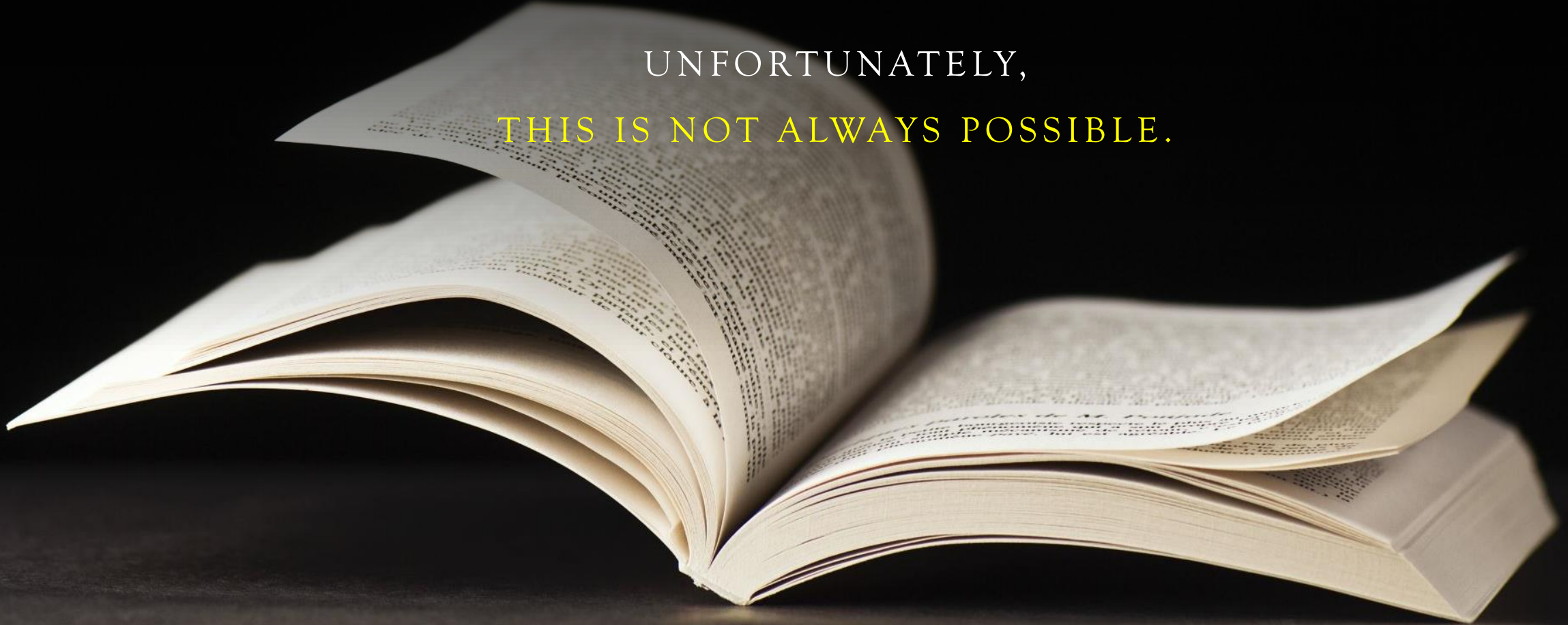


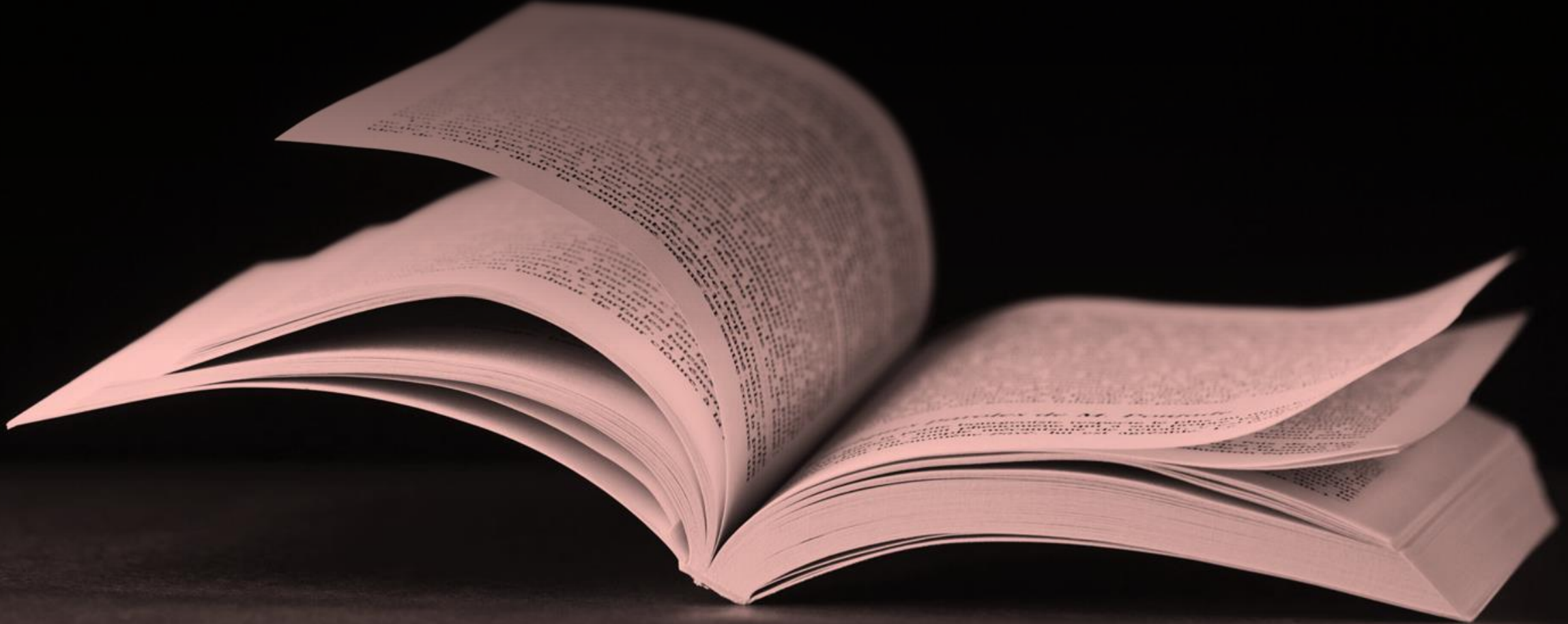
WHEN WE BUILD A REGRESSION MODEL,
WE WOULD LIKE IT TO CONTAIN ALL X'S
THAT ARE IMPORTANT TO EXPLAIN OUR Y...


UNFORTUNATELY,

THIS IS NOT ALWAYS POSSIBLE.



