Estimating the Value of Trading Cards

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Why Analyze Trading Cards?

Once a Hobby, Now an Investment

- Collected when younger and cheaper, often shelved and forgotten
- Value appreciates over time as cards go out of print
- Generally less susceptible to market volatility

Trading Cards Experiencing Resurgence in Popularity

c|net **Rapper Logic drops $220,000 on rare Pokemon card**

"***YouTube stars, celebrities and investors*** have dropped big bucks on cards, which has … helped push up their value," *Marketplace*

Final Fantasy Trading Card Game (TCG) Cards

Background

◎ Turn-based strategy game where each player builds a deck of 50 cards to battle opponents head-to-head

◎ Popularity driven by characters featured from *Final Fantasy* game series

◎ Cards can be purchased through booster packs (**card value not known**) or through second-hand markets (**seller's price known**)

Investigation:

1. What features contribute to pricing trading cards?
2. Can these features be used to accurately value trading cards?

Data

Market price and features for 3,945 individual cards webscraped from **TCGplayer.com** (online marketplace)

- Price data represents *snapshot* of card value, does not identify value of cards over time

Observable Card Features

1 - Art Design

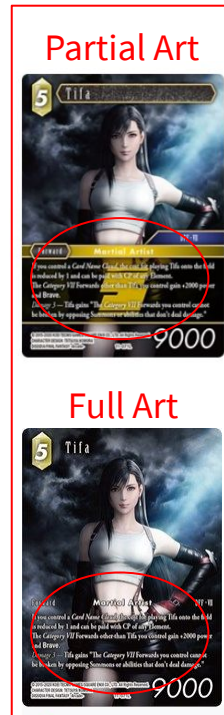- Partial vs Full Art

2 - Rarity

- Determines supply of card

3 - Card Material

- Normal or Foil (Shiny)

4 - Market Price

- **Target variable**

Observable Card Features - In-Game Attributes

5 - Release Set Name

- Controls for time, meta

6 - Description Text

- Length of description
- Type and Number of Abilities

7 - Card Cost to Play in Game

8 - Card Power

Summary of Price Model Predictors

Card Appearance (2) + **Card Availability (18)** + **Card Playability (5)**   **= 25 Total Predictors**

- Partial vs Full Art
- Normal vs Foil Card Material

- Listed Rarity (5*)
- Release Set Name (13*)

- Card Power
- Card Cost
- Description Text Length
- Number of Abilities
- Ability Type

Number of categories

Model Construction Workflow

Linear Regression on 25 variables

Include Interaction Terms (300)

Regularize Features: **Ridge Regression Selected**

R^2 low: determined that model was ***underfit***

R^2 artificially high: determined that model was ***overfit***
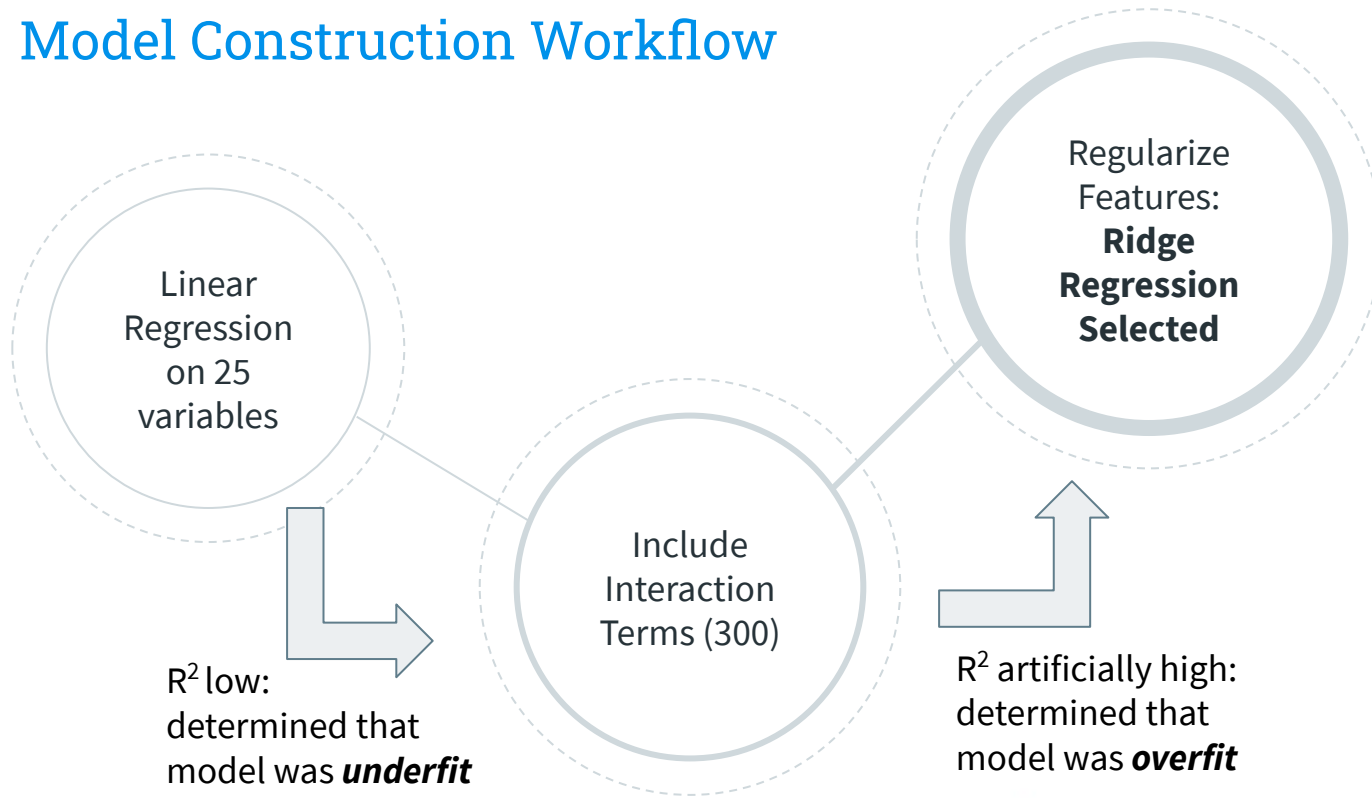
Results

