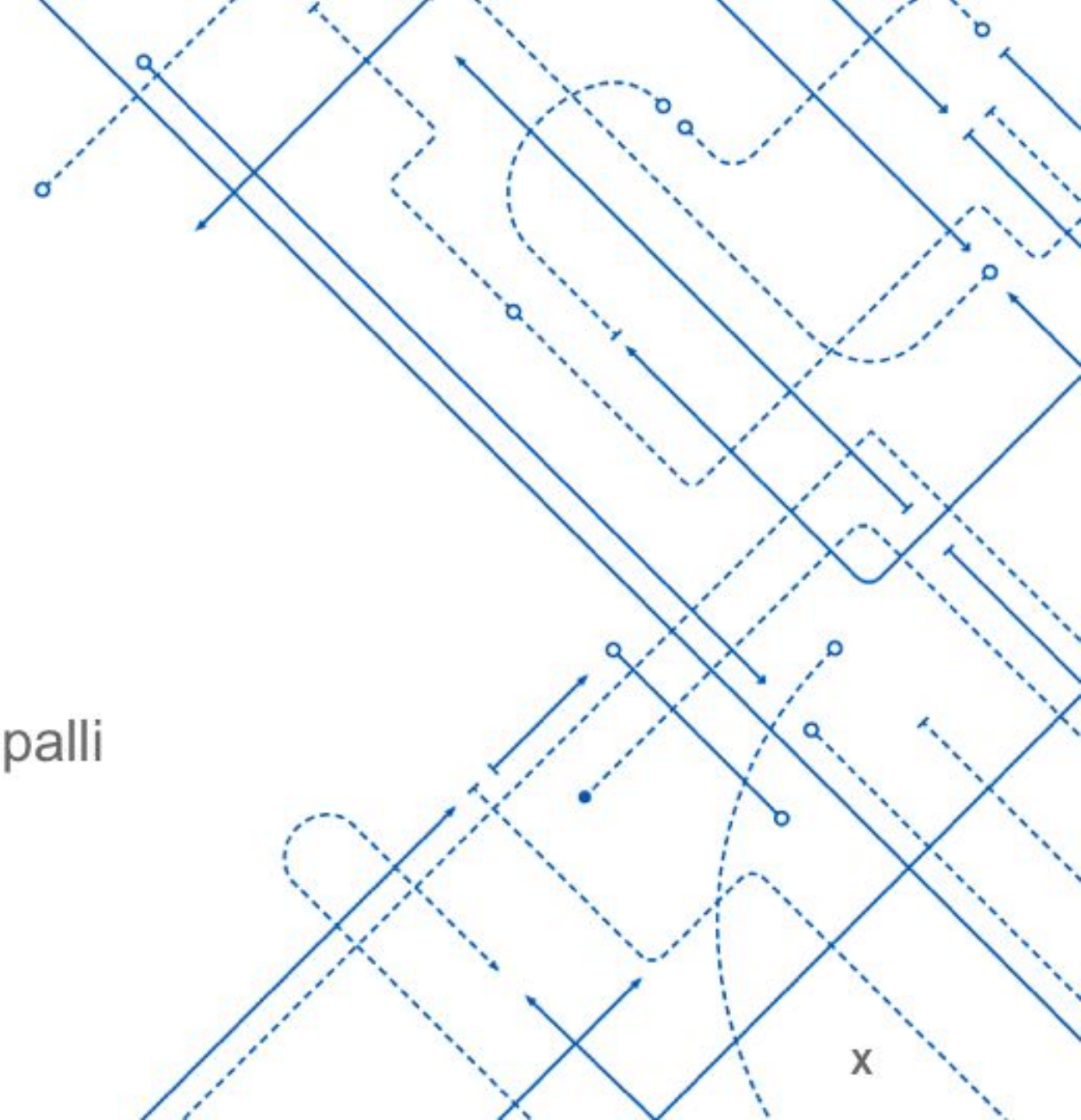
WORLD OF WARCRAFT ECONOMY

Syed Aqhib, Jose Barajas,
Hyungkyu Lim, Abhishek Sarvepalli

University at Buffalo The State University of New York



World of Warcraft

- Massively multiplayer online role playing game (MMO RPG)
- Almost 6 million subscribers
- Players interact with the simulated environment as well as other players:

  Player/environment interactions:

  Quests, gathering resources, battling NPCs, world exploring

  Player/player interactions:

  Social, “Battling”, running through dungeons, and trading

Motivation

- World of Warcraft has been used in the past to gain insights on epidemics
- Could the same extend to, the already hard to predict, markets in real life?
- **Can inferences in the World of Warcraft market** shed some light on the real world market?

"Blood plague" incident in the news

World of Warcraft Economy

- Currency
  - Obtained by questing, selling items to vendors, and trading with players
- Resources
  - Herbs, cloth, ore/metal, leather, gems
  - Used to craft items
  - Parallels raw materials in the real world
- Items
- Player interactions
  - One on one trade
  - Auction house

Potential Economic Considerations

- **Market inference/prediction**
  - **What features contribute the most to item price?**
  - **What type of items are volatile in price?**
  - **Can we accurately predict the the average price of an item overtime?**
- Currency inflation/ arbitrage
  - What factors impact the in game currency?
  - Can we predict inflation?

Data Collection from TRADESKILLMASTER

- TradeSkillMaster (TSM) is an addon suite designed to help both players new to gold making as well as experienced auction house players streamline their gold-making processes.

- Holds all historical pricing data of every item that can be sold on the auction house (TSM pulls data from the auction house every hour for every server in the game).

- Only select data is made available to players in game through addon.

