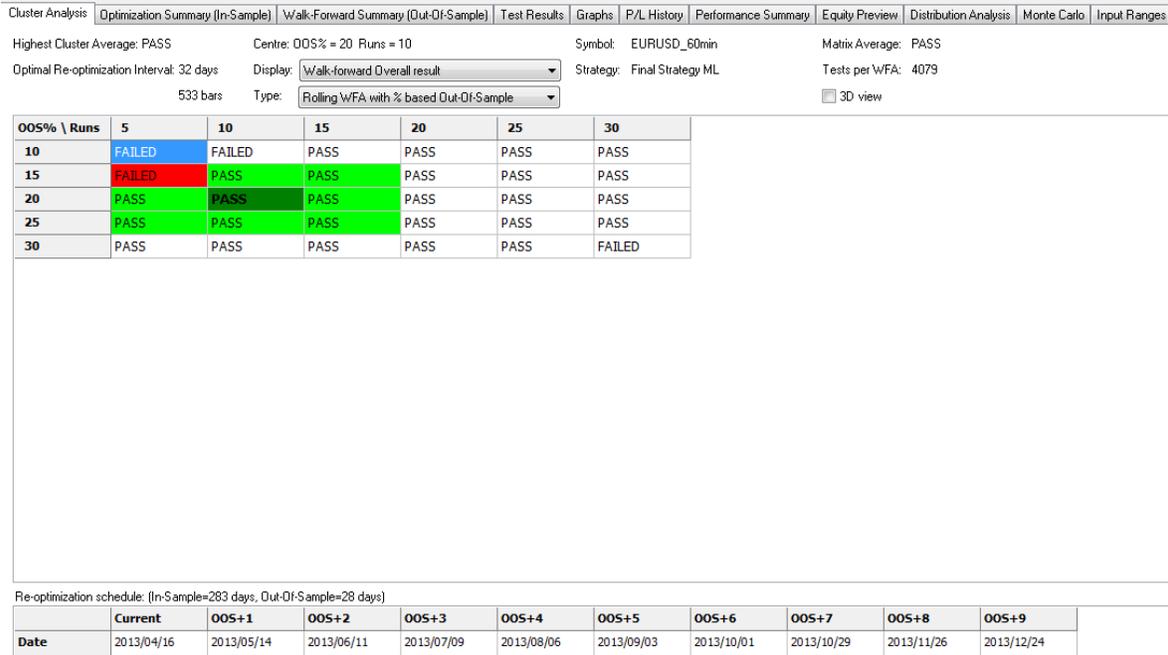


Figure 52: Walk Forward Analysis for EUR/USD.

#### 5.5.4. Mauricio's Trading System Monte Carlo Analysis

The results of the Monte Carlo Analysis for the EUR/USD final strategy are shown in figure 53. This analysis shows that there is a 100% probability that the return is 5% and there is a 90% probability that the system generates a 6% return or higher. This is an interesting examination which gives the trader an alternate angle of the expected performance of his system compared to regular backtesting results. For example, according to the backtesting results, this robot is supposed to make around 12% annual return; however, with the Monte Carlo simulation we get a better in depth perspective of the return of the system since it shuffles the order of the trades and gives a confidence level for the return of the robot.

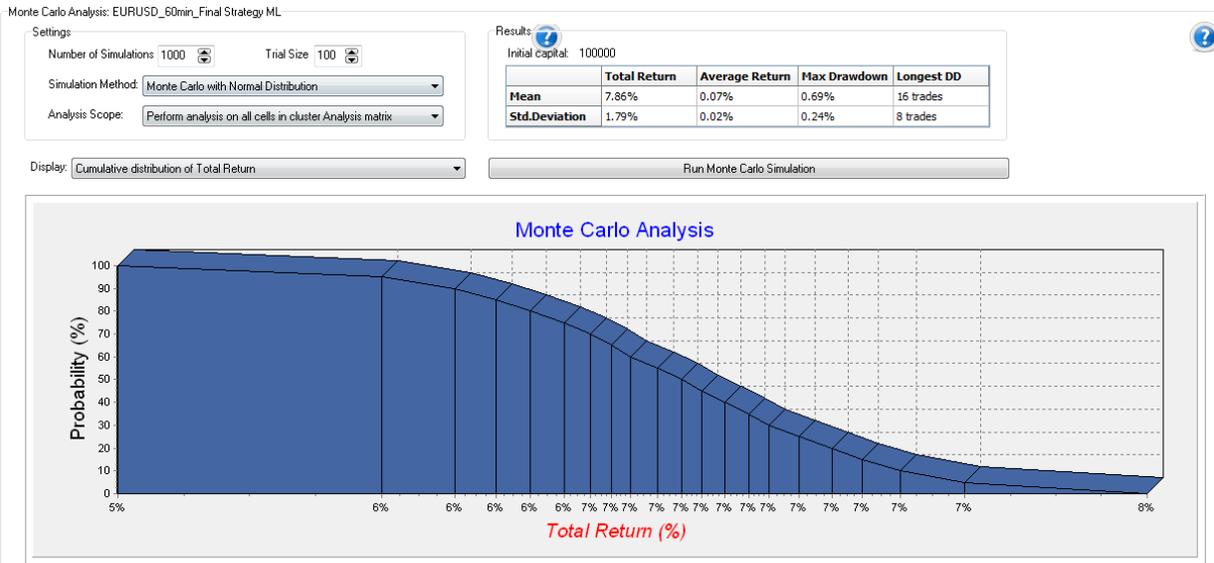


Figure 53: Monte Carlo Analysis for EUR/USD.

### 5.5.5. Paolo's Trading System Walk Forward Analysis

The Walk Forward Analysis shows a passing matrix average of the 30 simulations made using the final strategy trading AUD/USD. Figure 54 shown below, shows that 8 out of the 30 runs failed; even with these results the system is still profitable. Due to the large ranges used to optimize the strategy's parameters, a genetic approach was used in this analysis to get the values for the walk forward optimization.

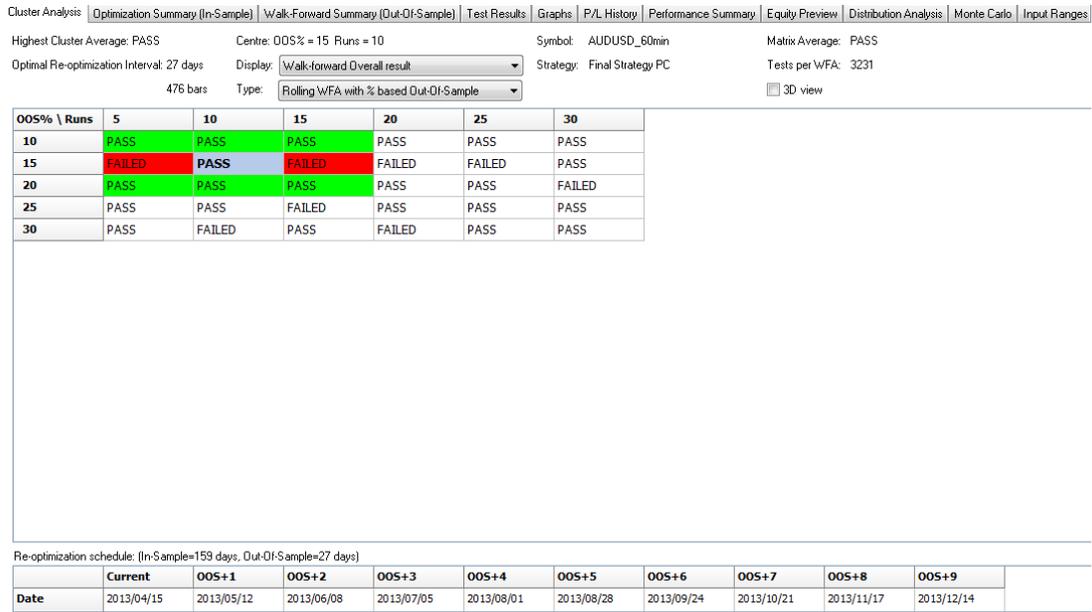


Figure 54: Walk Forward Analysis for AUD/USD

### 5.5.6. Paolo's Trading System Monte Carlo Analysis

The Monte Carlo Analysis for the AUD/USD trading, shown below in figure 55, shows a 4% return with a 100% probability, the probability is still large enough for a 5% return. The probability gets smaller as the profit percentage gets larger as seen in the Monte Carlo Analysis graph.

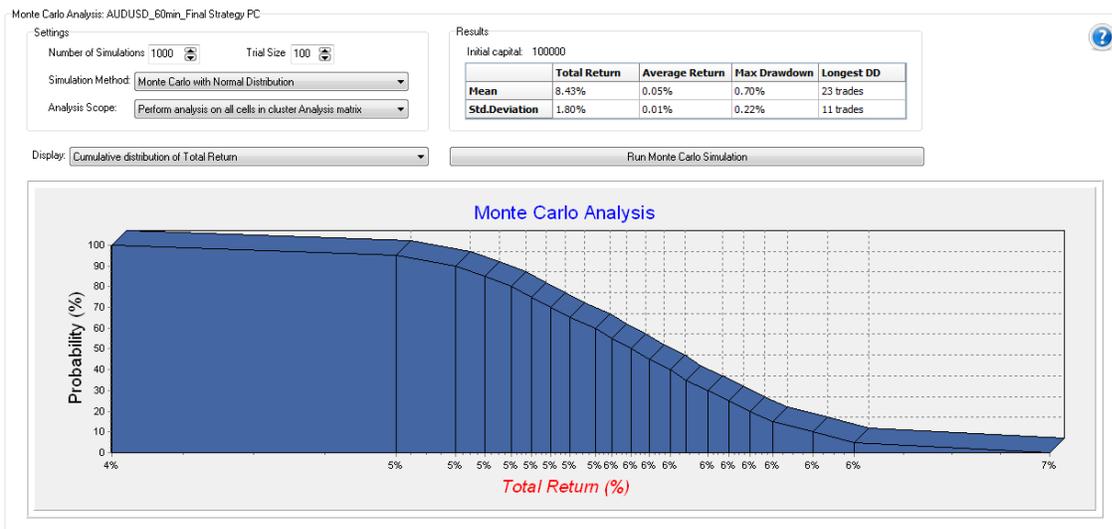


Figure 55: Monte Carlo Analysis for AUD/USD

### 5.5.7. Steven's Trading System Walk Forward Analysis

After performing the Walk Forward Analysis for the Final Strategy on the GBP/USD pair the results were as shown in figure 56. These results showed that the strategy is robust enough to successfully pass 24 out of 30 tests. As it is recommended in the TradeStation manual, the optimization was done using the 30% out of sample data.

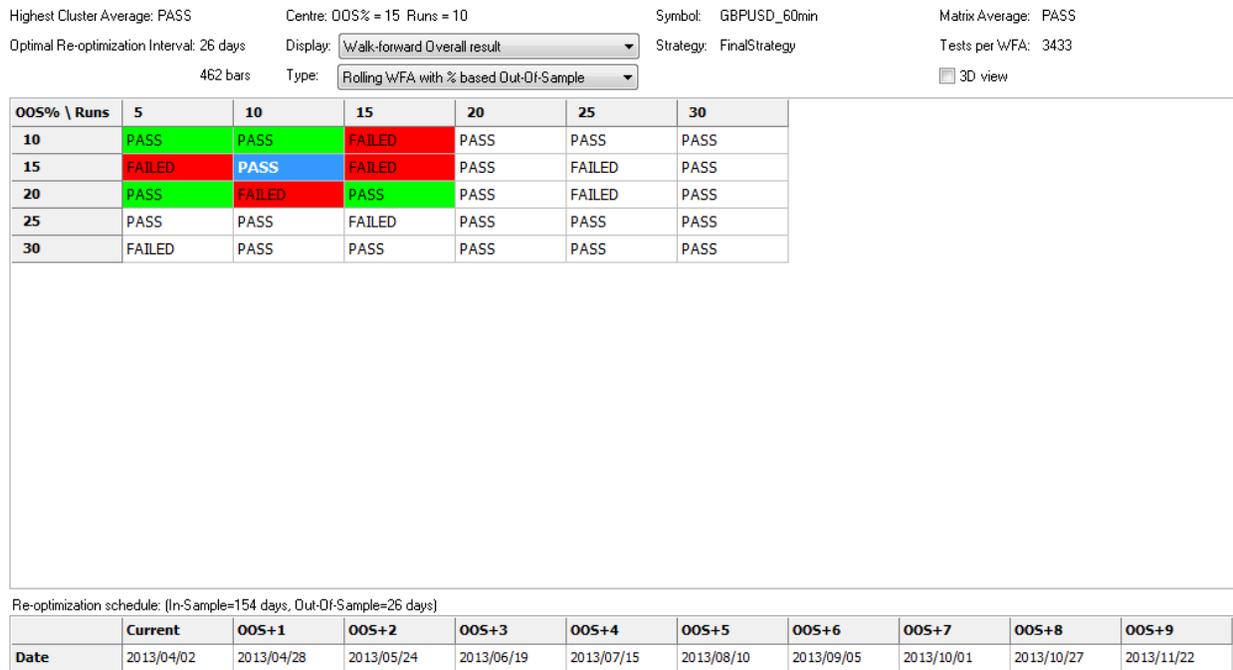


Figure 56: Walk Forward Analysis for GBP/USD

### 5.5.8. Steven's Trading System Monte Carlo Analysis

The Monte Carlo analysis results shown in figure 57 were done using the Walk-Forward built-in function with a normal distribution probability for the GBP/USD currency pair. These results demonstrate that the strategy is going to make at least a 6% return on the initial capital investment and a maximum predicted of 8% profit, which was one of the goals for the strategy, with considerably good chances to have a 7% profit. Even though the strategy is low by 1-2% in the profit goal, this is just an approximation to how the strategy

is predicted to work in the reality, meaning that has good chances to surpass the goal established in the objectives.

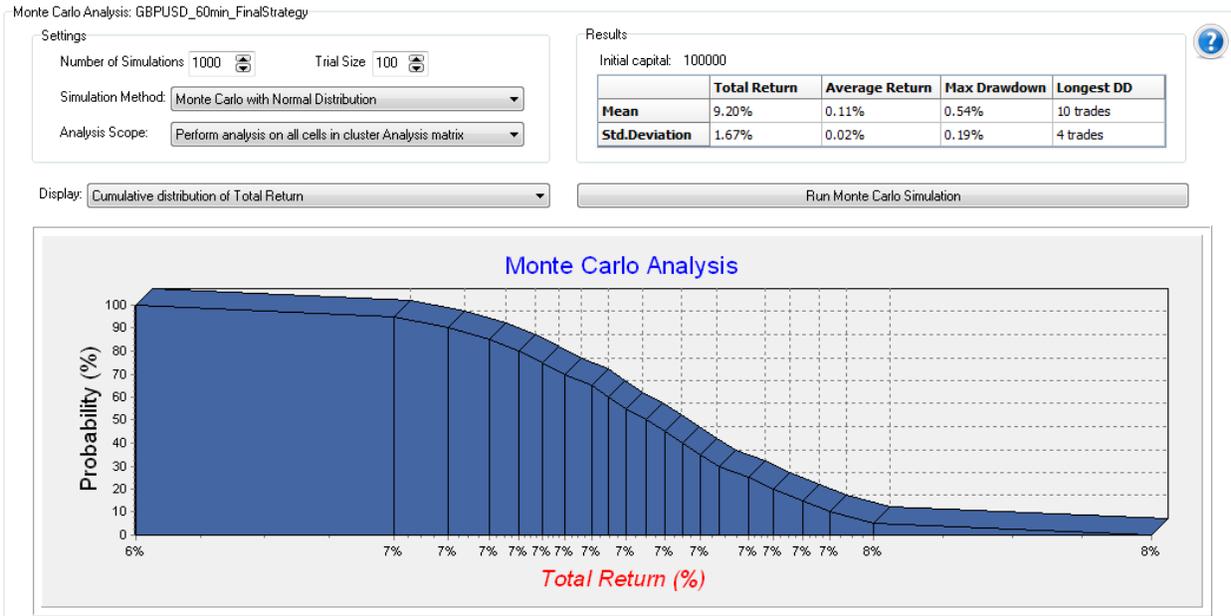


Figure 57: Monte Carlo Analysis for GBP/USD

## 6. Results

The following section describes the individual results of each member of the group in their personal trading activity. Each account was reset on February 1, 2013, in order to start recording the official simulated trades for the project. Since February 1st, each member traded their specific currency using the same automated trading strategy, but with different parameters according to what fitted best for their case. It is important to take into account that the group's trading strategy was not finished when the trading activity started. The strategy was being edited by each member of the team in real time while trading until late in March when the final automated strategy was completed. This section will illustrate the results of each member's trading activity, and at the end the group's results will be displayed and analyzed.

### 6.1. Antonio's Trading Results

Antonio chose the EUR/JPY pair to trade using the group's automated strategy. As shown in figure 58, Antonio's robot obtained a gross profit of \$1,796.20 and a gross loss of \$452.20. These values add up for a total net profit of \$1,344.00. The system performance was close to the group's expectations. The system had only a few losses, all of them at the beginning of April. These losses occurred when the currency started trading sideways and had no major trend, something that only happened twice during the two months that the group traded. The strategy worked accurately along the two months of trading, and it improved every time the group added parameters and ideas to help fix the flaws. The last trades, which were all losing trades, occurred when the EMA 50, the group's latest addition to the strategy to account for momentum, was moving really close to the other two EMA's. This

phenomenon occurred because of the sideways trend of the currency pair, which made the strategy trigger various entries and exits that ended up being losing trades.

TradeStation Performance Summary <span style="float: right;">Collapse ^</span>			
	All Trades	Long Trades	Short Trades
Total Net Profit	\$1,344.00	\$563.19	\$780.81
Gross Profit	\$1,796.20	\$780.56	\$1,015.64
Gross Loss	(\$452.20)	(\$217.37)	(\$234.83)
Profit Factor	3.97	3.59	4.32
Total Number of Trades	10	5	5
Percent Profitable	70.00%	80.00%	60.00%
Winning Trades	7	4	3
Losing Trades	3	1	2
Even Trades	0	0	0
Avg. Trade Net Profit	\$134.40	\$112.64	\$156.16
Avg. Winning Trade	\$256.60	\$195.14	\$338.55
Avg. Losing Trade	(\$150.73)	(\$217.37)	(\$117.42)
Ratio Avg. Win:Avg. Loss	1.70	0.90	2.88
Largest Winning Trade	\$418.05	\$298.38	\$418.05
Largest Losing Trade	(\$217.37)	(\$217.37)	(\$151.55)

Figure 58: Performance Summary EUR/JPY (02/01/2013-04/03-2013)

Antonio's system performed ten trades during the two months of trading, which gives an average of one trade per week. It is important to point out that the strategy was turned off some days because of work that was being done on it, optimizations, or no time availability for the trader. This number of trades was closed to the number desired by the group, since it did not demand a huge time commitment for the trader. Both the percent profitable and profit factor values were high for the two months of trading. The percent profitable was recorded in 70% while the profit factor was recorded in 3.97. Figure 59 below shows the equity curve of the system for the two months. As it can be seen, the curve went up for the first seven trades and went down at the end because of the last three losing trades, but still maintained a positive value.

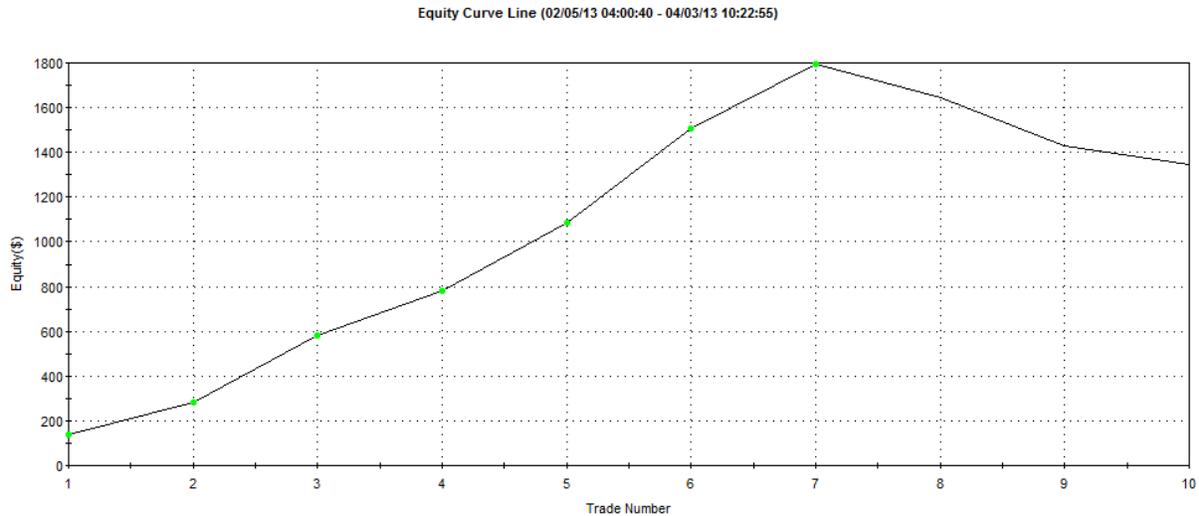


Figure 59: Equity curve line (02/01/2013-04/03/2013)

Antonio's system performed well during the two months of trading. The system only presented losing trades at the end of the trading period. This could be due to the fact that the EUR/JPY pair trended a lot during the two months, and it only traded sideways at the end. This means that the system could work better by shutting it down while there is no actual trend or by applying it to another instrument that is trending at the moment. Figure 60 below shows the sideways trend that caught the strategy and made it enter three losing trades.



Figure 60: Example of the sideways trend of the market and losing trades

To finalize, it can be said that the performance of this trading system was good, since it was very close to the group's objectives. It is important to point out that the system was a work in progress during most of the trading time and it was only at the end that the group reached the final strategy; however, even during the development phase, the strategy performed successfully. The only problem the strategy faced occurred while trading in a sideways trending market; this should be taken into consideration to simply decide when to activate or deactivate the strategy, or to look for another market which is actually trending. As a whole, the strategy can be taken as a good strategy for trending markets, which will make a good amount of profit without risking too much.

## 6.2. Mauricio's Trading Results

Mauricio traded EUR/USD with the group's automated trading system. As it can be seen in figure 61, Mauricio's robot gross profit is \$1,286.33, gross loss is \$1,712.63, and the total loss incurred is \$426.30. Even though this system ended up with a loss, it is understandable given the fact that when the system started trading, the strategy was still in the development phase. Most of the losing trades and difficulties encountered helped the group identify flaws in the system and address them. One interesting thing that can be observed from the performance summary is the fact that long trades had a total loss of \$506.97 while short trades a profit of \$80.66. This can be explained by the fact that the euro has been trending down since the beginning of February. This factor helped to identify an important thing that the strategy needed: taking into consideration the long term trend of a currency pair before actually entering the market. This flaw helped to implement one of the final things in the automated trading system, the slope of the EMA 50; the final strategy only buys long when the slope of the 50 EMA is positive and sells short only when it is negative, preventing, in this way, entering the market in the opposite direction of the long trend.

TradeStation Performance Summary		Collapse ^		
	All Trades	Long Trades	Short Trades	
Total Net Profit	(\$426.30)	(\$506.97)	\$80.66	
Gross Profit	\$1,286.33	\$514.89	\$771.43	
Gross Loss	(\$1,712.63)	(\$1,021.86)	(\$690.77)	
Profit Factor	0.75	0.50	1.12	
Total Number of Trades	15	7	8	
Percent Profitable	40.00%	42.86%	37.50%	
Winning Trades	6	3	3	
Losing Trades	9	4	5	
Even Trades	0	0	0	
Avg. Trade Net Profit	(\$28.42)	(\$72.42)	\$10.08	
Avg. Winning Trade	\$214.39	\$171.63	\$257.14	
Avg. Losing Trade	(\$190.29)	(\$255.46)	(\$138.15)	
Ratio Avg. Win:Avg. Loss	1.13	0.67	1.86	
Largest Winning Trade	\$300.31	\$242.13	\$300.31	
Largest Losing Trade	(\$401.47)	(\$401.47)	(\$394.35)	

Figure 61: Performance Summary EUR/USD (02/01/2013-04/01-2013)

Mauricio's system performed fifteen trades during the two months it traded; this gives an average of around one trade every four days. This number of trades fits one of the trading objectives of this project: having a system that requires a low time commitment. However, the percent of profitable trades is lower than what was expected, with only 40% of the trades being profitable. Again, the system was a work in progress at the time the trading was started on February 1<sup>st</sup>. Figure 62 shows the equity curve line of the EUR/USD system and we can see how it started with losses since the first trade but it went up and down constantly for the two months between February 1<sup>st</sup> and March 30<sup>th</sup> while the system was being edited, without really going further in the negative equity.

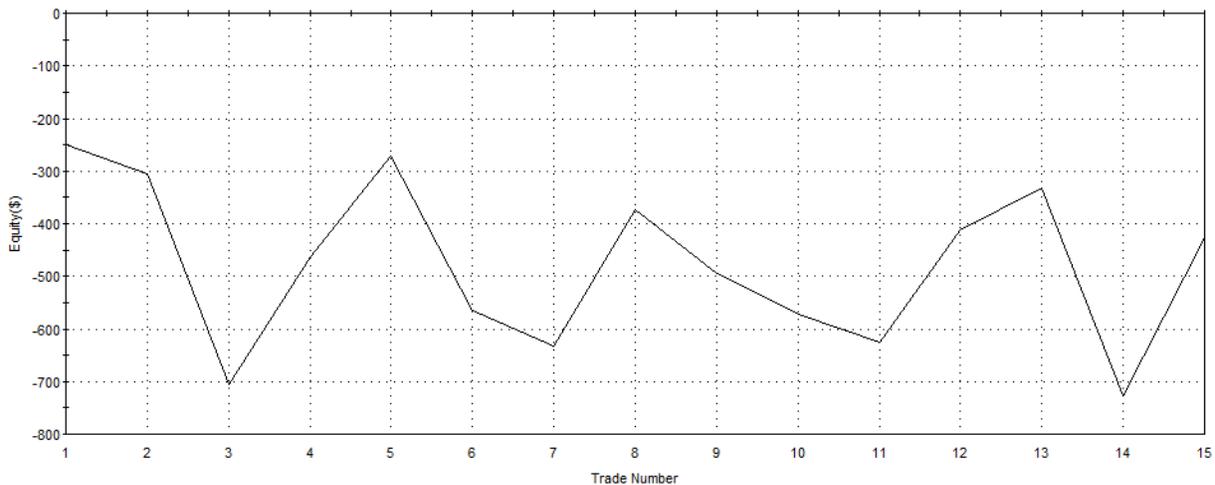


Figure 62: Equity curve line (02/01/2013-04/01/2013)

The two major problems that Mauricio encountered was having positions open at the time important news were released and technical difficulties involving internet and platform malfunctions. When the system has a position open and there is an important news release such as a European Central Bank press conference or jobless claims are published, the market can suddenly go in the opposite direction and the trading system may take too long to exit, incurring in major losses. For instance on February 7, 2013, Mauricio’s system had entered a long position around 4:00 a.m., after the fast EMA crossed over the slow EMA, the market was going upwards until Mario Draghi had a press conference and released negative news for the euro. Immediately after Draghi’s press conference, the euro dropped more than 100 pips and the trader had to exit manually in order to cut losses short, as shown in figure 63. On the other hand, it is also important for one to be attentive to the trading system whenever there is a position open. Even though the strategy is a robot, it still requires a lot of support from the trader in order to prevent things from going wrong.

For instance, the robot can experience technical difficulties such as the computer freezing or the internet failing at the time that an entry or exit order needed to be executed. Technical difficulties can severely affect the profits of an automated trading system if the trader is not aware of them. As shown in figure 64, due to internet technical difficulties, the robot could not execute the exit order on March 22 at 7a.m. and this resulted in a much bigger loss than what it would have ideally been if the robot had executed the exit when the EMAs crossed in the opposite direction.



Figure 63: Example of loss due to news release on 02/07/2013



Figure 64: Robot malfunction due to internet technical difficulties on 03/22/2013

To finalize, it can be said that the performance of the trading system with EUR/USD was not very promising, but it did not reach the maximum drawdown of \$1,000 in one month established by the group. It is important to take into consideration that most of the time that the system was trading, since February 1<sup>st</sup>, the strategy was a work in progress. Further performance results of actual –simulated- trading should be done before arriving to a conclusion of whether this system is profitable or not. The best suggestion that can be stated from the performance of this case is, one needs to be attentive while trading during important news releases and always monitor how the system is working in order to prevent technical difficulties from bringing up losses.

### 6.3. Paolo's Trading Results

Paolo chose the AUD/USD pair and traded it using the group's automated strategy. The system resulted to be profitable after the 9 trades that it made. The different trades were made using the strategy which kept changing, giving the group training and ideas to come

up with the final version. With a gross profit of \$1,320.85 and a gross loss of \$14.33, the total net profit was of 1,306.53. In order to improve the strategy, different techniques were used, such as trying different triggers and exit strategies, increasing the position sizing, trading at different times in the market, varying profit and loss limits, varying time frames per bar, and changing the length of the EMAs. The Australian Dollar has been fluctuating a lot since the beginning of the year, because of intentions from the Reserve Bank of Australia on changing the interest rate. Being seen as a “safe haven” by many people, the Australian Dollar has become a strong and solid currency; this is a situation many countries would like to have, but for Australia it negatively affects investment because of the high expenses it requires.