R^2: 46.0%

- Selected model explains 46.0% of variance in test data

Mean Absolute Error (MAE): $1.53

- On average, selected model predicts price in test data with an error of ±$1.53

Large Coefficients Associated with Interaction Terms

Rank by Size	Variable	Coefficient
1	Full Art Legend	$1.14
2	Full Art Opus XII	$1.05
3	Full Art Normal	-$0.67
4	Full Art	$0.63
5	Legend Opus I	$0.62
6	Full Art Opus XI	$0.58
7	Legend	$0.58
8	Normal Legend	-$0.55
9	Cost Legend	$0.55
10	Legend Opus XI	$0.50

Large Price Differences Indicated by Card Appearance
Presence of full art indicates significant differences in price compared to card material
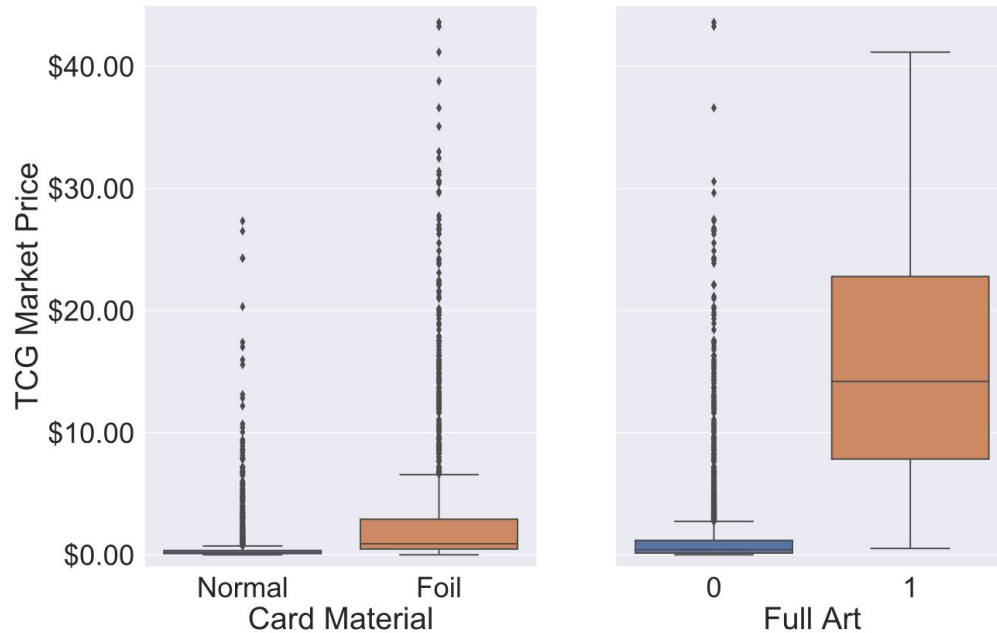
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Rarity Also Indicates Clear Price Differences
Hierarchy shown across categories
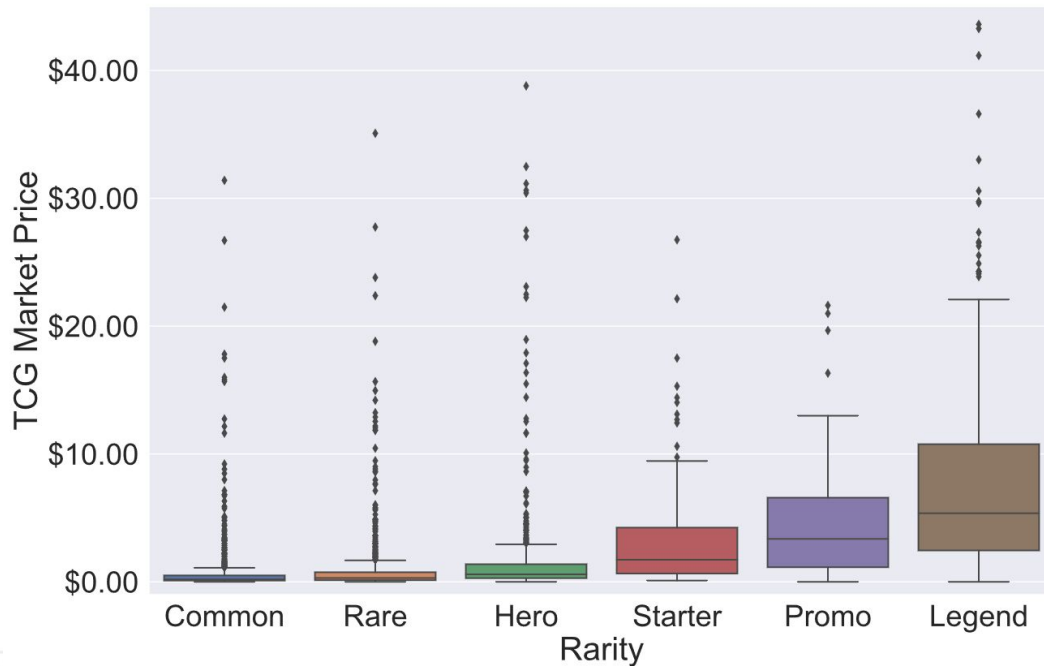
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No Clear Relationship between Price and In-Game Attributes
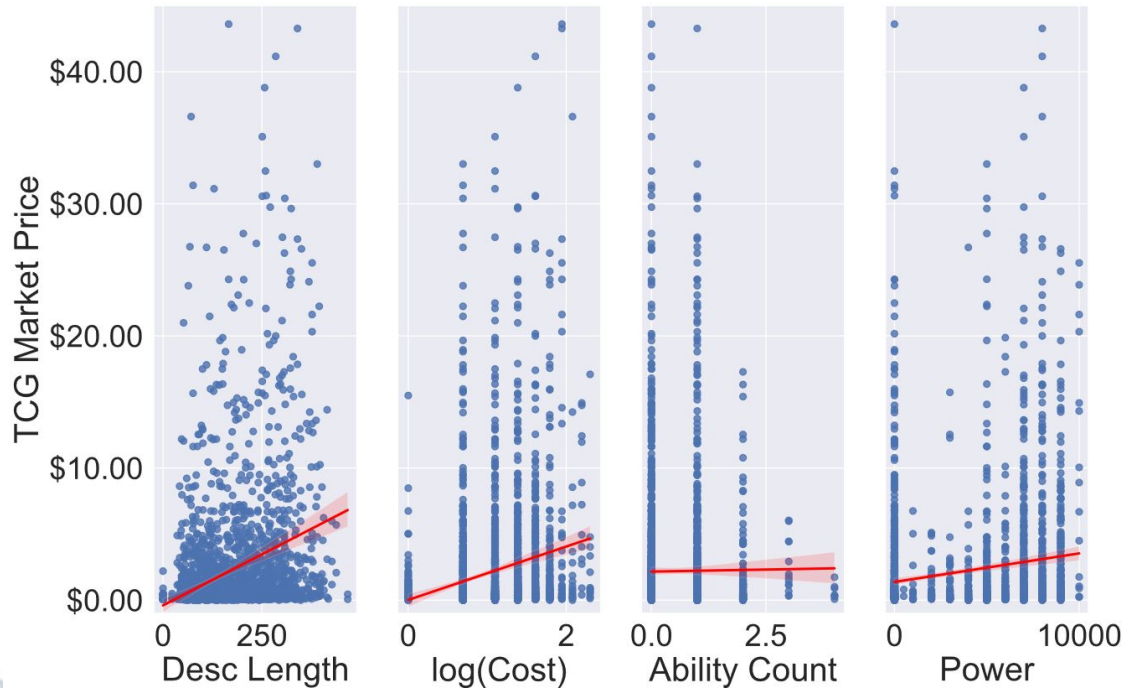
Model's MAE of $1.53 may arise at unwanted errors

