Algorithmic Trading on the Forex Market

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Part I

Analysis

1 Research

1.1 Forex Trading

The Forex (foreign exchange) trading market is huge. Every day, $5.3 trillion US Dollars are traded on the forex market - 53 x the volume that is traded on the New York Stock exchange [1].

Successful traders are often those that have lots of experience with markets. Over time they gain some intuition or "feel" for how the market will act. That being said however, markets move randomly. Trading, especially forex trading, has been likened to gambling because of this - it's risky and very difficult to reliably predict [3]. Even when a correct prediction is made, margins in forex are very small as the markets do not move a large amount so turning a profit is difficult, especially when taking into account the broker's fees to carry out the trade. In order to make any significant profits, large investments need to be made, which carries large risk with it.

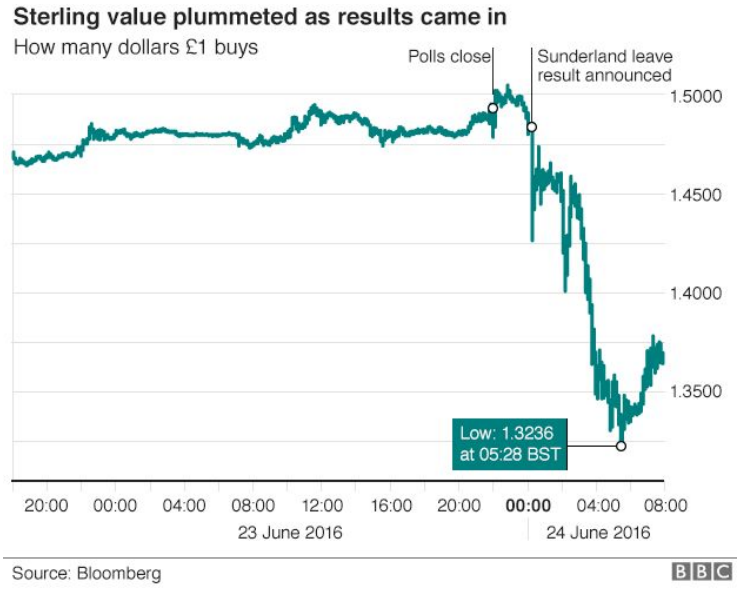

Figure 1: Pound against the dollar around the result of the Brexit Vote [9]

To an extent, a trader can try to predict long term forex trends through following

current events. For example, if a country is going through a period of political instability or uncertainty, a trader might choose to sell that currency. For example, the result of the 2016 "Brexit" vote caused the pound to fall to a 31 year low [9] *(See Figure 1)*. This aspect of trading strategy presents challenges for algorithmic trading as it is difficult to inform a program about the political climate of a country.

1.1.1 Mechanics of Trading

When trading forex, we talk about trading currency pairs [3]. A currency pair is represented in the form *base currency/quote currency* and its value is how much of the quote currency the base currency buys. For example, EUR/USD = 1.2500 means that the Euro buys 1.25 US Dollars. When a pair is bought or sold, it involves buying ("going long") on one currency while simultaneously selling ("going short") on the other. E.g. putting a buy order on EUR/USD means going long on Euros while going short on Dollars.

Every time a currency pair is traded on the forex market, its price changes. If the price rises in a certain time frame the market described as bullish, if it falls it is described as bearish. The goal of a forex trader is to to try predict these changes and open buy or sell orders so that they can make a profit off the market movement when the order is closed. For example, if a trader thought that the price of EUR/USD was going to rise (the Euro strengthens against the dollar), they would buy EUR/USD. If the price of the Euro rises against the dollar, closing the trade at that point (selling the Euros) would result in an overall profit - the of Euros bought when closing the trade are more valuable than when the trade is opened, and so is worth more in whatever currency that the account is denominated in. If a downwards movement is predicted, then one can sell at the higher price and buy back at a lower price to make a profit.

For day traders (the group for which this project is aimed at) one needs to open an account with a brokerage firm. An account is opened with a base currency - the currency with which is used to buy/sell assets and the currency which profits/losses are given in. To carry out trades, one deposits money into their account with the broker. Brokers can make money in a number of different ways, including putting commission on trades (which is discussed below) or buy offering services such as data analysis or advice for a monthly fee.

1.1.2 Buying vs Selling

In trading, one does not have to previously own an asset to sell it. Shorting a currency works by borrowing the specified amount of the currency from your broker, agreeing to buy it back in the future at the future price.

Because of this, shorting has an inherent difference to buying in forex. When buying, you are betting on the price of a currency pair to rise. The worst

outcome of a trade is that the value of your trade goes to 0 as the price of the pair does i.e. you lose all of your initial investment. When shorting, there is theoretically no limit on how much you could lose. The price of a currency pair can keep rising, and with it the amount you need to repay when closing the trade does [10]. In practice, the value of a pair will not keep rising to infinity, however, it is important to consider this when shorting.