TradeStation Performance Summary <span style="float: right;">Collapse </span>			
	All Trades	Long Trades	Short Trades
Total Net Profit	\$1,306.53	\$721.87	\$584.66
Gross Profit	\$1,320.85	\$729.19	\$591.67
Gross Loss	(\$14.33)	(\$7.32)	(\$7.01)
Profit Factor	92.20	99.62	84.45
Roll Over Credit	\$28.11	\$44.82	(\$16.71)
Open Position P/L	\$0.00	\$0.00	\$0.00
Select Total Net Profit	\$1,306.53	\$721.87	\$584.66
Select Gross Profit	\$1,320.85	\$729.19	\$591.67
Select Gross Loss	(\$14.33)	(\$7.32)	(\$7.01)
Select Profit Factor	92.20	99.62	84.45
Adjusted Total Net Profit	\$708.66	(\$12.50)	\$283.87
Adjusted Gross Profit	\$730.15	\$0.00	\$295.83
Adjusted Gross Loss	(\$21.49)	(\$12.50)	(\$11.96)
Adjusted Profit Factor	33.98	0.00	24.74
Total Number of Trades	9	3	6
Percent Profitable	55.56%	33.33%	66.67%
Winning Trades	5	1	4
Losing Trades	4	2	2
Even Trades	0	0	0
Avg. Trade Net Profit	\$145.17	\$240.62	\$97.44
Avg. Winning Trade	\$264.17	\$729.19	\$147.92
Avg. Losing Trade	(\$3.58)	(\$3.66)	(\$3.50)
Ratio Avg. Win:Avg. Loss	73.76	199.23	42.23
Largest Winning Trade	\$729.19	\$729.19	\$277.85
Largest Losing Trade	(\$6.81)	(\$4.10)	(\$6.81)
Largest Winner as % of Gross Profit	55.21%	100.00%	46.96%
Largest Loser as % of Gross Loss	47.51%	56.01%	97.15%

Figure 65: Performance Summary AUD/USD (02/01/2013-04/01-2013)

Paolo's trading changed progressively, understanding that organization within the platform used was of great importance; each workspace must be named and saved correctly to be able to know which strategy is being used to avoid any kind of human mistakes. Paolo used automatic trading implementing the robot that applied the strategy. Since the beginning, the main strategy used was buying or selling when two exponential moving averages with different bar lengths crossed over. While gaining experience, details were modified to achieve better results. The first five trades made were short trades and the last four were long trades, what may have been an effect of the change in the market when the Reserve Bank of Australia quitted the idea of enhancing a cut in the interest rates. Some believe this recovered the investors' spirits in a positive way eliminating the existing doubts on the government.

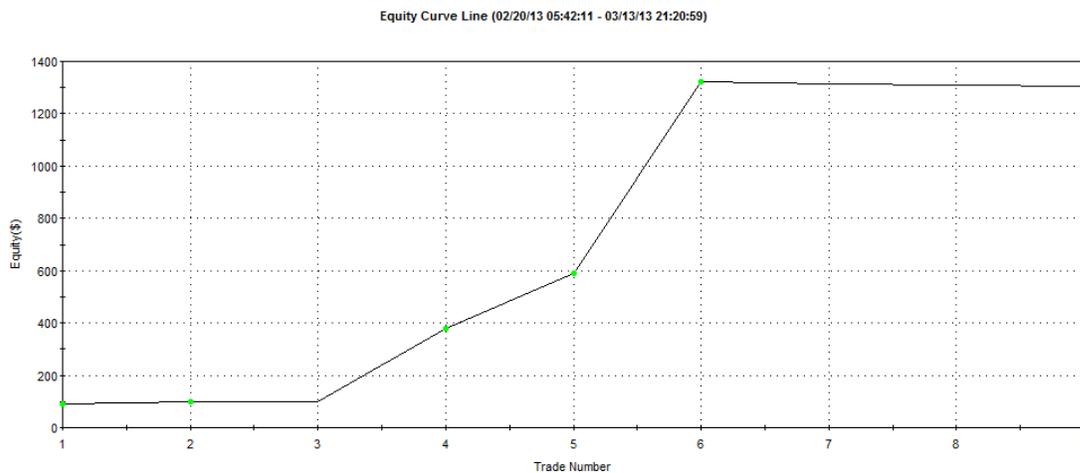


Figure 66: Equity curve line (02/01/2013-04/01/2013)

A detail of importance in one of Paolo's trades happened when removing a position. Making sure the whole position is removed is important because confusions with the amount of

shares or the amount of the currency needed to exit it may happen. In figure 67 shown below, it is possible to see how difficult it was to exit the complete position after making a first mistake when doing the exit, three more trades were made, incurring in a larger loss. First of all, the trade was made by a robot with a strategy that did not have a profit target because the trailing stop was deactivated. The length of the trade was longer than what it was supposed to, the reason it had to be exited manually. When closing the trade, a mistake was made using the price matrix: instead of using the exact amount of AUD to exit the position, 5 mini lots were used, which did not reach the exact amount of the currency to exit the position completely. To completely exit the position, the trader had to increase the amount of the position because this needed to be at least equal to a mini lot in order to be removed.

Trade Number	Price Bought	Shares	Net Profit	Cum. Net Profit
	Price Sold			
6	\$1.0154 \$1.0293	49200	\$729.29	\$1,320.65
7	\$1.0293 \$1.0375	800	(\$6.81)	\$1,323.85
8	\$1.0375 \$1.0372	9200	(\$3.22)	\$1,310.63
9	\$1.0376 \$1.0372	10000	(\$4.10)	\$1,306.53

Figure 67: Example of loss due to incomplete position exit (03/13/2013)

Paolo also tried using a larger position sizing in his trading; an interesting idea that implies that one may have a greater profit, but is also risking a greater loss as well. In this case, the trade was closed producing a higher profit. The entry for this trade was made using automated trading and it was closed manually.



Figure 68: Example of greater position sizing (03/04/2013-03/13/2013)

Paolo's trading system was profitable; it made 9 trades from which 5 were profitable, after every trade something new was learned and applied to the system. Risks need to be taken with responsibility and organization to be profitable, always following the stated parameters that define the system. Trading depends on the movements of the market, Paolo's system worked according to the stated parameters what allowed him to take reasonable risks that led to profitable trading.

#### 6.4. Steven's Trading Results

Steven traded GBP/USD using the strategies developed by the group. Figure 69 shown below shows that the trading gross profit was \$808.39, gross loss was \$1,523.66, and the total loss added up to be \$715.28. This negative balance can be understood as part of the process of the development of the strategy since all the members of the group tested all the different strategies. There were some important moments in the entire trading journey that explain better these results. The first couple trades were made using the original

strategy and following the strategy model done by the group and the rest were done by using the additional strategy described in a previous section. One of the reasons why the additional strategy was tested was because the equity curve and the total net profit were significantly higher, while the number of trades practically did not change. The other main reason why this strategy was chosen to be used was because it took advantage of the big hits that a market may have after the EMAs cross trade period. The losing trades happened because after the big hits the market started to trend in the other direction, so it was the position was opened in the wrong direction.

TradeStation Performance Summary <span style="float: right;">Expand ▾</span>			
	All Trades	Long Trades	Short Trades
Total Net Profit	(\$715.28)	(\$815.00)	\$99.72
Gross Profit	\$808.39	\$58.38	\$750.00
Gross Loss	(\$1,523.66)	(\$873.38)	(\$650.28)
Profit Factor	0.53	0.07	1.15
Total Number of Trades	22	10	12
Percent Profitable	31.82%	40.00%	25.00%
Winning Trades	7	4	3
Losing Trades	15	6	9
Even Trades	0	0	0
Avg. Trade Net Profit	(\$32.51)	(\$81.50)	\$8.31
Avg. Winning Trade	\$115.48	\$14.60	\$250.00
Avg. Losing Trade	(\$101.58)	(\$145.56)	(\$72.25)
Ratio Avg. Win:Avg. Loss	1.14	0.10	3.46
Largest Winning Trade	\$749.90	\$30.44	\$749.90
Largest Losing Trade	(\$367.55)	(\$367.55)	(\$200.50)

Figure 69: Performance Summary GBP/USD (02/01/2013-04/03/2013)

This system traded twenty-two times with a profitability of 32%. The number of trades is acceptable since it fulfills the project objectives and does not require too much time commitment from the trader. Another important point is the amount of time that the system is in the market, which is about 38%; this is also one of the goals for the project. There was discrepancy between the desired, the backtested, and the actual profitability of the system since the desired was above 55%, the backtested showed approximately 60%

and the actual one was 32%. Figure 70 shows the equity curve performance of this trading system of the GBP/USD. This curve shows two moments of the trading system, the first one is when the original strategy was used for the first five trades, making a couple of them losing trades and having a big winning trade,. The other part of the trading system was done using the additional strategy, which presented most of the losing trades.

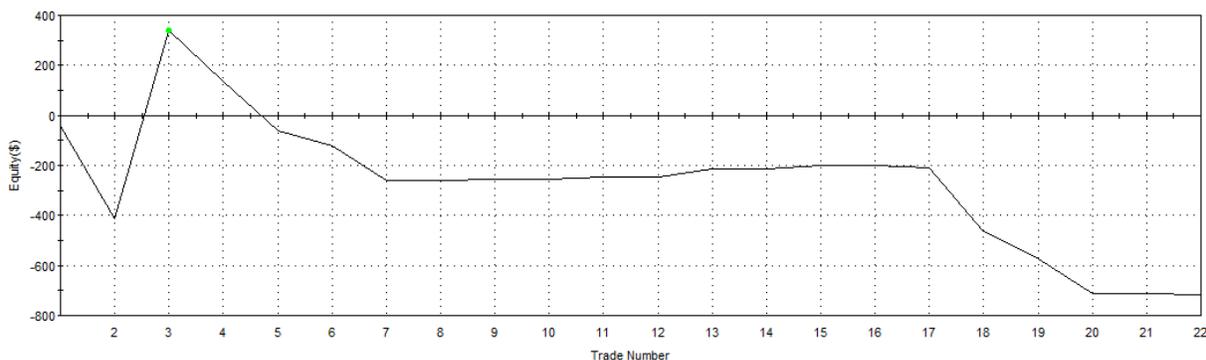


Figure 70: Equity curve line (02/1/2013-04/03/2013)

The main issues encountered in this trading system were when the market was trending sideways and software related problems occurred. When the market was trending sideways, some small changes in momentum triggered any of the entry conditions for the strategies, opening a position in the wrong direction. These positions remained open until one of the exit conditions was met, incurring in loses, some bigger than others. The other issue faced while trading was due to technical difficulties with TradeStation. On February 27, 2013, the platform entered and exited the market several times without meeting any of the entry conditions in a short period of time. As it can be observed in figure 71, there are multiple entries and random exits few bars later without any particular reason, some of these exits were from the same position, meaning that only closed a smaller portion of the entire position. This can be considered an internet connection problem or a bug in the

platform that altered the normal performance of the system. This is something that will never come while backtesting or optimizing; because of that, the trader needs to be attentive in order to take decisions as quick as possible.



Figure 71: Example of platform malfunctioning on 02/27/2013

Overall, the performance of the strategy with GBP/USD was not as good as the backtesting results were, even though this never reached the maximum monthly drawdown of \$1,000 determined by the group. The use of this system helped to develop the final strategy because some of the errors found in this particular system were fixed in the final strategy. An important consideration that can be taken from this system's performance is that even if the strategy seems to be optimal, the trader needs to be able to use it when the conditions in the market are promising for the strategy, and also the trader has to be very observant of the strategy possible misbehaving, in order to prevent this from affecting the actual performance.

## 6.5. Group Results

The group's overall performance was positive with a total net profit of \$1,508.95. Table 6, shows in detail the performance of the group's trading activity. Fifty-six total trades were performed using the four currency pairs, EUR/JPY, EUR/USD, AUS/USD, and GBP/USD, from February 1, 2013, to April 1, 2013. The total return on the initial investment is 0.38% (\$1,508.95/\$400,000) in two months, which is equivalent to 2.26% annualized. Even though this return is lower than the group's target (8% annually), the group still broke-even. It is important to take into account that it was the first time trading for the four individuals in the group, the trading results are only for two months, and that the trading system was a work in development for most of the time trading during the first month. As a group we consider the results partially successful and know that there is a lot of further testing and development needed to conclude that the trading system is profitable and robust.

	<b>Antonio EUR/JPY</b>	<b>Mauricio EUR/USD</b>	<b>Paolo AUS/USD</b>	<b>Steven GBP/USD</b>	<b>Group Total</b>
<b>Total Net Profit</b>	<b>\$1,344.00</b>	<b>\$(426.30)</b>	<b>\$1,306.53</b>	<b>\$(715.28)</b>	<b>\$1,508.95</b>
Gross Profit	\$1,796.20	\$1,286.33	\$1,320.85	\$808.39	\$5,211.77
Gross Loss	\$(452.20)	\$(1,712.63)	\$(14.33)	\$(1,523.66)	\$(3,702.82)
Profit Factor	3.97	0.75	92.2	0.53	1.41
Total Number of Trades	10	15	9	22	56
Percent Profitable	70.00%	40.00%	55.56%	31.82%	44.64%
Winning Trades	7	6	5	7	25
Losing Trades	3	9	4	15	31
Even Trades	0	0	0	0	0
Avg. Trade Net Profit	\$134.40	\$(28.42)	\$145.17	\$(32.51)	\$26.95
Avg. Winning Trade	\$256.60	\$214.39	\$264.17	\$115.48	\$208.47
Avg. Losing Trade	\$(150.73)	\$(190.29)	\$(3.59)	\$(101.58)	\$(119.45)
Ratio Avg. Win: Loss	1.7	1.13	73.76	1.14	1.75
Largest Winning Trade	\$418.05	\$300.31	\$729.19	\$749.90	\$749.90
Largest Losing Trade	\$(217.37)	\$(401.47)	\$(4.10)	\$(367.55)	\$(401.47)

Table 6: Group Performance Report (02/01/2013 - 04/01/2013)

Some of the major problems encountered by the traders in this group were: trading during important news releases, technical difficulties, and trading on sideways markets. The first difficulty that was encountered was that while the robot had an open position and important news that affected the specific currency pair were released, the market many times reversed in direction quickly. Taking into account that the robot performs task based on technical analysis based on the charts, it is not aware of anything else going on in the real world. One suggestion that can be derived from these experiences is do not open positions before important news affecting a specific market one is trading are released. Even though the automated trading system may be robust, it still needs a lot of support from the trader in order to have an edge and be able to detect a reverse in market direction before there are big losses. Secondly, a problem that was encountered quite often was having technical difficulties with the trading platform, the computer, or the Internet connection while trading. It is important for the trader to be closely monitoring the performance of the trading robot constantly and making sure everything is working as it should. Many times computers, the trading platform, or the Internet connection can crash just when an order needed to be executed. If the order is not executed at the precise time it needed to, this can result in serious drawdowns. Finally, one last problem that the group encountered was trading in sideways markets. The automated trading strategy is mostly designed for trending markets; when the markets are trading sideways the strategy may get fooled and opens and closes positions repetitively with almost minimal changes in momentum resulting in a series of losing trades. In order to prevent this, one needs to analyze the market and determine when the conditions are suitable for one's robot.

## 7. Conclusions

There were several topics analyzed and covered in this project related to trading, specifically to forex. The first part of the project was focused on learning and getting familiar with forex, since most of the team members' backgrounds were not very strong on finance or economics. An in-depth research was performed in order to have a strong theoretical background in order to be able to achieve the goals defined for the project. This learning process was essential since the group members had the chance to get a good understanding of the market and the trading instrument that was going to be used before they actually started trading.

After having acquired the necessary knowledge to trade, the next step was to start exploring TradeStation, the trading platform that was going to be used. It was necessary to learn and understand the programming language used by this platform, since one of the goals of this project was to develop an automated trading system. Mastering EasyLanguage was a key factor of the project since this was essential to understand different built-in indicators and strategies TradeStation had, and to develop the automated trading strategies.

The final step was to develop and implement an automated strategy, which was the main objective of this project. This final step consisted on a combination of all the previous steps, where the group had to successfully combine all the theoretical concepts learned during the research process and apply them to write the code for the strategy and implement it. This sequence of steps made the creation of the strategy more successful and significantly easier to do, because it followed a logical order.

After finishing this report, the group came to the conclusion that the Japanese Yen was probably the best currency to trade in this upcoming year with the robot that was developed. This is directly related to the fact that the Japanese Government and its Central Bank are trying many economic policies to weaken the currency in order to increase exports and help the economy get out of a long lasting deflation. Using EUR/JPY for the automated system that was developed made some of the largest profits for this group. With this said so, it can be said that the Yen is an interesting investment to sell short for this year, since there is a strong probability for it to continue getting weaker.

## 8. Recommendations for Future Projects

The results of this project can be considered successful; even though the group did not achieve the 0.67% monthly return that was targeted, the group had a good start, never reached the maximum monthly drawdown, and finished the second month of trading with profits. However, there are some improvements that can be made. Having some trading experience was very important for project's success; for this reason, one recommendation is to start simulating trading as early as possible, making it possible for the group to gain enough trading experience and practice that will be applied continuously through the duration of the project. Having some trading experience gives a big advantage in terms of identifying common errors or mistakes that can be encountered while trading. This would make it easier for the group members to make corrections later during the implementation of the strategy; furthermore, practicing trading with simulated accounts before actually starting to trade gives confidence to take determined decisions based on experience, rather than pure theory. The integration of experience, in addition to the theoretical concepts, can be really beneficial for the purpose of the project, since there are some theoretical concepts or events that do not always apply in reality.

Another important factor that was contributed to the success of the project was the programming experience, since one of the main goals was to develop automated strategies. Not all the people taking part in this project have a strong programming background, meaning that for some people this was the first time coding. Because of this, a recommendation would be to prepare the groups in this field earlier so everyone has more experience and also more confidence with the specific programming language. With this said so, if groups would prepare in advance for programming, a more complex and robust

strategy could be developed in a shorter period of time, allowing more time to actually trade.

Even though in automated trading the orders are executed by the robot, the trader still needs time commitment to supervise that everything is working as it should. During the trading phase of the project, many group members experienced some technical difficulties that prevented the automated trading system from executing some trades. For instance, sometimes when an automated trading strategy is activated, something could go wrong with the internet connection or the computer, and when an entry or exit criteria is met, the robot would not be able to fill an order. It is important for the trader to constantly monitor how the system is performing and intervene if something goes wrong, avoiding a severe loss that could result if the user does not realize this on time.

One last recommendation is to always be very attentive to news releases affecting the different trading instruments being traded. Whenever one has an open position, it is extremely important to be aware that an important news release can easily make a trend reverse in direction and potential profits turn into huge losses. Due to this high volatility that some financial instruments have during important news releases, a suggestion would be to either avoid trading during the news releases or to trade but be very careful and attentive to how the news may affect the specific instrument one is trading.

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## Appendix A: List of Trades

### Antonio's Trades

No. Trade	Order Type	Symbol	Date	Time	Position	Entry/Exit Price	Net Profit	Cumulative Net Profit
1	Buy	EURJPY	2/5/2013	4:00	36900	¥125.34	\$140.25	\$140.25
	Sell	EURJPY	2/5/2013	4:15		¥125.69		
2	Buy	EURJPY	2/21/2013	22:40	37800	¥123.11	\$142.50	\$282.75
	Sell	EURJPY	2/22/2013	3:25		¥123.46		
3	Buy	EURJPY	3/1/2013	12:18	38400	¥121.41	\$298.38	\$581.13
	Sell	EURJPY	3/1/2013	13:00		¥122.14		
4	Buy	EURJPY	3/4/2013	16:23	38300	¥121.75	\$199.42	\$780.55
	Sell	EURJPY	3/6/2013	14:23		¥122.23		
5	Sell	EURJPY	3/19/2013	11:03	-38600	¥122.85	\$307.38	\$1,087.93
	Buy	EURJPY	3/19/2013	13:00		¥122.09		
6	Sell	EURJPY	3/25/2013	9:00	-38600	¥122.57	\$418.05	\$1,505.98
	Buy	EURJPY	3/25/2013	11:21		¥121.55		
7	Sell	EURJPY	3/27/2013	5:33	-39000	¥121.13	\$290.22	\$1,796.20
	Buy	EURJPY	3/27/2013	10:49		¥120.42		
8	Sell	EURJPY	4/3/2013	3:01	-39000	¥119.58	\$(151.55)	\$1,644.65
	Buy	EURJPY	4/3/2013	5:03		¥119.94		
9	Buy	EURJPY	4/3/2013	5:03	38900	¥119.94	\$(217.37)	\$1,427.28
	Sell	EURJPY	4/3/2013	10:00		¥119.42		
10	Sell	EURJPY	4/3/2013	10:00	-38900	¥119.38	\$(83.28)	\$1,344.00
	Buy	EURJPY	4/3/2013	10:23		¥119.58		

## Mauricio's Trades

No. Trade	Order Type	Symbol	Date	Time	Position	Entry/Exit Price	Net Profit	Cumulative Net Profit
1	Buy	EURUSD	2/5/2013	6:47	50000	\$1.3557	\$(250.50)	\$(250.50)
	Sell	EURUSD	2/5/2013	9:40		\$1.3507		
2	Sell	EURUSD	2/6/2013	3:02	-36900	\$1.3529	\$(53.84)	\$(304.34)
	Buy	EURUSD	2/7/2013	3:17		\$1.3544		
3	Buy	EURUSD	2/7/2013	3:17	36900	\$1.3544	\$(401.47)	\$(705.81)
	Sell	EURUSD	2/7/2013	9:22		\$1.3435		
4	Buy	EURUSD	2/19/2013	1:14	37400	\$1.3357	\$242.13	\$(463.68)
	Sell	EURUSD	2/19/2013	20:06		\$1.3422		
5	Buy	EURUSD	2/25/2013	5:26	37700	\$1.3251	\$192.65	\$(271.03)
	Sell	EURUSD	2/25/2013	7:50		\$1.3302		
6	Buy	EURUSD	2/25/2013	9:00	37600	\$1.3291	\$(292.90)	\$(563.94)
	Sell	EURUSD	2/25/2013	10:56		\$1.3213		
7	Sell	EURUSD	2/26/2013	10:11	-37600	\$1.3063	\$(68.24)	\$(632.18)
	Buy	EURUSD	2/27/2013	4:37		\$1.3081		
8	Sell	EURUSD	2/28/2013	10:58	38100	\$1.3070	\$259.16	\$(373.03)
	Buy	EURUSD	3/1/2013	7:50		\$1.3002		
9	Sell	EURUSD	3/12/2013	3:54	-38400	\$1.3010	\$(120.96)	\$(493.99)
	Buy	EURUSD	3/12/2013	8:32		\$1.3042		
10	Buy	EURUSD	3/12/2013	9:00	38300	\$1.3040	\$(76.98)	\$(570.97)
	Sell	EURUSD	3/12/2013	12:00		\$1.3020		
11	Sell	EURUSD	3/12/2013	12:00	-38400	\$1.3019	\$(53.38)	\$(624.34)
	Buy	EURUSD	3/12/2013	12:57		\$1.3033		
12	Sell	EURUSD	3/13/2013	7:43	-38400	\$1.3003	\$211.97	\$(412.37)
	Buy	EURUSD	3/13/2013	9:41		\$1.2948		
13	Buy	EURUSD	3/14/2013	12:16	38500	\$1.2986	\$80.12	\$(332.26)
	Sell	EURUSD	3/14/2013	20:20		\$1.3007		
14	Sell	EURUSD	3/22/2013	2:00	-38700	\$1.2888	\$(394.35)	\$(726.61)
	Buy	EURUSD	3/22/2013	11:24		\$1.2990		
15	Sell	EURUSD	3/25/2013	9:10	-38600	\$1.2934	\$300.31	<b>\$(426.30)</b>
	Buy	EURUSD	3/25/2013	12:55		\$1.2857		

## Paolo's Trades

No. Trade	Order Type	Symbol	Date	Time	Position	Entry/Exit Price	Net Profit	Cumulative Net Profit
1	Sell	AUDUSD	2/20/2013	5:42	-48300	\$1.0337	\$88.87	\$88.87
	Buy	AUDUSD	2/20/2013	7:07		\$1.0318		
2	Sell	AUDUSD	2/25/2013	11:02	-48600	\$1.0276	\$11.52	\$100.39
	Buy	AUDUSD	2/26/2013	5:00		\$1.0272		
3	Sell	AUDUSD	2/26/2013	3:00	-100	\$1.0252	\$(0.20)	\$100.19
	Buy	AUDUSD	2/26/2013	5:00		\$1.0272		
4	Sell	AUDUSD	2/26/2013	3:00	-48600	\$1.0252	\$277.85	\$378.04
	Buy	AUDUSD	2/27/2013	12:13		\$1.0194		
5	Sell	AUDUSD	3/4/2013	7:00	-48800	\$1.0239	\$213.43	\$591.47
	Buy	AUDUSD	3/13/2013	12:13		\$1.0194		
6	Buy	AUDUSD	3/13/2013	9:40	49200	\$1.0154	\$729.19	\$1,320.65
	Sell	AUDUSD	3/13/2013	11:02		\$1.0293		
7	Buy	AUDUSD	3/13/2013	11:02	800	\$1.0293	\$(6.81)	\$1,313.85
	Sell	AUDUSD	3/13/2013	21:18		\$1.0375		
8	Buy	AUDUSD	3/13/2013	21:18	9200	\$1.0375	\$(3.22)	\$1,310.63
	Sell	AUDUSD	3/13/2013	21:20		\$1.0372		
9	Buy	AUDUSD	3/13/2013	21:20	10000	\$1.0376	\$(4.10)	<b>\$1,306.53</b>
	Sell	AUDUSD	3/13/2013	21:20		\$1.0372		

## Steven's Trades

No. Trade	Order Type	Symbol	Date	Time	Position	Entry/Exit Price	Net Profit	Cumulative Net Profit
1	Buy	GBPUSD	2/8/2013	3:31	100000	\$1.5736	\$(43.00)	\$(43.00)
	Sell	GBPUSD	2/8/2013	4:00		\$1.5732		
2	Buy	GBPUSD	2/15/2013	3:02	50000	\$1.5548	\$(367.55)	\$(410.55)
	Sell	GBPUSD	2/18/2013	10:46		\$1.5474		
3	Sell	GBPUSD	2/19/2013	8:00	50000	\$1.5454	\$749.90	\$339.35
	Buy	GBPUSD	2/20/2013	7:53		\$1.5303		
4	Sell	GBPUSD	2/21/2013	0:53	50000	\$1.5154	\$(200.50)	\$138.85
	Buy	GBPUSD	2/21/2013	2:07		\$1.5194		
5	Buy	GBPUSD	2/25/2013	22:00	32900	\$1.5183	\$(200.69)	\$(61.84)
	Sell	GBPUSD	2/26/2013	10:34		\$1.5122		
6	Sell	GBPUSD	2/26/2013	10:34	17100	\$1.5122	\$(58.35)	\$(120.18)
	Buy	GBPUSD	2/27/2013	9:18		\$1.5156		
7	Sell	GBPUSD	2/26/2013	11:16	32900	\$1.5114	\$(139.23)	\$(259.41)
	Buy	GBPUSD	2/27/2013	9:18		\$1.5156		
8	Sell	GBPUSD	2/27/2013	11:16	100	\$1.5114	\$(0.45)	\$(259.86)
	Buy	GBPUSD	2/27/2013	9:19		\$1.5158		
9	Buy	GBPUSD	2/27/2013	9:19	49900	\$1.5158	\$2.99	\$(256.87)
	Sell	GBPUSD	2/27/2013	9:23		\$1.5159		
10	Sell	GBPUSD	2/27/2013	9:23	100	\$1.5159	\$(0.00)	\$(256.87)
	Buy	GBPUSD	2/27/2013	9:24		\$1.5159		
11	Buy	GBPUSD	2/27/2013	9:24	49900	\$1.5159	\$12.97	\$(243.90)
	Sell	GBPUSD	2/27/2013	9:25		\$1.5162		
12	Sell	GBPUSD	2/27/2013	9:25	100	\$1.5162	\$0.04	\$(243.86)
	Buy	GBPUSD	2/27/2013	9:29		\$1.5158		
13	Buy	GBPUSD	2/27/2013	9:29	49900	\$1.5158	\$30.44	\$(213.42)
	Sell	GBPUSD	2/27/2013	9:44		\$1.5164		
14	Sell	GBPUSD	2/27/2013	9:44	100	\$1.5164	\$0.07	\$(213.35)
	Buy	GBPUSD	2/27/2013	9:52		\$1.5157		
15	Buy	GBPUSD	2/27/2013	9:52	49900	\$1.5157	\$11.98	\$(201.38)
	Sell	GBPUSD	2/27/2013	9:53		\$1.5160		
16	Sell	GBPUSD	2/27/2013	9:53	100	\$1.5160	\$(0.04)	\$(201.41)
	Buy	GBPUSD	2/27/2013	10:09		\$1.5164		
17	Buy	GBPUSD	2/27/2013	10:09	49900	\$1.5164	\$(8.48)	\$(209.89)
	Sell	GBPUSD	2/27/2013	10:09		\$1.5162		
18	Buy	GBPUSD	3/15/2013	4:00	33000	\$1.5144	\$(251.36)	\$(461.25)
	Sell	GBPUSD	3/20/2013	4:38		\$1.5068		
19	Sell	GBPUSD	3/20/2013	4:38	17000	\$1.5068	\$(110.67)	\$(571.92)

	Buy	GBPUSD	3/21/2013	3:21		\$1.5132		
20	Sell	GBPUSD	3/20/2013	19:10	33000	\$1.5090	\$(140.58)	\$(712.50)
	Buy	GBPUSD	3/21/2013	3:21		\$1.5132		
21	Sell	GBPUSD	3/20/2013	19:10	100	\$1.5090	\$(0.47)	\$(712.97)
	Buy	GBPUSD	3/21/2013	23:42		\$1.5136		
22	Buy	GBPUSD	3/27/2013	23:42	10000	\$1.5136	\$(2.30)	<b>\$(715.27)</b>
	Sell	GBPUSD	3/27/2013	23:42		\$1.5133		

## Appendix B: Backtesting Performance Results from Previous Strategies

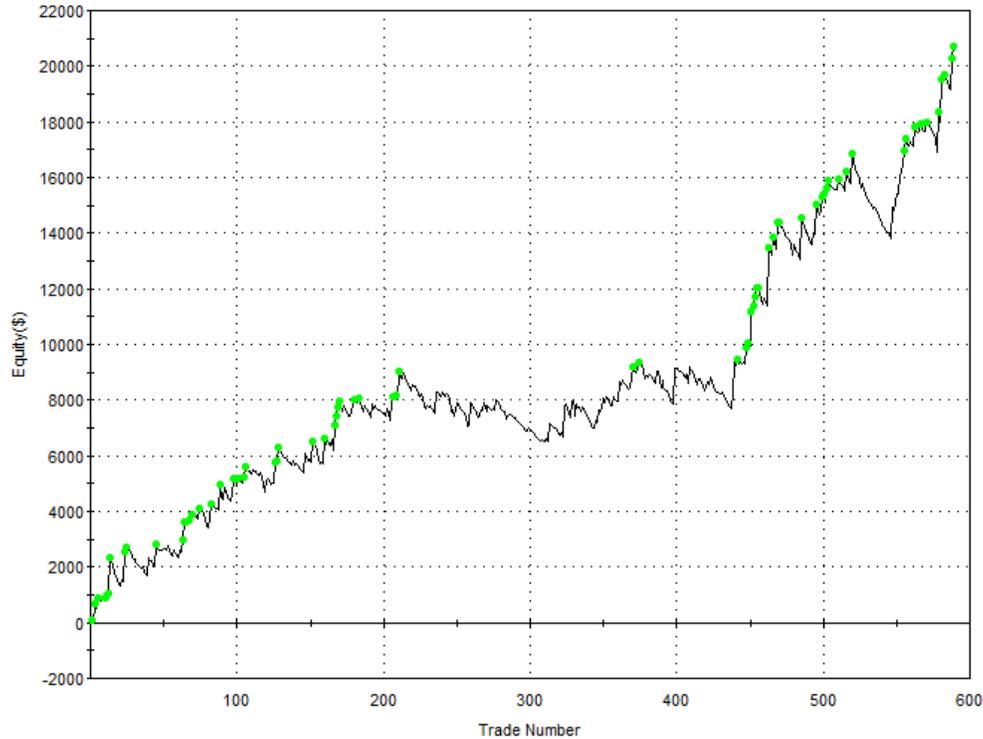
In the following appendix, the backtesting results of the strategies that were created in the process of developing the final strategy will be presented. The results for each of the four members of the team for each of the six development strategies show how the equity curves became smoother starting from the first strategy until the final strategy (the final strategy backtesting results are shown in the Individual Trading Projects section).

