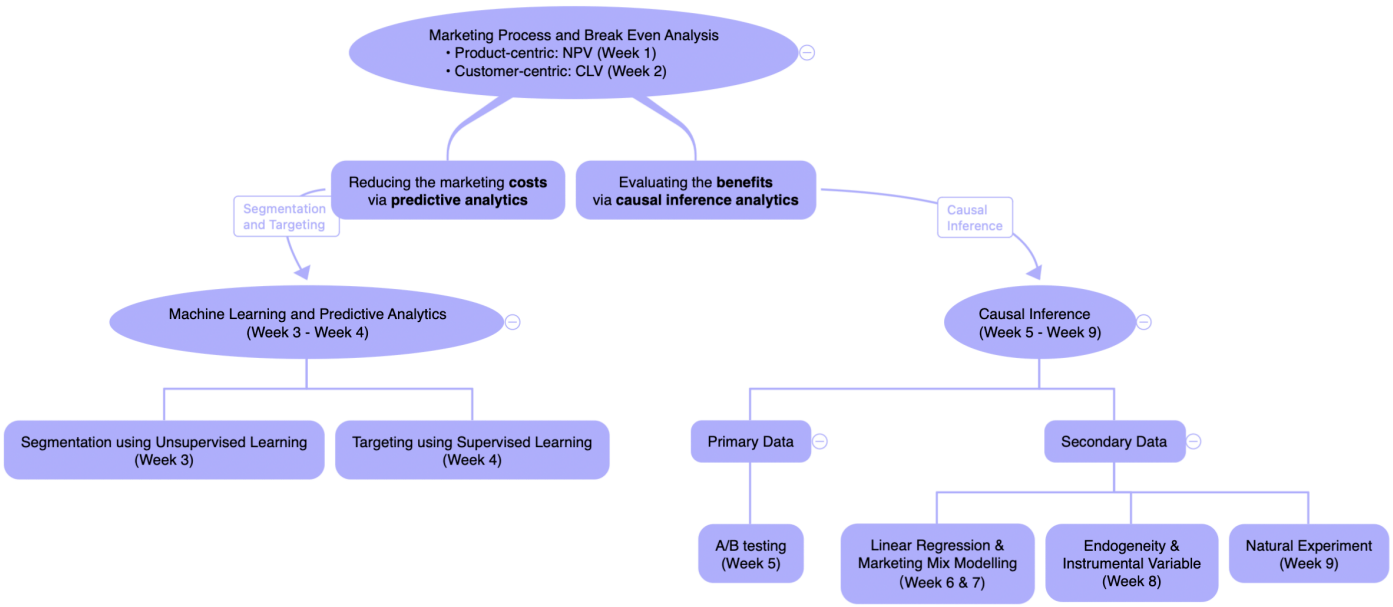
Week 10 Module Wrap-up

Dr Wei Miao

UCL School of Management

December 6, 2023


Marketing Process and Break Even Analysis
• Product-centric: NPV (Week 1)
• Customer-centric: CLV (Week 2)
Reducing the marketing costs via predictive analytics
Evaluating the benefits via causal inference analytics
Segmentation and Targeting
Causal Inference
Machine Learning and Predictive Analytics (Week 3 - Week 4)
Causal Inference (Week 5 - Week 9)
Segmentation using Unsupervised Learning (Week 3)
Targeting using Supervised Learning (Week 4)
Primary Data
Secondary Data
A/B testing (Week 5)
Linear Regression & Marketing Mix Modelling (Week 6 & 7)
Endogeneity & Instrumental Variable (Week 8)
Natural Experiment (Week 9)

Section 1

Intro to Marketing Analytics

Week 1: Marketing Process

- Situation analysis (5C analysis)

Week 1: Break-Even Analysis

- Break-even analysis is essential to any business activity
  - For business campaigns: Break-even quantity (BEQ) and Net present value (NPV)
  - For customers: Customer lifetime value (CLV)
- BEA is essentially cost-benefit analysis
  - PineApple case
  - i-basket case

Section 2

Descriptive Analytics

Week 2: Data Wrangling with `dplyr`

- Data manipulation with `dplyr`
  - basic operations: `filter`, `mutate`, `select`, `arrange`
  - group aggregation: `group_by`
  - multi-data joining: `left_join`
- Tesco case study: Preliminary customer analysis using `dplyr`