Data Collection from TRADESKILLMASTER

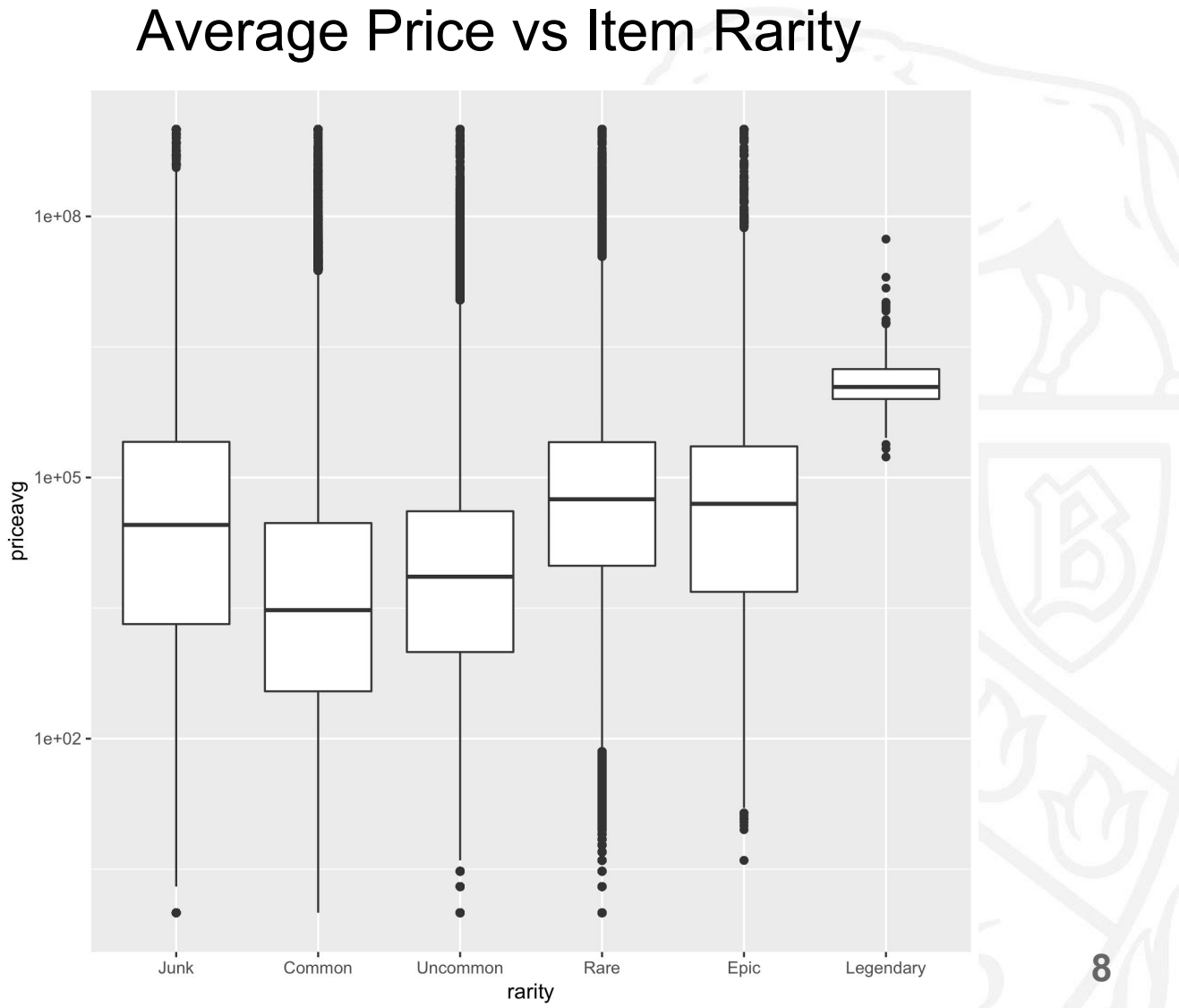
- Challenges:
  - Only way of getting the required data - API calls, limited to 50,000 per user per day.
- Workaround
  - Use 100 accounts to make a total of 5,000,000 API calls per day, to get a total of 56,541,829 records over 11 days.

default Show/Hide | List Operations | Expand Operations

GET	/item/{itemId}	Stats for a specific item
GET	/item/region/{region}	Stats for every item for a specific region
GET	/item/{region}/{realm}	Stats for every item for a specific realm
GET	/item/{region}/{realm}/{itemId}	Item stats for a specific realm