Large concentration of FF TCG cards below $1.00
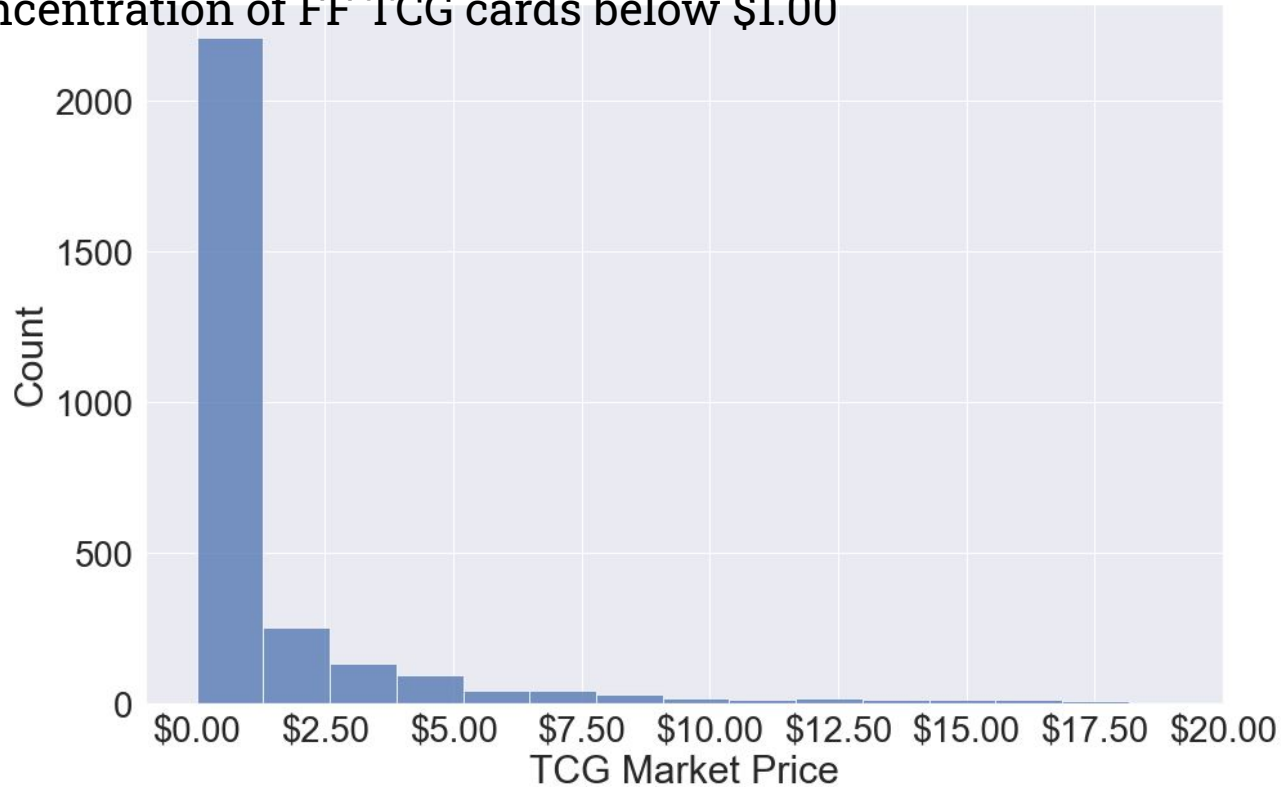
Takeaways

◎ Value may be indicated by card appearance and rarity
  ○ Card value associated with ***visual aspects*** of card
  ○ Features have a strong effect when considered in combination
◎ Current model's game attributes show unclear relationship to card value

Future Work

◎ Capture additional features that drive demand
  ○ Popularity of characters featured on cards
  ○ Add more information on card's game performance
◎ A more accurate model could be used to predict a return on investment booster packs given an expectation of the card composition of the booster pack

Thanks!

Any questions?

Appendix

Errors indicate that model does not capture various outliers
Additional features indicating card value missing from model