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## Does intraday technical trading have predictive power in precious metal markets?

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### ABSTRACT

Previous research has identified that investors place more emphasis on technical analysis than fundamental analysis, however the research has largely been confined to daily data and stock market indices. This paper studies whether intraday technical trading rules have any significant predictive power in the precious metals market through three popular moving average rules. We find that using the standard parameters previously used in the literature, technical trading rules offer no predictive power whatsoever. However after utilising a universe of parameters, we find a number of parameter combinations offer significant predictability in the gold market, but there remains no significant predictability in the silver market. Our results show that the longer parameters of the technical trading rules are more successful than the traditional parameters chosen in the literature. Therefore intraday technical trading rules have some predictive power in the gold market but offer no significant predictability in the silver market.

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### 1. Introduction

The efficient market hypothesis (EMH) is one of the most studied theories in the finance literature. In its weak-form, stock prices reflect all available information, such that technical analysis trading rules based on historical price data offer no predictive power (Fama, 1970). However, trading models based on technical analysis that employ momentum or trend following technology have been found to have significant predictive power (Brock et al., 1992 amongst others).<sup>1</sup> Technical analysis remains very popular among practitioners with Menkhoff (2010) showing that the vast majority of fund managers use technical analysis and it is preferred to fundamental analysis as a market timing and decision making tool. With the introduction of new technology and platforms, investors increasingly trade intraday rather than daily. As Marshall et al. (2008a,b) point out, investors have been found to place more emphasis on technical analysis the shorter the forecasting horizon, with investors placing twice as much weight on the technical analysis for intraday horizons as they do for one-year horizons.

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Given the increased attention on precious metals and their importance to investors, this study examines the intraday predictability of spot gold and silver at 5-min intervals using a number of popular technical trading rules. The sample commences in 2008 and ends in 2015 thereby including the effects on these markets of central bank quantitative easing. Gold and silver are two of the most traded assets worldwide, they also play an important role for investors as well as comprising an important asset for central banks.<sup>2</sup> Precious metals are also of paramount interest to investors as the introduction of new capital requirements for banks have enhanced demand for liquid assets in a banks risk management profile, while gold and silver have both been found to be safe havens, even at different times (Lucey and Li, 2015).

Precious metals are easily traded and have the advantage of being priced in a common currency, so are not subject to bias that may be associated with index construction and variation that may affect studies involving stock indices. Our approach is straight forward and follows other work such as Brock et al., 1992. Initially, we examine the various time series using simple, exponential and weighted moving average rules to determine whether these trading rules have any predictive power. We use the most popular parameters of these technical trading rules from studies of daily data and study their performance, although there is no reasonable rationale why investors would choose a certain set of parameters or follow the same set of parameters for daily data when analysing intraday data. Therefore we also run a parameter sweep where we study all possible combinations of the parameters of the rules. This provides a detailed analysis of the full performance of these technical trading rules over the sample period.

Nevertheless, any significant predictability found will be susceptible to the data-mining fallacy as noted by Zakamulin (2014). That is, using historical data to test k-trading rules, selecting the rule that performs best and then either explicitly or implicitly assuming that the expected future performance of this rule will be the same as the past performance. To avoid this, we run an in- and out-of-sample test to study whether the most successful predictive rules in the in-sample period are successful in the out-of-sample period, we also use the bootstrap methodology of Okunev and White (2003) to examine the robustness of our results.

The contributions of this study are as follows: Firstly no studies to our knowledge explore whether technical analysis has predictive power in spot precious metal markets at high-frequency. While some studies examine the predictive power of precious metals daily spot or daily futures markets, we examine the predictive power of some of the most popular trading rules in gold and silver markets at 5-min intervals. Secondly after examining the most popular parameters of the technical trading rules for daily data, we conduct a parameter sweep where we study which parameters of the technical trading rules are most predictive. This means that we examine in total 66,297 moving average rules for each market, which is one of the largest set of trading rules studied in the literature. Thirdly we report the average predictive power of the parameters of the technical trading rules, which shows that the longer the horizon, the more successful the technical trading rules become. Finally to avoid the data-mining fallacy, we examine the in- and out-of-sample performance the trading rules to determine whether investors could have had some rationale to trade on the successful parameters of the trading rules. To add further robustness to our results, we use the bootstrap methodology of Okunev and White (2003).

The remainder of the paper is organized as follows. The next section presents the related literature while Section 3 presents the methodology. Section 4 reports the data and Section 5 the empirical results, while Section 6 summarises the findings and provides conclusions.

## 2. Literature review

Despite the fact that investors have placed more value on short-term technical analysis, the majority of the financial literature has focused on the profitability of technical trading rules using daily data<sup>3</sup> (see for example Brock et al., 1992; Hudson et al., 1996; Shynkevich, 2012; Urquhart et al., 2015; Metghalchi et al., 2015). Given the availability of financial technology to trade at high frequencies, there has been a lack of studies that examine the predictability of intraday returns from technical trading rules (for some exceptions see Marshall et al., 2008a,b; Yamamoto, 2012; Duvinage et al., 2013; Cervelló-Royo et al., 2015). Furthermore, there is a distinct lack of studies examining technical trading rules on precious metals given the increased attention they have received in the literature and the fact that Emmrich and McGroarty (2013) find in favour of including gold in investment portfolios, especially since the financial crisis in 2007.

Technical trading rules have been examined in detail in the literature (see Park and Irwin, 2007), the study by Brock et al. (1992) where they find that technical trading rules have significant predictive power in the DJIA over 90 years is one of the most influential in the early literature. This result led to an explosion of studies scrutinising the results (see for instance Bessembinder and Chan, 1998; Sullivan et al., 1999; Day and Wang, 2002; Ready et al., 2002) and studying the performance of technical trading rules in other markets (see for instance Hudson et al., 1996; Fifield et al., 2005; Manahov et al., 2014; Hsu et al., 2016; Zarrabi et al., 2017). However, recently Fang et al. (2013) examined the DJIA and S&P500 out-of-sample data, both pre- and post-dating the original Brock et al. (1992) sample and find no evidence of statistical predictability in any of these additional periods. This result was confirmed by Urquhart et al. (2015) and as Schulmeister (2009) argues, the profitability of technical trading may have moved from daily to intraday data.

<sup>2</sup> The estimated daily turnover in the international gold market was 4000 metric tons in 2011 (Hauptfleisch et al., 2015) while silver's demand keeps on rising. The daily turnover of the gold market exceeds the turnover of all but four currency pairs.

<sup>3</sup> Park and Irwin (2007) provide an excellent overview of the literature.

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