

Lemonade Stand

A mini-game to understand challenges in decision-making

Prof. Murat Kocaoglu

Congrats!
You just purchased a
lemonade stand!



Rather than setting a price, you let customers decide on a fair price for a glass of lemonade.



To increase sales, you would like to employ a data-driven promotion campaign.



Observe two customer
features:

Sunglasses		4 \$
Beanies		4 \$

to decide which one to
give away to increase
profit!



Time to Play:
Follow the instructions
on your screen.
We will discuss the
results in a bit.



Which promotional item to give away?



Avg. price w/ Beanie. : 15 \$
Avg. price w/out Beanie: 16 \$



Avg. price w/ Sunglasses : 20 \$
Avg. price w/out Sunglasses: 12 \$

Overall Avg. price: 16 \$

Observations from Data:

- Customers with a beanie pay less than customers without a beanie.

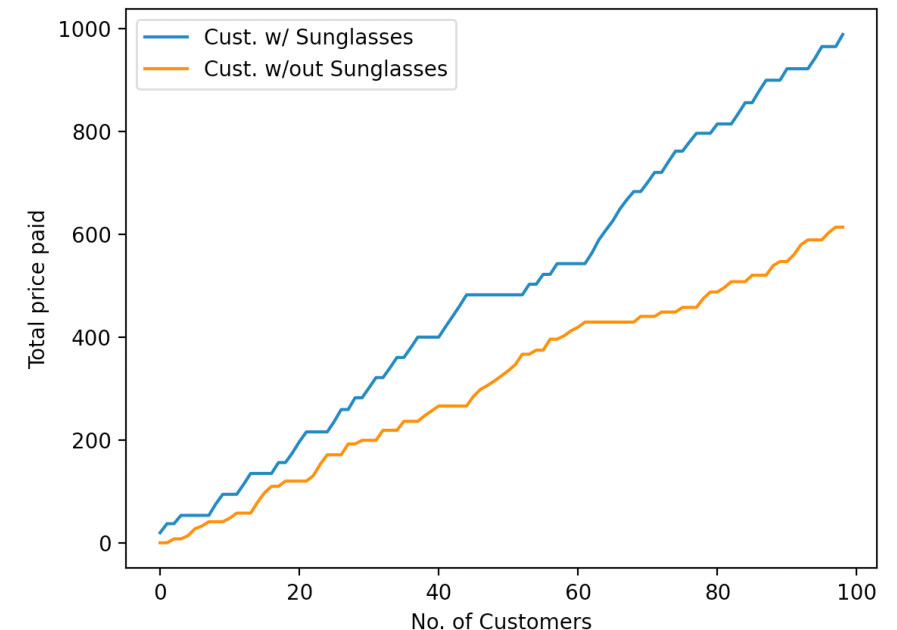
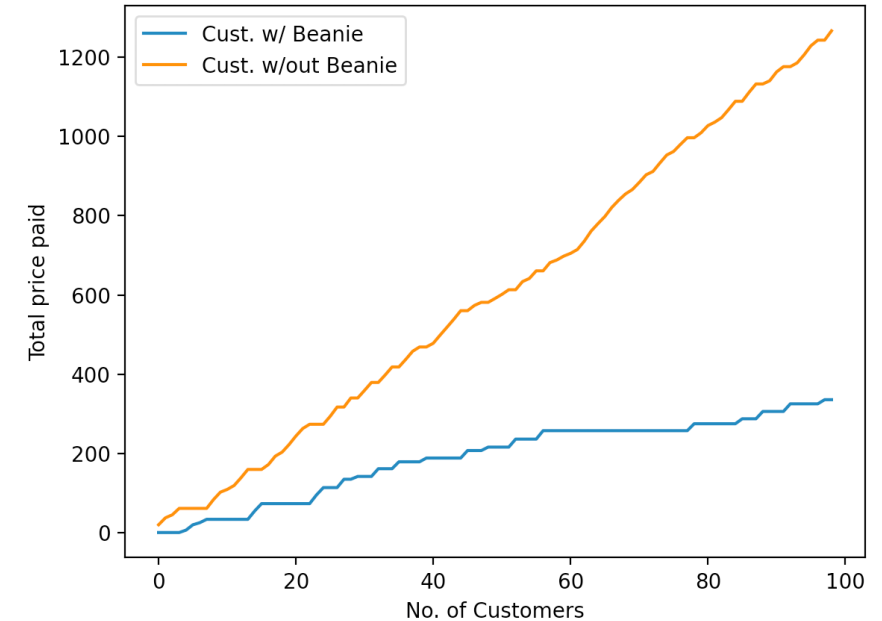
Avg. price w/ Beanie. : 15 \$

Avg. price w/out Beanie: 16 \$

- Customers with sunglasses pay more than customers without sunglasses.

