

# Risk Reduction Using Trailing Stop-Loss Rules

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## Abstract

Trailing stop-loss rules, which are different with traditional stops involving selling after a drop from the entry price, involving selling following a pre-specified decline from the highest price. These rules add value for risk-averse investors and are particularly useful for reducing downside risk. They have inferior returns and Sharpe ratios to a simple buy-and-hold strategy. However, trailing stops are superior for investors with normal risk aversion levels. Moreover, they perform very well at reducing downside risk (i.e. stopping losses), based on Value-at-Risk and Expected Shortfall measures. Our results hold across all U.S. stocks and are particularly strong for delisted stocks.

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## Introduction

Stop-loss rules, which involve selling a security when its price drops to a pre-determined threshold and buying the security back when its price rises a pre-specified amount, are widely used in financial markets (Han, Zhou and Zhu, 2016). There are two types of these rules - traditional and trailing stop. Traditional stop-loss rules are either price based or time based. Price based traditional rules involve selling when the price falls a certain percentage below the purchase price, irrespective of the price path since the purchase price, while time based rules involve selling if the price moves a certain percentage below the entry price within a specified time interval. Trailing stop-loss rules, in contrast, are more dynamic in that the sell trigger price is adjusted upwards if the price moves higher following a purchase. A position is then closed if the price subsequently declines a given percentage below the new high price. These rules are therefore designed to protect profits.<sup>1</sup>

Trailing stop-loss rules are most popular in both academia and industry. Existing academic papers that highlight theoretical aspects of trailing stop-loss rules include Glynn and Iglehart (1995) and Abramov, Khan and Khan (2008). These theoretical studies regarding applying trailing stop-loss rules to several price process models displays that the investigation of trailing stop-losses is of interest to researchers. It is therefore important to further examine trailing stop-loss rules in an empirical aspect, which is not comprehensively considered in academia.

Trailing stop-loss rules are also important for investors as a common trading tool in many trading systems that are used by investors every day. Practitioners summarise several techniques to effectively use these rules. Loton (2009) notes the trailing stop-loss sell order is often used by trend following investors to avoid the reverse of an upward trend. Wilcox and Crittenden (2009) show trailing stop-loss rules work as an exit method can earn an abnormal

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<sup>1</sup> See the Figure 1 that plots the different sell trigger points of these stop-loss rules.

return in trading the S&P 500 index. This strongly supports the effectiveness of trailing stop-loss rules as a trend following strategy. Moreover, Toit (2015) suggests the trailing stop-loss rules outperform the traditional stop-loss rules. Because trailing stops can protect the gained profits as the stop price is moving up with the actual increasing price, as noted in Clarke and Clarke (2011).<sup>2</sup> By contrast, the traditional stop-loss rules, regardless of price or time based, only set the stop price to a fixed distance from the entry price.

A fast declining market draws attention of investors regarding a market correction, which refers to a 10% or more reduction in the security price from its recent peak price. As mentioned before, the stop price of trailing stop-loss rules is set to a percentage below the highest price since the last transaction. The tight trailing stop-loss rules with a stop-loss threshold less than 10% is thus a natural method to avoid partial losses before a market correction. The declining market implies the potential downside risks, we therefore consider whether trailing stop-loss rules are effective at reducing downside risks in this paper.

We apply various stop-loss thresholds to a simple buy-and-hold strategy as the trailing stop-loss rules. All common stocks from 1926 to 2016 are selected and delisting returns are taken into account. A simple buy-and-hold strategy has the higher return and Sharpe ratio than those of stop-loss rules. Alternatively, a finding of the higher Certainty Equivalent Return of stop-loss rules than the simple buy-and-hold strategy suggests trailing stop-loss rules are preferred for investors with a prevalent level of risk aversion. Then we compare and contrast Value at Risk and Expected Shortfall of both strategies to investigate their effectiveness at reducing downside risks. Our results show that trailing stop-loss rules are more effective in controlling downside risks than a simple buy-and-hold strategy, especially for stocks that end up with delisting. Moreover, we find trailing stop-loss rules have an increasing effectiveness at reducing downside risks, compared with the simple buy-and-hold

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<sup>2</sup> See also Magliolo (2013); Teo (2018).

strategy over time. Trailing stop-loss rules are more effective during DOWN market but insignificant during recessions that determined by NBER. Finally, we find trailing stop-loss rules are more effective to control the risks for more volatile, liquid and cheaper stocks. The stocks with relatively high trading volume can also be beneficial from the trailing stop-loss rules regarding downside risks management.