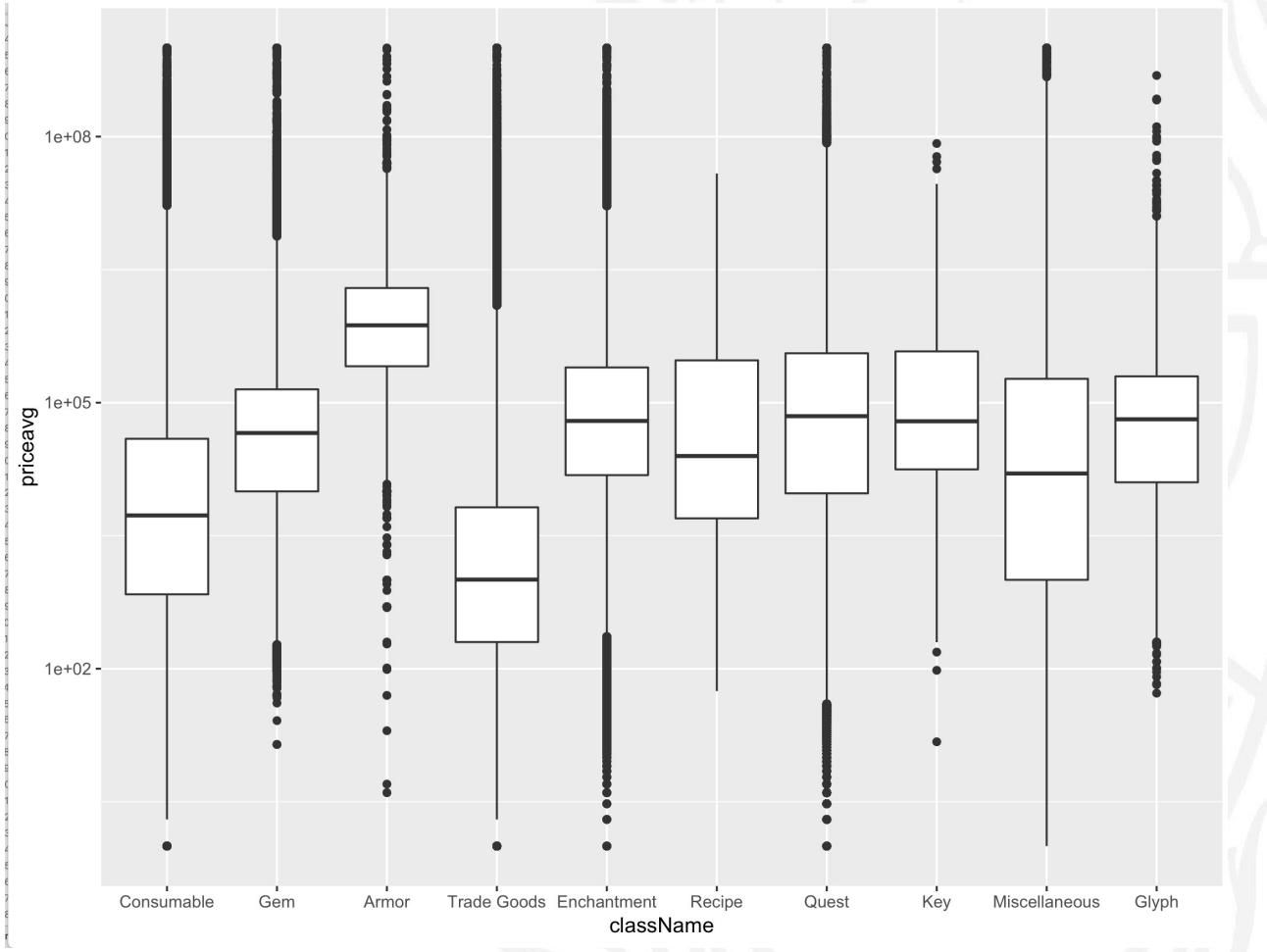
EDA - Box Plots

- Junk items on average cost the most
- As rarity increases so does average price (with the exception of junk items)
- Legendary items - the most rare and hard to obtain items - has the lowest spread



EDA - Box Plots

- Trade goods - which are abundant in the world and used as raw materials - were on average the lowest priced item.
- Armor - which requires certain skills and luck to obtain - were on average the highest priced item.

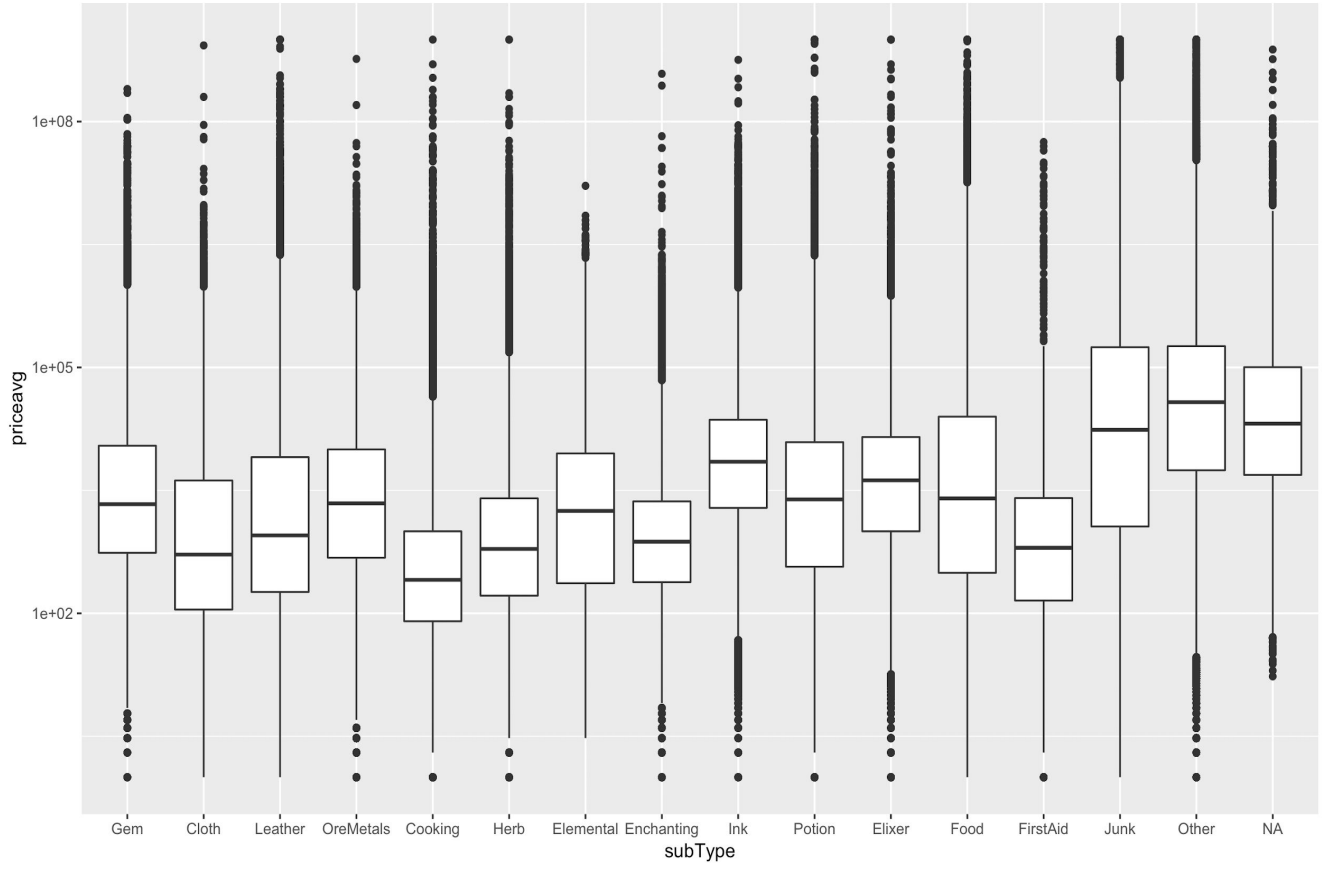


EDA - Box Plots

The maximum value of the average of price goes to Ink which is under the trade goods class