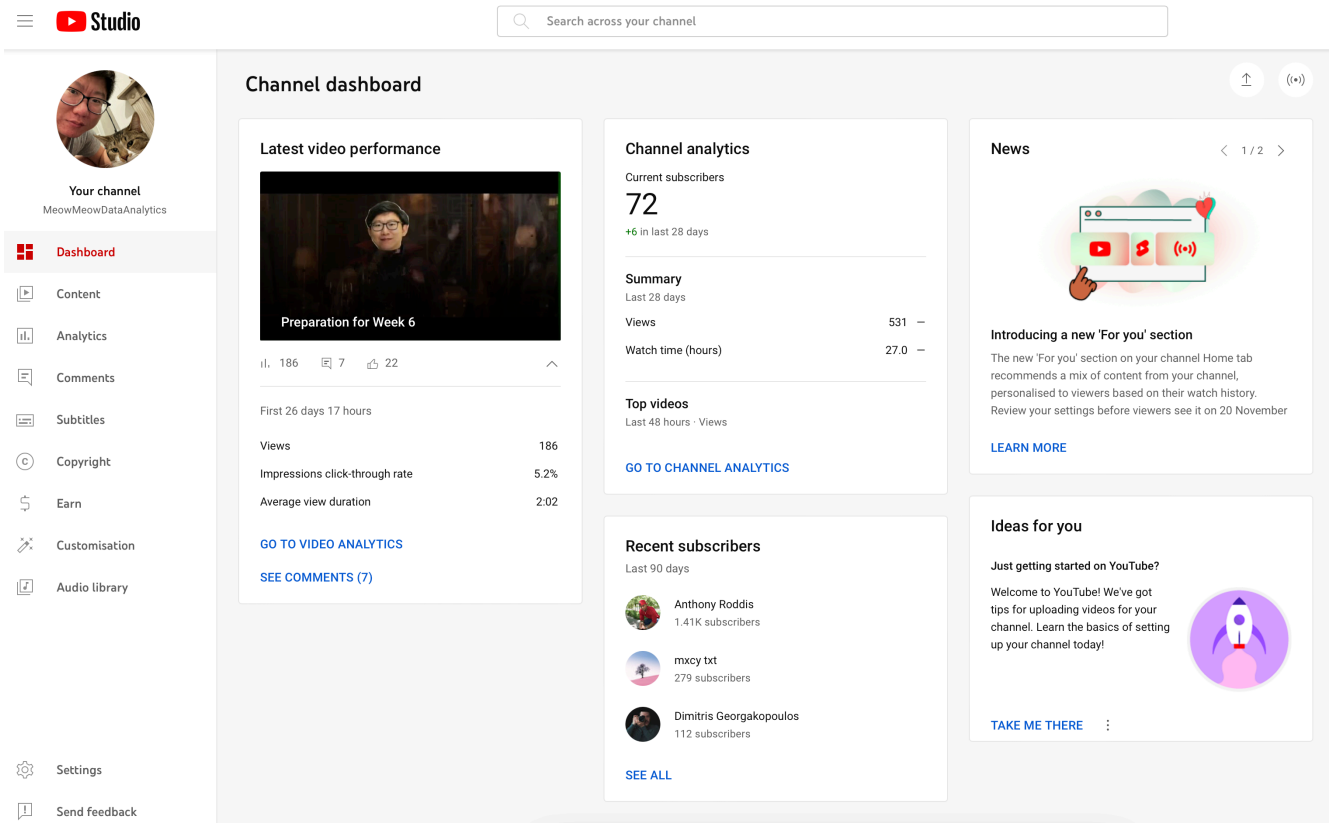
Week 2: Hey, I'm Wei, and I'm a musician!

How much £ would you like to pay for the album? (willingness to pay, WTP)