WHEN AN IMPORTANT X IS MISSING IN OUR
MODEL, **BAD THINGS CAN HAPPEN.**



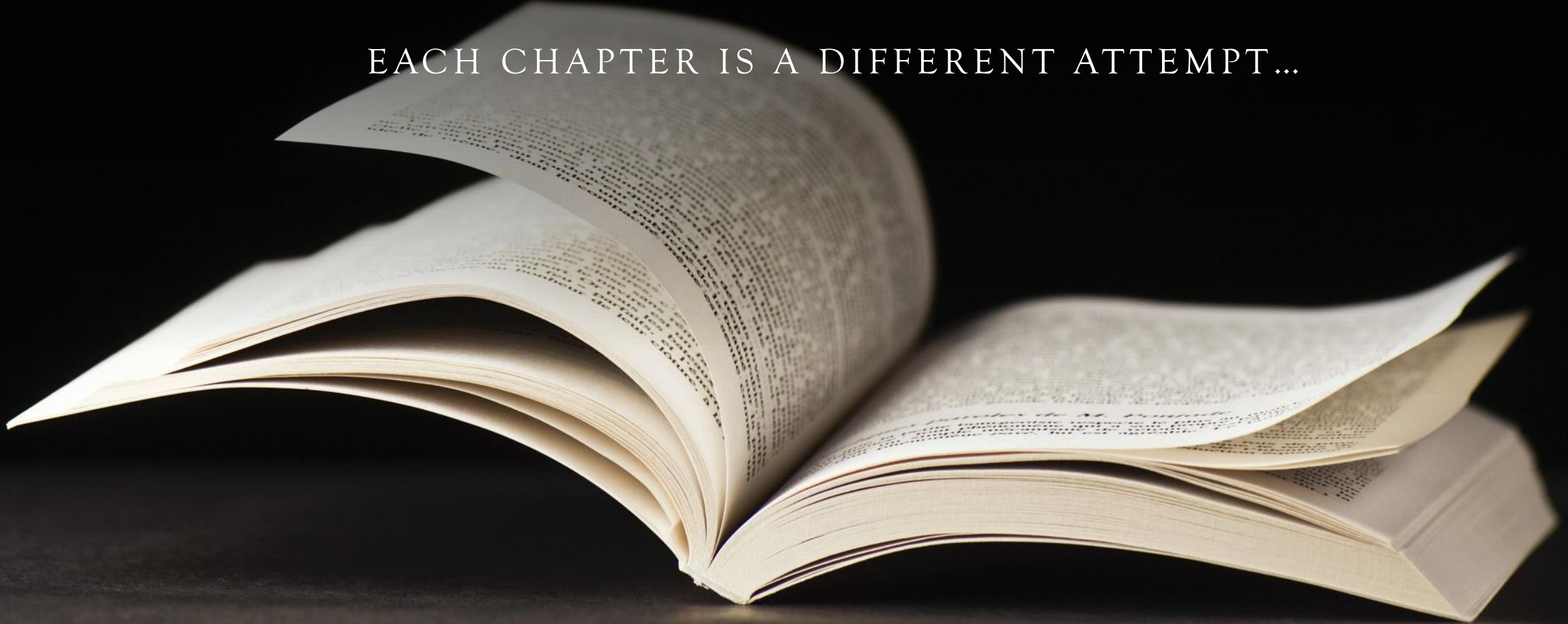
A close-up portrait of Maleficent, the character from Disney's 'Maleficent'. She is wearing her iconic black horned headdress and a black cape with a blue lining. She has pale skin, green eyes, and red lips. The background is a misty, mountainous landscape with a rainbow visible in the sky. A light blue, shield-shaped callout box with a dotted border is positioned on the right side of the image, containing text.

Maleficent's Theorem

A variable that wasn't invited
to a regression will curse the
coefficients of those that
were, making them biased

OUR COURSE IS THE STORY OF HOW
HUMANITY TACKLED THE CHALLENGE OF
MAKING A REGRESSION MODEL WITHOUT
KNOWING ALL THE X'S...

EACH CHAPTER IS A DIFFERENT ATTEMPT...