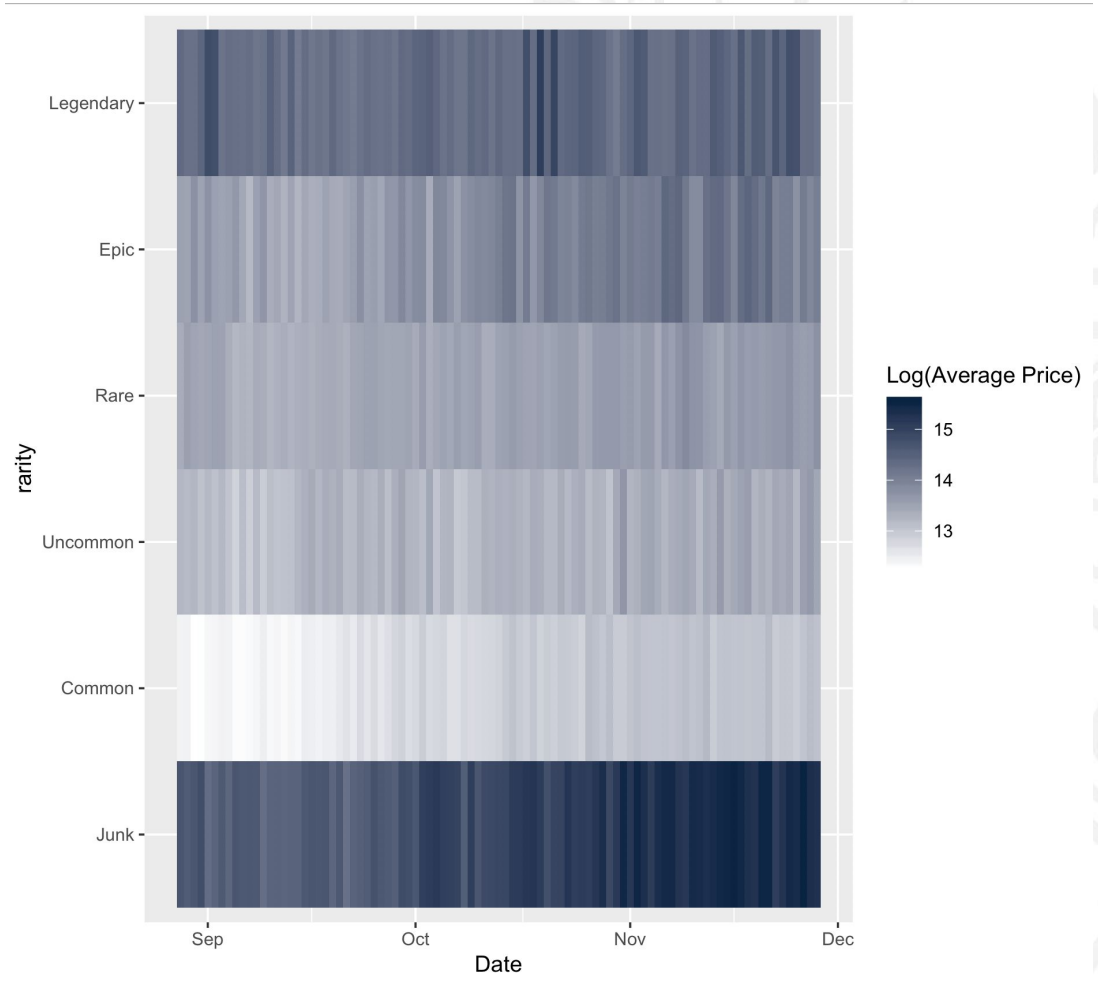
The minimum value of the average of price goes to cooking which is under the trade goods class

Average Price vs Sub type of class



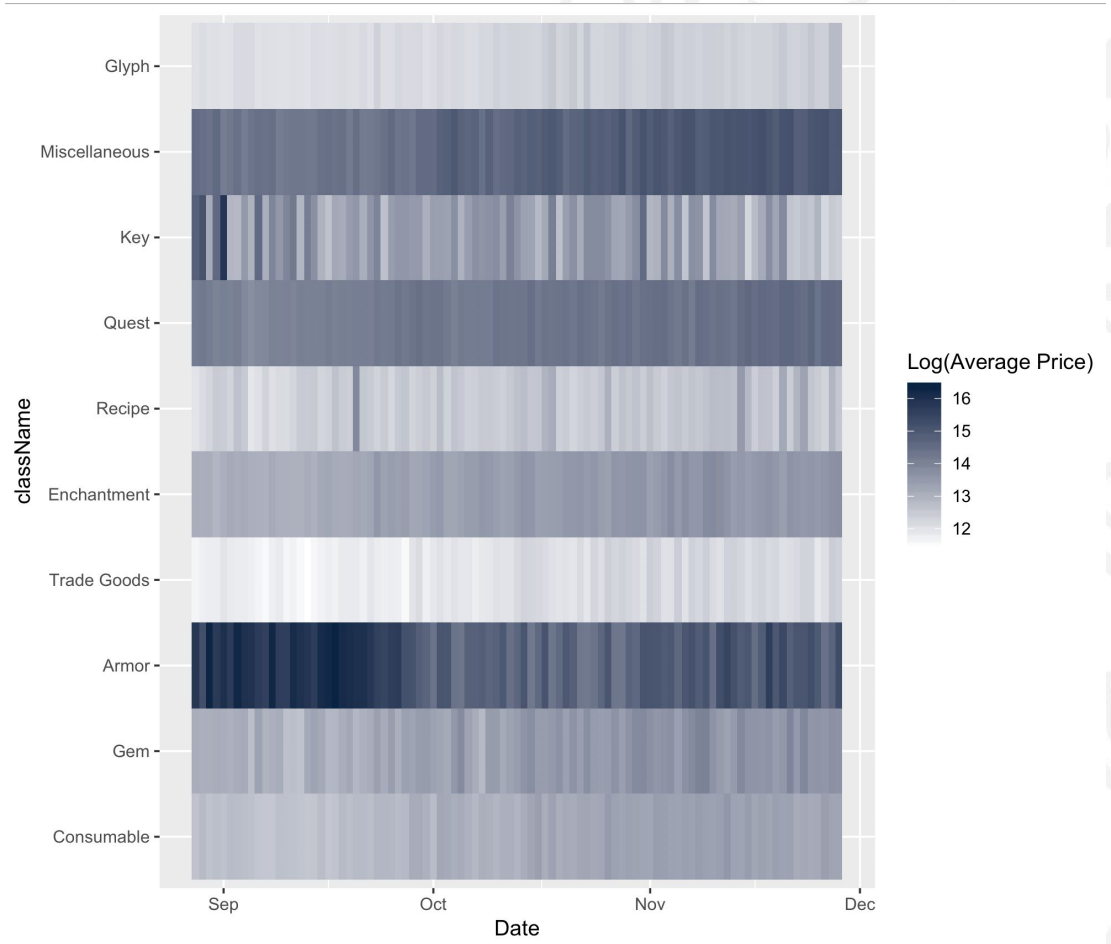
EDA - Heat Maps

- Again, with the exception of Junk items, the average price increases as rarity increases
- Temporally, we can note a slight increase in price over time
  - inflation?