UCL

0	5	1
100	5	£5
£100000	-7	5
1,000,000 POUNDS	$1747174928481059715174 8	10

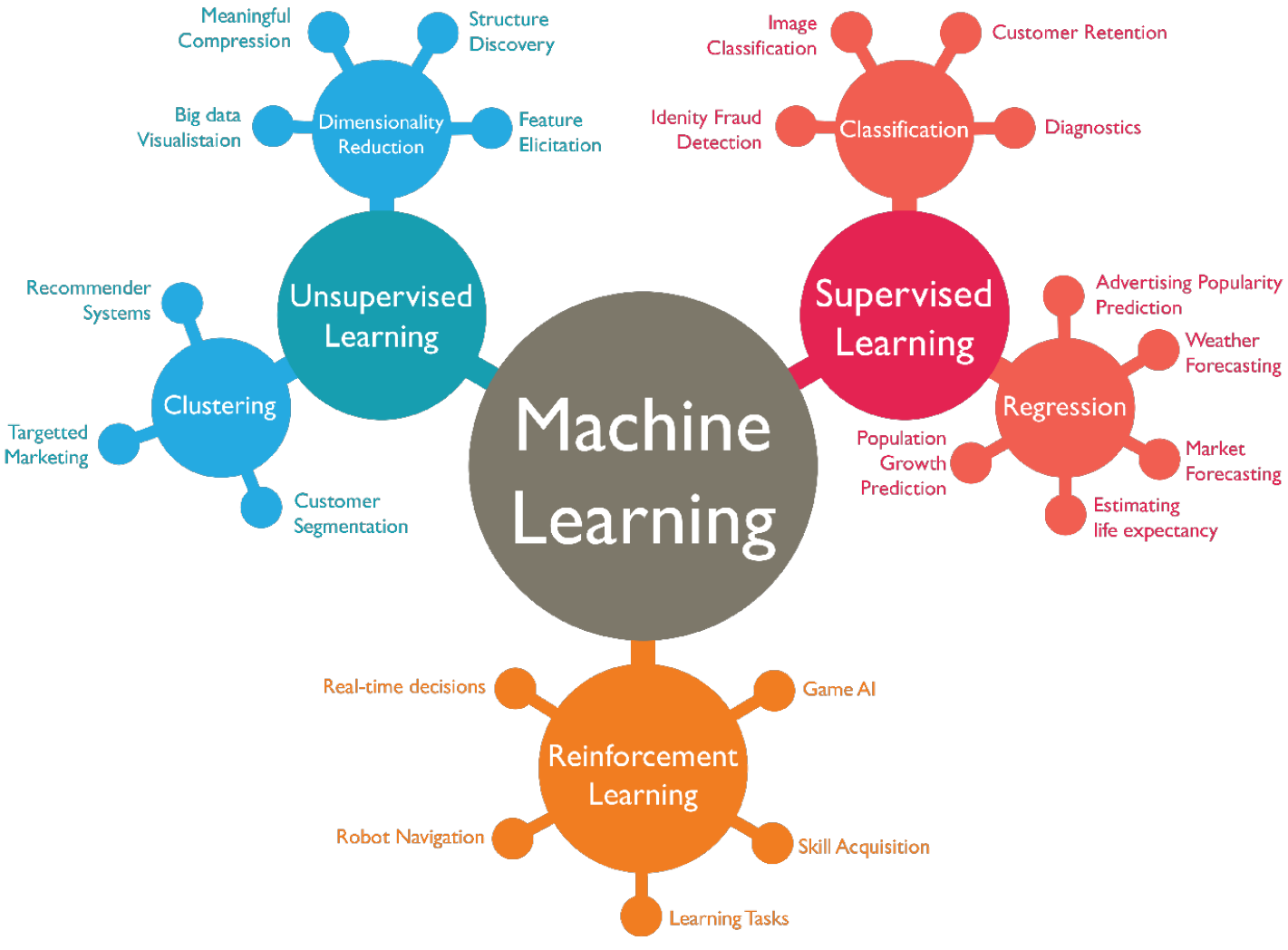
Week 2: Hey, I'm Wei, and I'm a Youtuber!