Avg. price w/ Sunglasses : 20 \$

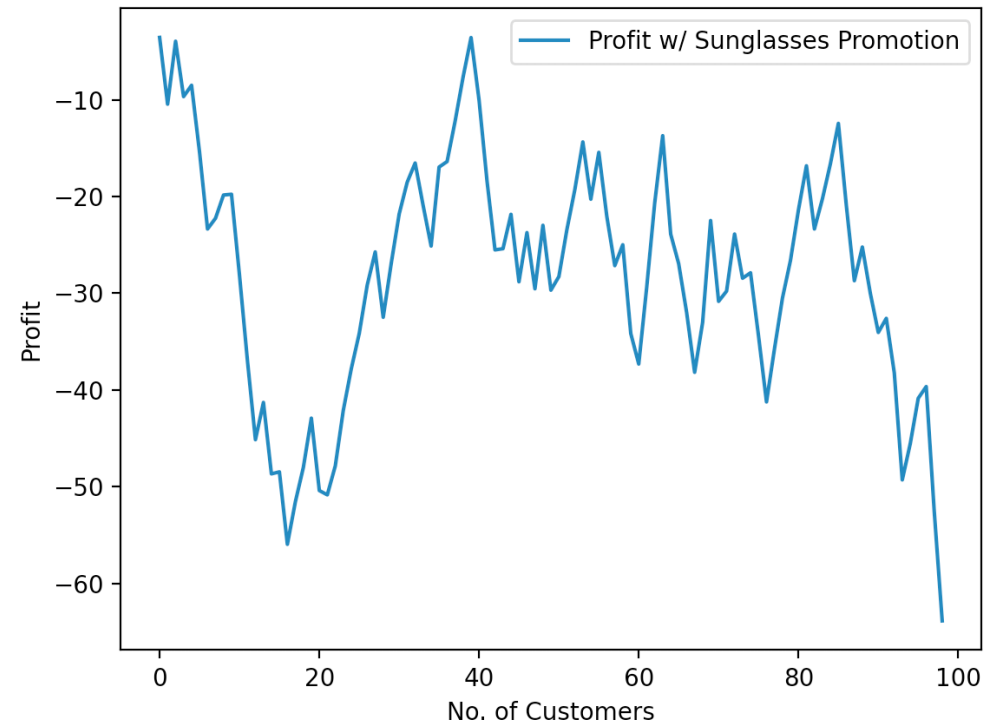
Avg. price w/out Sunglasses: 12 \$



Sunglasses Giveaway

- Giving away sunglasses did not affect how much customers pay for lemonade!