EDA - Heat Maps

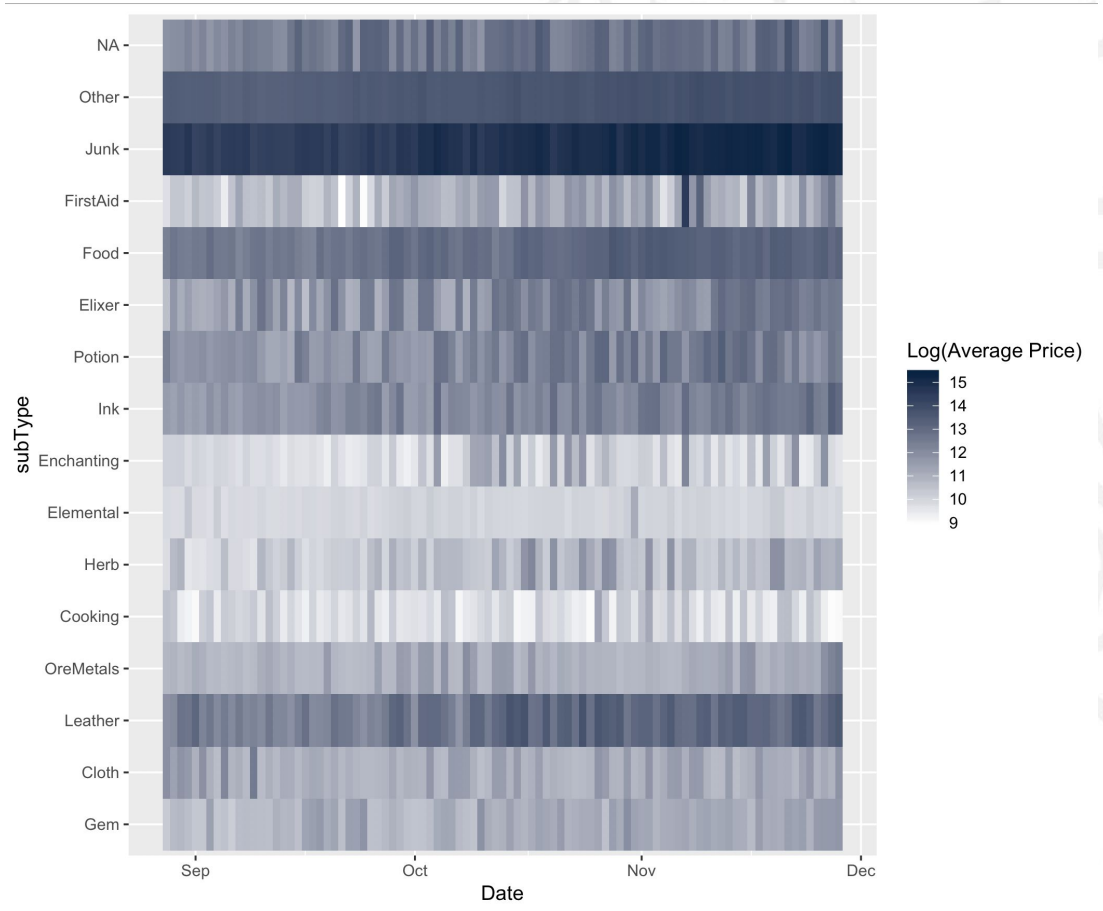
- Armor overall sells for a higher amount
- There is a spike in armor prices around August and september



EDA - Heat Maps

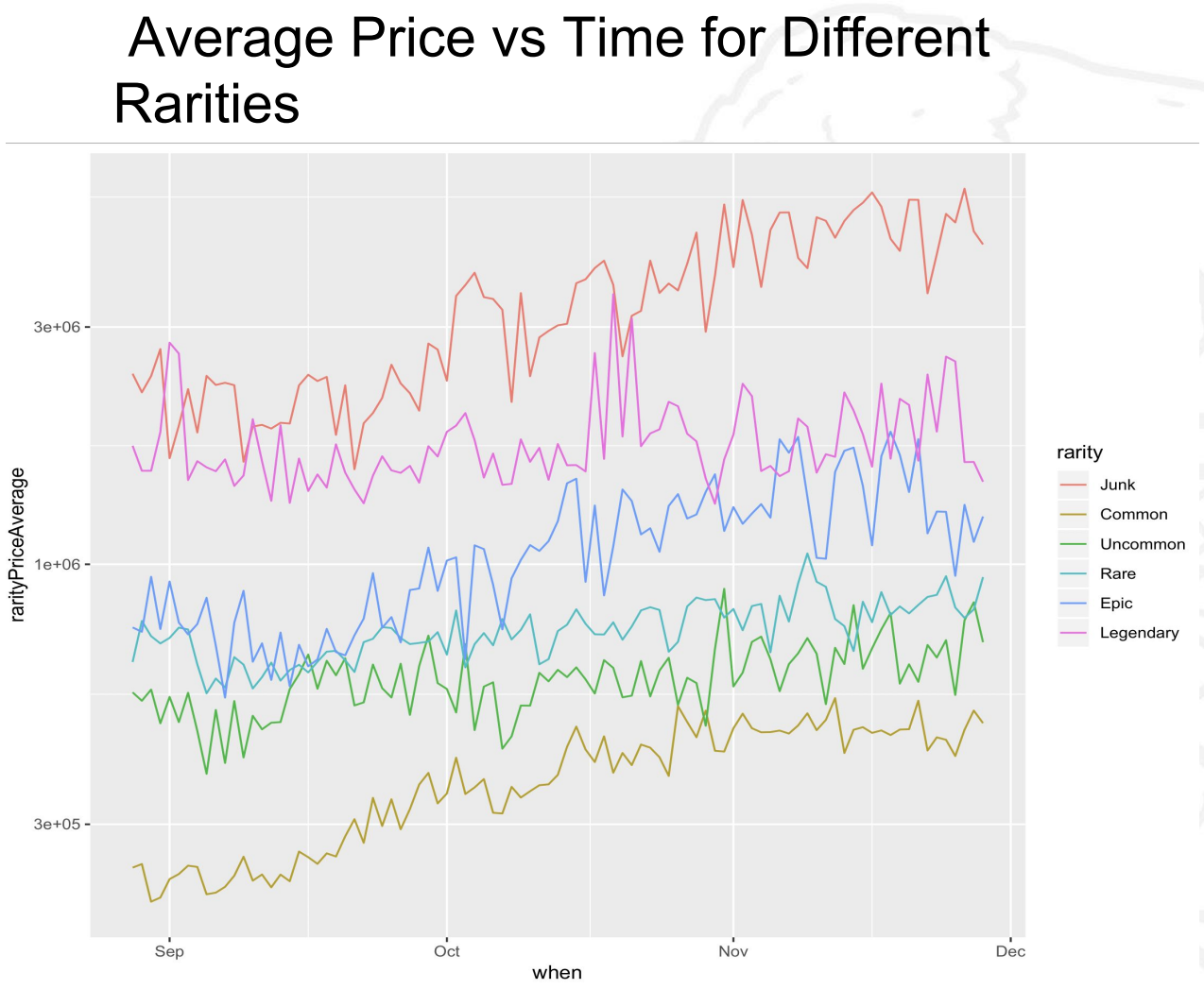
- “Heat” intensifies as color as time progresses