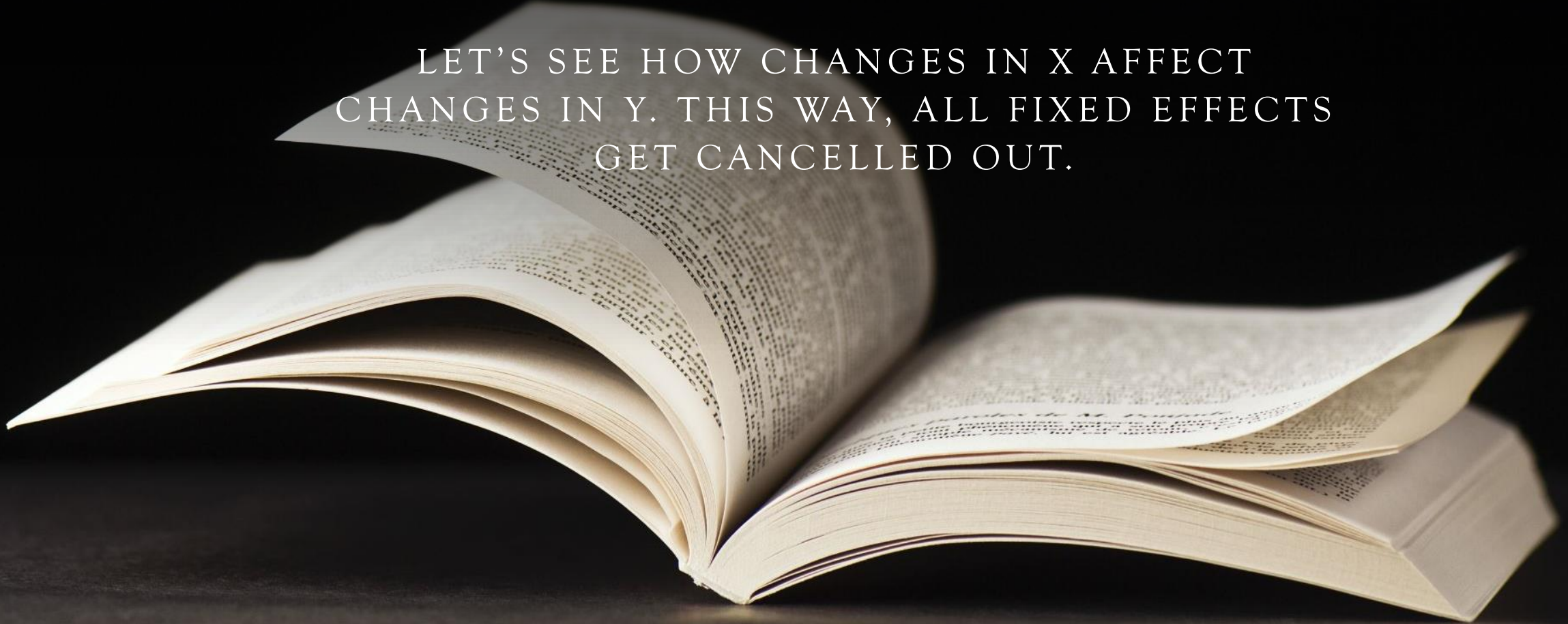
CHAPTER 1: POOLED REGRESSION

WHEN I FORGOT I HAD PANEL DATA AND
SIMPLY RAN A TRADITIONAL REGRESSION ON
EVERYTHING!



