Grand-Exchange-Analysis-Notes

mjchao

January 10, 2016

1 Project Goal

The computer game Runescape has a central trading platform called the Grand Exchange. The Grand Exchange functions like a stock exchange and allows players to buy and sell commodities from each other. From the perspective of a trader wishing to profit by trading on the exchange, there are both benefits and drawbacks to trading on this exchange. The goal of this project is to analyze historical price data in an attempt to make accurate predictions and trade accurately and profitably on the Grand Exchange.

2 Introduction

The in-game currency is called "gold pieces" (gp). We have approximately 2 million gp with which to trade. Currently, there are two primary types of traders knowing as "flippers" and "investors."

Flippers are what we know as the frequent click-traders and market-makers. They submit buy and sell orders to fill up the price margin and profit off the difference. There is absolutely no analysis required for this: for liquid commodities, there is always a price margin and there will always be people willing to buy higher and sell lower. The drawback is that one must be constantly online and monitoring their trades because creating a trade bot is grounds for the game moderators to permanently ban your account.

Investors buy commodities when they are at low prices and sell when they are much higher. This may require some analysis as prices can sometimes be unpredictable: sometimes the price may be low, but it stays low for too long, sometimes the price may shoot up to new highs. Investing may be slower than flipping, but the benefit is that one does not have to be as active.

This project will focus on investor trading. Currently, we are aware the prices tend to cycle from highs to lows over multiple months, but we would also like to predict when these trends occur and find indicators. In addition, we'd like to forecast unusual trends, such as prices skyrocketing. Finally, since one cannot short-sell on the exchange, we would like find multiple commodities on which to trade so that we do not have to wait for the price of a commodity to drop after selling before we buy again.

3   Market Properties

This in-game market is somewhat different from real-world markets. In particular, there are several properties that make the market easier to deal with than a real-world market:

- There are no trade commissions

- There are no trade bots, and therefore latency is not a major issue

There are also several properties that make the market more difficult to deal with than a real-world market:

- The order book is not visible

- Average prices are only published daily

- We cannot short-sell a commodity

- Bots may significantly influence the supply/demand of a commodity, but this factor is invisible to us.

4   Determining Commodities on which to Trade

Whether a commodity will be good to trade on depends on properties of the commodity. In addition, we have to consider how much money we have to invest and how much time we have.

For this analysis, we will pretend we are allowed to short-sell. This assumption should be valid because we should not penalize items whose prices fall - otherwise, we would be selecting for items whose prices only rise, an impossible property.

Suppose we have G gp. Let's say we consider commodity x. There will be some properties of interest:

Average maximum price changes: This determines if we are able to make a profit at all by taking a long position and then clearing it when the price rises.

We may consider the 1-day, 7-day, 30-day, or 90-day or k-day (where k is any desired duration) average price change. This works by assuming we purchased the commodity on some day and finding the maximum price difference within the given time frame. We take the absolute value only, to account for potential profits from short-selling.

Trend Line Reversals: If a commodity's price trend never changes, we will never clear our position at an optimal time. Specifically, we wish to use this property to identify extremely bad commodities for trading, such as worthless items, whose price falls with an asymptote at 0 gp. We use the average price trend line because a continuously falling price may sometimes fluctuate and increase, but that fluctuation is just an anomaly.

Trade Volume: We need to be able to buy/sell appropriate quantities. If a given commodity is not liquid and we need to trade on high quantities of that commodity, then trading on that commodity will prove disastrous.

Using the above properties, we can now check if x is a good commodity on which to trade. Let the most recent price of the commodity be R. Let the average trade volume (over the past 90 days) of the commodity be v. Then the maximum quantity, q, of the commodity we can feasibly buy is given approximately by

$$q = \texttt{min(} \ v \ , \ \tfrac{G}{R} \ \texttt{)}$$

Suppose we are interested in clearing out our position within k days. Let the average k-day price change be c. Then the expected average profit, P, would be

$$P = cq$$

We can apply this calculation to all commodities and sort the list by descending expected profit. The items at the front of the list would be the best commodities on which to trade.

5 Determining Price Change Indicators