### Antonio's Backtesting Results for Old Strategies (EUR/JPY)

Double EMA Cross I (entries and exits at market price)

TradeStation Strategy Inputs	
Description	Value
Strategy 1 - Price	Close
Strategy 1 - Fast_Length	4
Strategy 1 - Slow_Length	12

Equity Curve Line - EURJPY 60 min.(01/31/12 18:00 - 04/17/13 11:00)

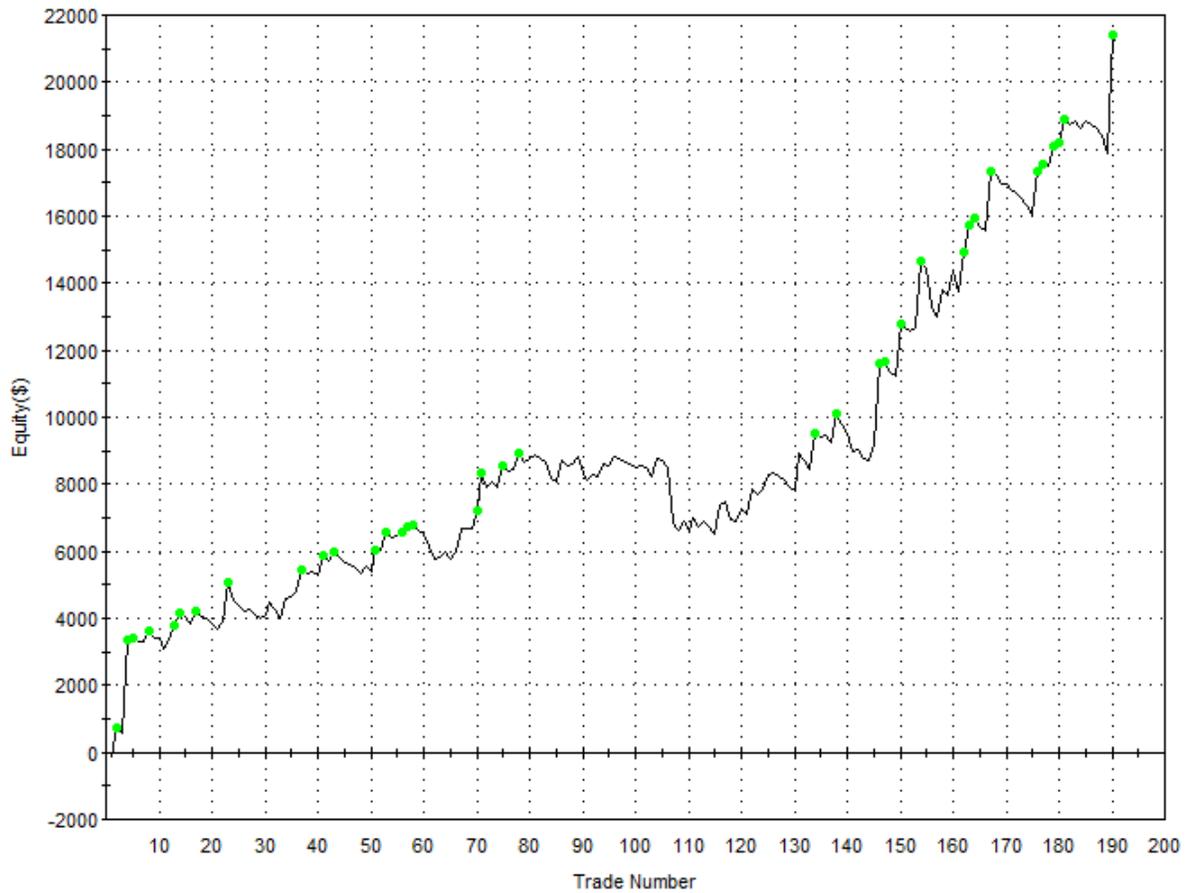


TradeStation Performance Summary		Expand ▾		
	All Trades	Long Trades	Short Trades	
Total Net Profit	\$20,696.92	\$16,542.83	\$4,154.08	
Gross Profit	\$64,387.48	\$36,825.45	\$27,562.04	
Gross Loss	(\$43,690.57)	(\$20,282.61)	(\$23,407.95)	
Profit Factor	1.47	1.82	1.18	
Total Number of Trades	589	295	294	
Percent Profitable	31.92%	33.90%	29.93%	
Winning Trades	188	100	88	
Losing Trades	401	195	206	
Even Trades	0	0	0	
Avg. Trade Net Profit	\$35.14	\$56.08	\$14.13	
Avg. Winning Trade	\$342.49	\$368.25	\$313.20	
Avg. Losing Trade	(\$108.95)	(\$104.01)	(\$113.63)	
Ratio Avg. Win:Avg. Loss	3.14	3.54	2.76	
Largest Winning Trade	\$2,100.46	\$2,100.46	\$1,146.64	
Largest Losing Trade	(\$512.43)	(\$417.72)	(\$512.43)	
Max. Consecutive Winning Trades	8	6	4	
Max. Consecutive Losing Trades	12	17	14	
Avg. Bars in Winning Trades	28.65	29.70	27.45	
Avg. Bars in Losing Trades	6.64	6.89	6.41	
Avg. Bars in Even Trades	0.00	0.00	0.00	
Max. Shares/Contracts Held	41400	41300	41400	
Total Shares/Contracts Held	22851400	11425900	11425500	
Account Size Required	\$3,041.91	\$2,120.13	\$3,996.90	
Return on Initial Capital	20.70%			
Annual Rate of Return	15.63%			
Return Retracement Ratio	1.31			
RINA Index	117.35			
Trading Period	1 Yr, 2 Mths, 12 Dys, 15 Hrs			
Percent of Time in the Market	99.93%			
Max. Equity Run-up	\$21,409.88			

Double EMA Cross II (entries and exits at highest-highs and lowest-lows of previous bars)

TradeStation Strategy Inputs		
Description		Value
Strategy 2 - Price		Close
Strategy 2 - Fast_Length		5
Strategy 2 - Slow_Length		15
Strategy 2 - Trigger_Long		2
Strategy 2 - Trigger_Short		1

Equity Curve Line - EURJPY 60 min.(01/31/12 18:00 - 04/17/13 11:00)



## TradeStation Performance Summary

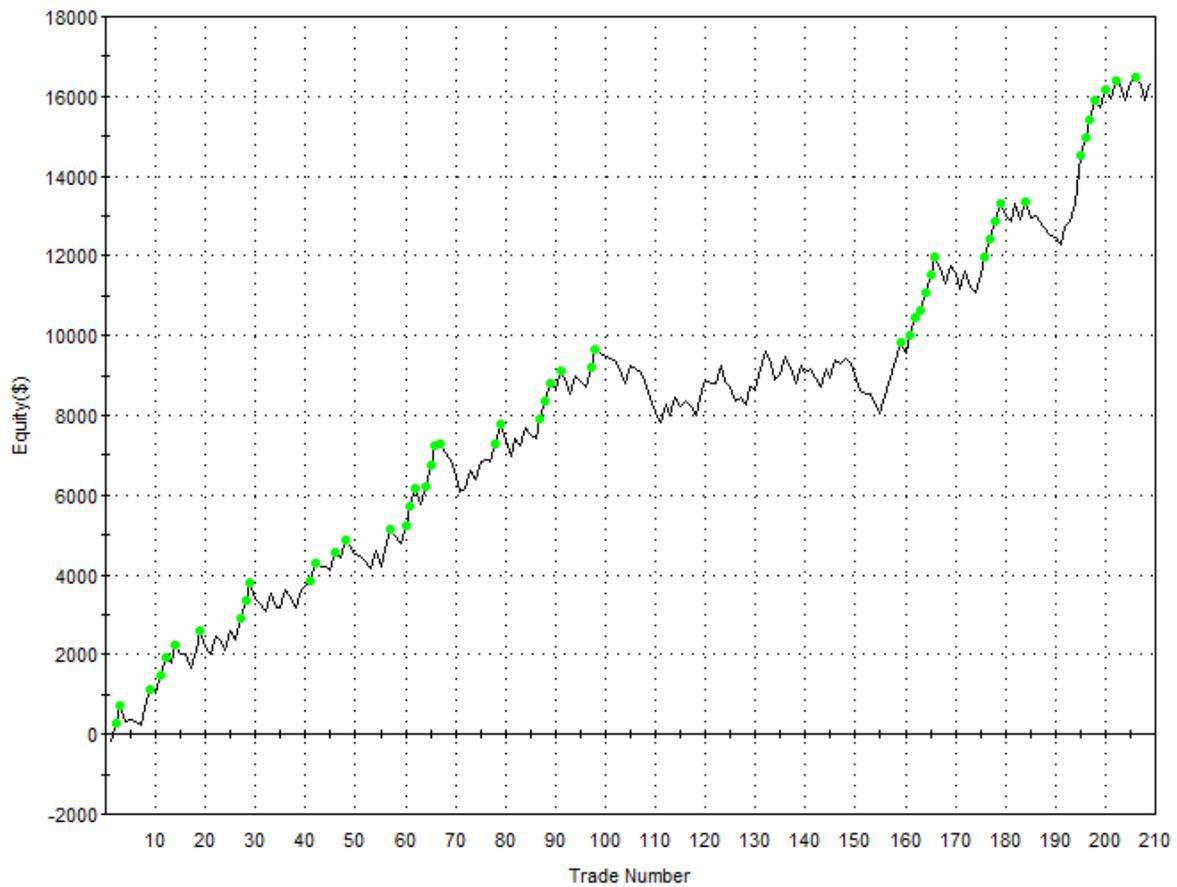
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$21,214.97	\$17,117.63	\$4,097.34
Gross Profit	\$43,914.29	\$27,586.63	\$16,327.65
Gross Loss	(\$22,699.32)	(\$10,469.00)	(\$12,230.32)
Profit Factor	1.93	2.64	1.34
Total Number of Trades	191	95	96
Percent Profitable	43.98%	44.21%	43.75%
Winning Trades	84	42	42
Losing Trades	107	53	54
Even Trades	0	0	0
Avg. Trade Net Profit	\$111.07	\$180.19	\$42.68
Avg. Winning Trade	\$522.79	\$656.82	\$388.75
Avg. Losing Trade	(\$212.14)	(\$197.53)	(\$226.49)
Ratio Avg. Win:Avg. Loss	2.46	3.33	1.72
Largest Winning Trade	\$3,547.81	\$3,547.81	\$1,767.02
Largest Losing Trade	(\$1,649.15)	(\$1,082.75)	(\$1,649.15)
Max. Consecutive Winning Trades	4	4	6
Max. Consecutive Losing Trades	8	9	6
Avg. Bars in Winning Trades	62.45	62.38	62.52
Avg. Bars in Losing Trades	21.36	17.00	25.65
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41200	41200
Total Shares/Contracts Held	7440300	3720100	3720200
Account Size Required	\$2,401.35	\$1,751.44	\$3,966.08
Return on Initial Capital	21.21%		
Annual Rate of Return	15.98%		
Return Retracement Ratio	1.46		
RINA Index	65.42		
Trading Period	1 Yr, 2 Mths, 12 Dys, 15 Hrs		
Percent of Time in the Market	99.30%		
Max. Equity Run-up	\$21,863.09		

Double EMA Cross III (entries and exits at highest-highs and lowest-lows of previous bars, exits when profit target and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
Strategy 3 - Price	Close
Strategy 3 - Fast_Length	6
Strategy 3 - Slow_Length	14
Strategy 3 - Trigger_Length_Long	1
Strategy 3 - Trigger_Length_Short	5
Strategy 3 - ShareOrPosition	2
Strategy 3 - ProfitTargetAmt	450
Strategy 3 - StopLossAmt	400
Strategy 3 - BreakevenFloorAmt	0
Strategy 3 - DollarTrailingAmt	0
Strategy 3 - PctTrailingFloorAmt	0
Strategy 3 - PctTrailingPct	0
Strategy 3 - ExitOnClose	false

Equity Curve Line - EURJPY 60 min.(01/31/12 18:00 - 04/17/13 12:00)



## TradeStation Performance Summary

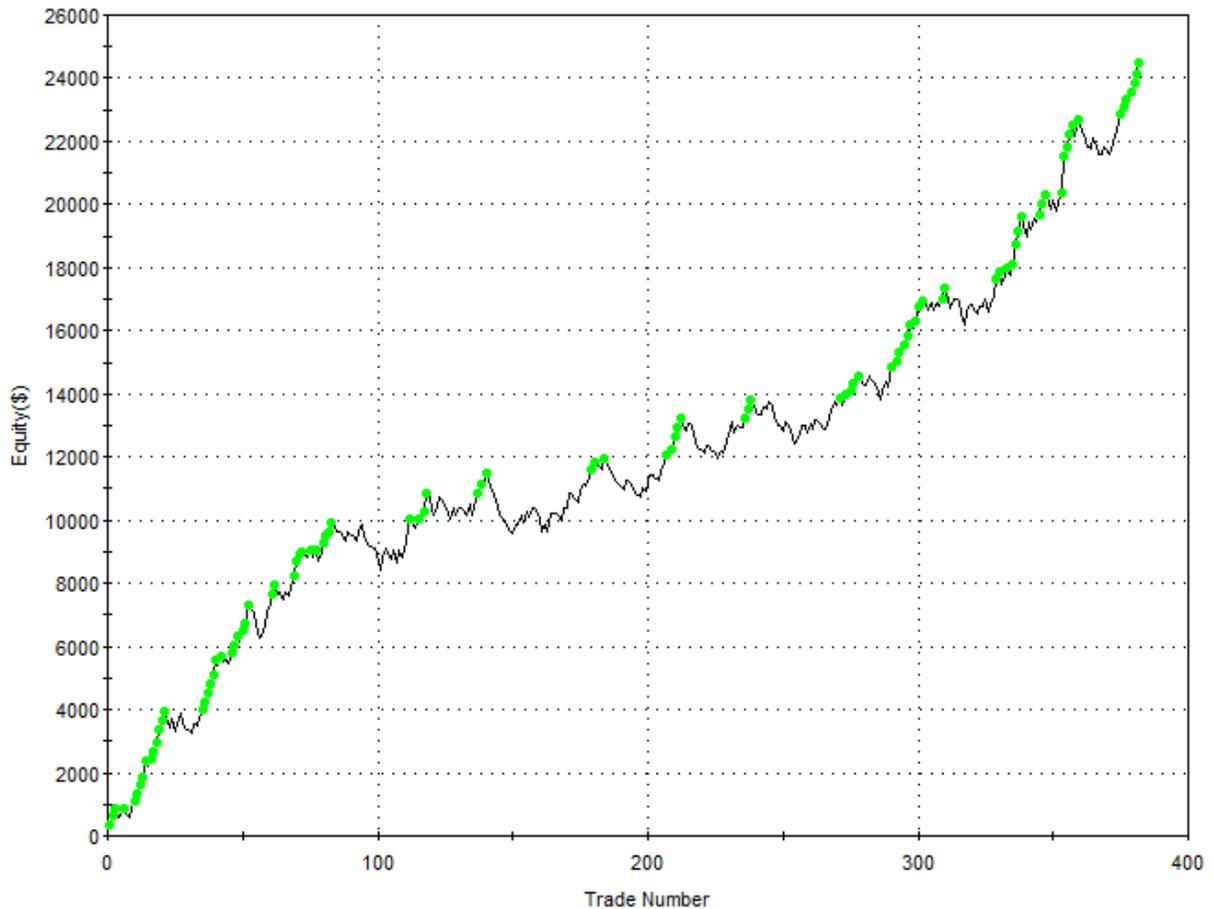
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$16,337.49	\$8,341.41	\$7,996.09
Gross Profit	\$39,791.42	\$19,540.11	\$20,251.31
Gross Loss	(\$23,453.93)	(\$11,198.71)	(\$12,255.22)
Profit Factor	1.70	1.74	1.65
Total Number of Trades	209	104	105
Percent Profitable	48.80%	50.00%	47.62%
Winning Trades	102	52	50
Losing Trades	107	52	55
Even Trades	0	0	0
Avg. Trade Net Profit	\$78.17	\$80.21	\$76.15
Avg. Winning Trade	\$390.11	\$375.77	\$405.03
Avg. Losing Trade	(\$219.20)	(\$215.36)	(\$222.82)
Ratio Avg. Win:Avg. Loss	1.78	1.74	1.82
Largest Winning Trade	\$1,214.28	\$564.24	\$1,214.28
Largest Losing Trade	(\$401.46)	(\$401.46)	(\$400.36)
Max. Consecutive Winning Trades	7	6	6
Max. Consecutive Losing Trades	7	7	9
Avg. Bars in Winning Trades	23.08	24.44	21.66
Avg. Bars in Losing Trades	18.14	18.54	17.76
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41100	41200
Total Shares/Contracts Held	8080000	4024000	4056000
Account Size Required	\$1,802.64	\$1,305.48	\$1,654.94
Return on Initial Capital	16.34%		
Annual Rate of Return	12.57%		
Return Retracement Ratio	1.33		
RINA Index	163.98		
Trading Period	1 Yr, 2 Mths, 12 Dys, 16 Hrs		
Percent of Time in the Market	53.79%		
Max. Equity Run-up	\$17,028.90		

Double EMA Cross IV (entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
Strategy 4 - Price	Close
Strategy 4 - Fast_Length	2
Strategy 4 - Slow_Length	12
Strategy 4 - Trigger_Length_Long	1
Strategy 4 - Trigger_Length_Short	7
Strategy 4 - ShareOrPosition	2
Strategy 4 - ProfitTargetAmt	0
Strategy 4 - StopLossAmt	400
Strategy 4 - BreakevenFloorAmt	0
Strategy 4 - DollarTrailingAmt	0
Strategy 4 - PctTrailingFloorAmt	250
Strategy 4 - PctTrailingPct	5
Strategy 4 - ExitOnClose	false

Equity Curve Line - EURJPY 60 min.(01/31/12 18:00 - 04/17/13 12:00)



## TradeStation Performance Summary

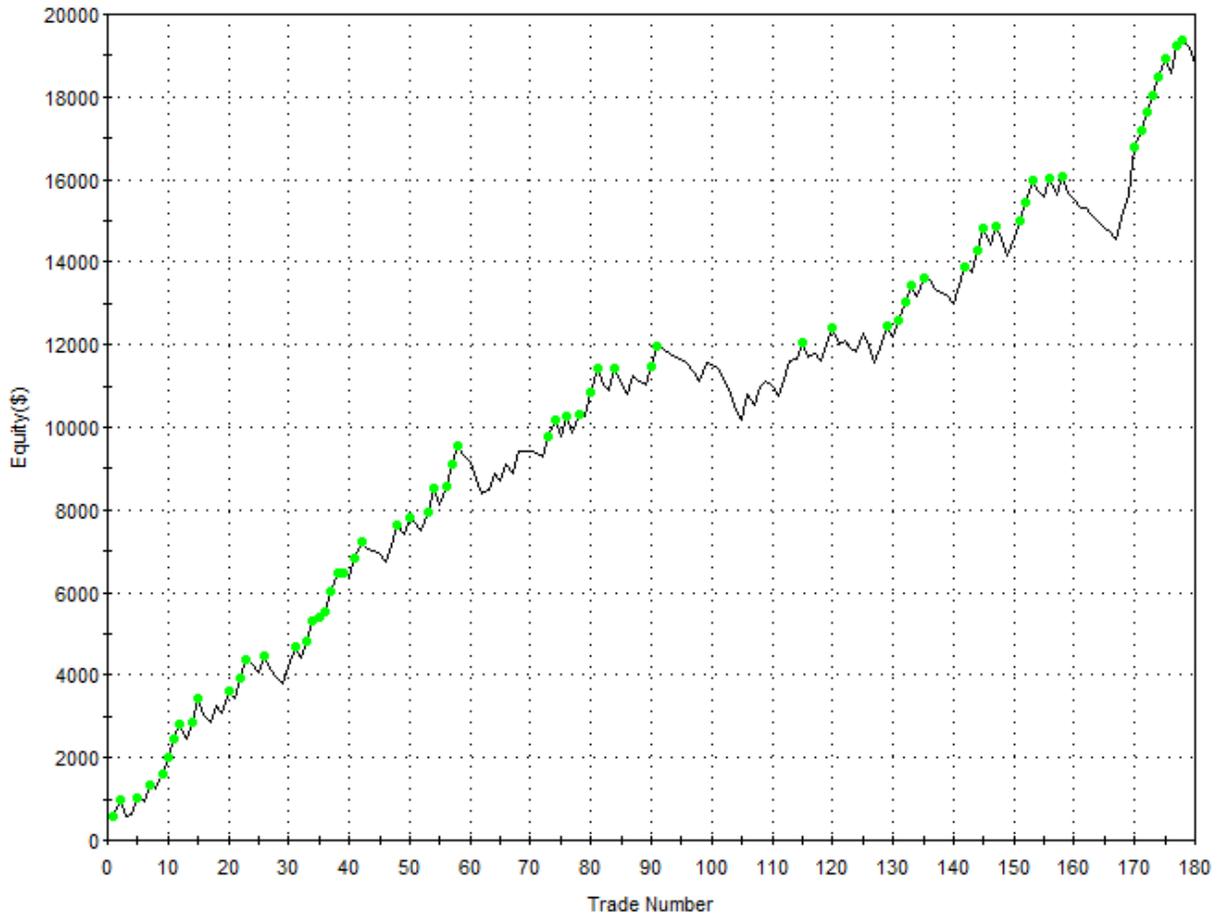
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$24,462.29	\$14,643.05	\$9,819.24
Gross Profit	\$56,528.95	\$31,979.54	\$24,549.42
Gross Loss	(\$32,066.67)	(\$17,336.49)	(\$14,730.18)
Profit Factor	1.76	1.84	1.67
Total Number of Trades	382	209	173
Percent Profitable	50.00%	53.59%	45.66%
Winning Trades	191	112	79
Losing Trades	191	97	94
Even Trades	0	0	0
Avg. Trade Net Profit	\$64.04	\$70.06	\$56.76
Avg. Winning Trade	\$295.96	\$285.53	\$310.75
Avg. Losing Trade	(\$167.89)	(\$178.73)	(\$156.70)
Ratio Avg. Win:Avg. Loss	1.76	1.60	1.98
Largest Winning Trade	\$1,157.98	\$628.89	\$1,157.98
Largest Losing Trade	(\$403.09)	(\$403.09)	(\$400.32)
Max. Consecutive Winning Trades	7	9	5
Max. Consecutive Losing Trades	10	12	8
Avg. Bars in Winning Trades	10.25	11.72	8.15
Avg. Bars in Losing Trades	10.55	12.52	8.53
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41300	41200	41300
Total Shares/Contracts Held	14817900	8097200	6720700
Account Size Required	\$1,941.19	\$2,004.27	\$1,566.15
Return on Initial Capital	24.46%		
Annual Rate of Return	18.18%		
Return Retracement Ratio	1.50		
RINA Index	366.70		
Trading Period	1 Yr, 2 Mths, 12 Dys, 16 Hrs		
Percent of Time in the Market	47.68%		
Max. Equity Run-up	\$24,532.61		

Double EMA Cross V (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
Strategy 5 - Price	Close
Strategy 5 - EMA_Fast	6
Strategy 5 - EMA_Slow	14
Strategy 5 - Trigger_Length_Long	1
Strategy 5 - Trigger_Length_Short	1
Strategy 5 - ShareOrPosition	2
Strategy 5 - ProfitTargetAmt	0
Strategy 5 - StopLossAmt	400
Strategy 5 - BreakevenFloorAmt	0
Strategy 5 - DollarTrailingAmt	0
Strategy 5 - PctTrailingFloorAmt	400
Strategy 5 - PctTrailingPct	5
Strategy 5 - ExitOnClose	false

Equity Curve Line - EURJPY 60 min.(01/31/12 18:00 - 04/17/13 12:00)