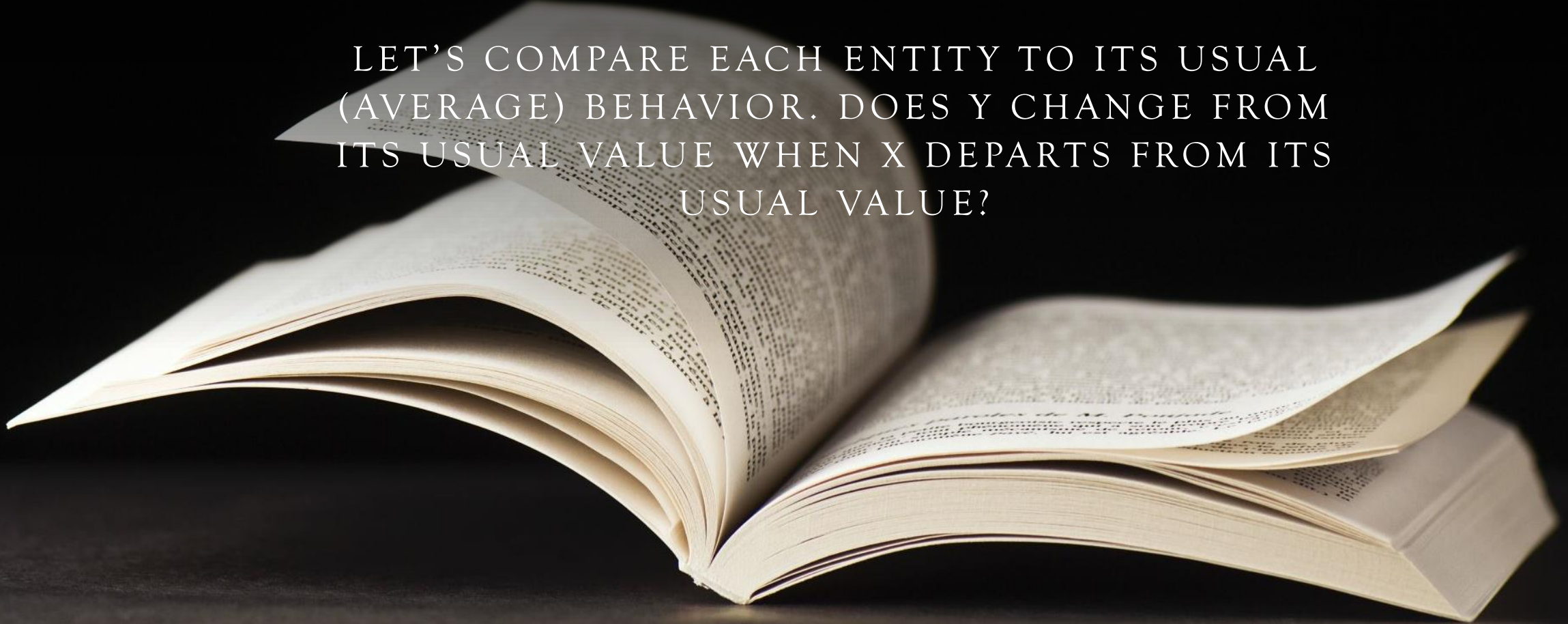
CHAPTER 2: FIRST DIFFERENCES

LET'S SEE HOW CHANGES IN X AFFECT
CHANGES IN Y. THIS WAY, ALL FIXED EFFECTS
GET CANCELLED OUT.