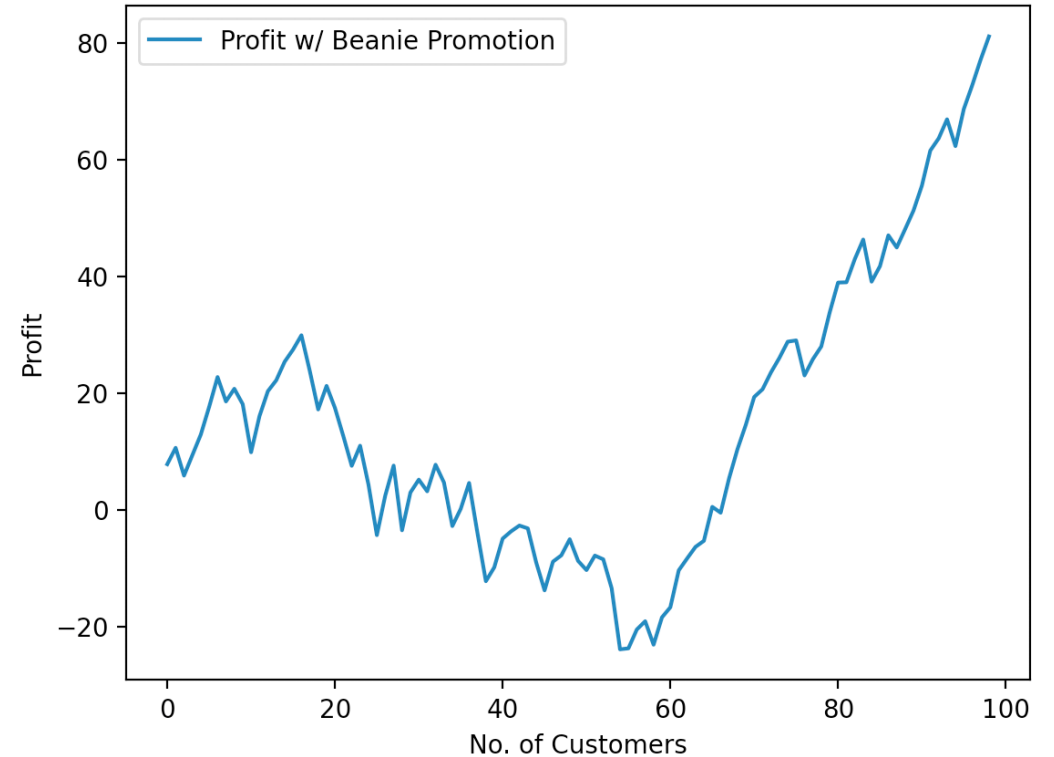
Avg. price: 16 \$



Beanie Giveaway

- Giving away beanies **did affect** how much customers pay for lemonade!

Avg. price: 17.5 \$



How can this happen?



Avg. price w/ Beanie. : 15 \$
Avg. price w/out Beanie: 16 \$

Avg. price after : 17.5 \$
Beanie Giveaway



Avg. price w/ Sunglasses : 20 \$
Avg. price w/out Sunglasses: 12 \$

Avg. price after : 16 \$
Sunglass Giveaway

Causality



Rooster Crows



Sun Rises

Does rooster crow cause sunrise?

Does sunrise cause rooster to crow?