## TradeStation Performance Summary

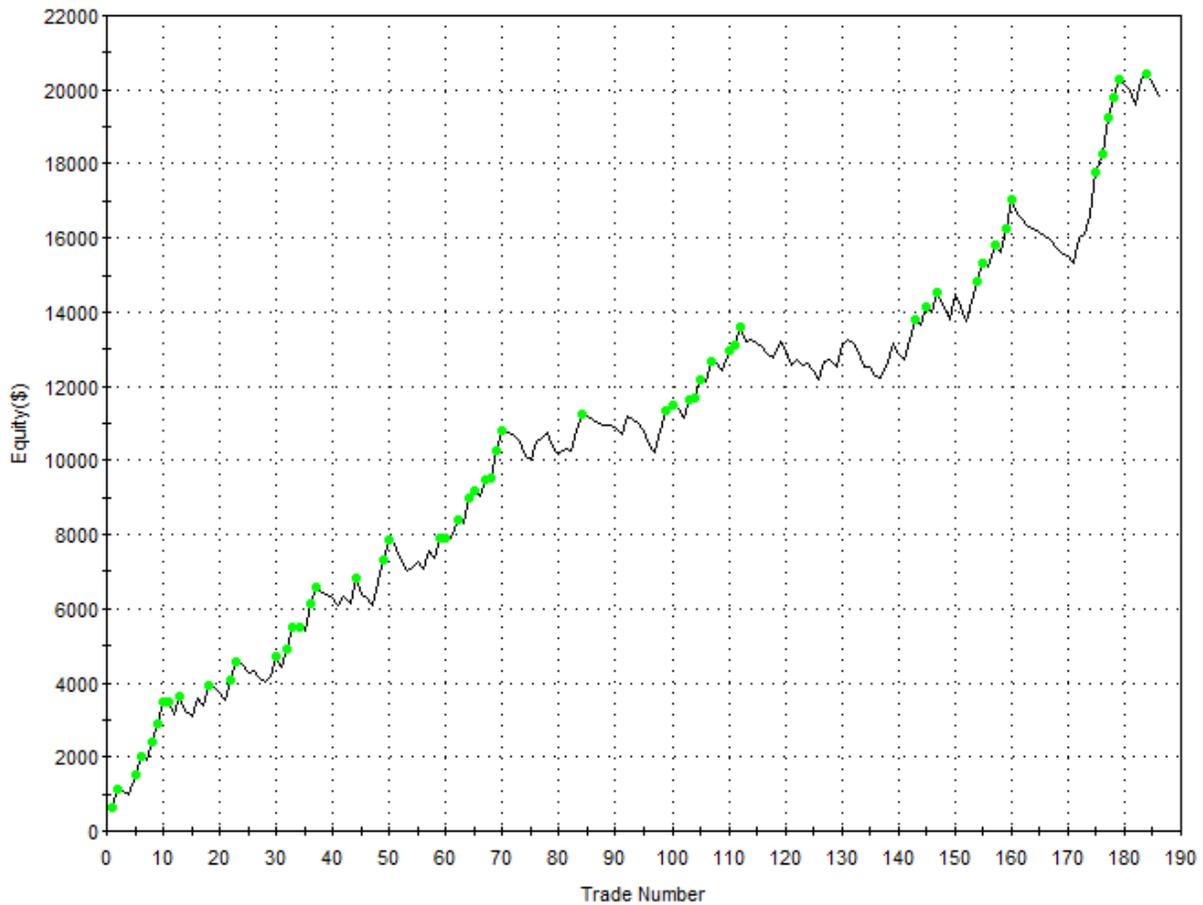
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$18,783.30	\$11,590.28	\$7,193.02
Gross Profit	\$37,680.80	\$19,214.78	\$18,466.01
Gross Loss	(\$18,897.50)	(\$7,624.50)	(\$11,273.00)
Profit Factor	1.99	2.52	1.64
Total Number of Trades	180	86	94
Percent Profitable	50.00%	53.49%	46.81%
Winning Trades	90	46	44
Losing Trades	90	40	50
Even Trades	0	0	0
Avg. Trade Net Profit	\$104.35	\$134.77	\$76.52
Avg. Winning Trade	\$418.68	\$417.71	\$419.68
Avg. Losing Trade	(\$209.97)	(\$190.61)	(\$225.46)
Ratio Avg. Win:Avg. Loss	1.99	2.19	1.86
Largest Winning Trade	\$1,157.98	\$690.71	\$1,157.98
Largest Losing Trade	(\$401.46)	(\$401.46)	(\$400.36)
Max. Consecutive Winning Trades	8	7	6
Max. Consecutive Losing Trades	9	6	12
Avg. Bars in Winning Trades	19.99	20.74	19.20
Avg. Bars in Losing Trades	15.08	15.63	14.64
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41100	41200
Total Shares/Contracts Held	6971200	3324500	3646700
Account Size Required	\$1,771.15	\$915.03	\$2,268.01
Return on Initial Capital	18.78%		
Annual Rate of Return	14.30%		
Return Retracement Ratio	1.29		
RINA Index	274.30		
Trading Period	1 Yr, 2 Mths, 12 Dys, 16 Hrs		
Percent of Time in the Market	41.00%		
Max. Equity Run-up	\$19,739.32		

Double EMA Cross VI (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA and slope, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
Strategy 6 - Price	Close
Strategy 6 - EMA_Fast	5
Strategy 6 - EMA_Slow	15
Strategy 6 - LengthSlope	3
Strategy 6 - Trigger_Length_Long	1
Strategy 6 - Trigger_Length_Short	1
Strategy 6 - ShareOrPosition	2
Strategy 6 - ProfitTargetAmt	0
Strategy 6 - StopLossAmt	400
Strategy 6 - BreakevenFloorAmt	0
Strategy 6 - DollarTrailingAmt	0
Strategy 6 - PctTrailingFloorAmt	500
Strategy 6 - PctTrailingPct	5
Strategy 6 - ExitOnClose	false

Equity Curve Line - EURJPY 60 min.(01/31/12 18:00 - 04/17/13 16:00)



## TradeStation Performance Summary

Expand 

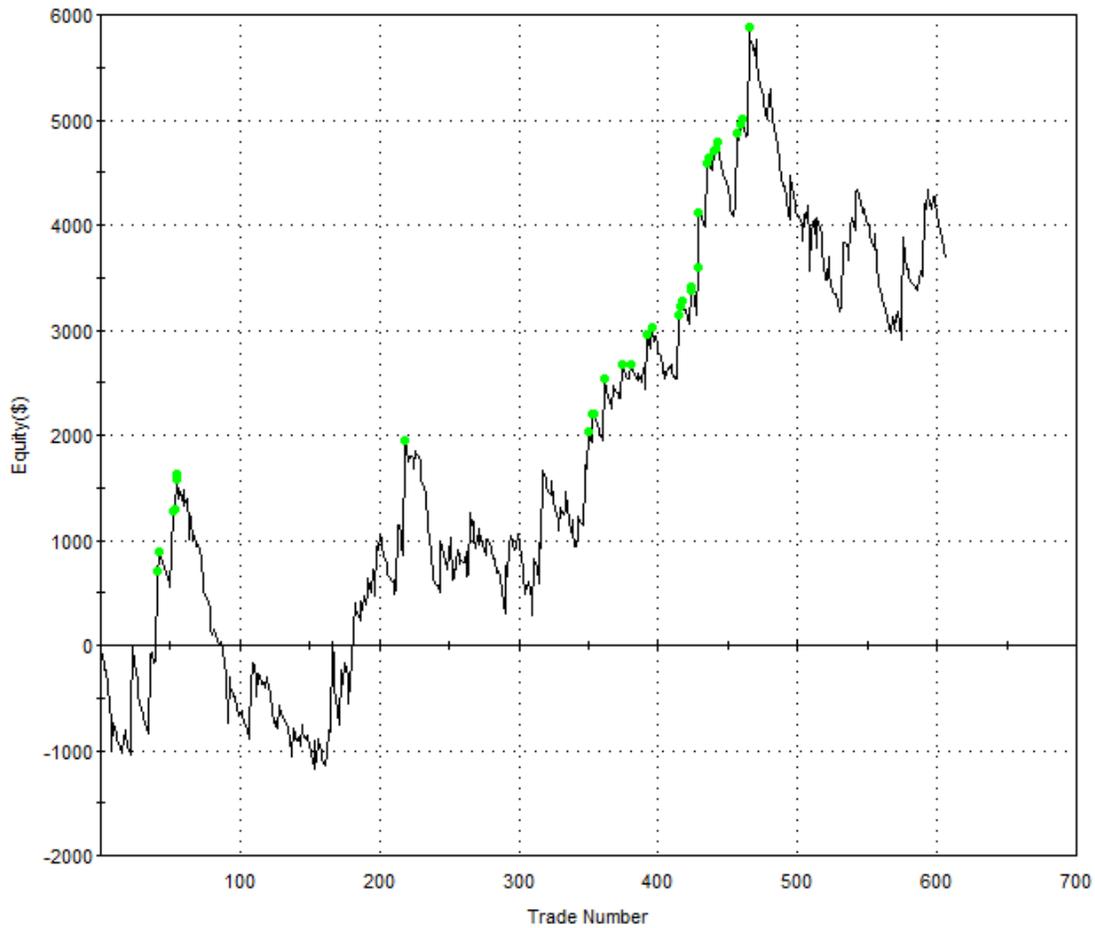
	All Trades	Long Trades	Short Trades
Total Net Profit	\$19,810.07	\$10,097.61	\$9,712.46
Gross Profit	\$38,170.71	\$18,227.98	\$19,942.73
Gross Loss	(\$18,360.64)	(\$8,130.36)	(\$10,230.28)
Profit Factor	2.08	2.24	1.95
Total Number of Trades	186	92	94
Percent Profitable	47.31%	47.83%	46.81%
Winning Trades	88	44	44
Losing Trades	98	48	50
Even Trades	0	0	0
Avg. Trade Net Profit	\$106.51	\$109.76	\$103.32
Avg. Winning Trade	\$433.76	\$414.27	\$453.24
Avg. Losing Trade	(\$187.35)	(\$169.38)	(\$204.61)
Ratio Avg. Win:Avg. Loss	2.32	2.45	2.22
Largest Winning Trade	\$1,157.98	\$690.71	\$1,157.98
Largest Losing Trade	(\$401.46)	(\$401.46)	(\$400.36)
Max. Consecutive Winning Trades	8	4	7
Max. Consecutive Losing Trades	11	7	6
Avg. Bars in Winning Trades	25.17	25.86	24.48
Avg. Bars in Losing Trades	13.98	14.19	13.78
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41200	41200
Total Shares/Contracts Held	7204100	3558000	3646100
Account Size Required	\$1,722.13	\$1,002.66	\$1,438.71
Return on Initial Capital	19.81%		
Annual Rate of Return	15.01%		
Return Retracement Ratio	1.35		
RINA Index	272.48		
Trading Period	1 Yr, 2 Mths, 12 Dys, 20 Hrs		
Percent of Time in the Market	45.44%		
Max. Equity Run-up	\$20,741.26		

# Mauricio's Backtesting Results for Old Strategies (EUR/USD)

Double EMA Cross I (entries and exits at market price)

TradeStation Strategy Inputs	
Description	Value
*Strategy 1 ML - Price	Close
*Strategy 1 ML - Fast_Length	2
*Strategy 1 ML - Slow_Length	21

Equity Curve Line - EURUSD 60 min.(01/31/12 18:00 - 04/17/13 00:00)



## TradeStation Performance Summary

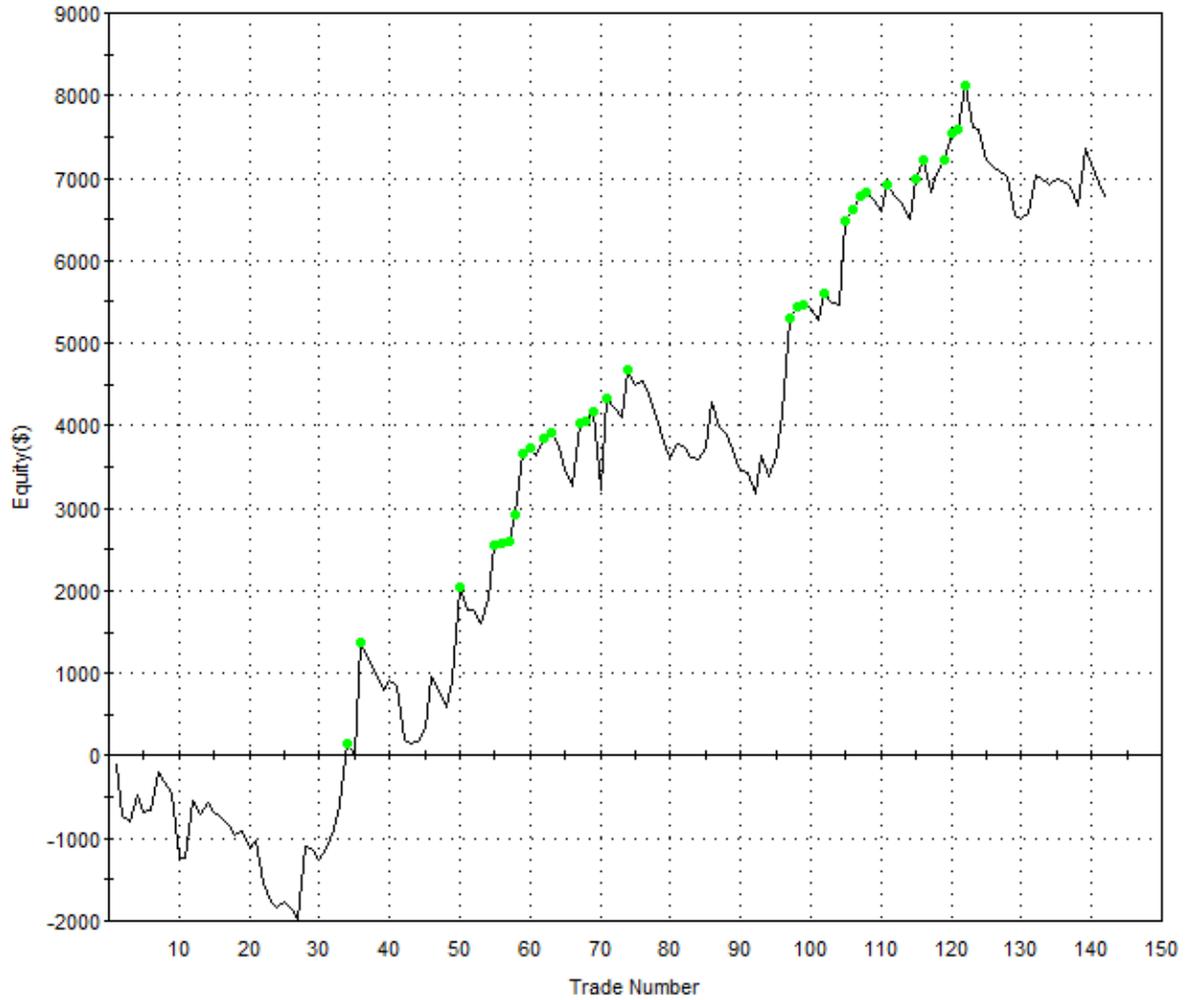
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$3,684.40	\$1,742.38	\$1,942.02
Gross Profit	\$35,395.43	\$17,358.57	\$18,036.86
Gross Loss	(\$31,711.03)	(\$15,616.19)	(\$16,094.84)
Profit Factor	1.12	1.11	1.12
Total Number of Trades	606	303	303
Percent Profitable	29.54%	30.03%	29.04%
Winning Trades	179	91	88
Losing Trades	427	212	215
Even Trades	0	0	0
Avg. Trade Net Profit	\$6.08	\$5.75	\$6.41
Avg. Winning Trade	\$197.74	\$190.75	\$204.96
Avg. Losing Trade	(\$74.26)	(\$73.66)	(\$74.86)
Ratio Avg. Win:Avg. Loss	2.66	2.59	2.74
Largest Winning Trade	\$1,090.80	\$1,037.70	\$1,090.80
Largest Losing Trade	(\$458.52)	(\$458.52)	(\$408.29)
Max. Consecutive Winning Trades	5	6	3
Max. Consecutive Losing Trades	17	18	14
Avg. Bars in Winning Trades	30.45	30.66	30.24
Avg. Bars in Losing Trades	6.07	6.21	5.94
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41300	41300	41200
Total Shares/Contracts Held	23448700	11744700	11704000
Account Size Required	\$2,974.24	\$2,498.35	\$1,999.38
Return on Initial Capital	3.68%		
Annual Rate of Return	3.01%		
Return Retracement Ratio	0.67		
RINA Index	(1.94)		
Trading Period	1 Yr, 2 Mths, 12 Dys, 4 Hrs		
Percent of Time in the Market	99.94%		
Max. Equity Run-up	\$7,335.43		

Double EMA Cross II (entries and exits at highest-highs and lowest-lows of previous bars)

TradeStation Strategy Inputs	
Description	Value
*Strategy 2 ML - Price	Close
*Strategy 2 ML - Fast_Length	10
*Strategy 2 ML - Slow_Length	13
*Strategy 2 ML - Trigger_Long	6
*Strategy 2 ML - Trigger_Short	1

Equity Curve Line - EURUSD 60 min.(01/31/12 18:00 - 04/17/13 00:00)



## TradeStation Performance Summary

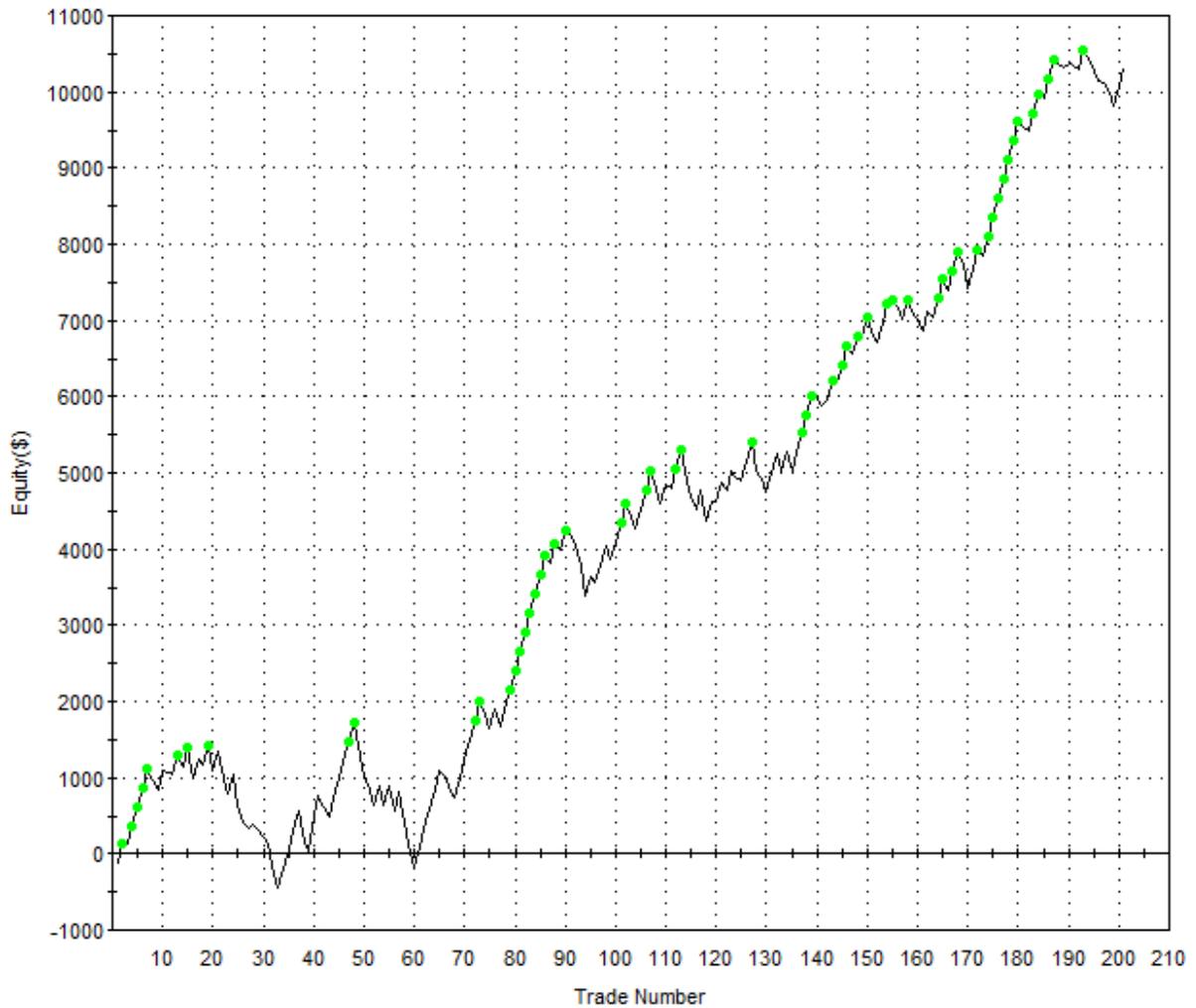
Expand ▾

	All Trades	Long Trades	Short Trades
Total Net Profit	\$6,767.08	\$3,309.29	\$3,457.79
Gross Profit	\$21,580.75	\$10,230.06	\$11,350.69
Gross Loss	(\$14,813.67)	(\$6,920.77)	(\$7,892.90)
Profit Factor	1.46	1.48	1.44
Total Number of Trades	142	71	71
Percent Profitable	43.66%	42.25%	45.07%
Winning Trades	62	30	32
Losing Trades	80	41	39
Even Trades	0	0	0
Avg. Trade Net Profit	\$47.66	\$46.61	\$48.70
Avg. Winning Trade	\$348.08	\$341.00	\$354.71
Avg. Losing Trade	(\$185.17)	(\$168.80)	(\$202.38)
Ratio Avg. Win:Avg. Loss	1.88	2.02	1.75
Largest Winning Trade	\$1,351.08	\$1,149.24	\$1,351.08
Largest Losing Trade	(\$957.37)	(\$510.79)	(\$957.37)
Max. Consecutive Winning Trades	7	4	7
Max. Consecutive Losing Trades	8	5	6
Avg. Bars in Winning Trades	75.56	69.73	81.03
Avg. Bars in Losing Trades	36.20	28.07	44.74
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41200	40900
Total Shares/Contracts Held	5519600	2780600	2739000
Account Size Required	\$1,970.79	\$1,576.46	\$1,625.95
Return on Initial Capital	6.77%		
Annual Rate of Return	5.45%		
Return Retracement Ratio	0.68		
RINA Index	29.95		
Trading Period	1 Yr, 2 Mths, 12 Dys, 4 Hrs		
Percent of Time in the Market	99.94%		
Max. Equity Run-up	\$10,621.10		

Double EMA Cross III (entries and exits at highest-highs and lowest-lows of previous bars, exits when profit target and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 3 ML - Price	Close
*Strategy 3 ML - Fast_Length	6
*Strategy 3 ML - Slow_Length	18
*Strategy 3 ML - Trigger_Length_Long	6
*Strategy 3 ML - Trigger_Length_Short	1
*Strategy 3 ML - ShareOrPosition	2
*Strategy 3 ML - ProfitTargetAmt	250
*Strategy 3 ML - StopLossAmt	400
*Strategy 3 ML - BreakevenFloorAmt	0
*Strategy 3 ML - DollarTrailingAmt	0
*Strategy 3 ML - PctTrailingFloorAmt	0
*Strategy 3 ML - PctTrailingPct	0
*Strategy 3 ML - ExitOnClose	false

Equity Curve Line - EURUSD 60 min.(01/31/12 18:00 - 04/17/13 13:00)



## TradeStation Performance Summary

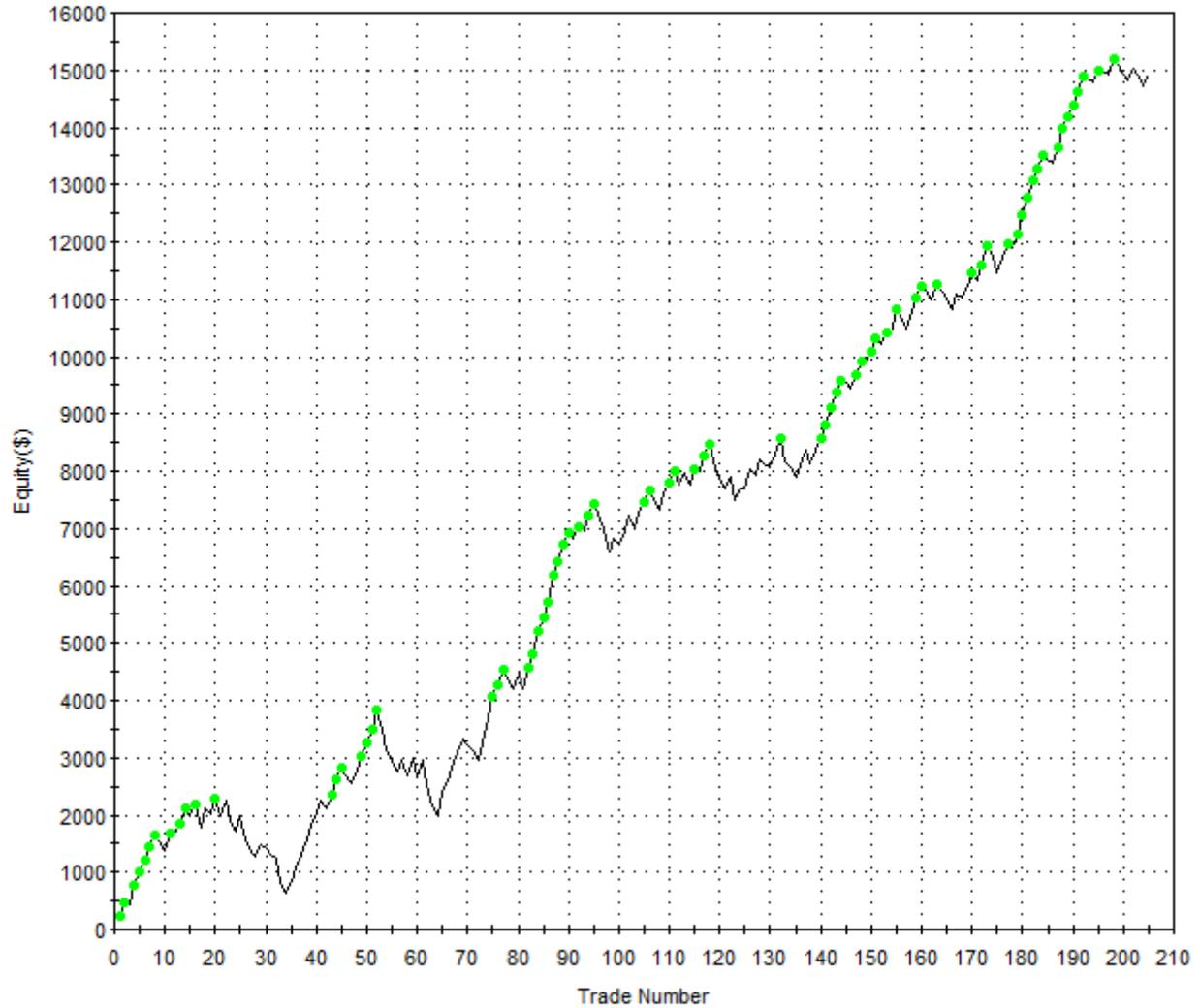
Expand ▾

	All Trades	Long Trades	Short Trades
Total Net Profit	\$10,317.94	\$4,216.42	\$6,101.52
Gross Profit	\$26,017.37	\$11,368.73	\$14,648.64
Gross Loss	(\$15,699.44)	(\$7,152.31)	(\$8,547.13)
Profit Factor	1.66	1.59	1.71
Total Number of Trades	201	91	110
Percent Profitable	52.74%	51.65%	53.64%
Winning Trades	106	47	59
Losing Trades	95	44	51
Even Trades	0	0	0
Avg. Trade Net Profit	\$51.33	\$46.33	\$55.47
Avg. Winning Trade	\$245.45	\$241.89	\$248.28
Avg. Losing Trade	(\$165.26)	(\$162.55)	(\$167.59)
Ratio Avg. Win:Avg. Loss	1.49	1.49	1.48
Largest Winning Trade	\$488.60	\$250.37	\$488.60
Largest Losing Trade	(\$400.24)	(\$400.20)	(\$400.24)
Max. Consecutive Winning Trades	9	5	6
Max. Consecutive Losing Trades	6	4	7
Avg. Bars in Winning Trades	19.30	20.11	18.66
Avg. Bars in Losing Trades	18.75	15.11	21.88
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41200	41200
Total Shares/Contracts Held	7764600	3515000	4249600
Account Size Required	\$1,889.19	\$997.96	\$1,467.11
Return on Initial Capital	10.32%		
Annual Rate of Return	8.16%		
Return Retracement Ratio	1.09		
RINA Index	165.46		
Trading Period	1 Yr, 2 Mths, 12 Dys, 17 Hrs		
Percent of Time in the Market	44.42%		
Max. Equity Run-up	\$11,311.80		

Double EMA Cross IV (entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 4 ML - Price	Close
*Strategy 4 ML - Fast_Length	6
*Strategy 4 ML - Slow_Length	18
*Strategy 4 ML - Trigger_Length_Long	6
*Strategy 4 ML - Trigger_Length_Short	1
*Strategy 4 ML - ShareOrPosition	2
*Strategy 4 ML - ProfitTargetAmt	0
*Strategy 4 ML - StopLossAmt	400
*Strategy 4 ML - BreakevenFloorAmt	0
*Strategy 4 ML - DollarTrailingAmt	0
*Strategy 4 ML - PctTrailingFloorAmt	200
*Strategy 4 ML - PctTrailingPct	1
*Strategy 4 ML - ExitOnClose	false

Equity Curve Line - EURUSD 60 min.(01/31/12 18:00 - 04/17/13 00:00)