Average Price vs Sub Type



EDA - Time Series Plot

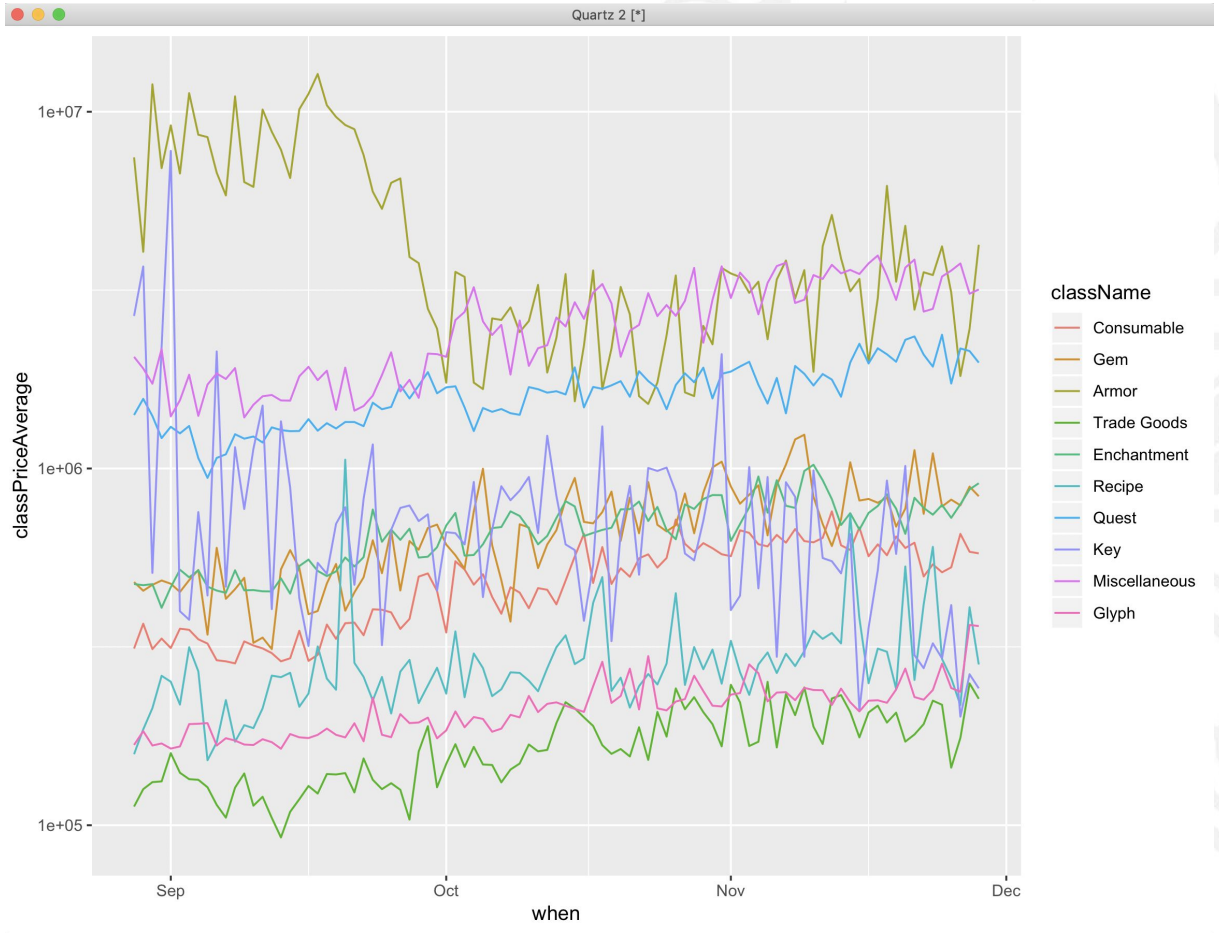
- All timelines, overall, increase as time increases
- As rarity increases so does the price



EDA - Time Series Plot

- Armor spikes in August and September, quickly falls off and plateaus
  - This spike coincides with the release of new content

