Validating the win-rate of Heroes in Dota 2 using instrumental variable estimation

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Research Project CSE3000

Introduction

- Instrumental variables (IV) is a widely used technique in causal inference studies
- The methods capabilities are yet to be determined fully
- Validating other predictive models using IV
- Dota 2 as basis for capabilities and validation test

The goal of this research project is to test the usefulness of instrumental variables by validating other predictive models using data from the game Dota 2.

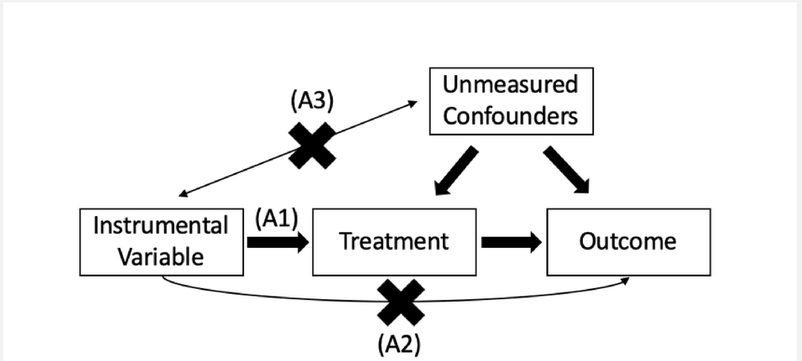
Background information

- Dota 2 is a MOBA where 2 teams face off in battle
- Validating the win-rate of hero “Viper” in Dota 2
- This can be influenced by many confounders, think of team composition, countering heroes etc.
- What would the win ratio be if the confounders are left out?

Method: IV’s

How do we model Vipers win-rate without confounding factors?

According to the IV method it is required to have an “instrument” that only effects the treatment of the experiment which in term affects the outcome. However the instrument can not directly impact the outcome nor can it influence any of the possible confounders.[1]



[2]

Assumptions

- The instrument chosen is the bans in the game mode of single draft. This game mode only lets players select from a 3 hero pool whilst being unable to see what other players picked.
- It is assumed that the reduced hero selection draft will not influence other confounders since the instrument does not affect skill levels nor team building.

Results

- Modelled for Viper and Meepo

	Actual win rate	Ivs win-rate	Variance
Viper	49.03%*	48.73%	0.24%
Meepo	53.71%	47.22%	0.49%

- No significant difference for Viper, but there is for Meepo
- Bigger variance due to weaker instrument on Meepo

*Difference in win-rate is because sample data was not taken on the same day as picture.

Discussion

- Meepos win-rate is biased, but Vipers is not?
- Win-rates still not accurate?
- In comparison to the full-randomized experiment (Avigousti, S.) Meepos calculated win-rate is still too high.
- Is there still bias in the results?

- IV is too unreliable within these complex causal

References

1. Facure, M. (2021). “Causality handbook”: Instrumental Variables. https://matheusfacure.github.io/python-causality-handbook/08-Instrumental-Variables.html#
2. Michael Johnson, Jiongyi Cao, and Hyunseung Kang. Detecting heterogeneous treatment effect with instrumental variables, 08 2019