Causality



Rooster Crows



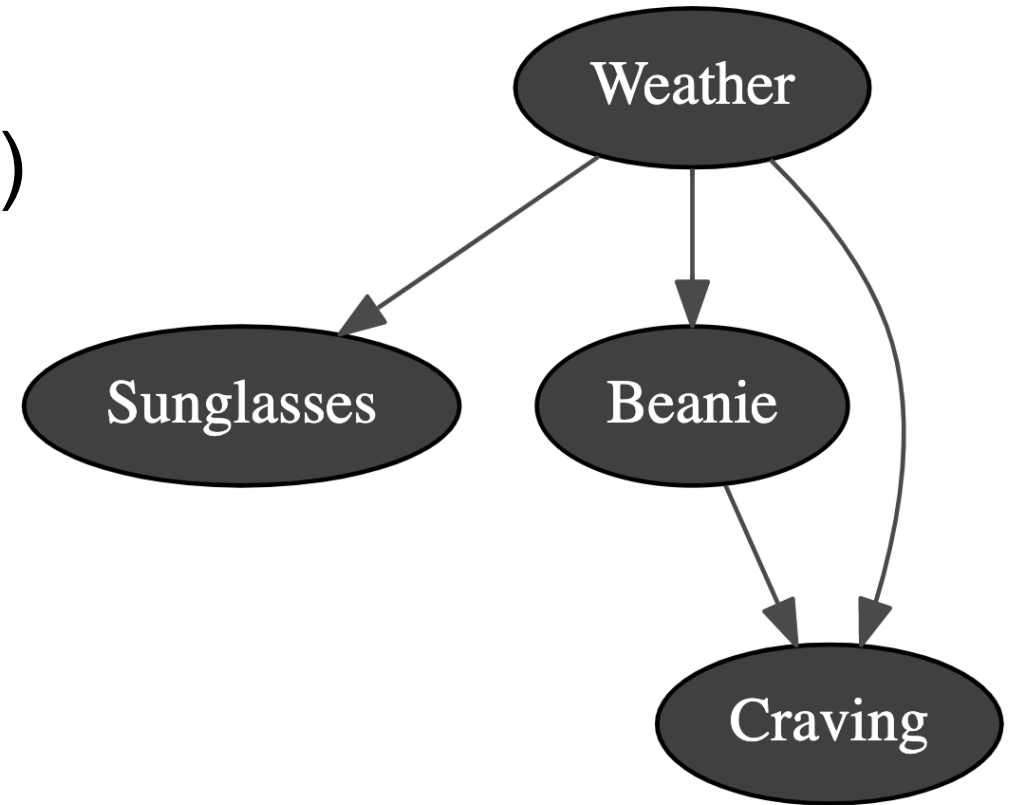
Sun Rises

Causality allows us to understand consequences of our actions.

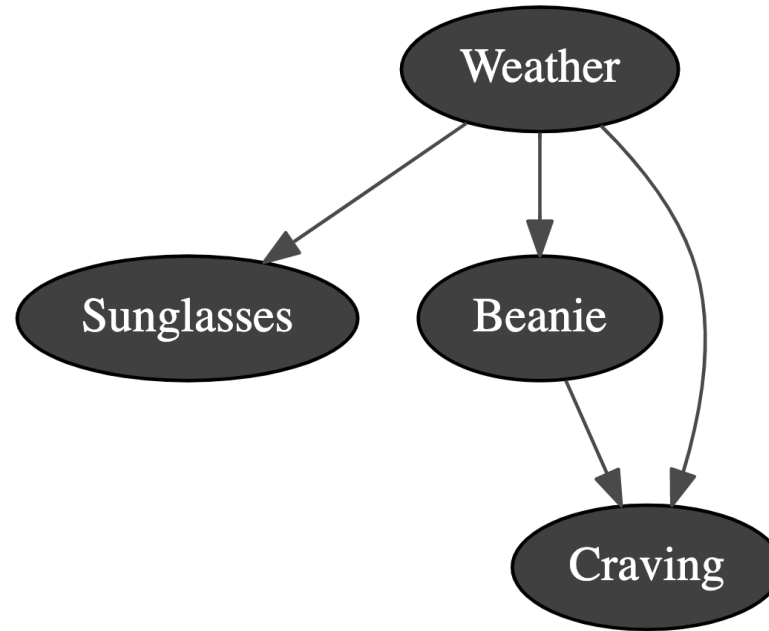
Would sun stop rising if we lock the rooster in the basement?

Causal Structure of Lemonade Stand Game

- Customer features are affected by weather (not accounted for in our data!)
- Weather and beanie affect craving (customers want lemonade if they feel hot!)
- Sunglasses are worn if weather is hot. But giving out sunglasses does not affect the craving!



