# READING BETWEEN THE CANDLES

How the evolution of trade automation and extreme volatility in currency prices portends the demise of the manual trader

KNOCKOUT® FOREX

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# EXECUTIVE SUMMARY

Like all technology, trade automation has evolved at an exponential rate in recent years. However, Automated Trading Systems (ATS) have a history of varied sophistication and efficacy. For retail traders, most of the "automated" trading programs currently available, are little more than simple plug-in files for the Meta-Trader trading platform. Many of these programs are sold with promises of astounding profitability but offer little transparency and no ability for the trader to make alterations to the parameters to meet their own trading requirements. Automation for retail traders, therefore, lacks a significant amount of the sophistication that is required to effectively compete against the wild price action that results from the competition between the much more advanced algorithms in use by the major banking institutions and investment houses.

With the recent turmoil in currency markets resulting from Central Bank interventions and massive upheavals in the political landscapes of the World's major economies, the markets have become subject to violent reversals in price action with a greater degree of regularity than ever before. The ever growing degree of severity and speed of the reversals is evidence of competing algorithms attempting to "outrun" one another. While this alone poses questions of the viability of a market prone to erratic behavior, the problems can be compounded by bugs and glitches hidden within the algorithms, sometimes unbeknownst to even the designer of the algorithms. While the onus remains on the institutions developing the algorithms to conduct their own analyses to ensure their own safety, some propose greater regulatory oversight and additional technology to evaluate the various trading systems and strategies to determine all possible behaviors of the algorithms, in an attempt to predict what could possibly go wrong, and to fix breaches before they can affect markets.

We propose that the widespread application of such technology is a very remote possibility given the power of the institutions that would be subject to this intrusion on their intellectual property rights.

While ticker tape had been in use since the 1870's, it wasn't until 1949 that a publically held commodity fund, designed a set of rules to chart prices (manually) and generate buy and sell signals from the information flowing in from the ticker tape. While this hardly resembles what we have come to know as trade automation, it was the start of a sequence of events that would propel algorithmically designed trading philosophies. [1] Just two years later, in 1951, Harry Markowitz, a Ph.D. student at the University of Chicago, presented a dissertation on applied mathematics in stock market transactions, which resulted in the modern portfolio theory, suggesting that security price variances affect the returns that risk-averse investors demand for riskier securities. Shortly thereafter, Markowitz became the preeminent developer of financial algorithms for optimizing investment portfolios.

The introduction of the IBM System/360 computer in 1965, revolutionized the way the markets were analyzed and traded, as economists, traders, and algorithm developers were able to gather, organize, and analyze millions of data points. In the years that followed, the largest investment banks used the information to develop pricing/risk models that could be coded to signal traders when a security was undervalued or overvalued. In the 1980's patterns in the data were more widely used by chartists to find opportunities in repetitive behaviors of traders (technical analysis) that could signal trading opportunities in shorter time frames than the previously applied fundamental analysis could reveal. However, as the information revealed through technical analysis depreciates quickly, the shorter trading time frames inherently meant that the signals that technical analysis offered needed to be acted on almost immediately. Throughout the 1990s, the speed and accuracy of computers led to an ever greater emphasis on coding software to not only reveal the potential opportunities revealed through technical analysis, but to act on them immediately and automatically.

Over this same period, many of the large investment houses and brokerages discovered that with the rapid growth of the use of the personal-computer came another significant opportunity to market their proprietary techniques and a "retail" version of their technology to the masses. Throughout the mid-1990s, while trade automation was not made widely available, some trend following models were made available for purchase, allowing individual investors to use their own personal computers to crunch data and generate signals before calling their broker with their trade orders. In the late 1990's, charting modules and manual trading platforms were offered to brokerage account holders, ushering in a new era of widespread investment and trading activity among non-professional traders and greatly increasing liquidity in the markets.

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Presently automated trading systems are being designed to trade strategies which can vastly differ from one another. While some basic systems are designed to pick market tops and bottoms or follow trends, others involve complex strategies which can include randomizing orders to make them inconspicuous in the market. Automated trading has become the preferred method of trading by banks, CTAs, brokerages and wealthy private investors who can afford to code software to execute their trades. There are, however, still very few options for pre-built, full trade automation available to non-professional traders, although there are a few notable offerings available in the Forex retail trading arena.