Section 3

Predictive Analytics

Predictive Analytics

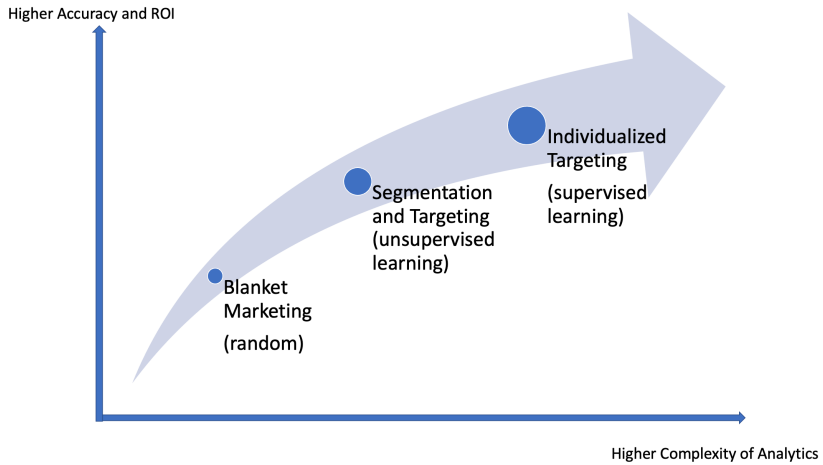


Week 3: Unsupervised Learning for Customer Segmentation

- Unsupervised learning such as K-means clustering help classify individuals into different segments.
- We then decide which segment(s) to serve based on our business objective.

Week 4: Supervised Learning for Customer Targeting

- Unsupervised learning is often not the most powerful tool for STP.



- Supervised learning models learn the relationship between outcome Y and X and can make **individualized** prediction.

Week 4: Fundamental Tradeoffs in Supervised Learning

- Accuracy-interpretability tradeoff
  - linear regression (high interpretability, low accuracy)
  - decision tree and random forest (good interpretability, good accuracy)
  - deep learning (no interpretability, high accuracy, term 2)
- Bias-variance trade-off

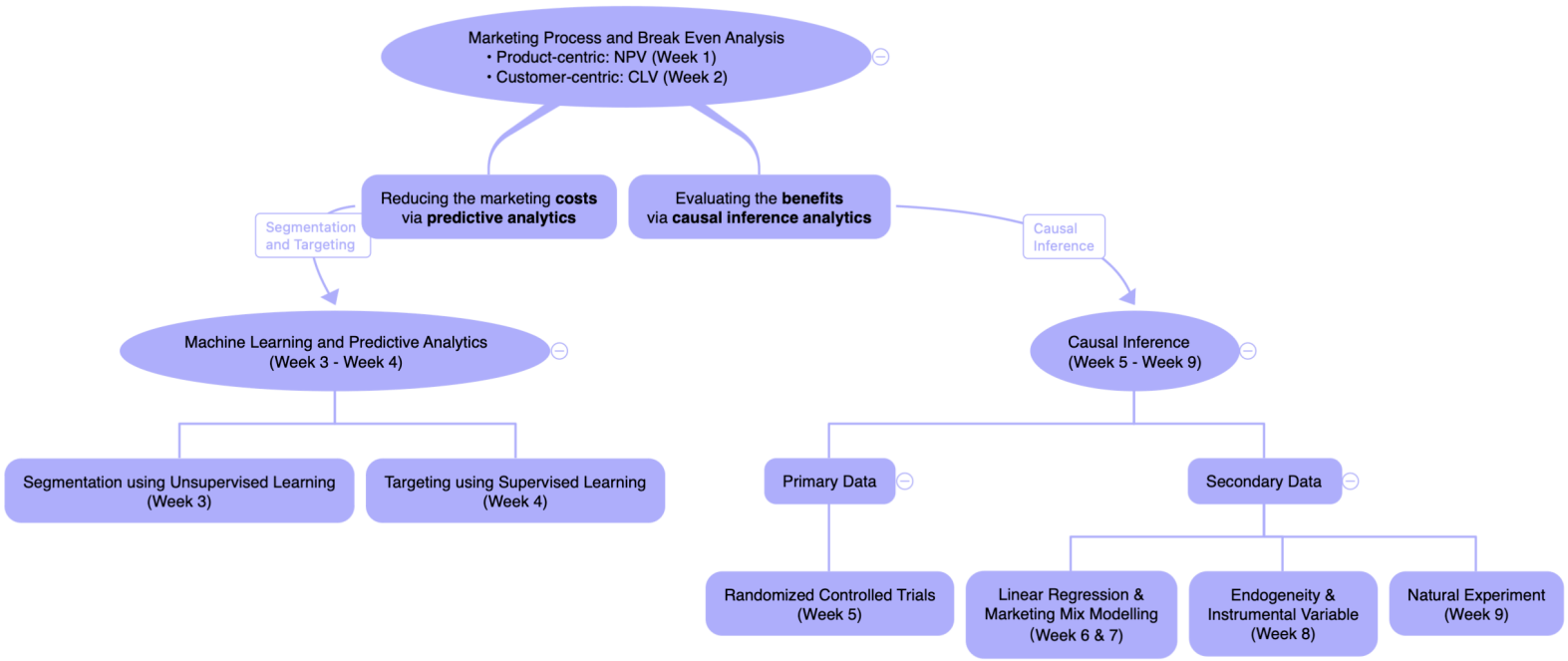
Week 4: Application in Marketing: Personalized Targeting