## TradeStation Performance Summary

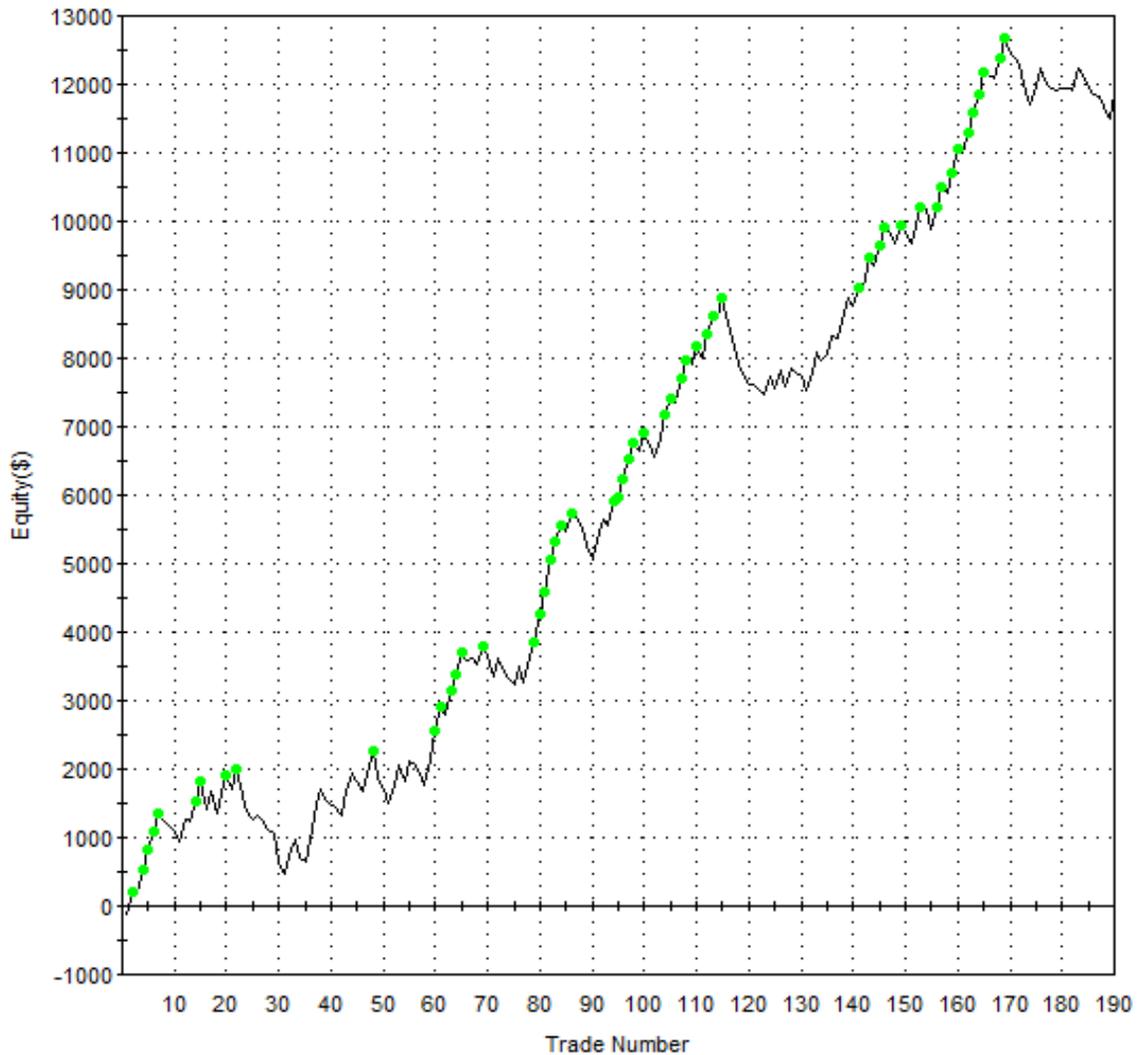
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$14,931.82	\$6,834.97	\$8,096.85
Gross Profit	\$29,752.26	\$13,609.33	\$16,142.93
Gross Loss	(\$14,820.44)	(\$6,774.36)	(\$8,046.08)
Profit Factor	2.01	2.01	2.01
Total Number of Trades	205	93	112
Percent Profitable	57.07%	56.99%	57.14%
Winning Trades	117	53	64
Losing Trades	88	40	48
Even Trades	0	0	0
Avg. Trade Net Profit	\$72.84	\$73.49	\$72.29
Avg. Winning Trade	\$254.29	\$256.78	\$252.23
Avg. Losing Trade	(\$168.41)	(\$169.36)	(\$167.63)
Ratio Avg. Win:Avg. Loss	1.51	1.52	1.50
Largest Winning Trade	\$460.12	\$460.12	\$352.80
Largest Losing Trade	(\$400.24)	(\$400.20)	(\$400.24)
Max. Consecutive Winning Trades	9	5	6
Max. Consecutive Losing Trades	5	4	7
Avg. Bars in Winning Trades	15.72	14.81	16.47
Avg. Bars in Losing Trades	15.69	14.13	17.00
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41200	41200	41200
Total Shares/Contracts Held	7918300	3591700	4326600
Account Size Required	\$1,840.34	\$927.99	\$1,317.15
Return on Initial Capital	14.93%		
Annual Rate of Return	11.57%		
Return Retracement Ratio	1.25		
RINA Index	293.06		
Trading Period	1 Yr, 2 Mths, 12 Dys, 5 Hrs		
Percent of Time in the Market	36.37%		
Max. Equity Run-up	\$15,466.04		

Double EMA Cross V (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 5 ML - Price	Close
*Strategy 5 ML - EMA_Fast	6
*Strategy 5 ML - EMA_Slow	16
*Strategy 5 ML - Trigger_Length_Long	1
*Strategy 5 ML - Trigger_Length_Short	1
*Strategy 5 ML - ShareOrPosition	2
*Strategy 5 ML - ProfitTargetAmt	0
*Strategy 5 ML - StopLossAmt	400
*Strategy 5 ML - BreakevenFloorAmt	0
*Strategy 5 ML - DollarTrailingAmt	0
*Strategy 5 ML - PctTrailingFloorAmt	250
*Strategy 5 ML - PctTrailingPct	1
*Strategy 5 ML - ExitOnClose	false

Equity Curve Line - EURUSD 60 min.(01/31/12 18:00 - 04/17/13 16:59)



## TradeStation Performance Summary

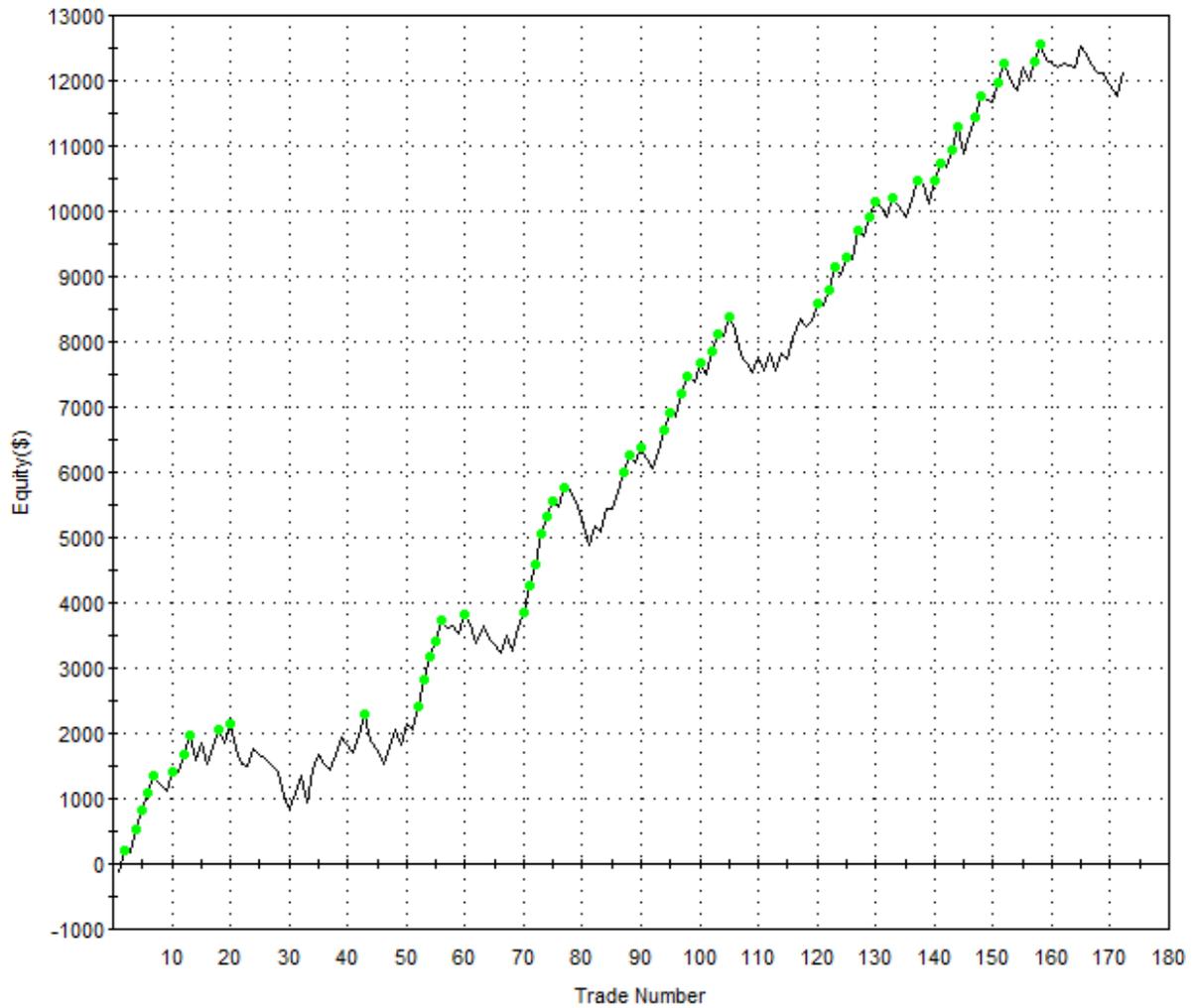
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$11,874.23	\$7,029.15	\$4,845.08
Gross Profit	\$25,984.78	\$13,427.33	\$12,557.45
Gross Loss	(\$14,110.55)	(\$6,398.19)	(\$7,712.37)
Profit Factor	1.84	2.10	1.63
Total Number of Trades	190	91	99
Percent Profitable	48.42%	51.65%	45.45%
Winning Trades	92	47	45
Losing Trades	98	44	54
Even Trades	0	0	0
Avg. Trade Net Profit	\$62.50	\$77.24	\$48.94
Avg. Winning Trade	\$282.44	\$285.69	\$279.05
Avg. Losing Trade	(\$143.99)	(\$145.41)	(\$142.82)
Ratio Avg. Win:Avg. Loss	1.96	1.96	1.95
Largest Winning Trade	\$479.10	\$460.12	\$479.10
Largest Losing Trade	(\$400.32)	(\$400.32)	(\$400.24)
Max. Consecutive Winning Trades	7	6	5
Max. Consecutive Losing Trades	6	5	8
Avg. Bars in Winning Trades	18.97	20.77	17.09
Avg. Bars in Losing Trades	15.63	13.20	17.61
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41300	41200	41300
Total Shares/Contracts Held	7352900	3515100	3837800
Account Size Required	\$1,536.97	\$1,052.40	\$1,752.19
Return on Initial Capital	11.87%		
Annual Rate of Return	9.32%		
Return Retracement Ratio	1.11		
RINA Index	246.49		
Trading Period	1 Yr, 2 Mths, 12 Dys, 20 Hrs, 59 Mins		
Percent of Time in the Market	38.36%		
Max. Equity Run-up	\$13,043.61		

Double EMA Cross VI (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA and slope, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 6 ML - Price	Close
*Strategy 6 ML - EMA_Fast	6
*Strategy 6 ML - EMA_Slow	16
*Strategy 6 ML - LengthSlope	2
*Strategy 6 ML - Trigger_Length_Long_Entry	6
*Strategy 6 ML - Trigger_Length_Short_Entry	1
*Strategy 6 ML - ShareOrPosition	2
*Strategy 6 ML - ProfitTargetAmt	0
*Strategy 6 ML - StopLossAmt	400
*Strategy 6 ML - BreakevenFloorAmt	0
*Strategy 6 ML - DollarTrailingAmt	0
*Strategy 6 ML - PctTrailingFloorAmt	250
*Strategy 6 ML - PctTrailingPct	1
*Strategy 6 ML - ExitOnClose	false

Equity Curve Line - EURUSD 60 min.(01/31/12 18:00 - 04/17/13 13:00)



## TradeStation Performance Summary

Expand 

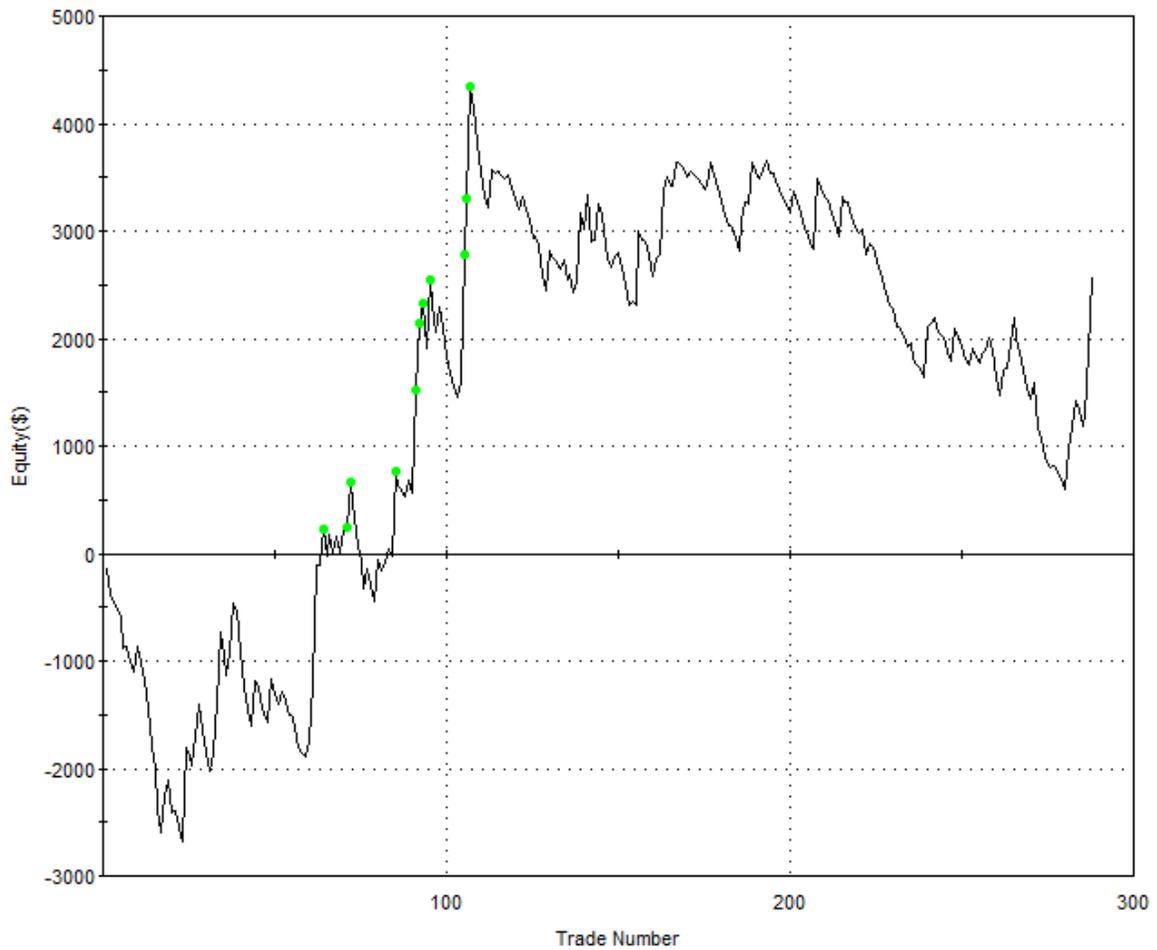
	All Trades	Long Trades	Short Trades
Total Net Profit	\$12,145.77	\$7,749.43	\$4,396.35
Gross Profit	\$25,166.61	\$12,729.58	\$12,437.02
Gross Loss	(\$13,020.83)	(\$4,980.16)	(\$8,040.68)
Profit Factor	1.93	2.56	1.55
Total Number of Trades	172	80	92
Percent Profitable	51.16%	55.00%	47.83%
Winning Trades	88	44	44
Losing Trades	84	36	48
Even Trades	0	0	0
Avg. Trade Net Profit	\$70.61	\$96.87	\$47.79
Avg. Winning Trade	\$285.98	\$289.31	\$282.66
Avg. Losing Trade	(\$155.01)	(\$138.34)	(\$167.51)
Ratio Avg. Win:Avg. Loss	1.84	2.09	1.69
Largest Winning Trade	\$479.10	\$460.12	\$479.10
Largest Losing Trade	(\$400.24)	(\$400.18)	(\$400.24)
Max. Consecutive Winning Trades	7	5	4
Max. Consecutive Losing Trades	6	4	8
Avg. Bars in Winning Trades	18.70	20.00	17.41
Avg. Bars in Losing Trades	17.81	14.14	20.56
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	41300	41200	41300
Total Shares/Contracts Held	6653700	3087200	3566500
Account Size Required	\$1,314.55	\$628.46	\$1,793.94
Return on Initial Capital	12.15%		
Annual Rate of Return	9.52%		
Return Retracement Ratio	1.16		
RINA Index	258.07		
Trading Period	1 Yr, 2 Mths, 12 Dys, 17 Hrs		
Percent of Time in the Market	36.81%		
Max. Equity Run-up	\$13,005.41		

# Paolo's Backtesting Results for Old Strategies (AUD/USD)

Double EMA Cross I (entries and exits at market price)

TradeStation Strategy Inputs	
Description	Value
*Strategy 1 - Price	Close
*Strategy 1 - Fast_Length	11
*Strategy 1 - Slow_Length	20

Equity Curve Line - AUDUSD 60 min.(01/31/12 18:00 - 04/17/13 00:00)



## TradeStation Performance Summary

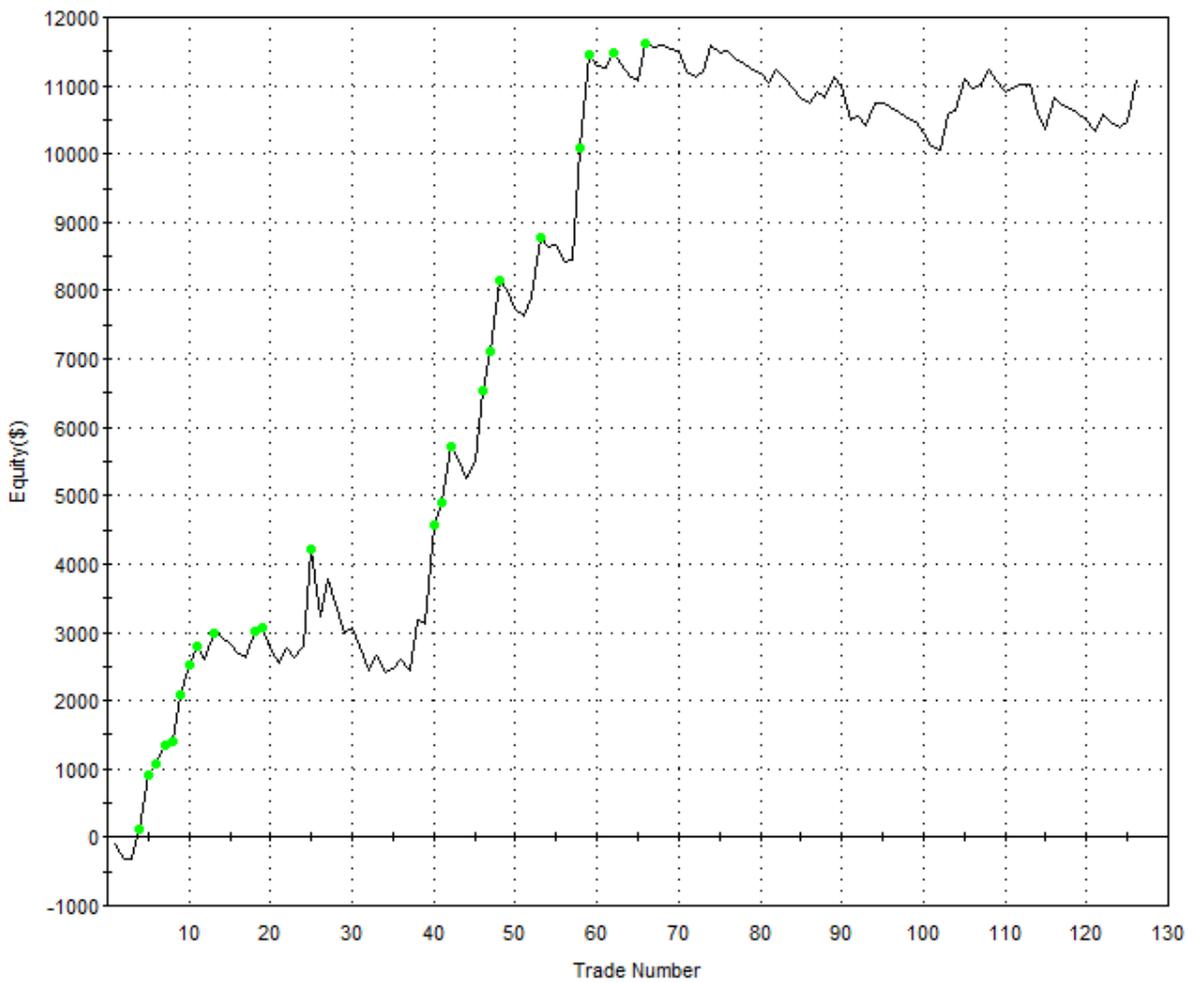
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$2,572.11	\$1,666.30	\$905.81
Gross Profit	\$27,019.40	\$13,263.94	\$13,755.46
Gross Loss	(\$24,447.29)	(\$11,597.64)	(\$12,849.65)
Profit Factor	1.11	1.14	1.07
Total Number of Trades	288	144	144
Percent Profitable	34.38%	34.03%	34.72%
Winning Trades	99	49	50
Losing Trades	189	95	94
Even Trades	0	0	0
Avg. Trade Net Profit	\$8.93	\$11.57	\$6.29
Avg. Winning Trade	\$272.92	\$270.69	\$275.11
Avg. Losing Trade	(\$129.35)	(\$122.08)	(\$136.70)
Ratio Avg. Win:Avg. Loss	2.11	2.22	2.01
Largest Winning Trade	\$1,177.55	\$1,177.55	\$1,094.23
Largest Losing Trade	(\$446.45)	(\$338.79)	(\$446.45)
Max. Consecutive Winning Trades	5	4	7
Max. Consecutive Losing Trades	11	11	15
Avg. Bars in Winning Trades	51.85	51.45	52.24
Avg. Bars in Losing Trades	13.73	14.11	13.35
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	51500	51500	51400
Total Shares/Contracts Held	13915300	6982000	6933300
Account Size Required	\$3,750.76	\$2,116.14	\$2,312.21
Return on Initial Capital	2.57%		
Annual Rate of Return	2.11%		
Return Retracement Ratio	0.32		
RINA Index	2.36		
Trading Period	1 Yr, 2 Mths, 12 Dys, 4 Hrs		
Percent of Time in the Market	99.91%		
Max. Equity Run-up	\$7,370.37		

Double EMA Cross II (entries and exits at highest-highs and lowest-lows of previous bars)

TradeStation Strategy Inputs	
Description	Value
*Strategy 2 - Price	Close
*Strategy 2 - Fast_Length	12
*Strategy 2 - Slow_Length	13
*Strategy 2 - Trigger_Long	6
*Strategy 2 - Trigger_Short	1

Equity Curve Line - AUDUSD 60 min.(01/31/12 18:00 - 04/17/13 00:00)



## TradeStation Performance Summary

Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$11,092.93	\$6,334.56	\$4,758.37
Gross Profit	\$22,315.89	\$12,475.69	\$9,840.20
Gross Loss	(\$11,222.96)	(\$6,141.13)	(\$5,081.84)
Profit Factor	1.99	2.03	1.94
Total Number of Trades	126	63	63
Percent Profitable	45.24%	47.62%	42.86%
Winning Trades	57	30	27
Losing Trades	69	33	36
Even Trades	0	0	0
Avg. Trade Net Profit	\$88.04	\$100.55	\$75.53
Avg. Winning Trade	\$391.51	\$415.86	\$364.45
Avg. Losing Trade	(\$162.65)	(\$186.09)	(\$141.16)
Ratio Avg. Win:Avg. Loss	2.41	2.23	2.58
Largest Winning Trade	\$1,639.96	\$1,639.96	\$1,405.96
Largest Losing Trade	(\$962.81)	(\$962.81)	(\$481.58)
Max. Consecutive Winning Trades	8	4	5
Max. Consecutive Losing Trades	7	4	6
Avg. Bars in Winning Trades	91.81	86.80	97.37
Avg. Bars in Losing Trades	32.30	23.64	40.25
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	51500	51500	51500
Total Shares/Contracts Held	6136600	3047500	3089100
Account Size Required	\$1,795.10	\$1,839.61	\$1,667.51
Return on Initial Capital	11.09%		
Annual Rate of Return	8.75%		
Return Retracement Ratio	0.95		
RINA Index	55.44		
Trading Period	1 Yr, 2 Mths, 12 Dys, 4 Hrs		
Percent of Time in the Market	99.09%		
Max. Equity Run-up	\$13,241.72		

Double EMA Cross III (entries and exits at highest-highs and lowest-lows of previous bars, exits when profit target and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 3 - Price	Close
*Strategy 3 - Fast_Length	6
*Strategy 3 - Slow_Length	16
*Strategy 3 - Trigger_Length_Long	6
*Strategy 3 - Trigger_Length_Short	1
*Strategy 3 - ShareOrPosition	2
*Strategy 3 - ProfitTargetAmt	350
*Strategy 3 - StopLossAmt	400
*Strategy 3 - BreakevenFloorAmt	0
*Strategy 3 - DollarTrailingAmt	0
*Strategy 3 - PctTrailingFloorAmt	0
*Strategy 3 - PctTrailingPct	0
*Strategy 3 - ExitOnClose	false

Equity Curve Line - AUDUSD 60 min.(01/31/12 18:00 - 04/17/13 19:00)



## TradeStation Performance Summary

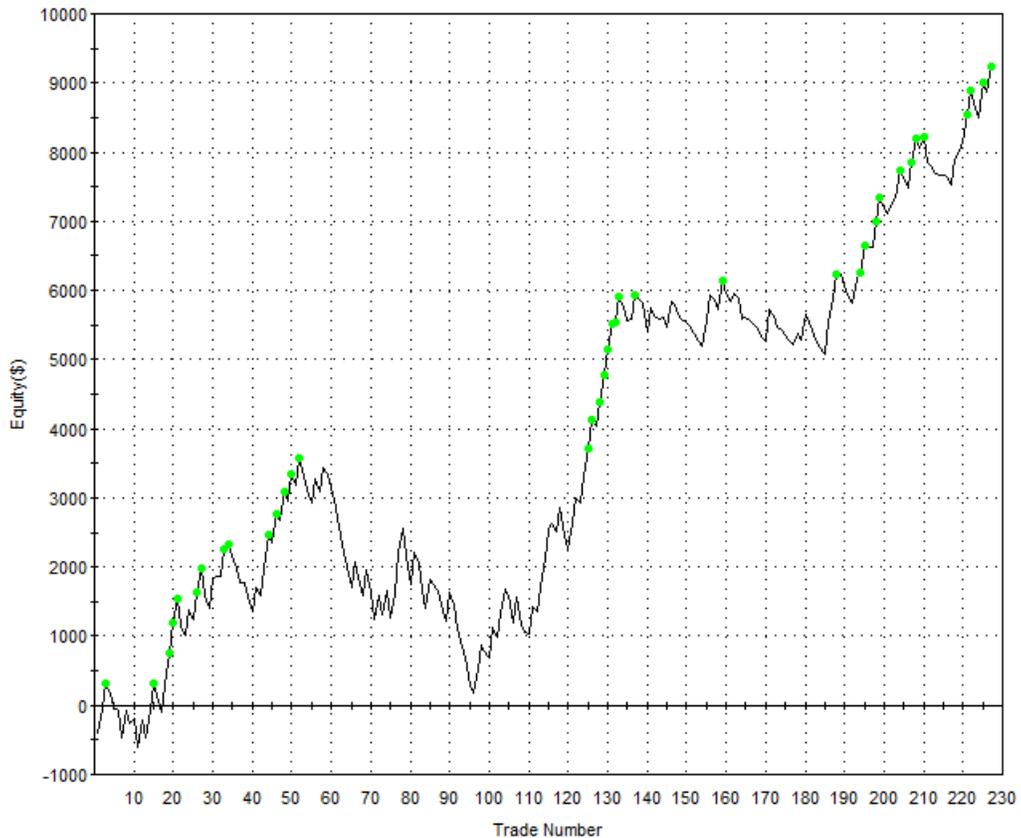
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$6,576.94	\$3,651.35	\$2,925.59
Gross Profit	\$28,818.60	\$12,995.19	\$15,823.41
Gross Loss	(\$22,241.65)	(\$9,343.84)	(\$12,897.82)
Profit Factor	1.30	1.39	1.23
Total Number of Trades	227	105	122
Percent Profitable	42.29%	41.90%	42.62%
Winning Trades	96	44	52
Losing Trades	131	61	70
Even Trades	0	0	0
Avg. Trade Net Profit	\$28.97	\$34.77	\$23.98
Avg. Winning Trade	\$300.19	\$295.35	\$304.30
Avg. Losing Trade	(\$169.78)	(\$153.18)	(\$184.25)
Ratio Avg. Win:Avg. Loss	1.77	1.93	1.65
Largest Winning Trade	\$475.71	\$475.71	\$372.14
Largest Losing Trade	(\$400.42)	(\$400.41)	(\$400.42)
Max. Consecutive Winning Trades	6	5	6
Max. Consecutive Losing Trades	8	6	7
Avg. Bars in Winning Trades	28.61	26.55	30.37
Avg. Bars in Losing Trades	15.79	14.00	17.36
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	51800	51500	51800
Total Shares/Contracts Held	10987100	5080100	5907000
Account Size Required	\$3,829.99	\$1,631.93	\$2,895.55
Return on Initial Capital	6.58%		
Annual Rate of Return	5.29%		
Return Retracement Ratio	0.95		
RINA Index	74.41		
Trading Period	1 Yr, 2 Mths, 12 Dys, 23 Hrs		
Percent of Time in the Market	60.59%		
Max. Equity Run-up	\$7,845.27		