**Current Automation in Retail Forex Trading**

Currently, most of the "automated" trading programs sold to retail traders are a little more than simple plug-in files for the Meta-Trader trading platform. Many of these programs are sold with promises of astounding profitability but with little transparency and all of these programs vary widely on their efficacy. Such programs include Expert Advisor programs/Trade Robots, Trade Signal programs, Mirror Trading and Copy Trading programs, PAMM programs, and Social Trading programs. Each of these offerings are summarized as follows:

Expert Advisor Programs – These programs, often referred to as EA's or Trade Robots, can vary widely in their sophistication, but typically, these programs are created from a few simple lines of code installed in the "expert" directory of the Meta Trader software. The files are coded to identify a trading opportunity based on a specific technical indicator, a combination of indicators, or some other logic. When the market conditions identified by the EA are met, the platform will then open a trade. Exiting from the trade is done either using a stop loss when the trade goes badly, or a simple trailing stop if a profit is reached. Very few of these programs offer advanced trade management or offer advanced hedging capabilities. Generally, this has more to do with the cost of coding a program like this and the limited profitability opportunity when trying to sell a program like this for a few hundred to a few thousand dollars. While, it's true that some EAs can be profitable sometimes, the success an EA depends entirely on the quality of the signals given by the specific indicator or indicators it employs, and in today's volatile and rapidly shifting markets, most technical indicators' success rates have only been rated to be as predictably effective as a flip of a coin. Most EAs are sold, however, on hypothetical performance based on optimized historical data. Unfortunately, for most purchasers of EAs, the results are often disastrous for the trader. Because the EA is a black box offering, meaning that the code is not revealed to the end-user, the trader using an EA has no

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understanding of why the program has failed or any means whereby they may tweak parameters to their liking.

Trade Signal Programs – These are relatively inexpensive subscription-based programs which simply send trade notifications to the subscriber, informing the trader of a trade opportunity and letting the trader place the trade manually, at the trader's discretion.

Mirror Trading and Copy Trading Programs – These programs allow Forex traders to select a trading strategy, typically presented by a broker, and allow the trader's account to automatically "mirror", or copy the trades executed by the selected strategies in the trader's brokerage account as well. Once a strategy has been selected, all the signals sent by the strategy will be automatically applied to the trader's brokerage account, thus requiring no intervention on the part of the trader.

PAMM Programs – The Percent Allocation Management Module, commonly known as PAMM, is a software application offered by Forex brokers to allow their clients to attach money to a specific trader managing one or more accounts appointed on the basis of a limited power of attorney. PAMM programs allow a trader on one trading platform to simultaneously manage a number of managed accounts. Each account in the PAMM comprises a portion of the total amount under management and thus, each account has its own ratio in the PAMM which is dependent on the size of the deposit. Trader's activity results (trades, profit, and loss) are allocated between managed accounts according to the ratio. While a PAMM offering can incorporate automated functions if the fund manager uses automation, it can also be traded manually by the fund manager.

Social trading – Social Trading is a recent introduction to the retail Forex trading market. Within this offering, a trader applies neither fundamental nor technical analysis to form trading decisions. Instead, a trader relies on user-generated financial content gathered from various online applications, as the primary information source and provides a new way of analyzing financial data, comparing and copying trades, and sharing techniques and strategies. Retail brokers have continued to introduce new social trading platforms since the early 2010s, recognizing that these programs are a major driver of growth of new users and assists in the retention of old or unsuccessful clients.

While a variety of options are available for retail traders to be able to reduce their manual inputting of trades, the vast majority of these alternative methods of trading do not represent a full trade automation process. Few users of these offerings have full trading autonomy, relying instead on the strategies of other traders and therefore, users of these offerings are reliant fully on the efficacy of the programs being pitched rather than their own analytical capabilities. Given the lack of transparency and the inability of the user to make adjustments, a strategy

offered through these programs difficult, if not impossible for the trader to alter as the markets change and produce new patterns of price movement. Because of this, a wise trader is often left with no choice but to either learn how to code their own EA or to hire someone to do so with the added caveat that such development would require a well-designed module for changing various parameters of the strategy. This method is highly cost prohibitive for most traders, placing the vast majority of the retail trading market at a considerable disadvantage to the large banks and investment houses with their currently running automated trading technology and teams of mathematicians and coders.