We contribute to the literature in several ways. First, there has been little focus on both traditional and trailing stop-loss rules in academic literature. In terms of traditional stop-loss rules, Kaminski and Lo (2014) suggest that time based traditional stop-loss rules underperformed under random walk and mean-reversion markets but outperformed under momentum and regime-switching models. More recently, Lo and Remerov (2017)<sup>3</sup> find the positive relationship between the outperformance of time based traditional stop-loss rules and returns' serial correlation. Additionally, Han et al. (2016) show that price based traditional stop-loss rules reduce the downside exposure and double the Shape ratio of momentum strategies in the U.S. equity market. Given momentum profits can be explained by lead-lag relations (Lewellen, 2002), traditional stop-loss rules should perform well under momentum strategies because the performance of both rules are positively correlated with autocorrelation in returns. These further support the idea that stop-loss rules have a better performance in the trending market. Furthermore, Fischbacher, Hoffmann and Schudy (2017) find price based traditional stop-loss rules decrease the realised losses and reduce disposition effects, which implies the potentially improved performance gained by traditional stop-loss rules.

On the other hand, there is only a little literature that has focused on the trailing stop-loss rules. A short numerical example in Glynn and Iglehart (1995) implies the trailing stop-

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<sup>3</sup> Lo and Remerov (2017) is a contemporary paper to us. They make important contributions for the time based traditional stop-loss rules in the theoretical aspect. Even though they have done empirical analysis for the downside risks of stop-loss rules, the time-series and cross-sectional determinants of downside risks that we focus on are unanswered in their study. On the other hand, we focus on the trailing stop-loss rules, which are more popular for investors in industry.

losses outperformed in a trending market instead of a mean-variance market.<sup>4</sup> In addition, Fu and Zhang (2012) suggest trailing stop-loss rules are not suitable for stock trading under a geometric Brownian motion from S&P 500 index. Alternatively, Snorrason and Yusupov (2009) find trailing stop-loss rules outperform the simple buy-and-hold strategy in Sweden markets. However, Lei and Li (2009) find that trailing stop-loss rules do not increase the return of the simple buy-and-hold strategy but reduce its risk. This implies that trailing stop-loss rules may be superior to the simple buy-and-hold strategy from a risk-adjusted perspective. More recently, Clare, Seaton, Smith, and Thomas (2013) show trailing stop-loss rules do not add value to trend following rules, such as moving average rules. These studies examine either the performance of trailing stop-loss rules or overlaid trailing stops to other trading rules. Overall, none of these has studied the trailing stop-loss rules in a comprehensively empirical insight.

Second, downside risks are closely related to investors and fund managers' career. Shleifer and Vishny (1997) who point out that asset managers who manage capital on behalf of outside investors often avoid volatile arbitrages due to the potential liquidating pressure from outside investors if there are losses in the short-term. Moreover, researchers now put more emphasis on the return time-series rather than the overall time-series average return due to potentially extreme drawdowns. For example, Barroso and Santa-Clara (2015), Daniel and Moskowitz (2016) point out that the momentum strategy can have extreme negative returns in some years. To our knowledge, there is a small number of literature has a little mention on stop-loss rules in the aspect of downside risks. James and Yang (2010) use simulated maximum drawdown returns to set the optimal stop price. Lo and Remorov (2017) find time based traditional stop-loss rules help to reduce downside risks but not substantially. However, we focus on downside risks of trailing stop-loss rules that are more popular in industry.

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<sup>4</sup> See also Davidsson (2010).

Third, a delisting return can be defined as a series of returns that appear after a common stock is delisted. Bessembinder (2018) states that approximately only 57% of common stocks can outperform one month T-bills, while taking delisting returns into account. We take delisting returns into account as they are important in studying overall earned equity returns. On the other hand, Bessembinder (2018) implies an investment strategy that exploits advantages of both stocks and T-bills is increasingly desirable for investors. Trailing stop-loss rules may help investors to exit positions in stocks prior to delisting so that avoid a dramatic loss in returns for investors.