Double EMA Cross IV (entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 4 - Price	Close
*Strategy 4 - Fast_Length	6
*Strategy 4 - Slow_Length	16
*Strategy 4 - Trigger_Length_Long	6
*Strategy 4 - Trigger_Length_Short	1
*Strategy 4 - ShareOrPosition	2
*Strategy 4 - ProfitTargetAmt	0
*Strategy 4 - StopLossAmt	400
*Strategy 4 - BreakevenFloorAmt	0
*Strategy 4 - DollarTrailingAmt	0
*Strategy 4 - PctTrailingFloorAmt	350
*Strategy 4 - PctTrailingPct	1
*Strategy 4 - ExitOnClose	false

Equity Curve Line - AUDUSD 60 min.(01/31/12 18:00 - 04/17/13 19:00)



## TradeStation Performance Summary

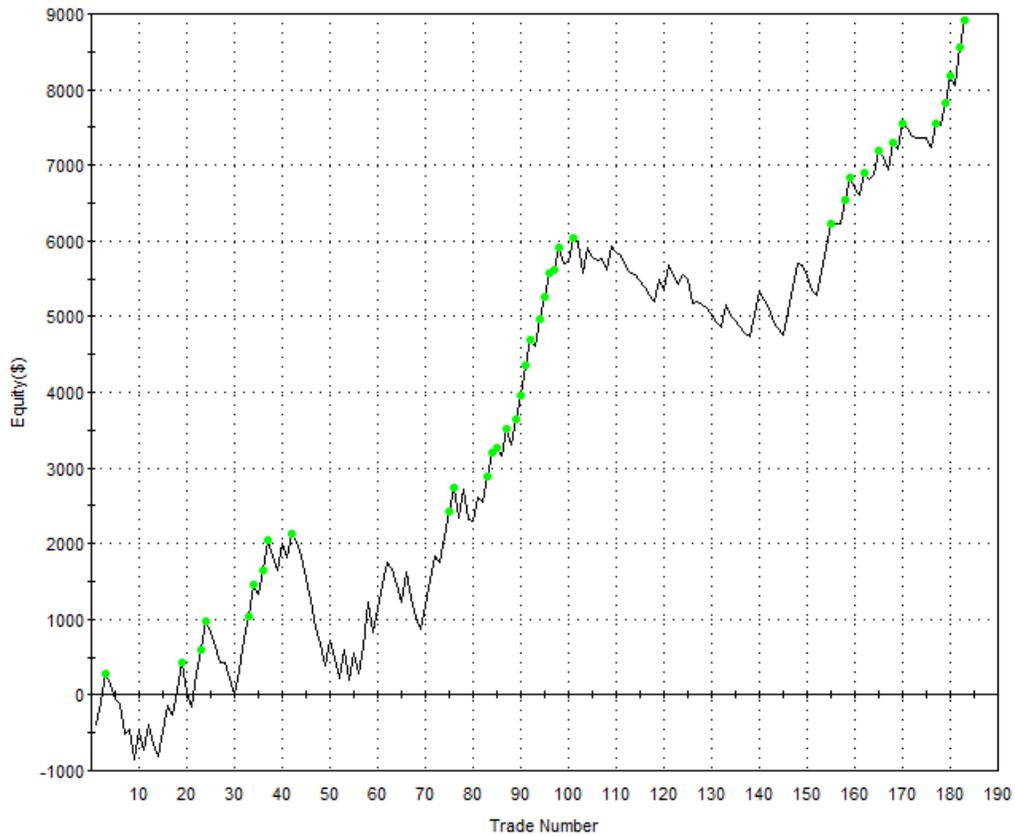
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$9,226.54	\$4,761.72	\$4,464.82
Gross Profit	\$31,468.19	\$14,105.55	\$17,362.64
Gross Loss	(\$22,241.65)	(\$9,343.84)	(\$12,897.82)
Profit Factor	1.41	1.51	1.35
Total Number of Trades	227	105	122
Percent Profitable	42.29%	41.90%	42.62%
Winning Trades	96	44	52
Losing Trades	131	61	70
Even Trades	0	0	0
Avg. Trade Net Profit	\$40.65	\$45.35	\$36.60
Avg. Winning Trade	\$327.79	\$320.58	\$333.90
Avg. Losing Trade	(\$169.78)	(\$153.18)	(\$184.25)
Ratio Avg. Win:Avg. Loss	1.93	2.09	1.81
Largest Winning Trade	\$586.81	\$586.81	\$513.86
Largest Losing Trade	(\$400.42)	(\$400.41)	(\$400.42)
Max. Consecutive Winning Trades	6	5	6
Max. Consecutive Losing Trades	8	6	7
Avg. Bars in Winning Trades	28.70	26.57	30.50
Avg. Bars in Losing Trades	15.79	14.00	17.36
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	51800	51500	51800
Total Shares/Contracts Held	10987100	5080100	5907000
Account Size Required	\$3,404.83	\$1,468.88	\$2,678.65
Return on Initial Capital	9.23%		
Annual Rate of Return	7.33%		
Return Retracement Ratio	1.01		
RINA Index	104.26		
Trading Period	1 Yr, 2 Mths, 12 Dys, 23 Hrs		
Percent of Time in the Market	60.67%		
Max. Equity Run-up	\$10,066.43		

Double EMA Cross V (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy5 - Price	Close
*Strategy5 - EMA_Fast	6
*Strategy5 - EMA_Slow	16
*Strategy5 - Trigger_Length_Long	6
*Strategy5 - Trigger_Length_Short	1
*Strategy5 - ShareOrPosition	2
*Strategy5 - ProfitTargetAmt	0
*Strategy5 - StopLossAmt	400
*Strategy5 - BreakevenFloorAmt	0
*Strategy5 - DollarTrailingAmt	0
*Strategy5 - PctTrailingFloorAmt	300
*Strategy5 - PctTrailingPct	1
*Strategy5 - ExitOnClose	false

Equity Curve Line - AUDUSD 60 min.(01/31/12 18:00 - 04/17/13 18:00)



## TradeStation Performance Summary

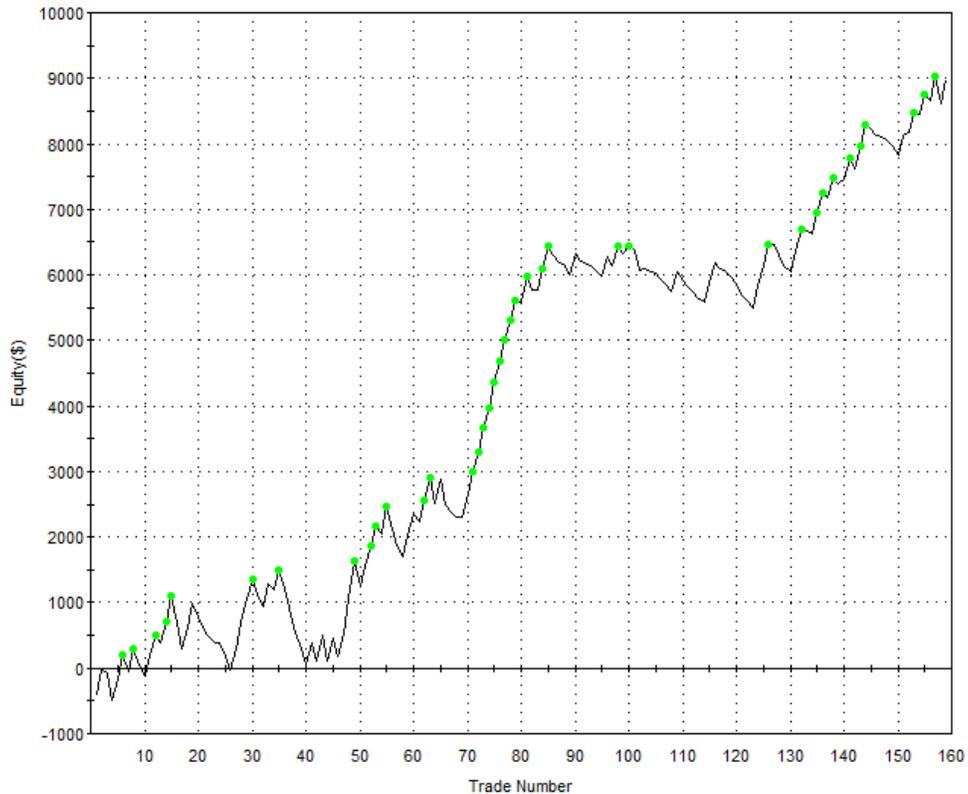
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$8,914.50	\$4,535.93	\$4,378.57
Gross Profit	\$24,957.90	\$11,017.76	\$13,940.14
Gross Loss	(\$16,043.40)	(\$6,481.83)	(\$9,561.57)
Profit Factor	1.56	1.70	1.46
Total Number of Trades	183	84	99
Percent Profitable	44.26%	44.05%	44.44%
Winning Trades	81	37	44
Losing Trades	102	47	55
Even Trades	0	0	0
Avg. Trade Net Profit	\$48.71	\$54.00	\$44.23
Avg. Winning Trade	\$308.12	\$297.78	\$316.82
Avg. Losing Trade	(\$157.29)	(\$137.91)	(\$173.85)
Ratio Avg. Win:Avg. Loss	1.96	2.16	1.82
Largest Winning Trade	\$586.81	\$586.81	\$513.86
Largest Losing Trade	(\$400.42)	(\$400.41)	(\$400.42)
Max. Consecutive Winning Trades	5	5	6
Max. Consecutive Losing Trades	9	5	7
Avg. Bars in Winning Trades	24.20	22.14	25.93
Avg. Bars in Losing Trades	15.90	14.81	16.84
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	51800	51500	51800
Total Shares/Contracts Held	8855600	4059500	4796100
Account Size Required	\$1,922.36	\$685.11	\$1,808.48
Return on Initial Capital	8.91%		
Annual Rate of Return	7.09%		
Return Retracement Ratio	0.96		
RINA Index	148.02		
Trading Period	1 Yr, 2 Mths, 12 Dys, 22 Hrs		
Percent of Time in the Market	43.81%		
Max. Equity Run-up	\$10,014.55		

Double EMA Cross VI (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA and slope, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
*Strategy 6 - Price	Close
*Strategy 6 - EMA_Fast	6
*Strategy 6 - EMA_Slow	17
*Strategy 6 - LengthSlope	3
*Strategy 6 - Trigger_Length_Long	5
*Strategy 6 - Trigger_Length_Short	3
*Strategy 6 - ShareOrPosition	2
*Strategy 6 - ProfitTargetAmt	0
*Strategy 6 - StopLossAmt	400
*Strategy 6 - BreakevenFloorAmt	0
*Strategy 6 - DollarTrailingAmt	0
*Strategy 6 - PctTrailingFloorAmt	300
*Strategy 6 - PctTrailingPct	1
*Strategy 6 - ExitOnClose	false

Equity Curve Line - AUDUSD 60 min.(01/31/12 18:00 - 04/17/13 18:00)



## TradeStation Performance Summary

Expand 

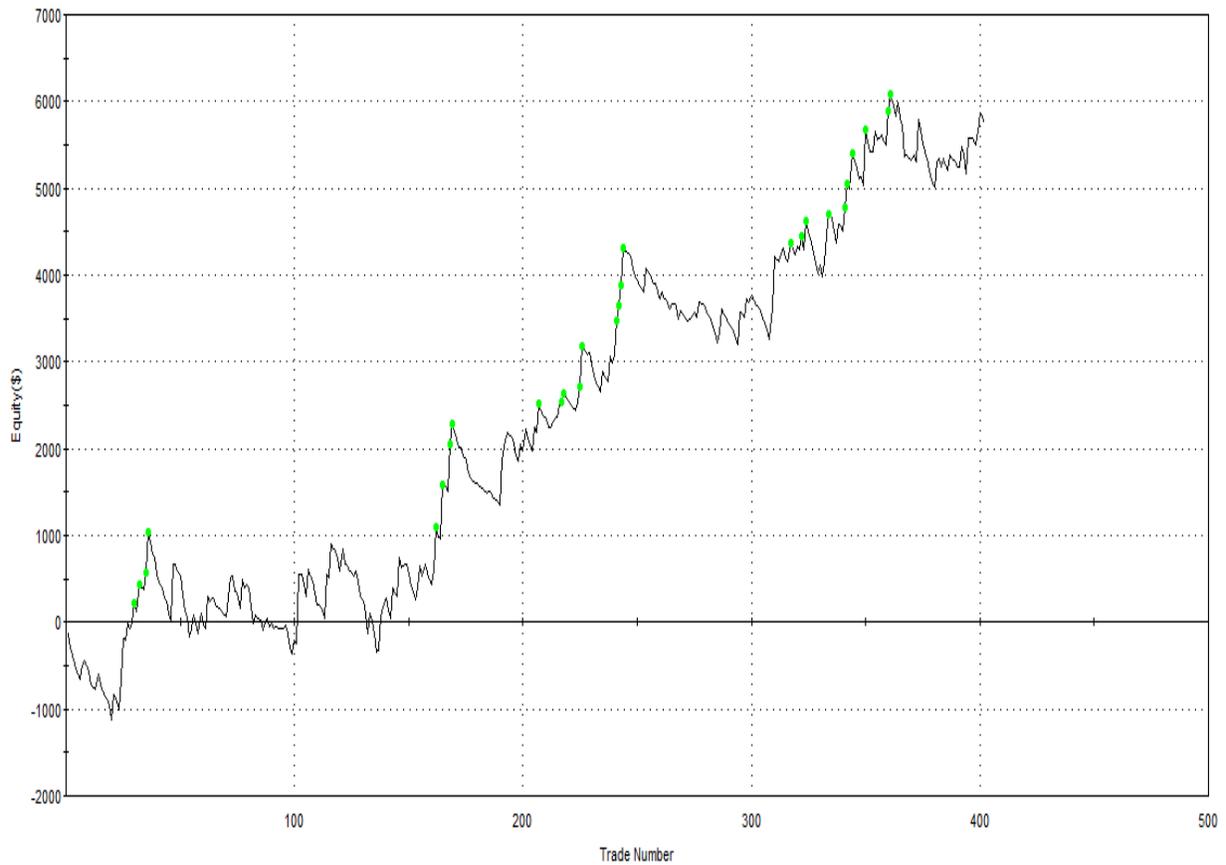
	All Trades	Long Trades	Short Trades
Total Net Profit	\$8,972.80	\$4,989.81	\$3,982.99
Gross Profit	\$22,643.95	\$10,656.22	\$11,987.73
Gross Loss	(\$13,671.15)	(\$5,666.41)	(\$8,004.73)
Profit Factor	1.66	1.88	1.50
Total Number of Trades	159	75	84
Percent Profitable	45.91%	45.33%	46.43%
Winning Trades	73	34	39
Losing Trades	86	41	45
Even Trades	0	0	0
Avg. Trade Net Profit	\$56.43	\$66.53	\$47.42
Avg. Winning Trade	\$310.19	\$313.42	\$307.38
Avg. Losing Trade	(\$158.97)	(\$138.21)	(\$177.88)
Ratio Avg. Win:Avg. Loss	1.95	2.27	1.73
Largest Winning Trade	\$586.81	\$586.81	\$413.95
Largest Losing Trade	(\$400.42)	(\$400.21)	(\$400.42)
Max. Consecutive Winning Trades	11	4	8
Max. Consecutive Losing Trades	7	6	6
Avg. Bars in Winning Trades	23.16	23.79	22.62
Avg. Bars in Losing Trades	17.98	18.15	17.82
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	51800	51500	51800
Total Shares/Contracts Held	7693100	3623900	4069200
Account Size Required	\$1,438.71	\$526.95	\$1,410.81
Return on Initial Capital	8.97%		
Annual Rate of Return	7.13%		
Return Retracement Ratio	1.04		
RINA Index	162.77		
Trading Period	1 Yr, 2 Mths, 12 Dys, 22 Hrs		
Percent of Time in the Market	40.77%		
Max. Equity Run-up	\$9,670.13		

# Steven's Backtesting Results for Old Strategies (GBP/USD)

Double EMA Cross I (entries and exits at market price)

TradeStation Strategy Inputs	
Description	Value
IQP_Test1_1 - Price	Close
IQP_Test1_1 - Fast_Length	6
IQP_Test1_1 - Slow_Length	16

Equity Curve Line - GBPUSD 60 min.(01/31/12 18:00 - 04/16/13 22:00)



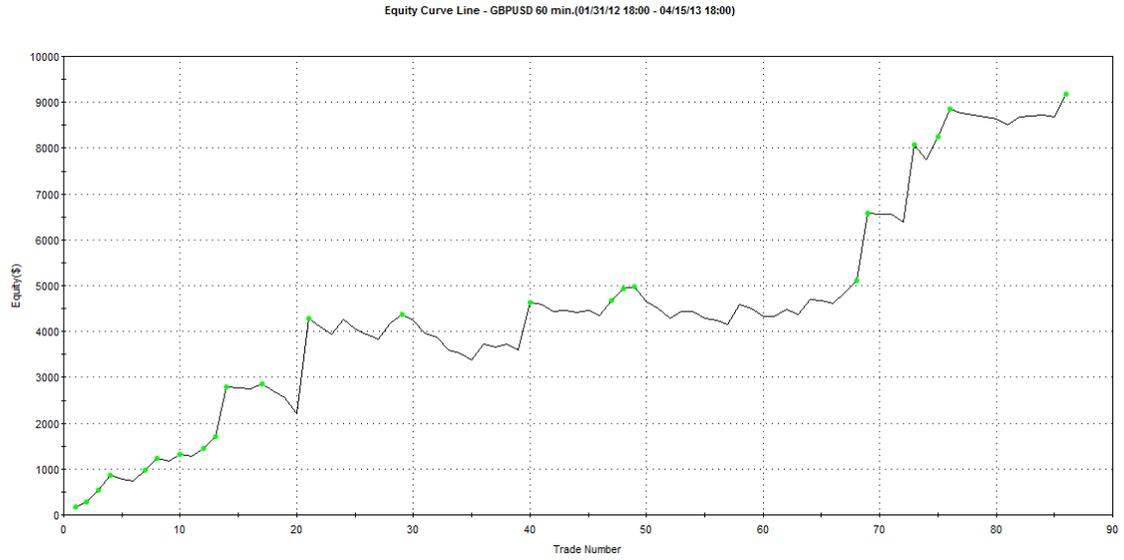
## TradeStation Performance Summary

Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$5,755.69	\$2,207.44	\$3,548.25
Gross Profit	\$26,973.23	\$12,634.25	\$14,338.98
Gross Loss	(\$21,217.54)	(\$10,426.81)	(\$10,790.73)
Profit Factor	1.27	1.21	1.33
Total Number of Trades	402	201	201
Percent Profitable	33.08%	32.84%	33.33%
Winning Trades	133	66	67
Losing Trades	269	135	134
Even Trades	0	0	0
Avg. Trade Net Profit	\$14.32	\$10.98	\$17.65
Avg. Winning Trade	\$202.81	\$191.43	\$214.01
Avg. Losing Trade	(\$78.88)	(\$77.24)	(\$80.53)
Ratio Avg. Win:Avg. Loss	2.57	2.48	2.66
Largest Winning Trade	\$803.53	\$640.39	\$803.53
Largest Losing Trade	(\$360.55)	(\$360.55)	(\$240.35)
Max. Consecutive Winning Trades	7	3	5
Max. Consecutive Losing Trades	11	16	11
Avg. Bars in Winning Trades	38.99	39.55	38.45
Avg. Bars in Losing Trades	9.90	9.97	9.84
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	33500	33500	33500
Total Shares/Contracts Held	12760600	6397900	6362700
Account Size Required	\$1,401.04	\$1,442.83	\$1,467.87
Return on Initial Capital	5.76%		
Annual Rate of Return	4.66%		
Return Retracement Ratio	0.99		
RINA Index	58.45		
Trading Period	1 Yr, 2 Mths, 12 Dys, 2 Hrs		
Percent of Time in the Market	99.97%		
Max. Equity Run-up	\$7,586.79		

# Double EMA Cross II (entries and exits at highest-highs and lowest-lows of previous bars)

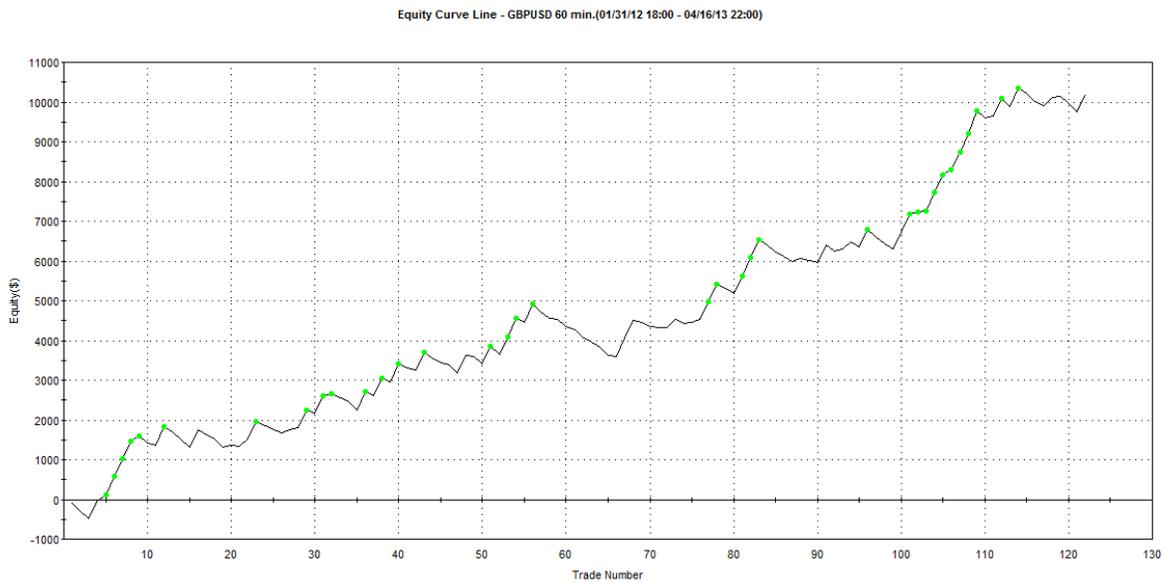
TradeStation Strategy Inputs		
Description		Value
IQP_Test2 - Price		Close
IQP_Test2 - Fast_Length		6
IQP_Test2 - Slow_Length		36
IQP_Test2 - Trigger_Long		5
IQP_Test2 - Trigger_Short		7



TradeStation Performance Summary		Expand ▾		
	All Trades	Long Trades	Short Trades	
Total Net Profit	\$9,176.14	\$3,977.29	\$5,198.85	
Gross Profit	\$14,754.62	\$6,882.49	\$7,872.13	
Gross Loss	(\$5,578.49)	(\$2,905.20)	(\$2,673.29)	
Profit Factor	2.64	2.37	2.94	
Total Number of Trades	86	43	43	
Percent Profitable	44.19%	46.51%	41.86%	
Winning Trades	38	20	18	
Losing Trades	48	23	25	
Even Trades	0	0	0	
Avg. Trade Net Profit	\$106.70	\$92.50	\$120.90	
Avg. Winning Trade	\$388.28	\$344.12	\$437.34	
Avg. Losing Trade	(\$116.22)	(\$126.31)	(\$106.93)	
Ratio Avg. Win:Avg. Loss	3.34	2.72	4.09	
Largest Winning Trade	\$2,077.64	\$1,071.46	\$2,077.64	
Largest Losing Trade	(\$346.02)	(\$346.02)	(\$288.70)	
Max. Consecutive Winning Trades	4	4	4	
Max. Consecutive Losing Trades	6	4	6	
Avg. Bars in Winning Trades	143.47	140.95	146.28	
Avg. Bars in Losing Trades	40.04	52.39	28.68	
Avg. Bars in Even Trades	0.00	0.00	0.00	
Max. Shares/Contracts Held	33500	33500	33100	
Total Shares/Contracts Held	2752600	1361700	1390900	
Account Size Required	\$1,013.07	\$725.96	\$1,219.33	
Return on Initial Capital	9.18%			
Annual Rate of Return	7.32%			
Return Retracement Ratio	1.29			
RINA Index	53.81			
Trading Period	1 Yr, 2 Mths, 10 Dys, 22 Hrs			
Percent of Time in the Market	98.46%			
Max. Equity Run-up	\$9,529.81			

Double EMA Cross III (entries and exits at highest-highs and lowest-lows of previous bars, exits when profit target and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
IQP_Test3 - Price	Close
IQP_Test3 - Fast_Length	12
IQP_Test3 - Slow_Length	27
IQP_Test3 - Trigger_Length_Long	7
IQP_Test3 - Trigger_Length_Short	1
IQP_Test3 - ShareOrPosition	2
IQP_Test3 - ProfitTargetAmt	420
IQP_Test3 - StopLossAmt	400
IQP_Test3 - BreakevenFloorAmt	0
IQP_Test3 - DollarTrailingAmt	0
IQP_Test3 - PctTrailingFloorAmt	0
IQP_Test3 - PctTrailingPct	0
IQP_Test3 - ExitOnClose	false



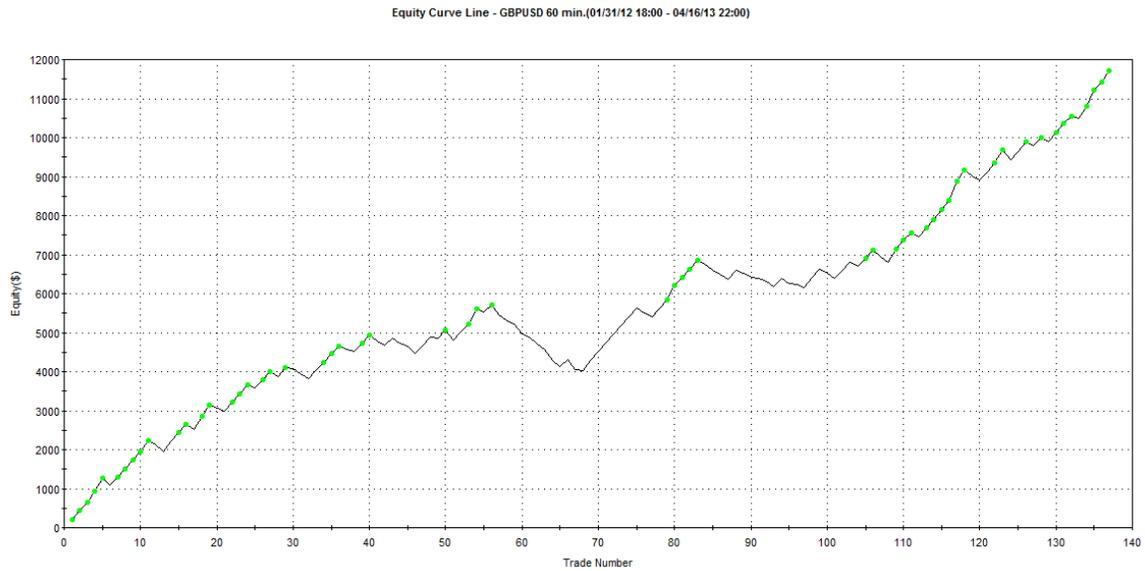
## TradeStation Performance Summary

Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$10,200.74	\$4,057.15	\$6,143.59
Gross Profit	\$18,599.55	\$8,836.91	\$9,762.64
Gross Loss	(\$8,398.81)	(\$4,779.76)	(\$3,619.05)
Profit Factor	2.21	1.85	2.70
Total Number of Trades	122	64	58
Percent Profitable	46.72%	43.75%	50.00%
Winning Trades	57	28	29
Losing Trades	65	36	29
Even Trades	0	0	0
Avg. Trade Net Profit	\$83.61	\$63.39	\$105.92
Avg. Winning Trade	\$326.31	\$315.60	\$336.64
Avg. Losing Trade	(\$129.21)	(\$132.77)	(\$124.79)
Ratio Avg. Win:Avg. Loss	2.53	2.38	2.70
Largest Winning Trade	\$586.90	\$450.30	\$586.90
Largest Losing Trade	(\$200.30)	(\$200.30)	(\$200.30)
Max. Consecutive Winning Trades	10	3	8
Max. Consecutive Losing Trades	10	5	9
Avg. Bars in Winning Trades	56.07	60.54	51.76
Avg. Bars in Losing Trades	22.08	21.39	22.93
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	33500	33500	33100
Total Shares/Contracts Held	3891200	2059200	1832000
Account Size Required	\$1,309.98	\$583.97	\$1,152.40
Return on Initial Capital	10.20%		
Annual Rate of Return	8.08%		
Return Retracement Ratio	1.25		
RINA Index	167.37		
Trading Period	1 Yr, 2 Mths, 12 Dys, 2 Hrs		
Percent of Time in the Market	60.76%		
Max. Equity Run-up	\$11,105.31		

Double EMA Cross IV (entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs		
Description		Value
IQP_Test4 - Price		Close
IQP_Test4 - Fast_Length		6
IQP_Test4 - Slow_Length		36
IQP_Test4 - Trigger_Length_Long		6
IQP_Test4 - Trigger_Length_Short		1
IQP_Test4 - ShareOrPosition		2
IQP_Test4 - ProfitTargetAmt		0
IQP_Test4 - StopLossAmt		400
IQP_Test4 - BreakevenFloorAmt		0
IQP_Test4 - DollarTrailingAmt		0
IQP_Test4 - PctTrailingFloorAmt		200
IQP_Test4 - PctTrailingPct		2
IQP_Test4 - ExitOnClose		false