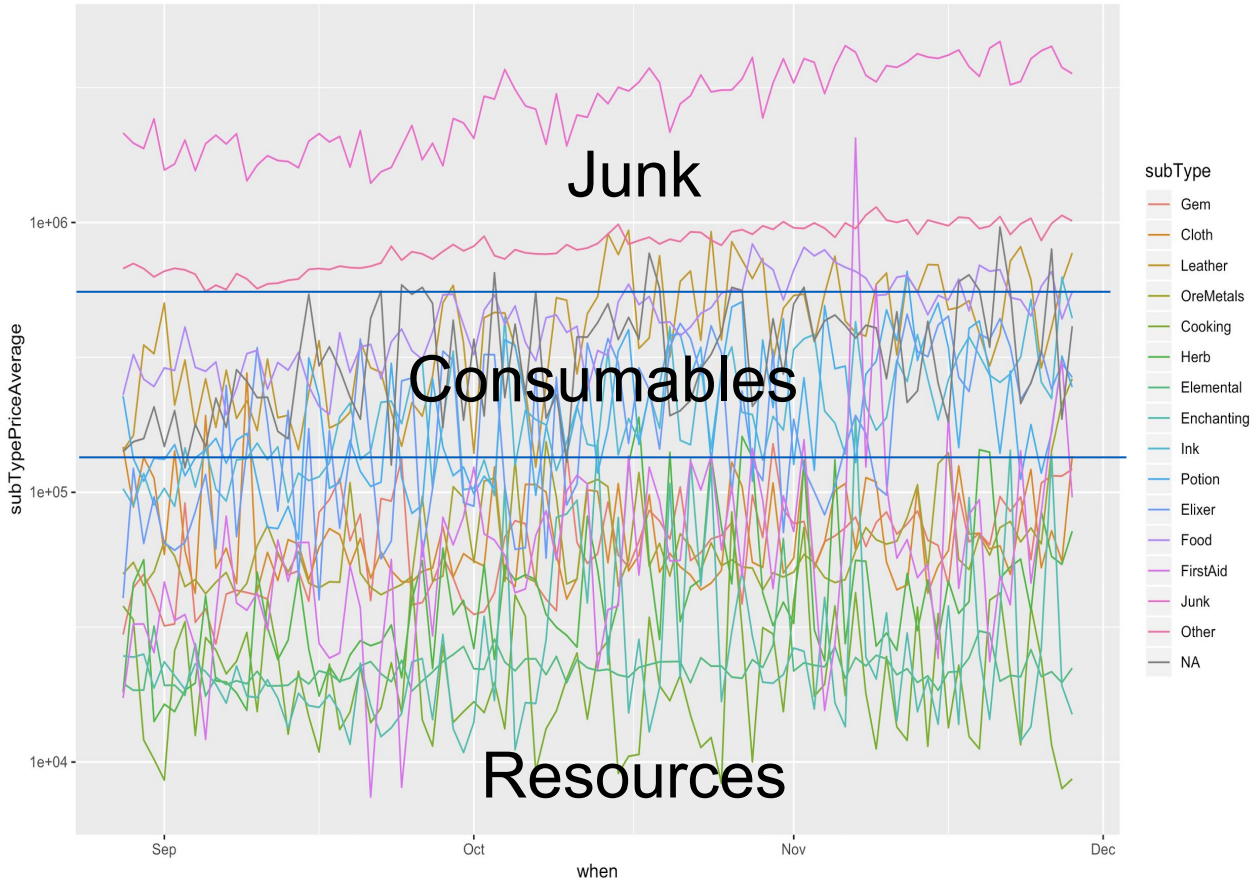
Average price of class of Item vs time



EDA - Time Series Plot

- Items classified as other show little variance over time
- color spread identifies different tiers