Time to Play Again

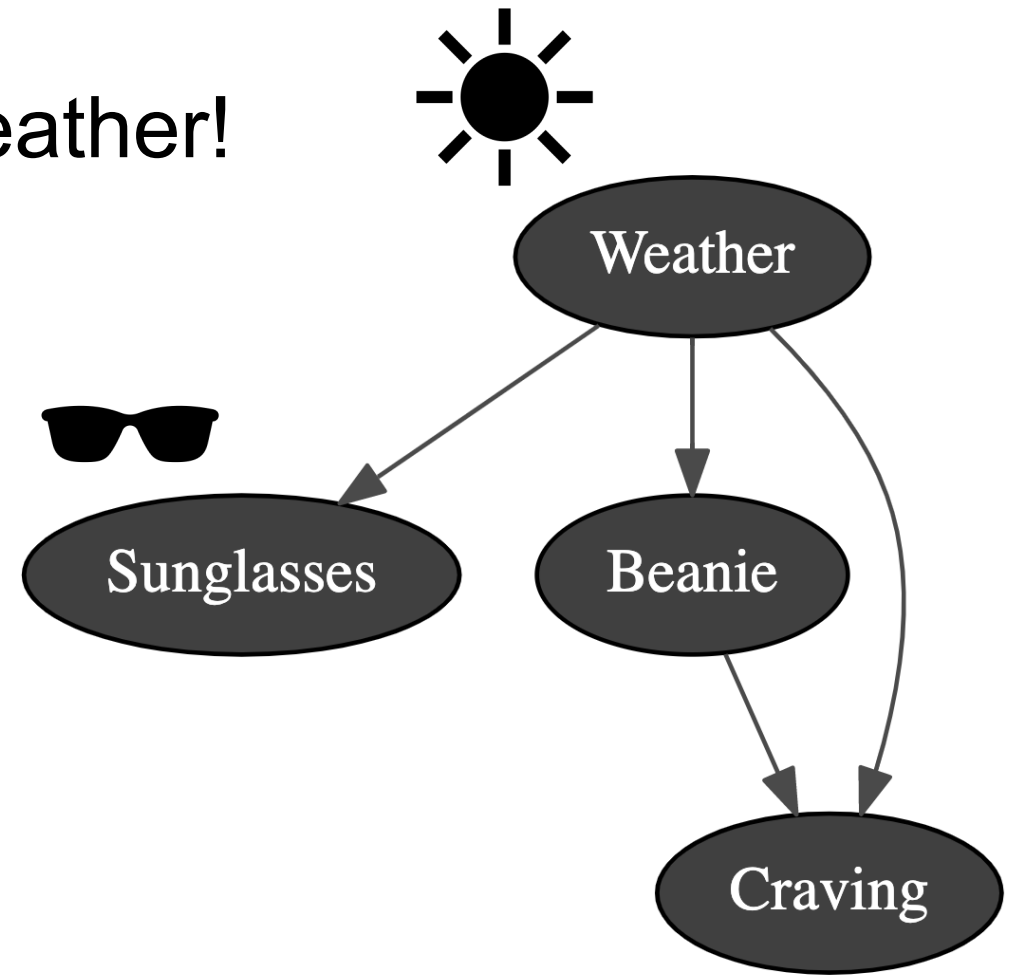


- Equipped with causal knowledge, come up with a customized promotion policy.
- Decide which customers to give away beanie to:
With glasses, with beanie?

Best Causal Policy

Use customer features to infer weather!

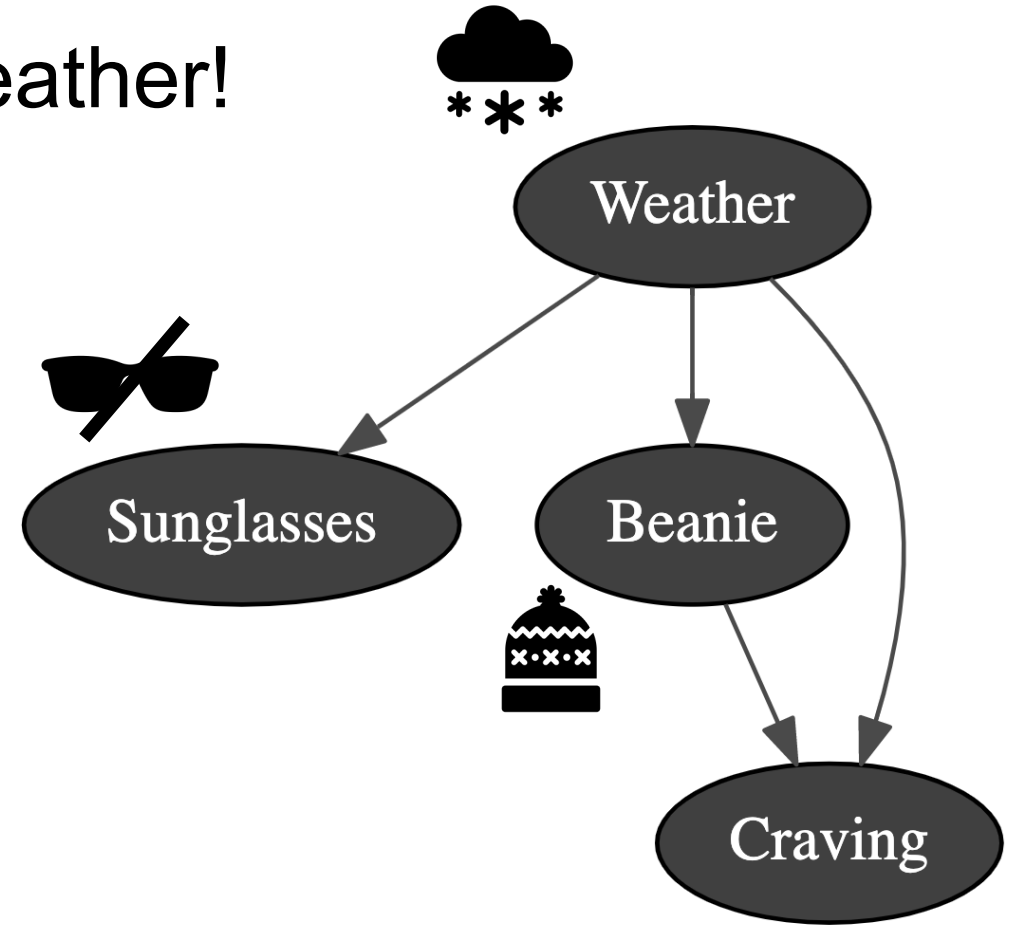
- If Sunglasses, nice weather, no need for a beanie.