## TradeStation Performance Summary

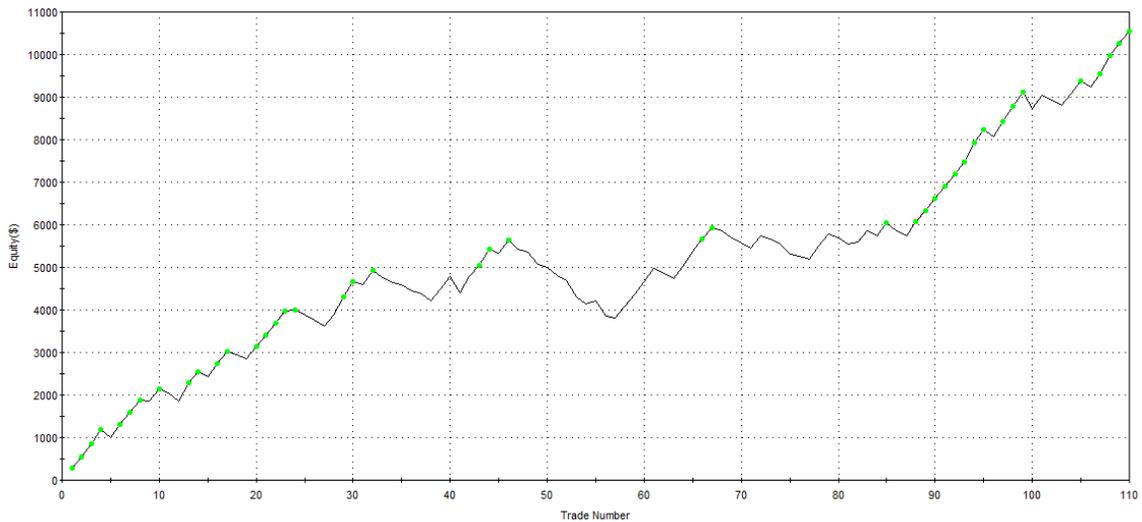
Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$11,714.48	\$5,840.03	\$5,874.45
Gross Profit	\$19,031.22	\$8,968.67	\$10,062.54
Gross Loss	(\$7,316.74)	(\$3,128.64)	(\$4,188.10)
Profit Factor	2.60	2.87	2.40
Total Number of Trades	137	64	73
Percent Profitable	57.66%	57.81%	57.53%
Winning Trades	79	37	42
Losing Trades	58	27	31
Even Trades	0	0	0
Avg. Trade Net Profit	\$85.51	\$91.25	\$80.47
Avg. Winning Trade	\$240.90	\$242.40	\$239.58
Avg. Losing Trade	(\$126.15)	(\$115.88)	(\$135.10)
Ratio Avg. Win:Avg. Loss	1.91	2.09	1.77
Largest Winning Trade	\$474.42	\$425.69	\$474.42
Largest Losing Trade	(\$275.29)	(\$275.23)	(\$275.29)
Max. Consecutive Winning Trades	7	5	7
Max. Consecutive Losing Trades	9	4	8
Avg. Bars in Winning Trades	21.23	21.54	20.95
Avg. Bars in Losing Trades	17.93	16.22	19.42
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	33500	33500	33100
Total Shares/Contracts Held	4373200	2066100	2307100
Account Size Required	\$1,702.96	\$482.34	\$1,622.03
Return on Initial Capital	11.71%		
Annual Rate of Return	9.21%		
Return Retracement Ratio	1.37		
RINA Index	369.33		
Trading Period	1 Yr, 2 Mths, 12 Dys, 2 Hrs		
Percent of Time in the Market	30.96%		
Max. Equity Run-up	\$11,916.80		

Double EMA Cross V (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
IQP_Test5 - Price	Close
IQP_Test5 - EMA_Fast	12
IQP_Test5 - EMA_Slow	24
IQP_Test5 - Trigger_Length_Long	1
IQP_Test5 - Trigger_Length_Short	2
IQP_Test5 - ShareOrPosition	2
IQP_Test5 - ProfitTargetAmt	0
IQP_Test5 - StopLossAmt	400
IQP_Test5 - BreakevenFloorAmt	0
IQP_Test5 - DollarTrailingAmt	0
IQP_Test5 - PctTrailingFloorAmt	200
IQP_Test5 - PctTrailingPct	2
IQP_Test5 - ExitOnClose	false

Equity Curve Line - GBPUSD 60 min.(01/31/12 18:00 - 04/16/13 23:00)



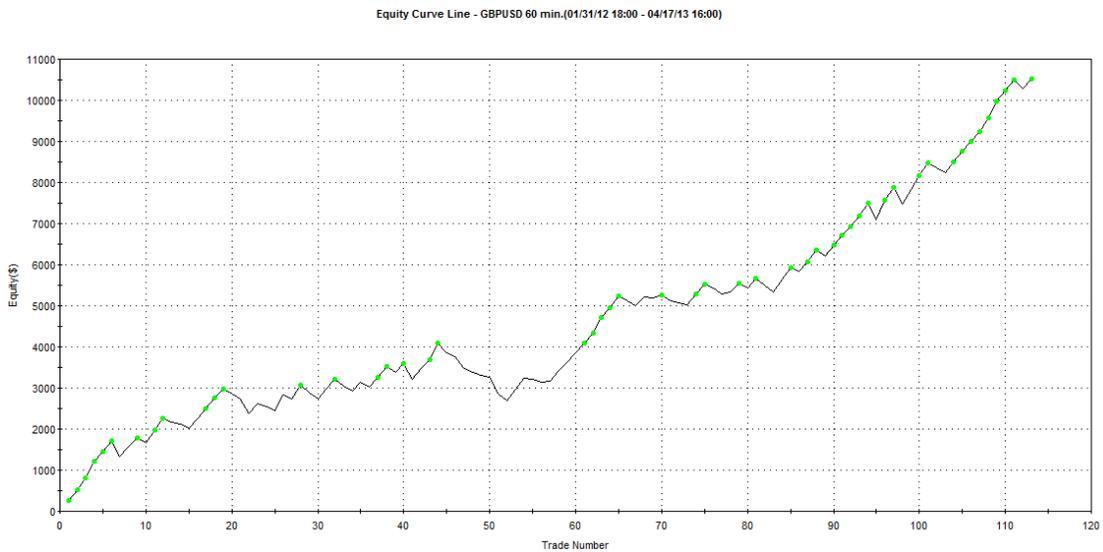
## TradeStation Performance Summary

Expand ▾

	All Trades	Long Trades	Short Trades
Total Net Profit	\$10,549.50	\$5,705.60	\$4,843.90
Gross Profit	\$17,710.87	\$8,854.94	\$8,855.93
Gross Loss	(\$7,161.37)	(\$3,149.34)	(\$4,012.03)
Profit Factor	2.47	2.81	2.21
Total Number of Trades	110	53	57
Percent Profitable	54.55%	54.72%	54.39%
Winning Trades	60	29	31
Losing Trades	50	24	26
Even Trades	0	0	0
Avg. Trade Net Profit	\$95.90	\$107.65	\$84.98
Avg. Winning Trade	\$295.18	\$305.34	\$285.68
Avg. Losing Trade	(\$143.23)	(\$131.22)	(\$154.31)
Ratio Avg. Win:Avg. Loss	2.06	2.33	1.85
Largest Winning Trade	\$469.58	\$426.05	\$469.58
Largest Losing Trade	(\$375.29)	(\$375.22)	(\$375.29)
Max. Consecutive Winning Trades	8	4	8
Max. Consecutive Losing Trades	8	4	7
Avg. Bars in Winning Trades	32.57	30.86	34.16
Avg. Bars in Losing Trades	26.42	23.00	29.58
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	33500	33500	33100
Total Shares/Contracts Held	3519100	1714900	1804200
Account Size Required	\$1,836.10	\$428.04	\$1,636.73
Return on Initial Capital	10.55%		
Annual Rate of Return	8.34%		
Return Retracement Ratio	1.42		
RINA Index	229.77		
Trading Period	1 Yr, 2 Mths, 12 Dys, 3 Hrs		
Percent of Time in the Market	39.71%		
Max. Equity Run-up	\$10,751.81		

Double EMA Cross VI (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA and slope, exits with trailing stops and maximum loss stops)

TradeStation Strategy Inputs	
Description	Value
IQP_Test - Price	Close
IQP_Test - EMA_Fast	6
IQP_Test - EMA_Slow	42
IQP_Test - LengthSlope	2
IQP_Test - Trigger_Length_Long	1
IQP_Test - Trigger_Length_Short	3
IQP_Test - ShareOrPosition	2
IQP_Test - ProfitTargetAmt	0
IQP_Test - StopLossAmt	400
IQP_Test - BreakevenFloorAmt	0
IQP_Test - DollarTrailingAmt	0
IQP_Test - PctTrailingFloorAmt	225
IQP_Test - PctTrailingPct	1
IQP_Test - ExitOnClose	false



## TradeStation Performance Summary

Expand 

	All Trades	Long Trades	Short Trades
Total Net Profit	\$10,514.17	\$4,460.96	\$6,053.21
Gross Profit	\$17,590.75	\$8,595.39	\$8,995.36
Gross Loss	(\$7,076.58)	(\$4,134.43)	(\$2,942.15)
Profit Factor	2.49	2.08	3.06
Total Number of Trades	113	56	57
Percent Profitable	59.29%	57.14%	61.40%
Winning Trades	67	32	35
Losing Trades	46	24	22
Even Trades	0	0	0
Avg. Trade Net Profit	\$93.05	\$79.66	\$106.20
Avg. Winning Trade	\$262.55	\$268.61	\$257.01
Avg. Losing Trade	(\$153.84)	(\$172.27)	(\$133.73)
Ratio Avg. Win:Avg. Loss	1.71	1.56	1.92
Largest Winning Trade	\$474.42	\$425.69	\$474.42
Largest Losing Trade	(\$400.30)	(\$400.30)	(\$400.04)
Max. Consecutive Winning Trades	9	4	10
Max. Consecutive Losing Trades	8	5	6
Avg. Bars in Winning Trades	25.42	29.75	21.46
Avg. Bars in Losing Trades	25.48	25.79	25.14
Avg. Bars in Even Trades	0.00	0.00	0.00
Max. Shares/Contracts Held	33400	33400	33100
Total Shares/Contracts Held	3580800	1775500	1805300
Account Size Required	\$1,398.68	\$853.70	\$1,215.11
Return on Initial Capital	10.51%		
Annual Rate of Return	8.30%		
Return Retracement Ratio	1.31		
RINA Index	283.99		
Trading Period	1 Yr, 2 Mths, 12 Dys, 20 Hrs		
Percent of Time in the Market	34.41%		
Max. Equity Run-up	\$10,660.61		

## Appendix C: EasyLanguage Codes

The following section shows the EasyLanguage codes for the Final Strategy, the six strategies made in the process of developing the final robot, and the additional strategy that Steven developed but did not fit the group's objectives so it was not used.

### FINAL STRATEGY CODE

Final Strategy - Monday, April 15, 2013, 17:05:37

```
Inputs:
Price ( Close ), { the type of price used }
EMA Fast ( 6 ), { the number of bars used for the fast EMA }
EMA Slow ( 16 ), { the number of bars used for the slow EMA }
LengthSlope (2), { the number of bars used for the slope calculation }
Trigger_Length_Long_Entry ( 2 ), { the number of bars considered for the long
entry }
Trigger_Length_Short_Entry ( 4 ), { the number of bars considered for the short
entry }
Trigger_Length_Long_Exit ( 6 ), { the number of bars considered to exit a long
position}
Trigger_Length_Short_Exit ( 1 ), { the number of bars considered to exit a short
position }
ShareOrPosition( 2 ), { pass in 1 for per share basis, 2 for position basis }
ProfitTargetAmt( 0 ), { pass in 0 if you don't want a profit target }
StopLossAmt( 400 ), { pass in 0 if you don't want a stop loss }
BreakevenFloorAmt( 0 ), { pass in 0 if you don't want a breakeven stop }
DollarTrailingAmt( 0 ), { pass in 0 if you don't want a dollar trailing stop }
PctTrailingFloorAmt( 250 ), { amount of the percent trailing stop }
PctTrailingPct( 2 ), { value for the percent trailing stop }
ExitOnClose( false ); { pass in true if you want to exit the position at the
close of the day, else pass in false }

Variables:
MP ( 0 ), { the variable used for MarketPosition }
Fast_Line ( 0 ), { the calculation of the fast EMA }
Slow_Line ( 0 ), { the calculation of the slow EMA }
EMA50 (0), { the calculation of the EMA50 }
LinReg ( 0 ), { the variable for the linear regression }
Slope ( 0 ), { the variable for the calculation of the slope }
TgtBar (0), { use current bar when the linear regression is being done }
oLRSlope (0), { the slope of the linear regression line }
oLRAngle (0), { the angle of the linear regression line in degrees }
oLRIntercept (0), { value at which the linear regression line crosses the current
bar position }
oLRValueRaw (0); { variable necessary to do the linear regression }

MP = MarketPosition ; { setting MP as the MarketPosition }
Fast_Line = XAverage ( Price , EMA_Fast ) ; { calculation of the fast EMA }
Slow_Line = XAverage ( Price , EMA_Slow ) ; { calculation of the slow EMA }
EMA50 = XAverage( Price, 50 ) ; { calculation of the EMA50 }

LinReg = LinearReg(EMA50, LengthSlope, TgtBar, oLRSlope, oLRAngle, oLRIntercept,
oLRValueRaw); { calculation of the linear regression }

Slope= oLRSlope * 1000; { slope being scaled to PIPs }

If MP = 0 then { when there are no positions open }
Begin
If Slope>0 and Fast_Line Crosses Over the Slow_Line and EMA50 < Price
Then { long entry condition }
Buy ( "LE" ) Next Bar at Highest ( High , Trigger_Length_Long_Entry )
Stop;

If Slope<0 and Fast_Line Crosses Under the Slow_Line and EMA50 > Price
Then { short entry condition }
Sell Short ( "SE" ) Next Bar at Lowest ( Low ,
Trigger_Length_Short_Entry ) Stop ;
end;

If MP > 0 then { when there is a long position }
Begin
If Fast_Line Crosses Under the Slow_Line Then { exit if EMAs cross
in opposite direction }
Sell Short ( "SL" ) Next Bar at Lowest ( Low ,
Trigger_Length_Short_Exit ) Stop ;
```

```

    if ProfitTargetAmt > 0 then
        SetProfitTarget( ProfitTargetAmt ) ;
    if StopLossAmt > 0 then
        SetStopLoss( StopLossAmt ) ;    { exit if StopLoss condition is
met }
    if BreakevenFloorAmt > 0 then
        SetBreakeven( BreakevenFloorAmt ) ;
    if DollarTrailingAmt > 0 then
        SetDollarTrailing( DollarTrailingAmt ) ;
    if PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then { exit if
Trailing Stop condition is met }
        SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
    if ExitOnClose = true then
        SetExitOnClose ;
    end;

    If MP < 0 then { when there is a long position }
        Begin
            if Fast_Line Crosses Over the Slow_Line then    { exit if EMAs
cross in opposite direction }
                Buy ( "SS" ) Next Bar at Highest ( High , Trigger_Length_Long_Exit
) Stop;

                if ProfitTargetAmt > 0 then
                    SetProfitTarget( ProfitTargetAmt ) ;
                if StopLossAmt > 0 then
                    SetStopLoss( StopLossAmt ) ;    { exit if StopLoss condition
is met }

                if BreakevenFloorAmt > 0 then
                    SetBreakeven( BreakevenFloorAmt ) ;
                if DollarTrailingAmt > 0 then
                    SetDollarTrailing( DollarTrailingAmt ) ;
                if PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then { exit if
Trailing Stop condition is met }
                    SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
                if ExitOnClose = true then
                    SetExitOnClose ;
                end;

        Commentary (
            " Fast_Line = " , Fast_Line , Newline+
            " Slow_Line = " , Slow_Line , Newline+
            " Market Position = " , MP , Newline
        ) ;

```

## Double EMA Cross I (entries and exits at market price)

IQP\_Simple - Monday, April 15, 2013, 17:55:41

---

```
Inputs:
Price ( Close ) ,
Fast_Length ( 7 ) ,
Slow_Length ( 30 ) ,
Trigger_Long ( 1 ) ,
Trigger_Short ( 1 ) ;

Variables:
MP ( 0 ) ,
Price_entry ( 0 ) ,
Fast_Line ( 0 ) ,
Slow_Line ( 0 ) ;

MP = MarketPosition ;
Fast_Line = XAverage ( Price , Fast_Length ) ;
Slow_Line = XAverage ( Price , Slow_Length ) ;

    if Fast_Line Crosses Over the Slow_Line then
    Buy ( "LE" ) Next Bar at Market;

    If Fast_Line Crosses Under the Slow_Line Then
    Sell Short ( "SE" ) Next Bar at Market;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;
```

## Double EMA Cross II (entries and exits at highest-highs and lowest-lows of previous bars)

IQP\_Simple - Monday, April 15, 2013, 17:44:14

---

```
Inputs:
Price ( Close ) ,
Fast_Length ( 7 ) ,
Slow_Length ( 30 ) ,
Trigger_Long ( 1 ) ,
Trigger_Short ( 1 ) ;

Variables:
MP ( 0 ) ,
Price_entry ( 0 ) ,
Fast_Line ( 0 ) ,
Slow_Line ( 0 ) ;

MP = MarketPosition ;
Fast_Line = XAverage ( Price , Fast_Length ) ;
Slow_Line = XAverage ( Price , Slow_Length ) ;

    if Fast_Line Crosses Over the Slow_Line then
    Buy ( "LE" ) Next Bar at Highest ( High , Trigger_Long ) Stop;

    If Fast_Line Crosses Under the Slow_Line Then
    Sell Short ( "SE" ) Next Bar at Lowest ( Low , Trigger_Short ) Stop ;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;
```

## Double EMA Cross III (entries and exits at highest-highs and lowest-lows of previous bars, exits when profit target and maximum loss stops)

IQP\_Simple2 - Monday, April 15, 2013, 18:33:51

```
Inputs:
Price ( Close ) ,
Fast_Length ( 7 ) ,
Slow_Length ( 30 ) ,
Trigger_Length_Long ( 1 ) ,
Trigger_Length_Short ( 8 ) ,
ShareOrPosition( 2 ) , { pass in 1 for per share basis, 2 for position basis }
ProfitTargetAmt( 300 ) , { pass in 0 if you don't want a profit target }
StopLossAmt( 400 ) , { pass in 0 if you don't want a stop loss }
BreakevenFloorAmt( 0 ) , { pass in 0 if you don't want a breakeven stop }
DollarTrailingAmt( 0 ) , { pass in 0 if you don't want a dollar trailing stop }
PctTrailingFloorAmt( 0 ) , { pass in 0 here and/or in next input if you don't want
    a percent trailing stop }
PctTrailingPct( 0 ) , { pass in 0 here and/or in previous input if you don't want
    a percent trailing stop; else pass in XX for XX percent }
ExitOnClose( false ) ; { pass in true if you want to exit the position at the
    close of the day, else pass in false. CAUTION: We recommend that you set this
to
    TRUE only for back-testing, if at all; in automated execution, the exit order
will NOT be filled at the close of the day; instead, the order can be sent
into
    the extended session as a limit order. }

Variables:
MP ( 0 ) ,
Price_entry ( 0 ) ,
Fast_Line ( 0 ) ,
Slow_Line ( 0 ) ;

MP = MarketPosition ;
Fast_Line = XAverage ( Price , Fast_Length ) ;
Slow_Line = XAverage ( Price , Slow_Length ) ;

if Fast_Line Crosses Over the Slow_Line then
Buy ( "LE" ) Next Bar at Highest ( High , Trigger_Length_Long ) Stop;

If Fast_Line Crosses Under the Slow_Line Then
Sell Short ( "SE" ) Next Bar at Lowest ( Low , Trigger_Length_Short ) Stop ;

If Fast_Line Crosses Under the Slow_Line Then
Sell Short ( "ST" ) Next Bar at Lowest ( Low , Trigger_Length_Short ) Stop ;
if ProfitTargetAmt > 0 then
    SetProfitTarget( ProfitTargetAmt ) ;
if StopLossAmt > 0 then
    SetStopLoss( StopLossAmt ) ;
if BreakevenFloorAmt > 0 then
    SetBreakeven( BreakevenFloorAmt ) ;
if DollarTrailingAmt > 0 then
    SetDollarTrailing( DollarTrailingAmt ) ;
if PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then
    SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
if ExitOnClose = true then
    SetExitOnClose ;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;
```

## Double EMA Cross IV (entries and exits at highest-highs and lowest-lows of previous bars, exits with trailing stops and maximum loss stops)

IQP\_Simple2 - Monday, April 15, 2013, 18:45:18

```

Inputs:
Price ( Close ) ,
Fast_Length ( 7 ) ,
Slow_Length ( 30 ) ,
Trigger_Length_Long ( 1 ) ,
Trigger_Length_Short ( 8 ) ,
ShareOrPosition( 2 ), { pass in 1 for per share basis, 2 for position basis }
ProfitTargetAmt( 0 ), { pass in 0 if you don't want a profit target }
StopLossAmt( 400 ), { pass in 0 if you don't want a stop loss }
BreakevenFloorAmt( 0 ), { pass in 0 if you don't want a breakeven stop }
DollarTrailingAmt( 0 ), { pass in 0 if you don't want a dollar trailing stop }
PctTrailingFloorAmt( 100 ), { pass in 0 here and/or in next input if you don't
want
a percent trailing stop }
PctTrailingPct( 2 ), { pass in 0 here and/or in previous input if you don't want
a percent trailing stop; else pass in XX for XX percent }
ExitOnClose( false ); { pass in true if you want to exit the position at the
close of the day, else pass in false. CAUTION: We recommend that you set this
to
TRUE only for back-testing, if at all; in automated execution, the exit order
will NOT be filled at the close of the day; instead, the order can be sent
into
the extended session as a limit order. }

Variables:
MP ( 0 ) ,
Price_entry ( 0 ) ,
Fast_Line ( 0 ) ,
Slow_Line ( 0 ) ;

MP = MarketPosition ;
Fast_Line = XAverage ( Price , Fast_Length ) ;
Slow_Line = XAverage ( Price , Slow_Length ) ;

if Fast_Line Crosses Over the Slow_Line then
Buy ( "LE" ) Next Bar at Highest ( High , Trigger_Length_Long ) Stop;

If Fast_Line Crosses Under the Slow_Line Then
Sell Short ( "SE" ) Next Bar at Lowest ( Low , Trigger_Length_Short ) Stop ;

If Fast_Line Crosses Under the Slow_Line Then
Sell Short ( "ST" ) Next Bar at Lowest ( Low , Trigger_Length_Short ) Stop ;
if ProfitTargetAmt > 0 then
SetProfitTarget( ProfitTargetAmt ) ;
if StopLossAmt > 0 then
SetStopLoss( StopLossAmt ) ;
if BreakevenFloorAmt > 0 then
SetBreakeven( BreakevenFloorAmt ) ;
if DollarTrailingAmt > 0 then
SetDollarTrailing( DollarTrailingAmt ) ;
if PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then
SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
if ExitOnClose = true then
SetExitOnClose ;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;

```

## Double EMA Cross V (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA, exits with trailing stops and maximum loss stops)

\*Strategy 5 ML - Wednesday, April 17, 2013, 19:21:06

```

Inputs:
Price ( Close ), { the type of price used }
EMA_Fast ( 6 ), { the number of bars used for the fast EMA }
EMA_Slow ( 16 ), { the number of bars used for the slow EMA }
Trigger_Length_Long( 2 ), { the number of bars considered for the long entry }
Trigger_Length_Short( 4 ), { the number of bars considered for the short entry }
}
ShareOrPosition( 2 ), { pass in 1 for per share basis, 2 for position basis }
ProfitTargetAmt( 0 ), { pass in 0 if you don't want a profit target }
StopLossAmt( 400 ), { pass in 0 if you don't want a stop loss }
BreakevenFloorAmt( 0 ), { pass in 0 if you don't want a breakeven stop }
DollarTrailingAmt( 0 ), { pass in 0 if you don't want a dollar trailing stop }
PotTrailingFloorAmt( 250 ), { profit target to activate the trailing stop }
PctTrailingPct( 2 ), { value for the percent trailing stop }
ExitOnClose( false ); { pass in true if you want to exit the position at the
close of the day, else pass in false }

Variables:
MP ( 0 ), { the variable used for MarketPosition }
Fast_Line ( 0 ), { the calculation of the fast EMA }
Slow_Line ( 0 ), { the calculation of the slow EMA }
EMA50 ( 0 ), { the calculation of the EMA50 }
LinReg ( 0 ), { the variable for the linear regression }
Slope ( 0 ), { the variable for the calculation of the slope }
TgtBar ( 0 ), { use current bar when the linear regression is being done }
oLRSlope ( 0 ), { the slope of the linear regression line }
oLRAngle ( 0 ), { the angle of the linear regression line in degrees }
oLRIntercept ( 0 ), { value at which the linear regression line crosses the current
bar position }
oLRValueRaw ( 0 ); { variable necessary to do the linear regression }

MP = MarketPosition ; { setting MP as the MarketPosition }
Fast_Line = XAverage ( Price , EMA_Fast ) ; { calculation of the fast
EMA }
Slow_Line = XAverage ( Price , EMA_Slow ) ; { calculation of the slow EMA }
EMA50 = XAverage( Price, 50 ) ; { calculation of the EMA50 }

If MP = 0 then { when there are no positions open }
Begin
Slow_Line and EMA50 < Price Then { long entry condition }
Buy ( "LE" ) Next Bar at Highest
( High , Trigger_Length_Long ) Stop;

Slow_Line and EMA50 > Price Then { short entry condition }
Sell Short ( "SE" ) Next Bar at
Lowest ( Low , Trigger_Length_Short ) Stop ;
end;

If MP > 0 then { when there is a long position }
Begin
Slow_Line Then { exit if EMAs cross in opposite direction }
Sell Short ( "SL" ) Next Bar at
Lowest ( Low , Trigger_Length_Short ) Stop ;

if ProfitTargetAmt > 0 then
SetProfitTarget(
ProfitTargetAmt ) ;
if StopLossAmt > 0 then
SetStopLoss(
StopLossAmt ) ; { exit if StopLoss condition is met }
if BreakevenFloorAmt > 0 then
SetBreakeven(
BreakevenFloorAmt ) ;
if DollarTrailingAmt > 0 then
SetDollarTrailing( DollarTrailingAmt ) ;
if PctTrailingFloorAmt > 0 and
PotTrailingPct > 0 then { exit if Trailing Stop condition is met }

```

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```
SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
                                if ExitOnClose = true then
                                SetExitOnClose ;
                                end;
                                If MP < 0 then    { when there is a long position
}
                                Begin
Crosses Over the Slow_Line then    { exit if EMAs cross in opposite direction }
                                if Fast_Line
Bar at Highest ( High , Trigger_Length_Long ) Stop;                                Buy ( "SS" ) Next
                                if
ProfitTargetAmt > 0 then
                                if StopLossAmt >
SetProfitTarget( ProfitTargetAmt ) ;
                                0 then
SetStopLoss( StopLossAmt ) ;    { exit if StopLoss condition is met }
                                if
BreakevenFloorAmt > 0 then
                                if
SetBreakeven( BreakevenFloorAmt ) ;
                                DollarTrailingAmt > 0 then
                                if
SetDollarTrailing( DollarTrailingAmt ) ;
                                PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then { exit if Trailing Stop
                                condition is met }
SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
                                if ExitOnClose =
true then
SetExitOnClose ;
                                end;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;
```

## Double EMA Cross VI (entries and exits at highest-highs and lowest-lows of previous bars if above or below 50 EMA and slope, exits with trailing stops and maximum loss stops)

\*Strategy 6 ML - Wednesday, April 17, 2013, 19:14:13

```

Inputs:
Price ( Close ), { the type of price used }
EMA_Fast ( 6 ), { the number of bars used for the fast EMA }
EMA_Slow ( 16 ), { the number of bars used for the slow EMA }
LengthSlope (2), { the number of bars used for the slope calculation }
Trigger_Length_Long ( 2 ), { the number of bars considered for the long entry }
Trigger_Length_Short ( 4 ), { the number of bars considered for the short entry }
}
ShareOrPosition( 2 ), { pass in 1 for per share basis, 2 for position basis }
ProfitTargetAmt( 0 ), { pass in 0 if you don't want a profit target }
StopLossAmt( 400 ), { pass in 0 if you don't want a stop loss }
BreakevenFloorAmt( 0 ), { pass in 0 if you don't want a breakeven stop }
DollarTrailingAmt( 0 ), { pass in 0 if you don't want a dollar trailing stop }
PctTrailingFloorAmt( 250 ), { amount of the percent trailing stop }
PctTrailingPct( 2 ), { value for the percent trailing stop }
ExitOnClose( false ); { pass in true if you want to exit the position at the
close of the day, else pass in false }

Variables:
MP ( 0 ), { the variable used for MarketPosition }
Fast_Line ( 0 ), { the calculation of the fast EMA }
Slow_Line ( 0 ), { the calculation of the slow EMA }
EMA50 (0), { the calculation of the EMA50 }
LinReg ( 0 ), { the variable for the linear regression }
Slope ( 0 ), { the variable for the calculation of the slope }
TgtBar (0), { use current bar when the linear regression is being done }
oLRSlope (0), { the slope of the linear regression line }
oLRAngle (0), { the angle of the linear regression line in degrees }
oLRIntercept (0), { value at which the linear regression line crosses the current
bar position }
oLRValueRaw (0): { variable necessary to do the linear regression }