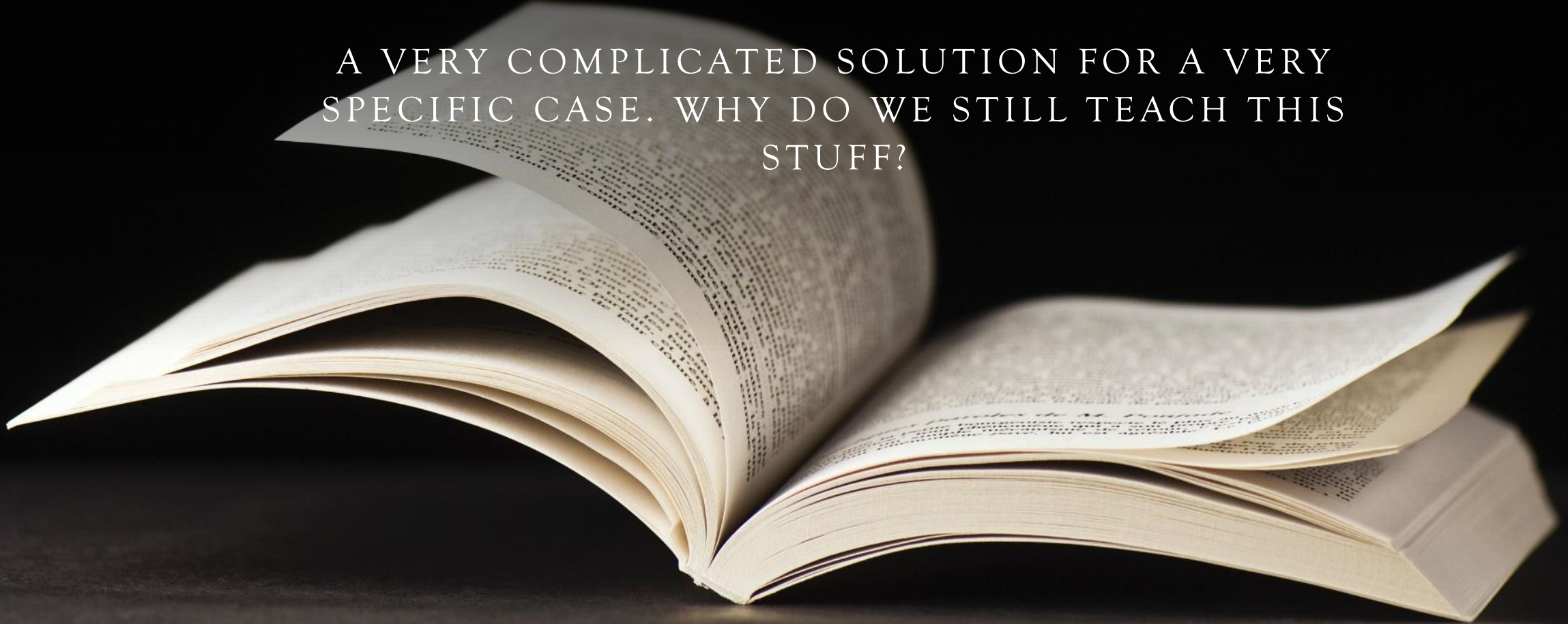
CHAPTER 3: FIXED EFFECTS

LET'S COMPARE EACH ENTITY TO ITS USUAL
(AVERAGE) BEHAVIOR. DOES Y CHANGE FROM
ITS USUAL VALUE WHEN X DEPARTS FROM ITS
USUAL VALUE?