**Retail Trade Automation Has Little to No Bearing on Price**

Despite the availability of new and innovative trading platforms, most retail traders are not placing trades against which the large banks and investments houses are taking opposing positions. As discussed in our previous white paper entitled _Preparing for Reduced Leverage in Forex Markets_, the overwhelming majority of retail traders are trading "off-exchange". This means that the private liquidity providers and market making brokers, which are well aware of the efficacy of all of these programs, take the opposing side of the retail clients' trades with the expectation of the failure of the client. Therefore, this also means that the "added liquidity" that the retail markets could be bringing to Interbank Exchange is unfortunately stuck with private brokers and private liquidity.

At this stage, one must consider the simple concept that the greater the number of buyers and sellers in a market, the more liquid the market is and therefore, the more stable the prices in that market. The Interbank Exchange has relatively few market participants in comparison to the potential that could exist were all retail traders to have free access to it. Instead, the Interbank Exchange is comprised primarily of the largest banks and investors and, if the retail broker deems appropriate, the most successful traders that would otherwise constitute "Toxic Flow" to a market maker. The limited market participation within the Interbank Exchange, of course, leads to greater volatility in price action. It's important to point out, though, that while the vast majority of retail traders are not trading on the Interbank Exchange, the retail brokerages tend to align (however loosely) their reported pricing with quotes from the Interbank Exchange. This means that rapid price movements also occur on retail trader's platforms and can create both opportunity and risk for a retail trader.

Recently, a number of bloggers, journalists, and market commentators have expressed concerns about the impact of trade automation on the stability of the financial markets. Ultimately, when such concerns are raised, the trade automation available to a retail client is not the focus, as it has little, if any impact on the markets as a whole and more often than not, only impacts the private market makers

**Automation in Institutional Forex Trading**

It is generally understood that retail trade automation has little bearing on the overall market as most retail traders aren't accessing the Interbank Exchange. However, it is also important to note that the impact of automation originating from retail traders is not readily quantifiable, as each retail brokerage operates as its own exchange when the brokerage takes an opposing side of the clients' trades. This means that there is no centralized repository of data on retail trading activity.

Regarding Institutional trading, however, there is readily quantifiable data. A 2015 CFTC publication entitled Automated Trading in Futures Markets provides insight into the widespread growth of trade automation using data provided by the Chicago Mercantile Exchange (CME) regarding futures products over a time period of approximately two years. [2] The data set included 1.5 billion trades, across 805 futures products and approximately 362 thousand individual accounts. The report found that automation is becoming more prevalent than manual trading and that the Forex market was the most highly automated market with 79.9% of trades being executed through the use of automation at the institutional level. The report also notes that:

> "...tools for automated trading have been in use in this asset class since at least the early 1980's when Reuters began offering an electronic trading platform. With such a lengthy history, this product class remains one of the most mature for automated execution, widely used in both the currency futures and spot (immediate delivery) markets."

Because a modern computer can now execute millions of calculations in a millisecond, and given advancements in electronic order management and communication networks, automated trading has naturally evolved into High-Frequency Trading (HFT), sometimes referred to as "Nano-Trading". This style of trading involves such aggressive trade execution that many have questioned whether or not the markets are overly exposed to unforeseen devastation. In fact, such devastation is much less a hypothetical potential as it is an anticipated likelihood since the "Flash Crash" of May 6, 2010, that occurred in the U.S. Equities markets. [3] The event sparked debate regarding the viability of markets in light of a new automated reactions to price action, and studies of trading data gathered between 2006 and 2011 and sorted in fine-grained, millisecond-by-millisecond detail revealed that no fewer than 18,520 crashes and spikes occurred below the 950-millisecond level, where computerized trading occurs so quickly that human traders can't even react.

While this particular event revealed vulnerability in the U.S. Equities markets, it also clearly portended susceptibility of the world's financial markets to the same computer-driven spikes

and crashes. These have played out violently in recent years, emerging both concurrently with major news events, but also as "shockwaves" in months following major events. Perhaps the most indicative evidence of this came with the recent "Brexit" Referendum which precipitated a 6.3% drop in the GBP/JPY pair in a matter of fewer than two minutes, with the majority of the move occurring in a matter of seconds.