MP = MarketPosition ; { setting MP as the MarketPosition }
Fast_Line = XAverage ( Price , EMA_Fast ); { calculation of the fast
EMA }
Slow_Line = XAverage ( Price , EMA_Slow ); { calculation of the slow EMA
}
EMA50 = XAverage( Price, 50 ); { calculation of the EMA50 }

LinReg = LinearReg(EMA50, LengthSlope, TgtBar, oLRSlope, oLRAngle, oLRIntercept,
oLRValueRaw); { calculation of the linear regression }

Slope= oLRSlope * 1000; { slope being scaled to PIPs }

If MP = 0 then { when there are no positions open }
Begin
If Slope>0 and Fast_Line Crosses
Over the Slow_Line and EMA50 < Price Then { long entry condition }
Buy ( "LE" ) Next Bar at Highest
( High , Trigger_Length_Long ) Stop;

If Slope<0 and Fast_Line Crosses
Under the Slow_Line and EMA50 > Price Then { short entry condition }
Sell Short ( "SE" ) Next Bar at
Lowest ( Low , Trigger_Length_Short ) Stop ;
end;

If MP > 0 then { when there is a long position }
Begin
If Fast_Line Crosses Under the
Slow_Line Then { exit if EMAs cross in opposite direction }
Sell Short ( "SL" ) Next Bar at
Lowest ( Low , Trigger_Length_Short ) Stop ;

if ProfitTargetAmt > 0 then
SetProfitTarget(
ProfitTargetAmt ) ;
if StopLossAmt > 0 then
SetStopLoss(
StopLossAmt ) ; { exit if StopLoss condition is met }
if BreakevenFloorAmt > 0 then
SetBreakeven(
BreakevenFloorAmt ) ;

```

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```

                                                                    if DollarTrailingAmt > 0 then
SetDollarTrailing( DollarTrailingAmt ) ;
                                                                    if PctTrailingFloorAmt > 0 and
PctTrailingPct > 0 then { exit if Trailing Stop condition is met }
SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
                                                                    if ExitOnClose = true then
                                                                    SetExitOnClose ;
                                                                    end;
                                                                    If MP < 0 then { when there is a long position
}
                                                                    Begin
                                                                    if Fast_Line
Crosses Over the Slow_Line then { exit if EMAs cross in opposite direction }
                                                                    Buy ( "SS" ) Next
Bar at Highest ( High , Trigger_Length_Long ) Stop;
                                                                    if
ProfitTargetAmt > 0 then
                                                                    if StopLossAmt >
SetProfitTarget( ProfitTargetAmt ) ;
                                                                    0 then
SetStopLoss( StopLossAmt ) ; { exit if StopLoss condition is met }
                                                                    if
BreakevenFloorAmt > 0 then
                                                                    if
SetBreakeven( BreakevenFloorAmt ) ;
                                                                    DollarTrailingAmt > 0 then
                                                                    SetDollarTrailing( DollarTrailingAmt ) ;
                                                                    if
PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then { exit if Trailing Stop
condition is met }
                                                                    if ExitOnClose =
SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
                                                                    true then
SetExitOnClose ;
                                                                    end;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;
```

## Additional Strategy (Steven)

IQP\_Strategy14 - Wednesday, April 17, 2013, 20:02:14

```
Inputs:
BarNum ( 2 ),
MinBar ( -18 ),
MaxBar ( 30 ),
Price ( Close ),
Fast_Length ( 7 ),
Slow_Length ( 30 ),
Trigger_Length_Long ( 1 ),
Trigger_Length_Short ( 7 ),
ShareOrPosition( 2 ), { pass in 1 for per share basis, 2 for position basis }
ProfitTargetAmt( 0 ), { pass in 0 if you don't want a profit target }
StopLossAmt( 400 ), { pass in 0 if you don't want a stop loss }
BreakevenFloorAmt( 0 ), { pass in 0 if you don't want a breakeven stop }
DollarTrailingAmt( 0 ), { pass in 0 if you don't want a dollar trailing stop }
PctTrailingFloorAmt( 200 ), { pass in 0 here and/or in next input if you don't
want
    a percent trailing stop }
PctTrailingPct( 1 ), { pass in 0 here and/or in previous input if you don't want
    a percent trailing stop; else pass in XX for XX percent }
ExitOnClose( false ); { pass in true if you want to exit the position at the
close of the day, else pass in false. CAUTION: We recommend that you set this
to
    TRUE only for back-testing, if at all; in automated execution, the exit order
will NOT be filled at the close of the day; instead, the order can be sent
into
    the extended session as a limit order. }

Variables:
MP ( 0 ),
Price_entry ( 0 ),
Fast_Line ( 0 ),
Slow_Line ( 0 ),
EMA50 ( 0 ),
CloseAvg ( 0 ),
OpenAvg ( 0 ),
OpenCloseAvg ( 0 ),
LinReg ( 0 ),
Slope ( 0 ),
Angle ( 0 ),
TgtBar ( 0 ),
oLRSlope(0),
oLRAngle(0),
oLRIntercept(0),
oLRValueRaw(0);

MP = MarketPosition ;
Fast_Line = XAverage ( Price , Fast_Length ) ;
Slow_Line = XAverage ( Price , Slow_Length ) ;
EMA50 = XAverage ( Price, 50);

LinReg = LinearReg(EMA50, 10, TgtBar, oLRSlope, oLRAngle, oLRIntercept,
oLRValueRaw);

Slope = oLRSlope*10000;

CloseAvg = Average (close, BarNum);
OpenAvg = Average (open, BarNum);

OpenCloseAvg = 10000 *(CloseAvg - OpenAvg);

If MP = 0 then
Begin
    if Fast Line Crosses Over the Slow Line {and EMA50 > Price} then
    {Buy ( "LE" ) Next Bar at Market ;}
```

```

Buy ( "LE" ) Next Bar at Highest ( High , Trigger_Length_Long ) Stop;

If Fast_Line Crosses Under the Slow_Line {and EMA50 < Price} Then
{Sell Short ( "SE" ) Next Bar at Market ;}
Sell Short ( "SE" ) Next Bar at Lowest ( Low , Trigger_Length_Short ) Stop
;

If OpenCloseAvg < MinBar then
    Sell Short ("Extra S") This Bar;

If OpenCloseAvg > MaxBar then
    Buy ("Extra L") This Bar;
end;

If MP > 0 then
Begin
If Fast_Line Crosses Under the Slow_Line and EMA50 < Price Then
{Sell Short ( "SE" ) Next Bar at Market ;}
Sell Short ( "ST" ) Next Bar at Lowest ( Low , Trigger_Length_Short ) Stop
;

if ProfitTargetAmt > 0 then
    SetProfitTarget( ProfitTargetAmt ) ;
if StopLossAmt > 0 then
    SetStopLoss( StopLossAmt ) ;
if BreakevenFloorAmt > 0 then
    SetBreakeven( BreakevenFloorAmt ) ;
if DollarTrailingAmt > 0 then
    SetDollarTrailing( DollarTrailingAmt ) ;
if PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then
    SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
if ExitOnClose = true then
    SetExitOnClose ;
{If OpenCloseAvg > 20 then
    Buy ("Extra L") This Bar;}
end;

If MP < 0 then
Begin
if Fast_Line Crosses Over the Slow_Line and EMA50 > Price then
{Buy ( "LE" ) Next Bar at Market ;}
Buy ( "LI" ) Next Bar at Highest ( High , Trigger_Length_Long ) Stop;
if ProfitTargetAmt > 0 then
    SetProfitTarget( ProfitTargetAmt ) ;
if StopLossAmt > 0 then
    SetStopLoss( StopLossAmt ) ;
if BreakevenFloorAmt > 0 then
    SetBreakeven( BreakevenFloorAmt ) ;
if DollarTrailingAmt > 0 then
    SetDollarTrailing( DollarTrailingAmt ) ;
if PctTrailingFloorAmt > 0 and PctTrailingPct > 0 then
    SetPercentTrailing( PctTrailingFloorAmt, PctTrailingPct ) ;
if ExitOnClose = true then
    SetExitOnClose ;

end;

Commentary (
" Fast_Line = " , Fast_Line , Newline+
" Slow_Line = " , Slow_Line , Newline+
" Market Position = " , MP , Newline
) ;

```

## Appendix D: Summaries of Articles Relevant to Trading Activity

In the following section, a summary of some articles relevant to the currencies the team was trading is presented. As mentioned in the methodologies section, it is important for traders to be aware of current events and news releases that may directly or indirectly affect the financial instrument that is being traded.

### *David B. Rivkin, Jr. and Lee A. Casey: The Myth of Government Default WSJ - 01/11/2013*

This article by Rivkin and Casey, published on the Wall Street Journal on January 11, 2013, speaks about three false arguments going on around that have been accepted by people. The first is that if the Congress doesn't approve to raise the debt ceiling, the US will have to default on the national debt. Secondly, federal entitlement programs are constitutionally protected from spending cuts. Finally, the third false argument is that the president can raise the debt ceiling on his own authority.

It is explained that the Congress's refusal to allow more borrowing due to debt ceiling will not provoke the US to default on its public debt. This is due to the fact that section 4 of the 14th amendment states "the validity of the public debt of the United States, authorized by law ... shall not be questioned". This section from the 14th amendment prevents the Congress from denying paying the lawfully incurred public debt. In other words, theoretically in the debt ceiling is not raised, it cannot put the United States' current creditors at risk.

Moreover the article explains how the 14th amendment does not include entitlement programs like Social Security as part of those protected "debts". So despite the white house claims that the debt ceiling must be raised to be able to pay the bills of these entitlement programs, these are not part of the so called "public debt". In fact, these entitlement programs can be reduced by the congress at any time.

Finally the third false argument is addressed by explaining that nowhere in the constitution the president is authorized to borrow or spend money without congressional approval.

The article concludes in an interesting way. After clearing up these very common false arguments, Rivkin and Casey talk about the real issue in the current debt ceiling debate. If the congress fails to increase the debt ceiling, the result would be major government spending cuts without affecting payments on public debt.

***Damian Paletta and Jon Hilsenrath: Ugly Choices Loom over Debt Clash WSJ - 01/14/2013***

In this article from The Wall Street Journal, Paletta and Hilsenrath discuss about some possible drastic steps the government could need to consider due to the debt ceiling. It first states that the Obama administration has said to have no backup plan to pay the bills if the Congress refuses to pay the \$16.4 trillion federal borrowing limit.

The article states that the treasury might need to consider some proposals such as selling assets like gold or mortgage-backed securities to raise funds, cutting all spending by 40%, or prioritizing payments. The proposal considered most viable was to pay the bills as tax revenue became available -which would in fact delay many payments. There are some estimates that say that the treasury will run short on cash some point between February 15 and March 1 if the debt ceiling is not raised.

The White House stated that it will not pursue the idea of minting the \$1 trillion platinum coin or borrowing beyond the ceiling by invoking the 14th amendment. However, in the House, the majority of the Republican Party says that they won't raise the ceiling without cutting expenses of the same amounts. President Obama clearly stated that he won't negotiate about the expense cut matter.

Currently the government spends 40% more than it takes, and of course borrows to cover the difference. If there is no raise in the ceiling, the Treasury won't be able to cover the bills and this could create a big chaos in the economy and financial markets.

The US government makes 80 million payments per month, so prioritizing this can be a complete nightmare when figuring which to pay first. The officials say this plan is unworkable since there is no fair way to pick which bill to pay among all the ones that come every day.

***Alan S. Blinder: The Debt Ceiling Is Scarier Than the Fiscal Cliff WSJ - 01/14/2013***

In this article, Alan S. Blinder starts by talking about the Fiscal Cliff, and how the measures that were taken were "better" than what could have been. However, the next big budget impasse over the federal debt is even more scarier than the Fiscal Cliff and it is approaching very fast. The republicans don't want to raise the debt ceiling, and reaching it will occur very soon. The government has never before crashed the debt ceiling so no one really knows for certain what could happen but it is certain that it will not be good. Even though the Congress raises the debt ceiling, the problems are not going to vanish. The Congress hasn't been able to pass a budget for several years, they just keep using a series of temporary continuing resolutions; the current resolution expires on March 27, 2013. Unless the congress passes another resolution, the government faces a shutdown like it happened 1995-96 when the government was obliged to declare many services inessential

(like national parks, museums, and more). All of these measures, the debt ceiling and the budget, if not solved could lead the US to another recession and financial crisis.

***Nina Koeppen & Brian Blackstone: Euro Crisis Damps German Growth WSJ - 01/16/2013***

Germany's economy started to fall in 2012 due to global weaker demand throughout southern Europe. Sales in the United States and China started to pick up, and expectations of European recovery have risen this year. The problem with exports is due to the weak situation of the rest of the euro-zone has a very low demand. After two straight years with a growing GDP of 3% or more, in 2012 Germany's GDP dropped to 0.7% (what means 0.5% in the last quarter or 2% throughout the year). A drop in investment was notable during the summer, but a supposed increase is expected due to machinery orders placed during October and November. The economist Steffen Elstner claims an expected increase in the GDP this quarter and a 0.7% this year because the demand coming from China is larger than the decrease in European demand, and also positive movements in consumption and construction. Germany's contraction is another one of the causes of the third quarter of contraction of the European Union's GDP at the end of last year. Andreas Rees, chief German economist at UniCredit, says GDP will increase 0.3% quarterly due to increases in the investment and the exports sector. Concluding that this year there are better expectations of Germany and the European Union as a whole.

***William Kemble-Diaz: U.K. Pound Loses Its Sterling Appeal WSJ - 01/16/2013***

The British pound seems to continue in a negative trend, which has been a big flag for some investors since this currency is considered one of the strongest in the market. There is also a fear that this could lead to a recession, which could be the third in the last five years. Another important fact that can weigh the pound is the measures that The Bank of England can take: reducing interest rates, something that hasn't happened since 2009 and would not contribute to investors willing to buy U.K. debt. Additional to that, Moody's Investors Service and Fitch Ratings might downgrade the triple-A credit ranking that the U.K. has it as of now. This measurements and possible decisions can make traders and investors stop considering the British pound as a strong currency.

Also, according to the information disclosed in the article, on Monday the pound hit a nine-month low against the euro and keeps getting weak compared with the US dollar. But, it is not all bad news for the U.K.'s economy, according to some analysts, having a weaker pound will benefit the exports of the country, which represent approximately 31% of the country's gross domestic product.

***Brian Blackstone: Bundesbank Head Cautions Japan WSJ - 01/21/2013***

In this article, Brian Blackstone addresses the warning Bundesbank president, Jens Weidman, gave Japan after they declared they were going to aim for an inflation of 2%. He

thinks that applying this policy will “politicize” the exchange rate by “pursuing an overly aggressive monetary policy”. Blackstone also points out that not only Japan’s government, but also Hungary’s are intervening in the duties of the central banks.

Weidman’s concern is that with a politicized exchange rate, the Euro could get stronger while other currencies get weaker; an outcome that will make European exports less attractive to the world’s markets. This would definitely harm the already troubled economies, like Spain’s and Italy’s. Other economists around the world also expressed their worries. Jean-Claude Juncker, from France, said the Japanese policy is worrying. Marco Valli also expressed his concern, stating that a rise of 10% in the currency means a loss of 0.8-percentage point from the gross domestic product after 6 months. Mervyn King, from the Bank of England, said that 2013 was going to be a challenging year since a lot of countries were going to try to push their currencies.

***Megumi Fujikawa, Tatsuo Ito & Takashi Nakamichi: Bank of Japan Relents, Raises Inflation Target WSJ - 01/22/2013***

In this article, the authors explain that the Central Bank of Japan decided to end their deflation and set the goal of having an inflation of 2%, different from the goal of 1% they had before. This measure was taken to help restore the growth of their economy.

This measure initially made the yen fall and the stocks prices in Japan to rise, but it didn’t last much. BOJ Gov. Masaaki Shirakawa warned that the goal of 2% wasn’t easy to fulfill and that “considerably drastic efforts are necessary” in order to achieve it. Even 2 of the 9 members of the BOJ policy’s board voted against adopting the measure because they said it was “highly unrealistic”. With this measure, the BOJ expects to have an increase of 10 trillion of Yens for the 2014 budget.

Hideo Kumano of Dai-Ichi Life is also skeptical of the policy. He said that he thought the BOJ wanted to impress everyone, but that they will end up coming short of what they expected. On the other hand, Naohiko Baba of Goldman Sachs thinks that the BOJ took the maximum action they could take, considering they have a governor change in April of this same year.

***Ainsley Thomson & Cassell Bryan-Low: U.K. Economy Turns Back Down WSJ - 01/25/2013***

Another analysis related to the U.K economy and specific to the British pound is made in this article. The main concentration of this article though is political reasons that are making the U.K. economy keep going down instead of recovering and improving as it is expected to do. As it has been discussed earlier, the U.K. economy is in danger to enter to the third recession in the last 4 years, which is a really clear prove that the economy is not being handled correctly by Cameron.

Another important concept that has been mentioned is the main indicator about this possible recession process, the first quarter of 2013 economic growth. If this value comes as expected, then Cameron will have a lot of pressure to take decisions that will have to help the U.K. get out of this recession hole that has been dragged in.

Another reason why the U.K. economy is not performing well is because the economy in the Euro region is slowly getting better. This makes the U.K. economy look bad compared to them and also to the U.S. that are the 3 biggest economies in the world.

#### ***Brian Blackstone & David Enrich: Europe's Banks Repay Aid Early WSJ - 01/25/2013***

This article discusses about how hundreds of European banks are paying back the billions of euros they have borrowed from the European Central Bank (ECB) since three years ago, when the region's crisis started. This is definitely a good show of confidence that the financial markets in the Eurozone are healing – at least for now. It is said that the ECB will get back €137 billion from 278 banks on January 30, 2013. It is important to notice that this is two years before they are due. The chairman and CEO of the Spanish bank BBVA stated, "It's a very good sign that the trust in the euro has come". Indeed, the euro hit a 10-month high against the US Dollar after the ECB published the repayment data. An ECB research paper released on January 23 estimates that these three-year loans will add between 0.7 and 0.8 to the GDP of the euro-zone by mid-2013. This is good news since in part it will allow banks to lend the money into the economy. It is interesting that not only the banks from the healthier parts of the euro-zone are beginning to pay back their loans early, but also those in economically stressed parts of the zone.

#### ***Jon Hilsenrath: How a Trust Deficit Is Hurting the Economy WSJ - 01/27/2013***

Jon Hilsenrath states an important point of view in this article, suggesting that one thing holding back the economic recovery is the lack of trust. The article states that trust is an essential enhancer for economic activity since it makes everyone –investors, employers, policy makers, and consumers– be willing to make transactions with each other. Giving an emphasis on Nobel-Prize winning economist Kenneth Arrow's point, "Virtually every commercial transaction has within itself an element of trust", Hilsenrath suggests that American economy is being hurt due to the lack of trust of its people. Some interesting surveys from University of Chicago and Northwestern University show that only one third of Americans trust banks, and one sixth trust the stock market and large corporations. Among many other statistics in this article, one of the most interesting ones point out that only one half of Americans trust the government to solve domestic problems. Another interesting point is that mistrust affects the relationship between the government and businesses. This is due to the increase of regulations that are implemented by regulators when they do not trust the businesses they monitor. Even though these regulations may be necessary, at the same time they hurt the economy by putting businesses on a tighter leash, continuing to increment the lack of trust turning into a vicious cycle.

***Enda Curran: Australian Dollar Out of Government Control, PM Gillard Says WSJ - 01/29/2013***

The Australian Prime Minister Julia Gillard has the purpose to add pressure to the central bank to cut rates. The strong Australian Dollar stays strong because of certain external factors that the government cannot manage. The reasons for this situation are: a weak global economy, a close to zero interest rates of many nations, the increasing view of Australia as a safe haven

The government needs to pressure the RBA (Reserve Bank of Australia) to cut interest rates with the purpose of easing the strength of the Aussie dollar. The actions are going to be taken this February 5th; the actions must be stronger than the ones taken in 2011 when the cut was of 1.75%, nowadays the Australian rates are too high for international standards in about 3%.

Some members of the bank's board believe that stronger actions must be takes, Heather Ridout believes there is a need of a more "active management". The actions would give some time for local business to get ready and prepared for the upcoming strong exchange rate.

***Francesco Guerrera: Currency War Has Started WSJ - 02/04/2013***

The article talks about the different economic situation occurring all over the world. Countries which economies are the actual engine of the world economy find themselves in difficult times, for example the United States, Japan, and China, as well as the whole European Union. China's economy which had been on the rise for a while has had problems with the value of their currency; because as the economy gains strength the currency does as well what is a problem because their economy depends on their cheap exports which would become much more expensive. China has been implementing the technique of devaluating its currency but the problem is that this strategy is harming other countries' economies the reason why they will have to find another solution to their problem. As for the U.S.A. and Japan, they are trying to give an impulse to their economy by printing money and lowering their interest rates, a strategy they will have to drop as well. An option is for the International Monetary Fund to collaborate maybe by applying a monetary stimulus. Many people believe this is a "foolish" idea but it is actually one of the most reasonable ways to approach situations as this one.

***Matthew Walter & Ira Iosebashvili: Euro Retreats From \$1.37 WSJ - 02/04/2013***

In this article, Matthew Walter and Ira Iosebashvili talk about the drop the Euro had in the past days. It was the biggest one-day drop the Euro had seen in more than a month, this due to the fact the uncertainties about Spain and Italy rose again. Concerns rose because there were allegations that Spanish Prime Minister, Mariano Rajoy, received secret cash payments. Also, Silvio Berlusconi in Italy is rising in the election polls and he has said that

he plans to reverse the conservative policies of his predecessor. This made the Spanish bonds' prices to soar to their highest level since December.

Some people think that the fact that everyone forgot about the political issues that were going on in Europe was one of the reasons that made the Euro go up. But the Euro went down to a 1.3513, after being traded at a 1.37 that was reached past Friday. Nevertheless, some analysts think that the fact that Mario Draghi said he was going to do whatever was necessary to hold the euro zone together will eliminate concerns about political complications, making them short-term drivers in the FOREX market.

***Colleen McCain Nelson, Jared A. Favole, and Damian Paletta: Obama Presses for Delaying Sequester WSJ - 02/19/2013***

This article talks about president Obama's statement on Tuesday February 19, 2013, to the congress to avoid automatic spending cuts, which are set to start in March 1. Obama expressed, "These cuts are not smart, they are not fair, they will hurt our economy, they will add hundreds of thousands of Americans to the unemployment rolls. This is not an abstraction: People will lose their jobs, the unemployment rate might tick up again." Obama warned of the significant and unpleasant consequences that this implementation of spending cuts would produce. The president is pressing the congress for sequestration – temporarily delay the cuts- trying to convince lawmakers to pass lower spending cuts and tax increases. Despite the constant pressing of president Obama, many republicans have rejected these calls.

During president Obama's statement, he offered no new plan or details on what he is willing to cut to reduce the deficit. However, he deeply criticized Republicans for the proposals to avoid sequester, and he said they would be responsible if the cuts would take effect. The president said that the current proposals have too much emphasis on spending cuts and that they would burden middle class families. He stated, "I will not sign a plan that harms the middle class".

The spending cuts set for March 1 are the result of the 2011 agreement that raised the federal borrowing limit. They would reduce spending in areas like defense, housing, education, and transportation. These cuts are only a small part of the government's annual budget that exceeds \$3.5 trillion. The big-ticket programs such as Social Security and Medicare benefits are immune from these cuts.

***Nicholas Hastings: Australia Could Be Next into Currency Fray WSJ - 02/19/2013***

Australia could be joining the "currency war" due to several reasons: first of all Australia wants the AUD weaker because its strength is not helping their domestic economy. The general economy is doing well; iron ore prices are strong, China's recovery from their downturn looks good, the United States is avoiding a relapse into the previous recession, and Australian imports are up 1% bringing domestic improvements to the country.

Because of the positive aspects on the world economy the RBA decided to leave the interest rates as they were instead of cutting them, as the plan used to be. Currently positive flows into the Aussie are visible thanks to their base rate at 3%. Even though the debt crisis was avoided the risk of falling into a crisis is still in the map. Japanese monetary policy easing by the new government to devalue the yen is creating uncertainty for investors, what is making Japanese investors to look for alternatives and the first one is the AUD. While the Aussie keeps getting stronger, the Australian government keeps on thinking about devaluating their currency to improve their domestic economy.

### *Alexandra Fletcher: Pound Sinks After BOE Minutes WSJ - 02/20/2013*

A big announcement was sent from the Bank of England on the minutes from the last meeting on policy, stating that the U.K. economy will have more stimuli to boost, showing growing support from the BoE. This news made the British pound drop significantly especially compared to the euro and the dollar, hitting its lowest value in the last eight months.

What these minutes showed was that three members of the BoE are in favor of increasing the size of the bond-buying stimulus program by £25 billion to £400 billion. The shocking part was that the previous meeting was an 8-1 in favor of not changing this program capital, and now there are more members interested in the modification of this.

The surprising part of the news was the fact that the BoE has been trying to push inflation up, but now if this decision is being approved and held it will cause an opposite effect. This, according to analysts, was very unpredictable and unexpected because of the policy that was previously mentioned from the BoE of trying to push the inflation up.

### *Alessandra Galloni & Giada Zampano: Messy Italian Election Shakes World Markets WSJ - 02/25/2013*

This article talks about the political instability that Italy is going through after the electoral votes. The markets in Europe went down in a considerable amount after the release of the unofficial election results. The results are as follows: Center-Left Coalition (led by Pier Luigi Bersani) 31.6% in the senate and 29.6% in the lower house, Center-Right Coalition (led by Silvio Berlusconi) 30.7% in the senate and 29.2% in the lower house, Five-Star Movement (led by Beppe Grillo) 23.8% in the senate and 25.6% in the lower house, and the Civic Choice (led by Mario Monti) 9.1% in the senate and 10.6% in the lower house. The euro dropped 1% against the dollar, the worst day since the beginning of the year. Most of the uncertainty came because of the surprise lifts of two parties, the Center-Right Coalition led by the former premier Berlusconi and the Five-Star Movement led by a former comedian. The main worry is that both of these parties that gained much support in the results had promised to tone down and even reverse the financial sacrifices Italy has promised its European partners to help keep the euro together. "The situation looks

ungovernable, and that's the worst outcome you can imagine," said Guido Rosa, president of the Italian Foreign Bank Association, taking into account the almost draw between the three parties which have the majority.

***Jason Douglas & Paul Hannon: BOE Discussed Negative Interest Rates, Official Says WSJ - 02/26/2013***

After the shaking news from last week, there have been some new theories and thoughts about the applications of the new regulation for economic policies in the U.K. economy. The biggest one that is rounding the BOE officials is the application of a negative interest rate, this means that the Bank of England will charge commercial lender to deposit cash, so in this way they can stimulate the economy in a more efficient way according to the deputy governor.

The explanation behind this new economy policy idea is that if banks are charged to deposit cash, the best way to get around it will be to lend money to their clients, making the buying power from businesses and households increase which will give the economy a good stimulus to start growing again and to get out of the hole that has been for the last few years.

Now it depends on the people running the Bank of England to choose this new option or to keep looking for a better answer to the current problem.

***Damian Paletta: GOP Budget Establishes Contrast with Democrats WSJ - 03/11/2013***

On March 12, 2013, Paul Ryan offered the Republican's most provocative budget in years. This fiscal framework calls for Medicare and Medicaid cuts, and sets a new limit on defense spending, which had not been previously set by party leaders. Damian Paletta states that neither the House Republican framework or a counterproposal, which will be soon released by Democrats, is likely to be enacted but these two plans will set an important battle line for tax and spending fights that will be one of the most important topics in Washington in the upcoming months. This GOP budget presented by Paul Ryan says it would accomplish 40% of its \$4.6 trillion in spending cuts over the next 10 years. In order to balance the Budget, the GOP budget would cut spending from a projected 22.9% of GDP to 19.1%. Under the Republican plan the spending would still grow but slower than the current projections, Mr. Ryan states spending would increase by 3.4% per year, compared to 5% under current law. Much of the initial and future cuts would come from repealing the health-care law and other cuts will come from turning Medicaid into a state block-grant program (\$750 billion over 10 years). On the other hand, Medicare would also have transformations, but with minor savings (\$129 billion over 10 years). Finally, Ryan's plan does not present a great detail about where the defense cuts would fall, but says it would authorize \$560.2 billion in defense spending in the fiscal year that begins in October, totaling more than \$6 trillion for defense spending over 10 years.

*Jason Douglas & Ainsley Thomas: U.K. Risks Recession as Output Drops WSJ - 03/12/2013*

New important data was released that has affected the pound. The industrial production report from January was very low, which has enforced what has been said since 2010, the U.K. economy is stuck in the hole that has been and the expectations about getting out of this hole are getting smaller and smaller, what also shows the weaker and weaker that the British pound is getting.

Next week, Chancellor of the Exchequer George Osborne's annual budget statement is going to come out, and this last release of information is putting a lot of pressure on his declarations and the measures that are expected to be taken to overcome this big economic challenge that has been presented to the U.K.'s economy.

According to some analysts, this report of the industrial production has been the lowest since 1991 and is considered to be 15% below the prerecession peak. Another important information released by the National Institute of Economic and Social Research stated that the economy in the U.K. is expected to shrink 0.1% in the first quarter of this year, which breaks all the predictions and expectations made at the beginning of the year.