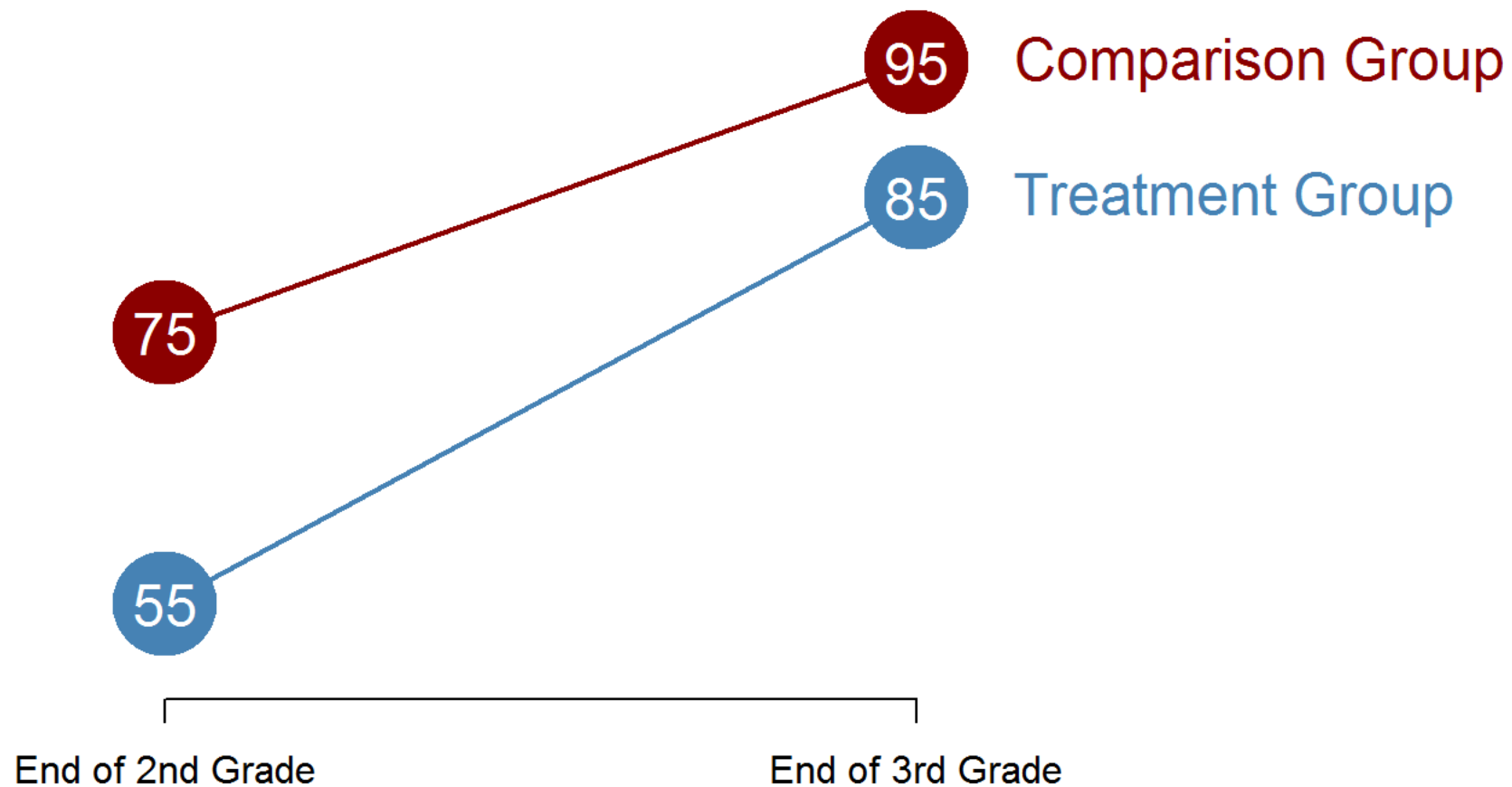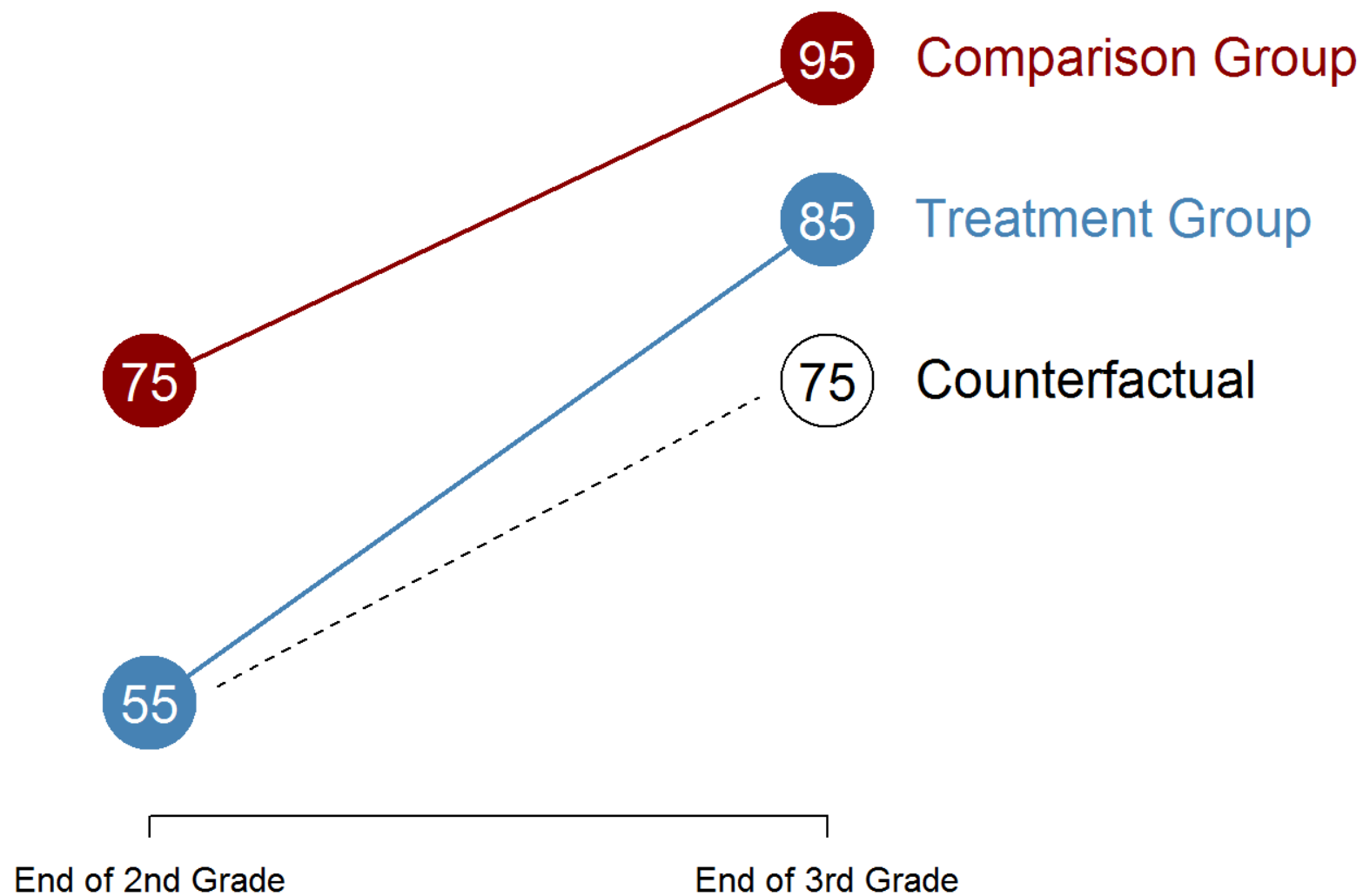# INTERACTIONS IN REGRESSION MODELS