Best Causal Policy

Use customer features to infer weather!

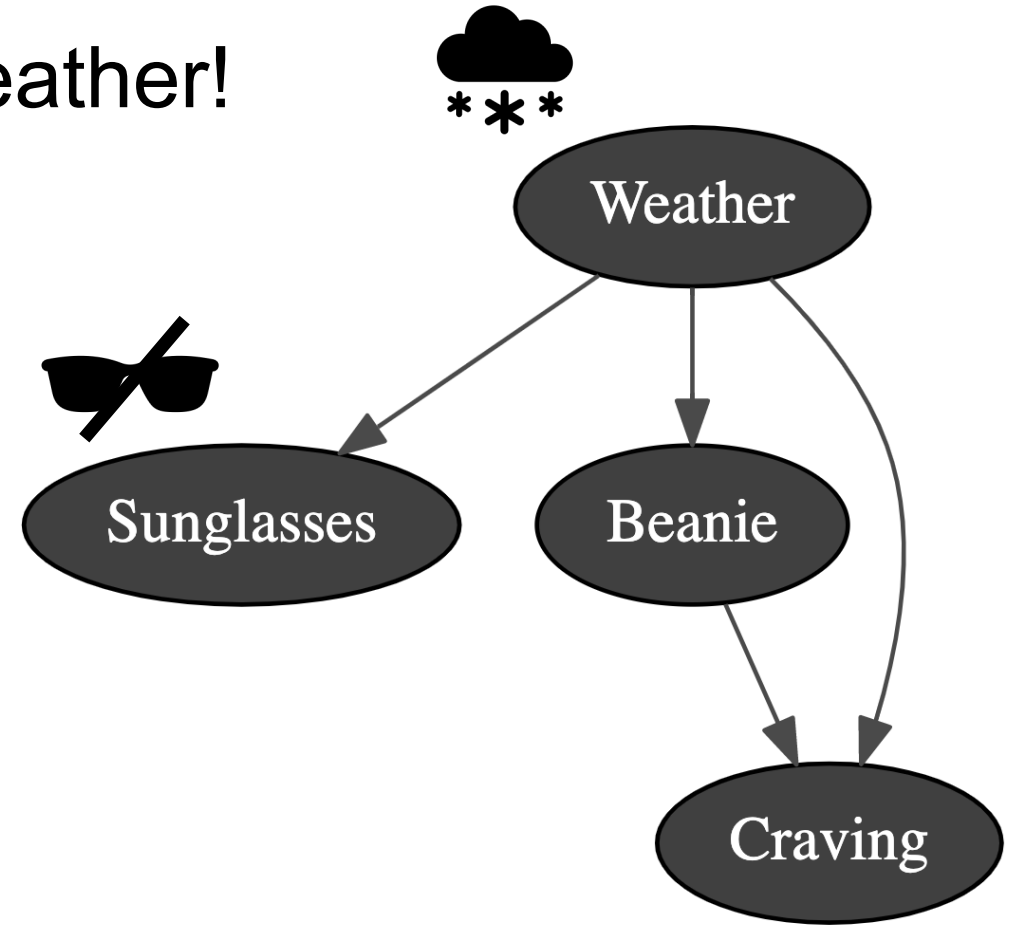
- If Sunglasses, nice weather, no need for a beanie.
- If no sunglasses, and beanie, no need to give away beanie.