Drop in GBP/JPY at the time of report of 10% of voting results.
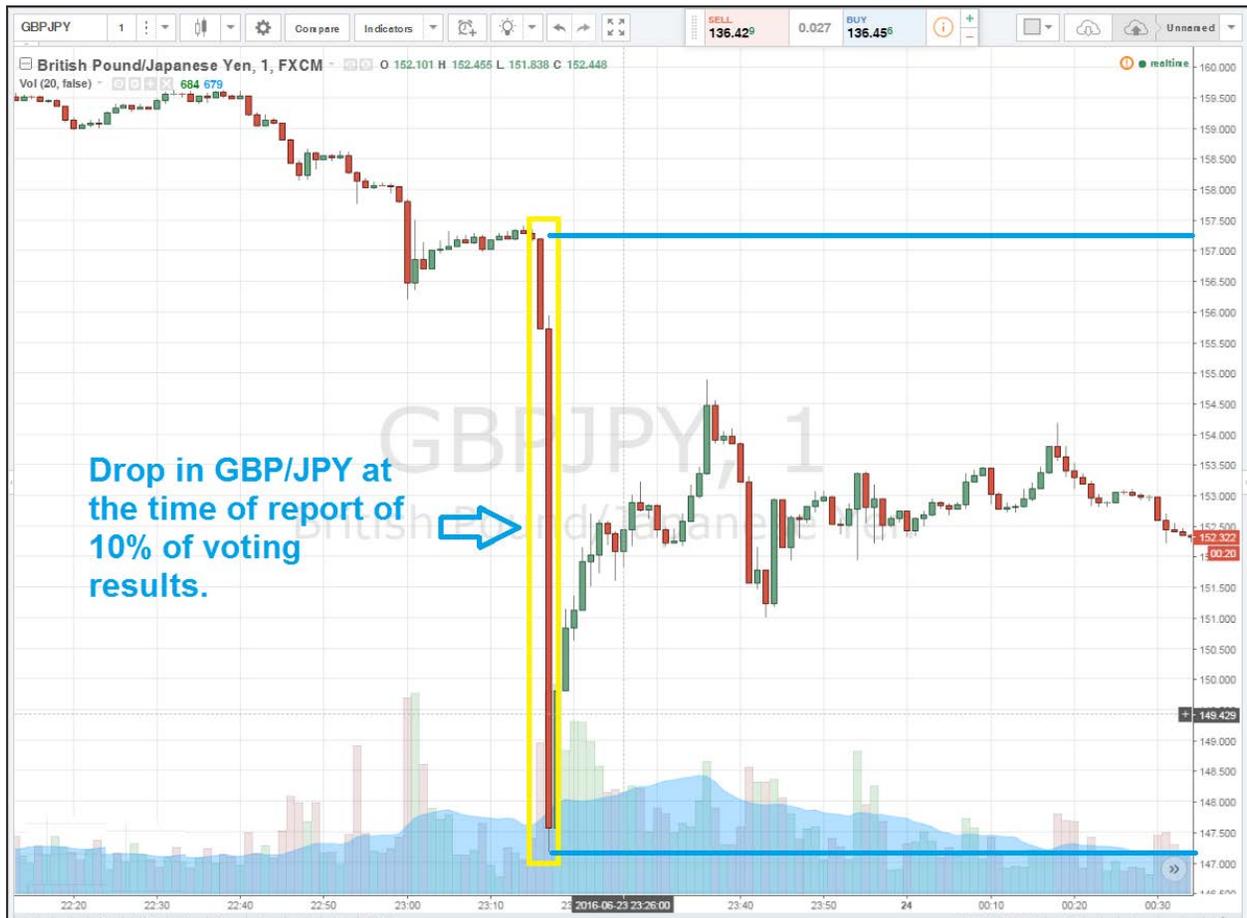
While many novice traders may see a massive move like this and believe they could have been enriched by it, seasoned traders understand that the speed and lack of liquidity during an event like this mean that only automated systems were able to get trade orders submitted and filled (potentially) in such short periods. Additionally, few charts can truly exhibit the whipsawing effect that took place within fractions of seconds that could and did, easily unseat traders, manual and automated alike, from positions that could have been profitable during this short period. No charts can exhibit the massive slippage that is the hallmark of an event like this.

In short, only automation can effectively compete on a field beset with so many potential pitfalls, and in fact, it is automation that creates the very trading environment in which only automation can thrive, while manual traders suffer massive defeats.