CHAPTER 4: RANDOM EFFECTS

A VERY COMPLICATED SOLUTION FOR A VERY
SPECIFIC CASE. WHY DO WE STILL TEACH THIS
STUFF?



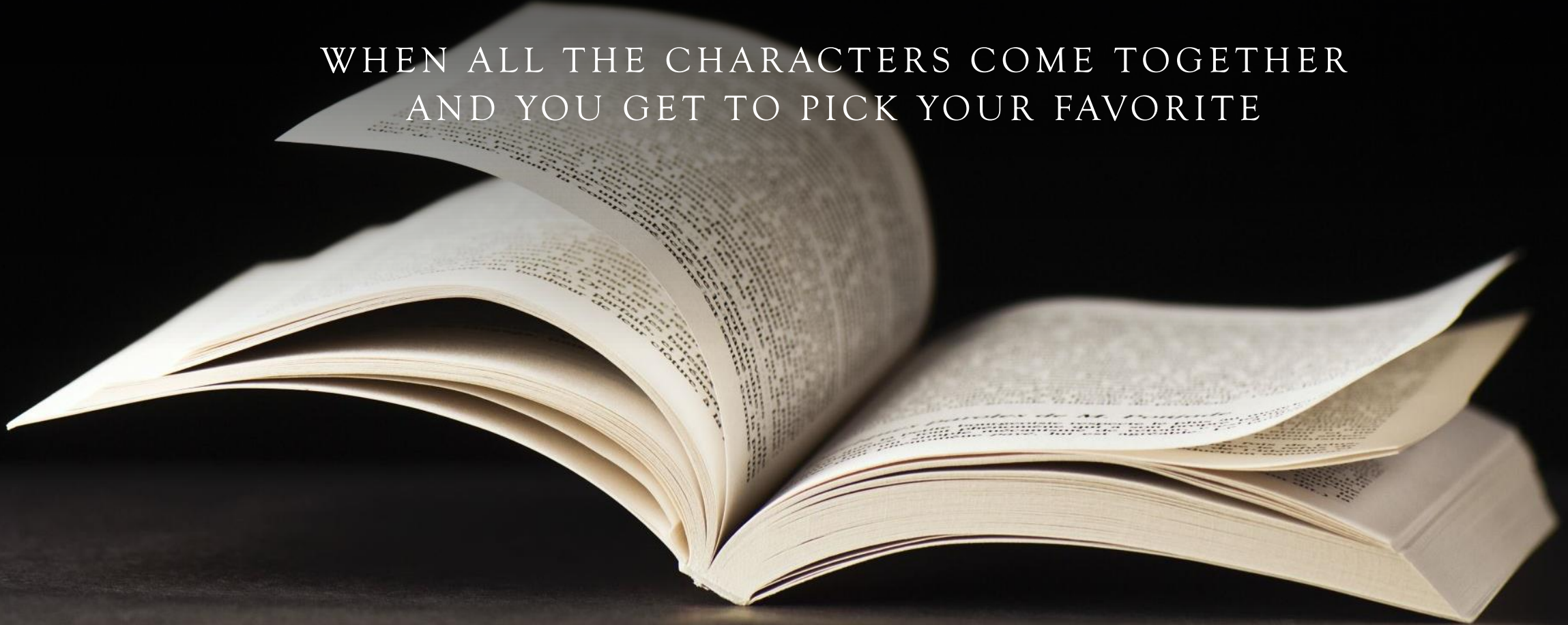
CHAPTER 5: MODELS FOR RESIDUALS CORRELATED AS AN AR(1)