Best Causal Policy

Use customer features to infer weather!

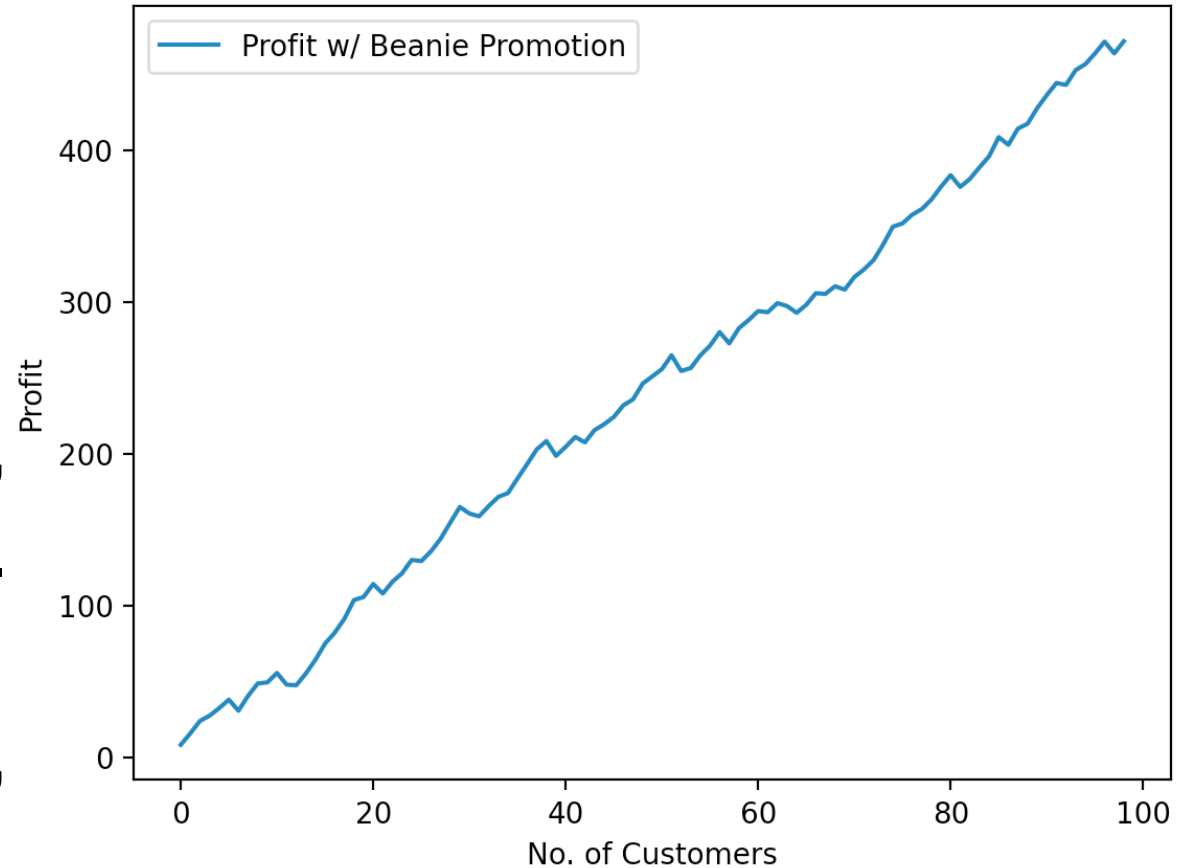
- If Sunglasses, nice weather, no need for a beanie.
- If no sunglasses, and beanie, no need to give away beanie.
- If no sunglasses, and no beanie, give away beanie to keep customers warm!



Best Causal Policy

Use customer features to infer weather!

- If Sunglasses, nice weather, no need for a beanie.
- If no sunglasses, and beanie, no need to give away beanie.
- If no sunglasses, and beanie, give away beanie to keep customers warm!



That's a lot of profit!

Takeaways

- Think about causality. Seeing things together often does not mean one causes the other.
- We need to understand causal mechanisms!
- Causality can help find the best policies in industries from healthcare to engineering.