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# ARTICULATING AREAS OF CONCERN

Unlike most trading systems offered to the retail Forex market, institutionally applied financial algorithms are vastly complex, accepting and producing an unfathomable degree of data and orders, respectively, in any given second. The enormity of potential configurations and the computational power of these systems creates a variety of regulatory concerns and hurdles. Some commonly raised concerns are noted as follows [4]

1. The ability to know with full certainty, whether a trading system's logic is robust enough to protect itself from making bad decisions, remains elusive to both regulators and even the system architects themselves?

2. Glitches, hidden deep within complex combinations of system logic are often completely missed by testing, to profound negative effect, requiring more thorough means of testing.

3. Regulators need to design and communicate precise and unambiguous directives on financial algorithms.

4. Market participants need to be required to incorporate these directives into their design, testing and compliance processes to meet minimum testing sufficiency standards.

5. Regulators need advanced technology to adequately execute proper oversight.

The preceding concerns and recommendations do not come without reservations among both market participants and regulators. Implementation of the recommendations that have been circulating would undoubtedly require growth of the regulatory bodies themselves at considerable cost. Additionally, issues of protection of intellectual property cannot be avoided, given the extent of the recommended approaches.

The recent introduction of the Aesthetic Integration's Imandra product, while offering the potential to assist regulators, brings many arguments both for and against such software applications to the forefront.

Imandra is software that allows for [5] formal verification of complex financial algorithms by regulators and algorithm developers. Aesthetic Integration proposes that with Imandra, fairness principles can be encoded and analyzed automatically, translating various scenarios into a sequence of FIX® messages that exhibit any potentially unfair behaviors within the system. Aesthetic Integration suggests that Imandra can be a tremendous value for finding and fixing bugs and violations before they hit the markets. [4] Additionally Aesthetic Integration argues that precedent exists to justify the implementation of such applications in financial markets, pointing to industries like aerospace and drawing parallels of safety and well-being of participants, noting:

> "In aerospace, formal verification is typically used to verify the safety of complex software systems underlying Air Traffic Management and on-board Collision Avoidance for autonomous aircraft and autopilots... In fact, we see financial markets as a vast collection of autopilot trading algorithms making critical decisions about transactions constantly. But, there is currently a significant divide between the safety of algorithms in aerospace and finance. Our mission is to close this gap – to bring tools that institutions like NASA use for designing safe autopilot programs to finance."

While Aesthetic Integration recognizes that protection of intellectual property is an issue of concern for those being regulated, they believe the issue can be resolved, noting:

> "Intellectual property (IP) issues currently pose a challenge for the regulators. Compromising trade secrets guiding the logic of trading systems can expose firms to adverse selection and hurt business… With formal verification, this issue can be side-stepped in a compelling way: From the regulators' perspective, trade secrets and sensitive IP particular to a high-performance system implementation are irrelevant, provided these systems abide by regulatory constraints."

Many Institutional level market participants, however, would have to view this argument as an obtuse and unrealistic defense. The very existence of regulatory software being presented by a private entity to evaluate another private entity's proprietary trading algorithms opens questions of access. When one also considers the size and power of the participants (the World's largest banks) being scrutinized, the likelihood that any such programs could be widely implemented seems to be a rather remote possibility.

# SUMMATION

Given the profit potential in the financial markets, trading technology was advanced and implemented at perhaps the fastest rate of any computing-based technologies. This is especially true as automation relates to institutional trading. While retail traders often lament the speed and degree at which markets can move counter to a forming trend, there is little sign that the violent volatility that has become so prevalent in many of the widely traded currency pairs will subside in coming years. While greater liquidity within the Interbank Exchange could help to smooth markets to a certain degree, the danger of massive price reversals as automated systems attempt to outpace one another will continue to be a concern. However, such an event can be managed and even become a profitable opportunity for a well-designed algorithm.

While many propose that regulatory bodies need to take a more aggressive approach to creating a more rigorous level of oversight, others contend that creating such oversight is unrealistic given the complexity of the systems being used, the power of the institutions using these systems, and the rights to intellectual property that will undoubtedly be arduously defended by well-funded institutional market participants, which benefit the most from the new status quo.

Rather than join the chorus of the malcontents seeking more regulatory intervention in the markets, we have adopted the approach that a better use of time and resources is now, and will continue to be, an aggressive focus on research and development of new models of trading in these volatile markets, to reveal opportunities for our technology to find profit potential where others see only danger.

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