WHEN THINGS THAT HAPPEN IN VEGAS DON'T
JUST STAY IN VEGAS...



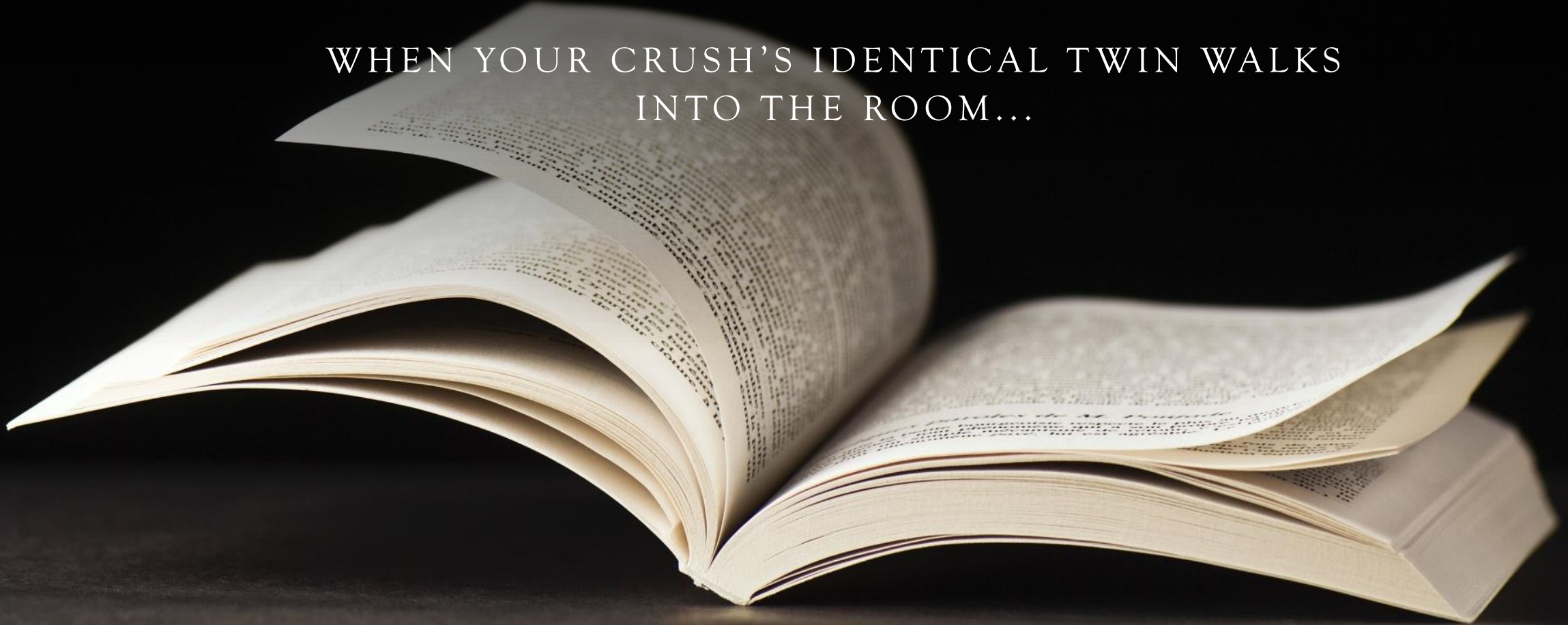
CHAPTER 6: CHOOSING THE BEST MODEL

WHEN ALL THE CHARACTERS COME TOGETHER
AND YOU GET TO PICK YOUR FAVORITE



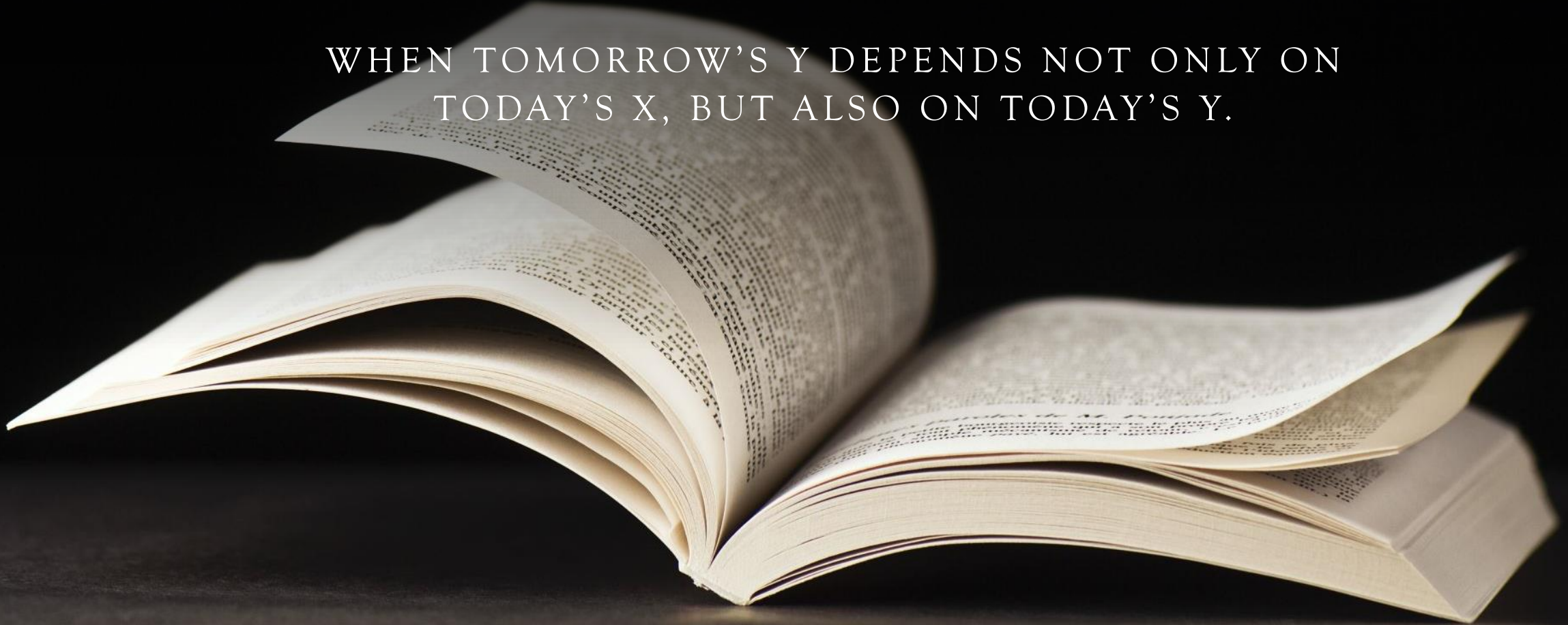
CHAPTER 7: INSTRUMENTAL VARIABLES

WHEN YOUR CRUSH'S IDENTICAL TWIN WALKS
INTO THE ROOM...



CHAPTER 8: DYNAMIC PANELS

WHEN TOMORROW'S Y DEPENDS NOT ONLY ON
TODAY'S X , BUT ALSO ON TODAY'S Y .



CHAPTER 9: GENERALIZED TIME MODELS

THINGS HAPPEN IN TIME...

THINGS ALSO HAPPEN IN SPACE, IN SCHOOLS,
IN MUNICIPALITIES...

CAN WE ALSO USE PANEL DATA IN SUCH CASES?