- With **targeted marketing** from supervised learning, we can effectively reduce marketing costs and boost the ROI.
  - Case study: Improving Marketing Efficiency Using Predictive Analytics for Tesco case
  - 2nd assignment: Amazon Prime case

Section 4

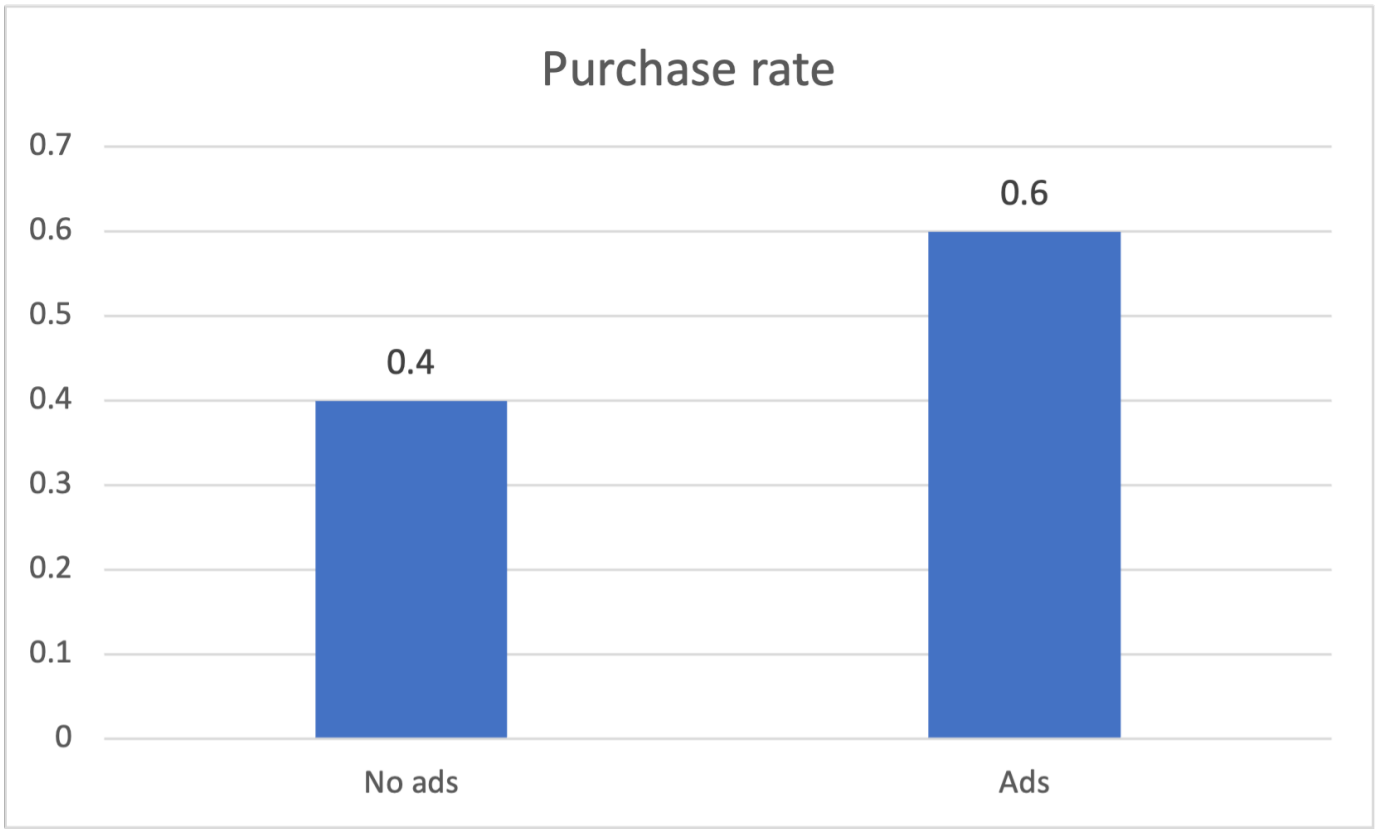
Causal Inference

Causal Inference

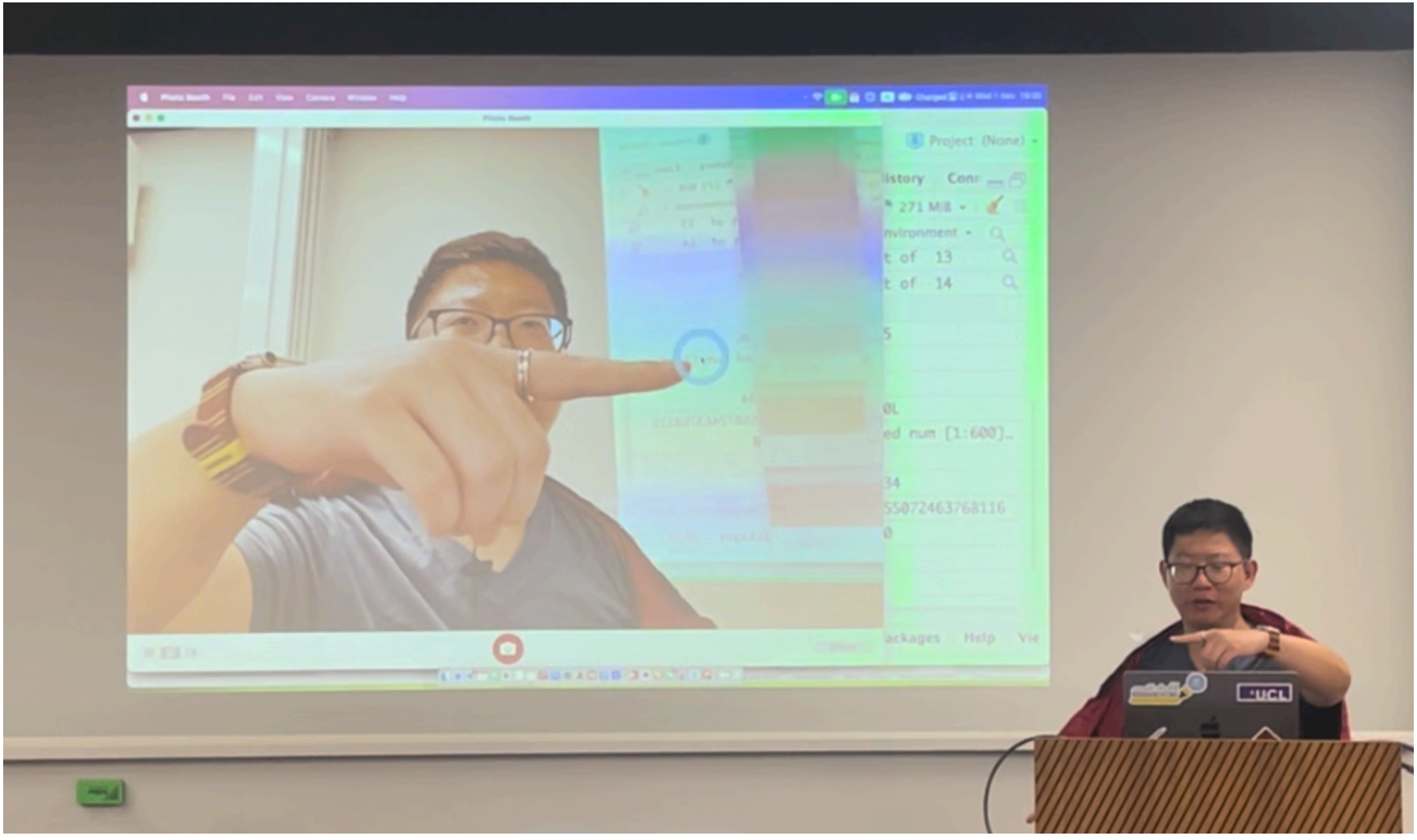


Week 5: Why Causal Inference Matters?

- Managers easily make costly mistakes if they do not understand causal inference.