Average price of Sub-Type vs Time



EDA - Time Series Plot

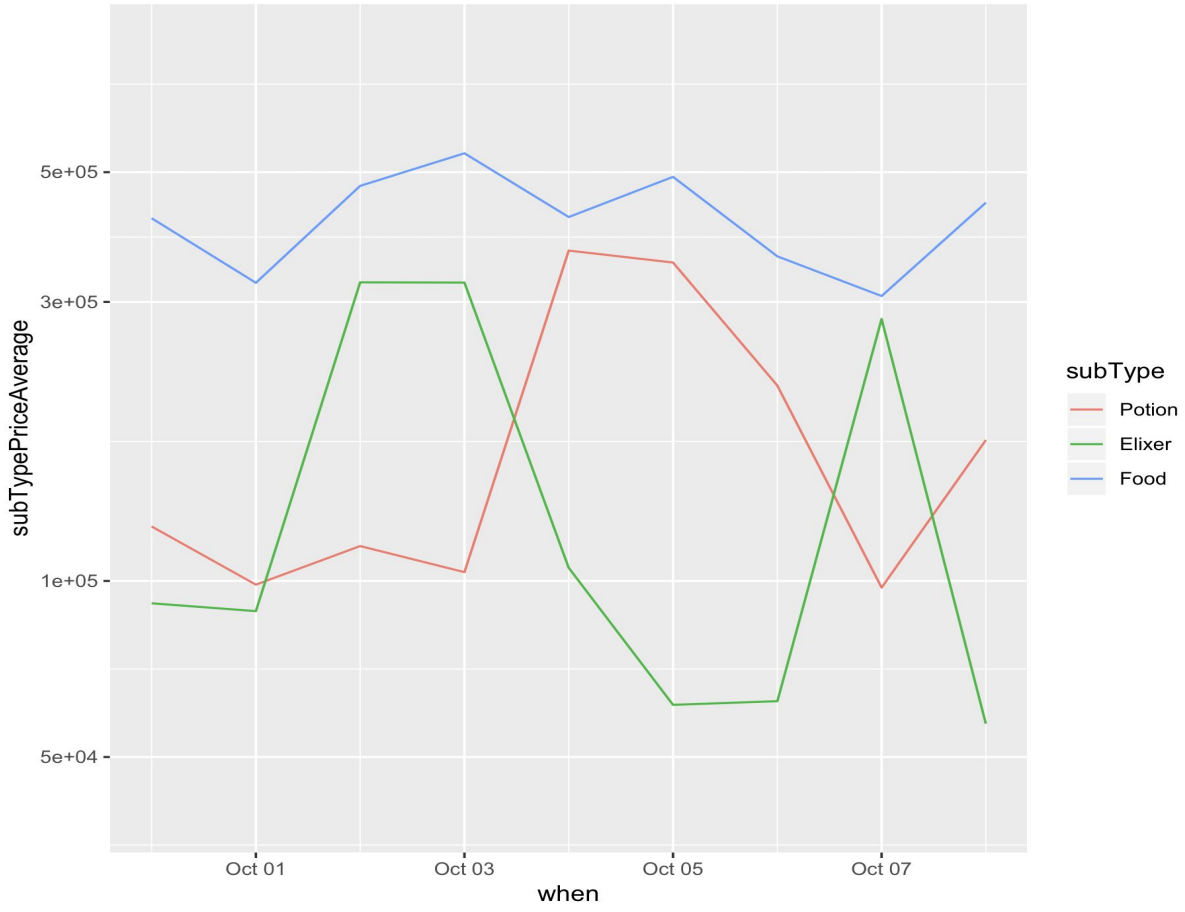
- Increases over time

Average price of Consumables vs Time

EDA - Time Series Plot

- Spikes on Tuesday

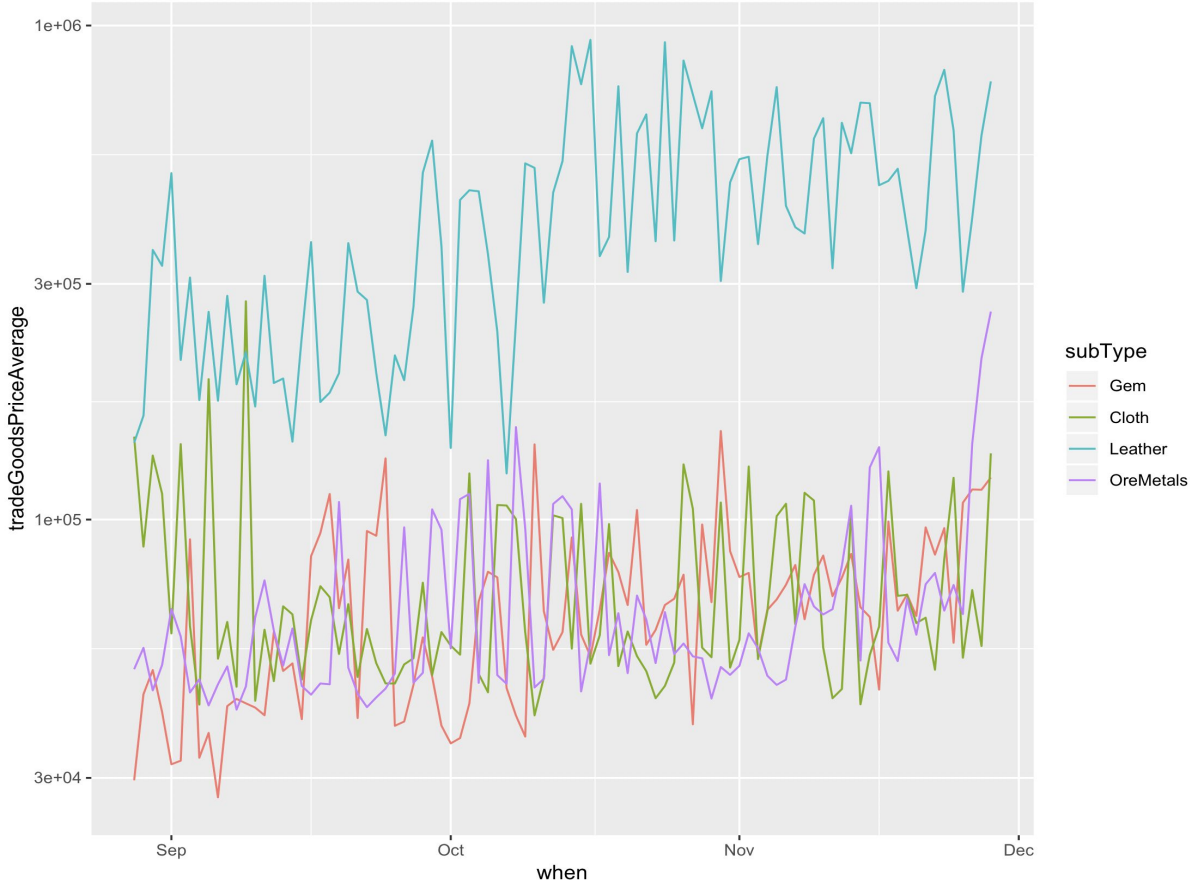
Average price of Consumables vs Time



EDA - Time Series Plot

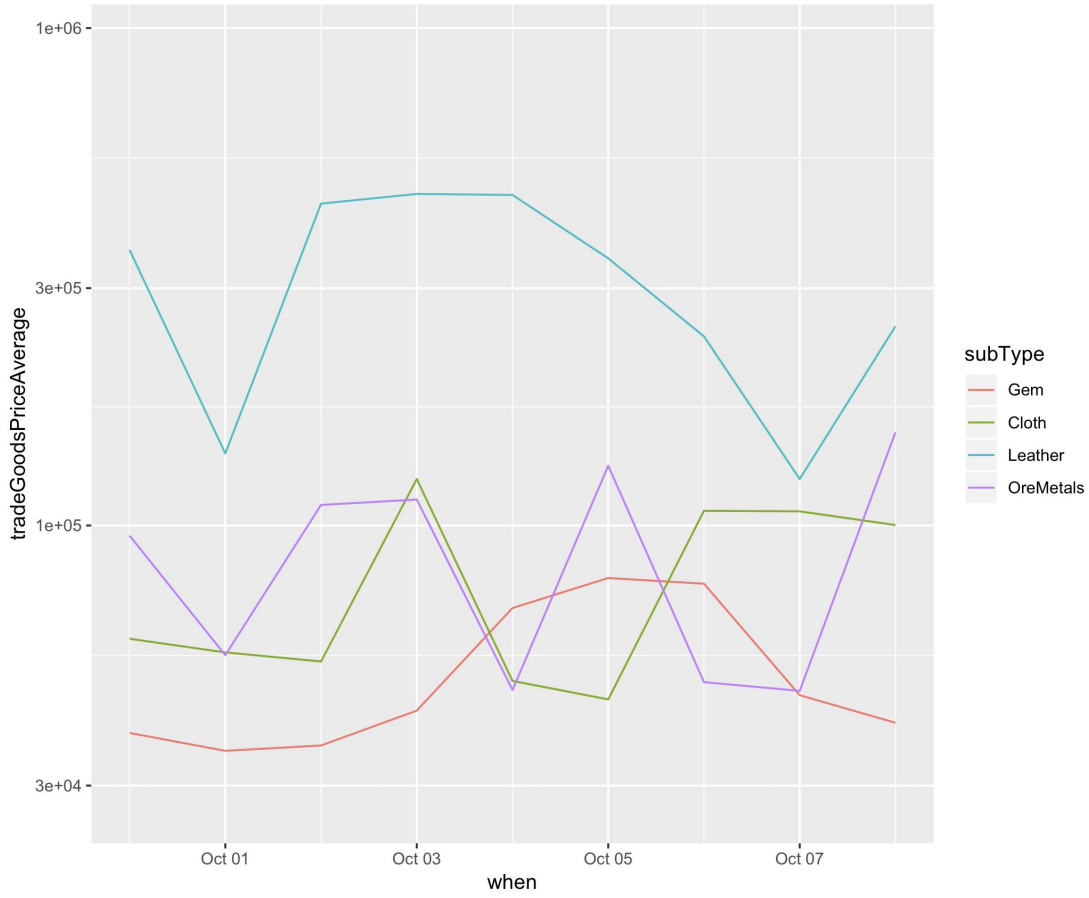
- Out of all resources, leather was consistently more expensive.
- Cloth and leather had small spikes in the beginning of september.

Average price of Resources vs Time



EDA : Time Series Plot

- Cloth, leather and ore/metals show similar patterns
- Cloth leather and ore/metals are also the materials that players use to craft armor (unlike gems).



EDA summary

- Overall, junk items are, on average more expensive than other items.
- Prices increase as rarity increases
- Items classified as armor are, on average more expensive,
- Spike in armor prices around the time of new content release
- overall increases in prices as time progresses

Modeling Challenges

- Memory issues in R when working with 5gb of data
  - consider using python - numpy/pandas/scikit
- Unreasonable computational times for modeling
  - consider prototyping with a smaller sample of the data
- Cross validation with ridge regression even with 1/5th of the samples posed memory issues.

Future work

- Switch over to python
  - Python contains libraries that are optimized when it comes to dealing with large data sets. (i.e. multiprocessing, psutil, numpy, etc.)
- Identify which models can most appropriately be used when drawing parallels in real world application.
- Assess how accurate can analysis from World of Warcraft be when using it to compare real world features
  - What are the limitations?

Questions/Discussion