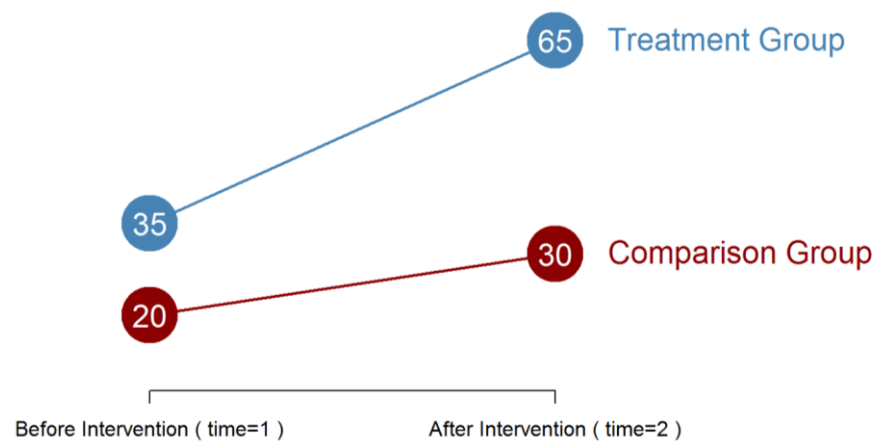
INTERACTING DUMMY VARIABLES:
THE DIFFERENCE-IN-DIFFERENCE MODEL

