BEM 117 Research Proposal
The Disposition Effect Resulting from Irregular Reference Point Setting

Jeremiah Dibble

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1 Introduction

In traditional investment theory market participants are rational agents attempting to maximize their long-run consumption. Under this assumption the market equilibrium that would be achieved does not align with the empirical evidence. Particularly, the disposition effect, which is the tendency for traders to disproportionately sell gains and hold losses, should not be observed under a fully rational market. This contradiction indicates that the utility function is not strictly maximizing long-run consumption.

The previous research from Kahneman and Tversky proposed an S-shape utility function explains the way in which investors evaluate performance and Thaler (1999) proposed reference dependence claiming realizing a gain or loss causes an instantaneous change in utility based on a reference point, which is supported by neural data from Frydman (2012). If utility is strictly based on realized gains and losses and the traders utility function is linear in the loss region, a trader would never sell a losing stock which is in-reconcilable with empirical data. Ingersoll and Jin solves this issue by combining the S-shape utility function with reference dependent utility, because once losses become sufficiently large freeing capital from a loss and allowing the capital to be used with a new reference point and higher chance of receiving utility.

This paper proposes that a rational investor would set her reference point based on her expectation of the growth or future value of the asset, rather than the purchase price. Additionally, an investor would not be able to set or update these reference points without spending some amount of time evaluating the companies, so evaluating will cost utility and reset the traders reference point. When selling, traders will receive an additional utility based on the difference between the trader reference point and current price of the stock, which is the primary non-rational behavior in this model. Realization utility is supported by Frydman (2012) and I propose this realization utility could me more accurately modeled as an internal reaction to the belief that the investor accurately set price targets, so investors would still value paper gains.

2 Model

In this model (i) the traders are assumed to be mostly rational, (ii) we assume evaluating stocks requires utility, and (iii) traders set a reference point with a rational growth rate in a single time period, we believe that having traders set a reference point with a growth rate is superior to a static reference point. This is because there is clear evidence to support realization utility but it is unclear if purchase price is the correct reference point. Additionally this model does not continue indefinitely, so traders will sell all their stocks at the final time period.

2.1 Trader Utility Function

Assuming traders are only irrational to the extent that they realize Kahneman and Tversky (1979) S-shaped utility from selling a stock that is above or below their reference. Otherwise traders are rational and attempting to maximize their wealth in each period. As a result traders would be maximizing:

$$\max E[U] = \max_{E}[W_{Current} + \sum_{j=0}^{n-1}\sum_{t=1}^{n} \mathcal{S}(Price_t - RefPrice_{t,j}) * [\mathbb{1} \text{ Sold at t and evaluated at j}]] \tag{1}$$

Where $\mathcal{S}$ is the Kahneman and Tversky S-shaped utility function (TK-utility). $RefPrice_{tj}$ refers to the traders reference price at time t for a stock evaluated at time j.

2.2 Stock Returns

Each stock has a Lognormal return distribution governed by the following equation, where return is the return of a stock in a single time period.

$$ln(Return) \sim \mathcal{N}(\mu, \sigma^2) \tag{2}$$

These rational traders are aware of the return distribution of the stocks after performing an "Evaluation," which costs utility and is always done when buying a stock. Because evaluations are always associated with purchases, trading costs will be included in evaluation cost during a purchase or sale. To be clear, these traders are supposed to model real traders so they believe stocks returns are not literally a random variable, but in this model after evaluation a trader is aware at this time period that (2) describes the stocks growth. As a result they will set references prices targets for all future time periods and will not adjust them without seeing new "fundamental information" which requires her to re-evaluate the stock to reveal, and thus set new reference price targets.

2.3 Trader Choices

The traders have three decisions to chose from in each time period and can exercise them in all periods excluding the first and the last. A trader can Hold, Trade, or Evaluate a stock.

Holding — Holding a stock has no utility cost and does not change reference price targets.

Trading — Selling a current stock and purchasing another, incurs a utility equal to the difference between the price and the reference price and evaluation cost for the new stock. This will also cause new reference price targets to be set.

Evaluating — New reference price targets are set based on the current price and mean growth rate.

For the final period the traders must liquidate all of their stocks and have a final utility given by (1)

In the first period traders would begin by trading from cash to a stock and they would set reference price targets for the remaining periods, as long as the mean return of the stocks are sufficiently large for the expected utility in round 1 to be positive. In other words μ and σ must be sufficiently large for (3) to hold.

$$W_0 * exp(\mu + \frac{\sigma^2}{2}) - Eval_{cost} + E[\mathcal{S}(Price_1 - W_0 * exp(\mu + \frac{\sigma^2}{2}))] > W_0 \quad (3)$$

Since all traders have this same utility function and evaluation cost are relatively low it is reasonable to assume μ and σ are sufficiently large for (3) to be satisfied because empirically stocks are purchased.

2.4 Trader Behavior

In the middle round (not the first or last), traders are able to make any of their three choices in each period.
At the beginning of each period the trader will attempt to maximize her utility for the next round. The trader will hold, trade, or evaluate based on the current difference between the $Price_t$ and $RefPrice_{t,j}$ and $Eval_{cost}$.

The trader will trade when (4) is positive, because she will hold an identical risky asset and lock in positive utility for realizing performance above her expectation.

$$\mathcal{S}(Price_t - RefPrice_{t,j}) - Eval_{cost} \quad (4)$$

Given (6) hold, when (5) holds the trader will re-Evaluate her current holding because it would create an expected price to reference price difference of zero

at the cost of an evaluation, which is positive based on (5). Lastly if (5) does not hold the trader will simply hold her investment because she does not realize the extra negative utility until she sells, but the potential negative utility is insufficient to justify re-Evaluation costs.

$$\mathcal{S}(Price_t - RefPrice_{t,j}) < Eval_{cost} \tag{5}$$

$$\mathcal{S}(Price_t - RefPrice_{t,j}) < 0 \tag{6}$$

3 Outcomes

From understanding the way the traders operate we can determine if the results of this model of trading agree with the empirical outcomes. When (4) is positive the price of a stock is outperforming its mean return plus additional friction, and traders will sell these stocks under this model to garner realization utility. This result aligns with the empirical data that winners are sold more often than losers. Traders will hold on to stocks that are under performing their mean returns, which would include losers once again aligning with empirical findings. unfortunately when (5) does not hold the trader will simply re-evaluate their price target, which is not observable in trading data but allows for traders to sell their losers which is obviously empirically true.

Since realization utility is being set for from a growing reference price the disposition effect should be more observable to a smaller extent in stocks that begin to slow their growth. In other words, one method for empirically testing this model would be to study the trading behavior of traders who purchase stocks' that growth rate decline after purchase. If these stocks do not suffer from the overselling of winners to the same extent as stocks who's growth did not change, that would indicate that traders are considering these under-performers to be losers (despite having positive returns). Where "losers" refer to stocks that would cause negative realization utility when sold.

This model seems to lead to many of the same results as the empirical data has shown and assumes very rational investors, who only deviate by excessively enjoying unexpected returns. Additionally this model's validity could be verified through empirical data, because it predicts a mild disposition effect for stocks that are under performing in the short term, but still have positive returns. Lastly recreating the Frydman (2012) study while having participants set price targets would validate this hypothesis.