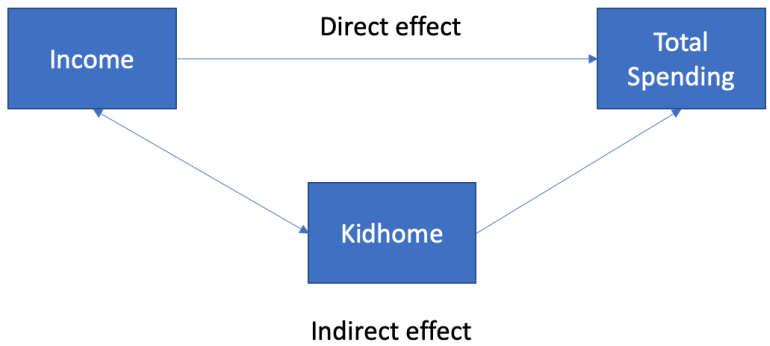


Week 5: I'm Wei and I'm from Hogwarts



Week 6 & 7 : OLS Regression and Marketing Mix Modeling

- Simple linear regression from secondary data can give causal inference **if and only if all confounding factors have been controlled** in the regression. In reality, this **never** happens, so linear regression can **never** give causal effects.



- In practice, companies often use linear regression to build **marketing mix modeling**, in order to set optimal prices for profit maximization (profit is often considered a quadratic function of price).

Week 8: Endogeneity and Instrument Variables

- Endogeneity
  - Omitted variable bias
  - Reverse causality/Simultaneity
  - Measurement error
- An instrument variable can give causal inference, which satisfies
  - Exogeneity: instrument is exogeneous and beyond individual control
  - Relevance: instrument affects X
  - Observable (implicit)

Week 8: Endogeneity and Instrument Variables

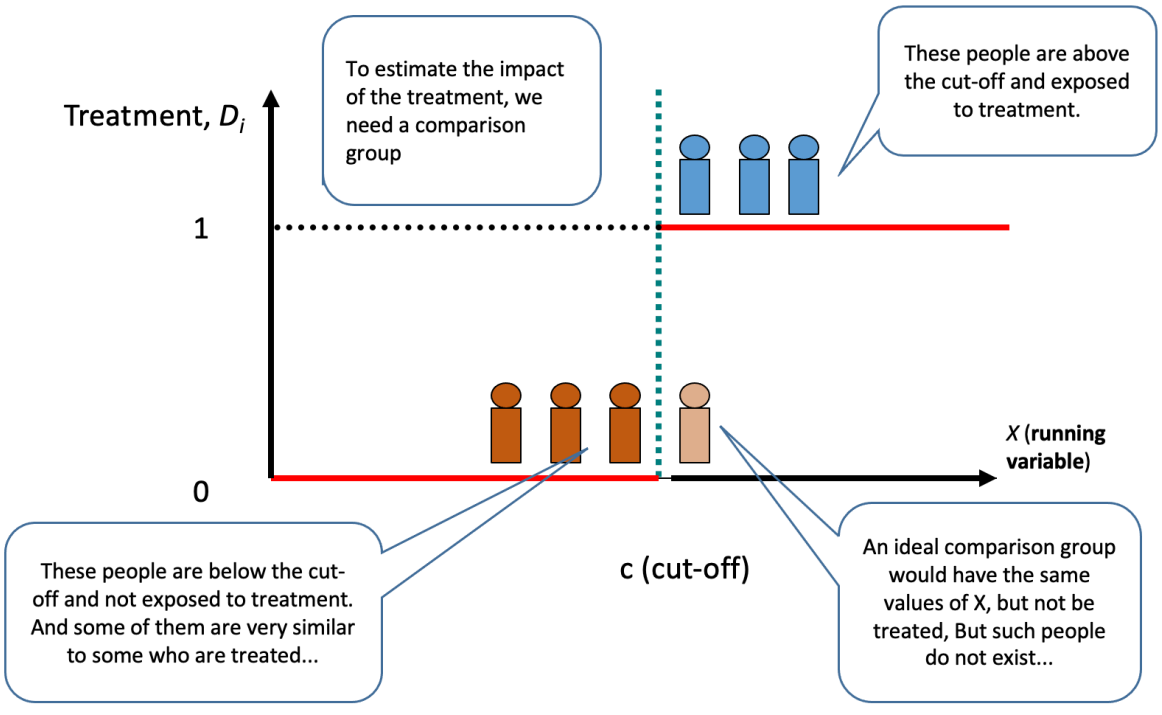
1. Explain X with Z. The predicted X, $\hat{X}$, is uncorrelated with the error term ϵ in the original regression.
   - **Important: other control variables are also considered exogenous and should be included in both stages.**

$$X_i = Z\eta + \epsilon_i$$

2. Use the explained part $\hat{X}$ to explain y, now $\hat{X}$ is exogenous and can give us causal inference.
   - COVID-19 case study: The causal impact of COVID-19 on Uber Driver Decision
   - third assignment

