NORTH-HOLLAND

International Review of Economics and Finance
12 (2003) 69–87

International Review of Economics & Finance

Risk-adjusted, ex ante, optimal technical trading rules in equity markets☆

Christopher J. Neely*

Research Department, Federal Reserve Bank of St. Louis, 411 Locust Street, St. Louis, MO 63102, USA

Received 22 January 2001; received in revised form 10 August 2001; accepted 22 January 2002

Abstract

This article uses genetic programming to construct risk-adjusted, ex ante, optimal, trading rules for the S&P500 Index and then characterizes the predictive content of these rules. These results extend previous results by using risk adjustment selection criteria to generate ex ante rules with improved performance. There is, however, no evidence that the rules significantly outperform the buy-and-hold strategy on a risk-adjusted basis. Therefore, the results are consistent with market efficiency. Nevertheless, risk-adjustment techniques should be seriously considered when evaluating trading strategies.

JEL classification: G0; G14
Keywords: Technical analysis; Genetic programming; Trading rule; Stock price; Equity price

1. Introduction

The use of technical trading rules—trading rules based on past price behavior—has been common in equity markets since the turn-of-the-century analysis of *Wall Street Journal* editor Charles Dow. Because excess returns generated from publicly available information would seem to contradict the efficient markets hypothesis (EMH), a number of authors have studied

☆ The views expressed are those of the author and do not necessarily reflect official positions of the Federal Reserve Bank of St. Louis or the Federal Reserve System.

* Tel.: +1-314-444-8568; fax: +1-314-444-8731.
E-mail address: neely@stls.frb.org (C.J. Neely).

1059-0560/02/$ – see front matter
PII: S1059-0560(02)00129-6

the usefulness of technical analysis in equity markets (Allen & Karjalainen, 1999; Bessembinder & Chan, 1995, 1998; Brock, Lakonishok, & Lebaron, 1992; Lo, Mamaysky, & Wang, 2000). Such studies have generally evaluated raw excess returns rather than explicitly risk-adjusted returns, leaving unclear the implications of their work for the EMH. Risk-adjusting the returns is necessary because the technical trading strategies spend time out of the market and therefore have less volatile returns than the buy-and-hold rule. Therefore, simply comparing the returns to each strategy is insufficient to compare the usefulness of the rules. An exception to the failure to adjust for risk is the work of Brown, Goetzmann, and Kumar (1998) that found value in the risk-adjusted returns generated by the market signals of William Peter Hamilton.[1]

Another common problem in the trading rule literature is that rules are evaluated precisely because they are widely used by technical traders (see Brock et al., 1992). Ready (1998) argues that testing such rules is a form of data snooping. This practice is likely to produce spurious evidence of technical trading profits; the rules are widely used precisely because they would have been profitable on past data.

Rather than evaluating widely used rules, one might search for optimal, ex ante rules with a nonlinear search procedure such as genetic programming (Koza, 1992). Allen and Karjalainen (1999)—hereafter AK—used genetic programming to generate optimal, ex ante, technical trading rules on daily S&P500 data over the period 1929–1995.[2] They found that the transactions cost-adjusted returns to these rules failed to exceed the returns to a buy-and-hold strategy—despite the exclusion of dividends from the stock return—and that the market was efficient in this sense.[3] There was, however, some evidence of predictability in returns as the rules tended to be in the market during periods of high returns and out of the market during periods of low returns. Although AK attributed this predictability to low-order serial correlation in the stock index, they speculated that the rules might be useful on a risk-adjusted basis despite their lower returns. "Even though the rules do not lead to higher absolute returns than a buy-and-hold strategy, the reduced volatility might still make them attractive to some investors on a risk-adjusted basis" (Allen & Karjalainen, 1999, p. 261). AK did not, however, use any risk adjustment techniques in their work.

This article extends the literature by investigating whether ex ante, optimal technical trading rules are useful on a risk-adjusted basis in equity markets. It is not sufficient merely to examine the results from previous genetic programming rules with common methods of risk adjustment. To fairly evaluate risk-adjusted returns, new sets of rules that maximize risk-adjusted measures like the Sharpe ratio (Sharpe, 1966), the X^* statistic (Sweeney & Lee, 1990), and the X_{eff} measure (Dacorogna, Gençay, Müller, & Pictet, 2001) are generated. In addition, this article more fully characterizes the predictability found by these rules and conducts formal

[1] Another exception is the work of Bessembinder and Chan (1998), which uses varying leverage with its technical trading rule to produce a rule with approximately the same risk as a buy-and-hold strategy.

[2] Neely, Weller, and Dittmar (1997) and Neely and Weller (1999, 2001) have applied genetic programming to find trading rules in the dollar foreign exchange market and the European Monetary System.

[3] The return to a dynamic strategy—moving in and out of the market—will be reduced less by the exclusion of dividends than will the return to a buy-and-hold strategy.