In this paper, the following section 2 states the data and trading rules for this study. Section 3 displays and discusses the results of regressions. Finally, section 4 provides a conclusion for this paper.

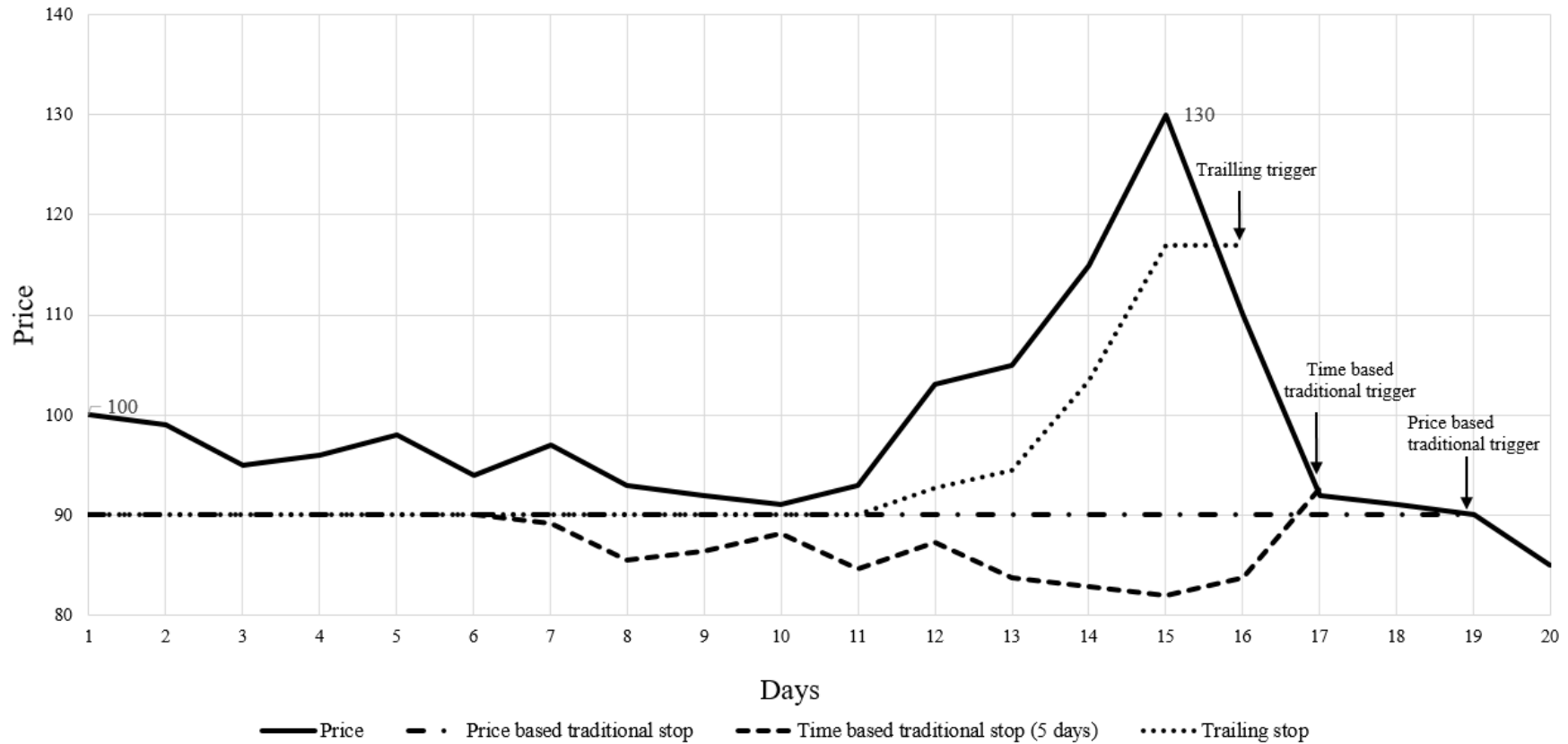
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**Figure 1**  
**Stop price movements (10% threshold applied)**



Note: This figure shows different stop prices of each stop-loss rules. The price is set to 100 at the beginning. The stop price of trailing stop-loss rules is increased only if the price is increased. The price based traditional stop-loss rules have a constant stop price over time. The time based traditional stop-loss rules have the stop price based on the price at the beginning of previous 5 days.