Performance on Exam Measuring Proficiency in Arithmetic

Comparison Group: 75 (End of 2nd Grade) → 95 (End of 3rd Grade)

Treatment Group: 55 (End of 2nd Grade) → 85 (End of 3rd Grade)

End of 2nd Grade   End of 3rd Grade

Performance on Exam Measuring Proficiency in Arithmetic

95 Comparison Group

85 Treatment Group

75

75 Counterfactual

55

End of 2nd Grade   End of 3rd Grade

$$Y = b_0 + b_1 \cdot Treat + b_2 \cdot Post + b_3 \cdot Treat \cdot Post + e$$

	Dependent variable:
	moxy
b0: Intercept (A)	20***
	(0)
b1: Treatment Group (B)	15***
	(0)
b2: Post-Period (C)	10***
	(0)
b3: Treat x Post (D)	20***
	(0)
Observations	400
Note:	p<0.1; **p<0.05;** p<0.01

$$Y = b_0 + b_1 \cdot Treat + b_2 \cdot Post + b_3 \cdot Treat \cdot Post + e$$

	Dependent variable:
	moxy
b0: Intercept (A)	20***
	(0)
b1: Treatment Group (B)	15***
	(0)
b2: Post-Period (C)	10***
	(0)
b3: Treat x Post (D)	20***
	(0)
Observations	400
Note:	p<0.1; **p<0.05;** p<0.01

65 — A + B + C + D

45 — A + B + C (counterfactual)

A + B — 35

30 — A + C

A — 20

Before Intervention (Time=1) After Intervention (Time=2)

INTERACTING SLOPES:
VARYING PROGRAM IMPACT BY GROUP

$$height = b_0 + b_1 dumA + b_2 dumB + b_3 fertilizer + b_4 dumA * fertilizer + b_5 dumB * fertilizer + e$$