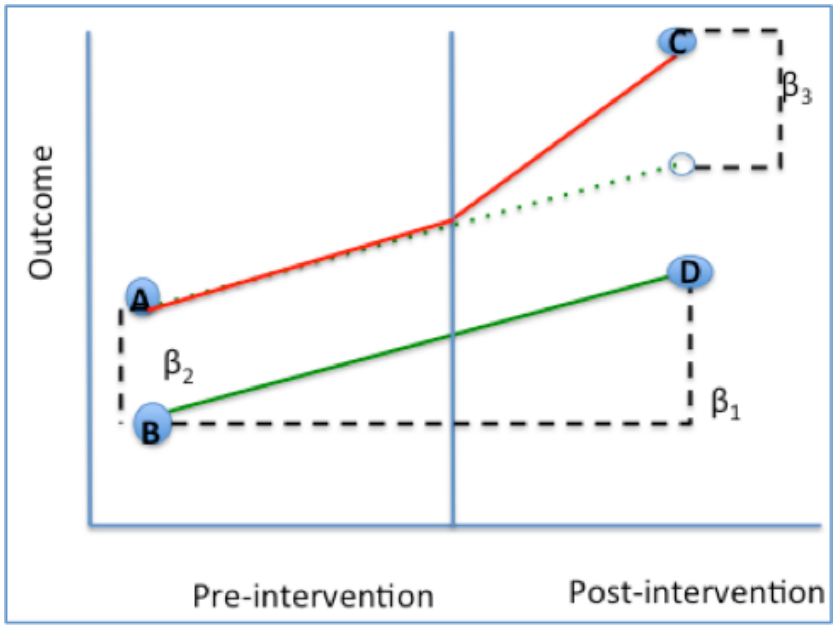
$$y_i = \hat{X}\beta + \varepsilon_i, \quad \text{cov}\left(\hat{X}_i, \varepsilon_i\right) = 0$$

Week 9: Regression Discontinuity Design



- Causal effect of "Distinction" on students' salaries
- Regression Discontinuity in Time (RDiT)

Week 9: Difference-in-Differences



- A new policy/regulation (GDPR, lockdown, etc.) and we have a control group which remains unaffected

One Causal Question, Many Solutions

- If we have historical data on **number of restaurants on UberEat** in each month, and **the total number of orders in each month**, can we get the causal effect?

$$NumOrders_t = \beta_0 + \beta_1 NumRestaurants_t + \epsilon_t$$

- Solutions
  - RCT
  - Instrumental Variable
  - DiD
  - RDD
  - RDiT

Section 5

Concluding Remarks

10 Weeks Not Enough?

- I love new challenges so my door is always open even after the class/program is over
- More learning materials
  - Optional reading materials in each week
  - I will keep uploading R tutorials/data analytics tools tutorials on my Youtube channel. **It's never too late to subscribe!**

What I learned

- Impressed with your perseverance and willingness to learn
  - My bestie predicts you would chase me out of the classroom for making you learn Marketing, R, and so many new models at the same time
- You've made me very proud:
  - It gives me a huge sense of achievement to see that you are able to apply the tools learned in various scenarios!
  - It gives me a weird sense of achievement to receive and answer questions for other modules :))
  - **R is the best language!!!! No Disagreement Allowed!!!!!!!!**

Looking into the Future

- Any case study in the marketing module can be used for your term 3 dissertation project.
  - Welcome to talk to me about your ideas; always happy to supervise
- [**IMPORTANT**]: **Start early for your job market**; use alumni resources (Linkedin) to network.
- Let's stay in touch even after graduation!

Thank you for being the BEST Students I can ever dream of!!

Thank you so much for your hard work and your support of the Marketing Analytics module throughout the term!

Though probably in 5 years you may have forgotten everything learned but only remember the following

- A module leader with a bubble tea belly uploads lousy weekly videos
- but he tries his best to be a good musician, Youtuber, magician, and stand-up comedian (and most importantly a good lecturer)
- A lame senior named Tom, who messed up everything and made you do so many assignments