To protect against the danger of this, you can set a stop order when you start a trade. There are discussed more below.

1.1.3 Broker Fees

Broker fees can come in a number of different varieties. Disregarding fees a broker might charge for advice or other services, two common fee types are spread and commission [13].

Spread is the difference between the buy and sell price of a currency pair quoted by a broker. This difference is given in pips - the fourth decimal place of a quoted price.[1] Spreads can be fixed or variable depending on the broker. Variable spreads could depend on market volatility or trading volume for example - if a currency pair moves a large amount, a broker would prefer to set a larger spread.

Commission can come in fixed and variable forms as well. Fixed fee commissions tend to be very large, and targeted for people trading at high volumes. Variable fees are dependant on the volume traded, and so offer a good middle ground for all traders. Because of this, variable fees are growing in popularity [6].

1.1.4 Trading on Leverage

As discussed above, currencies on the forex market do not move large amounts, and so huge investments are needed to make any non insignificant profits. To help with this individuals can trade with leverage from their broker.

Trading on leverage is the act of borrowing money to boost the size of an investment. It acts as a multiplier on the original investment, increasing both the potential profits and losses from it. For example, if 100 worth of USD is bought with 50:1 leverage, the trade has a value of 5000. If the trade is closed when GBP/USD has moved up 20 pips, 10 is made instead of the 0.20 made if leverage is not used. [4]This also works the opposite way however - if GBP/USD moves down 20 pips, then 10 is lost. Again, we can use stop orders to help protect against the risks of this.

[1]Imagine you are trading EUR/USD. The charts show a value of 1.2000 however your broker quotes two prices - a buy price of 1.2002 and a sell price of 1.2000. In this case we would say the spread is 2 pips. The small percentage on top of the actual value of the currency for the buy price is how the broker can make money off the spread.

1.1.5 Stop Orders

Stop orders can be used by traders to decrease the chance of loss on a trade. Stop orders are instructions for a broker, telling them to close a certain trade when the market has reached a certain price. Stop orders can be used to both minimize losses and secure profits. e.g. if after buying a currency pair, the value starts to decrease, a stop order lower than the initial value can protect from the initial investment depreciating in value too much. On the other side, if a trader is buying a pair and is happy to "cash out" when they have made a certain amount off the market movement, they can set a stop order with a price higher than that bought, to protect from negative impact of potential future downward movements. Stop orders could be used for volatile markets, or on trades that won't be able to be appropriately monitored by the trader. [7]

1.1.6 "2% Rule"

Stop orders can be used to help follow the 2% rule - a strategy used to balance risk and reward in which a trader risks no more than 2% of their available capital between all trades at any one time. When creating stop orders (and trading on leverage) one might use this to decide on the price to set the stop order at. [11]

1.1.7 Open High Low Close

When, trading it can be useful to look at other meta data in addition to the raw exchange rate to inform what action to take. For example, if there is an indication that the market is very volatile at a point in time, one might wish to hold off on a trade as a prediction could be more likely to be false.

Open High Low Close data gives us some indication of the volatility of an asset during a particular time frame. Open/Close prices are the price of the asset at the start/end of the time period. High/Low are the greatest and smallest prices within a time frame. [12]

These charts are typically represented in two ways. The first is simple known as a "bar chart". It has two short horizontal dashes - one line pointing to the left (back in time) at the opening price and one line pointing to the right (forward in time) indicating closing price. The range (high/low) is given by a vertical line with one end at the highest price and another at the low [8]. *(See Figure 2)*

The other is known as a "Japanese Candlestick Chart" a thin vertical line represents the range, and a thicker vertical box represents the open and close price [2]. *(See Figure 3)*

Figure 2: Example of an OHLC Bar Chart [8]

Figure 3: Example of an OHLC Japanese Candlestick Chart [2]

Both of these graphs (especially Japanese Candlestick) are usually colour-coded to help distinguish between bullish and bearish movements.

1.1.8 Why Trade Forex?

Forex trading attracts people for different reasons. One thing that makes forex attractive is that because movements are small, leverages offered are much larger than those on the stock market. This allows people to start trading effectively with relatively small sums of money. Unlike the stock market, forex is also open 24 hours a day (although retail brokers close on weekends).

Others however might not trade forex with the intention of directly making money. If a trader was trading US stocks, they might be worried about the potential decline/volatility of the dollar. To offset this - allowing them to still make money off their stock trades overall, they could short USD against Euro[5]

2 Design

3 Final Design

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