Height of Type C
at fertilizer=0

Height of Type A
above height of
Type C at
fertilizer=0

Effect of Fertilizer on Corn Growth: Three Hybrid Types

Height of Corn

80

71

50

Type B

Type A

Type C

0   20   40   60   80   100

Fertilizer Intensity
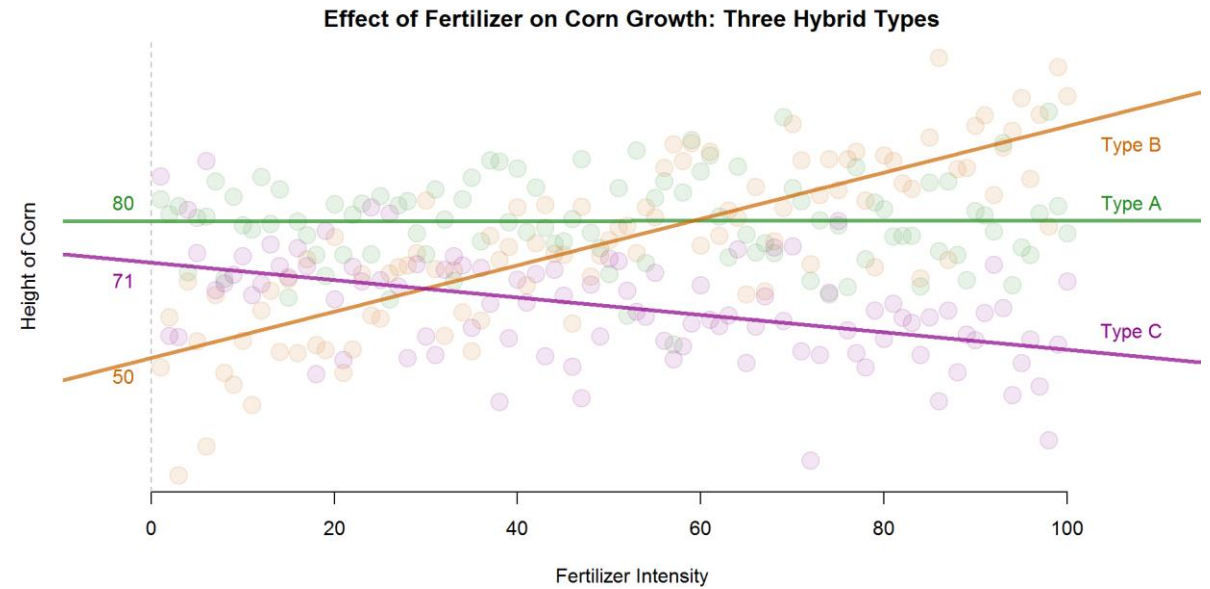
$$height = b_0 + b_1 dumA + b_2 dumB + b_3 fertilizer + b_4 (dumA \cdot fertilizer) + b_5 (dumB \cdot fertilizer) + e$$
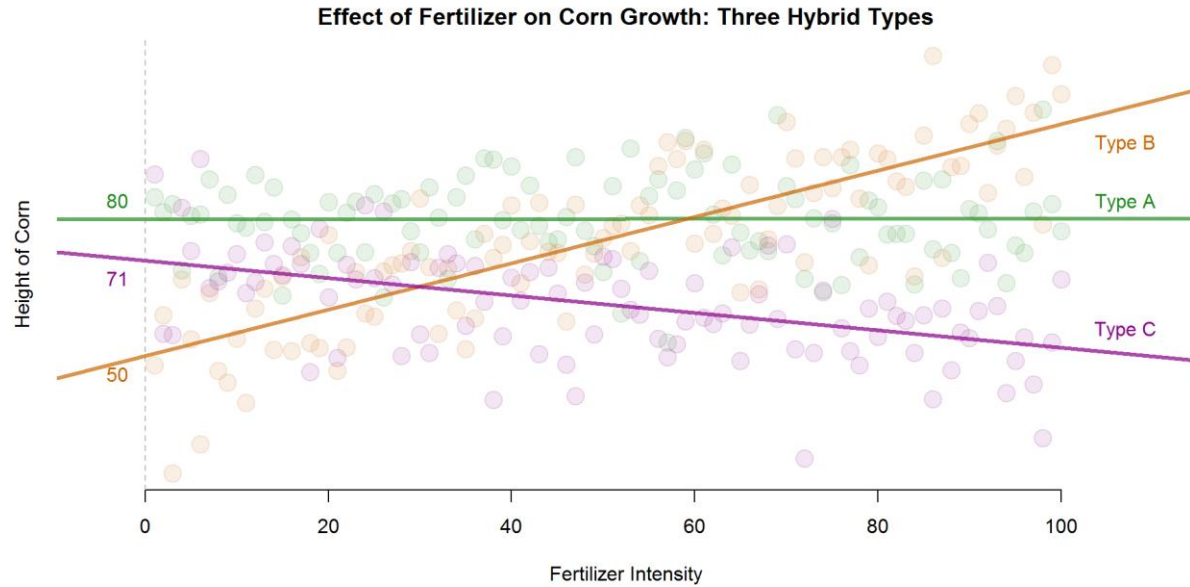
Impact of fertilizer intensity on height for Type C

Difference in fertilizer slope between Type A and Type C

Effect of Fertilizer on Corn Growth: Three Hybrid Types

Type B

Type A

Type C

Height of Corn

80

71

50

0   20   40   60   80   100

Fertilizer Intensity

Fertilizer slope for Type A: $b_3 + b_4$

$$height = b_0 + b_1 dumA + b_2 dumB + b_3 fertilizer + b_4 dumA * fertilizer + b_5 dumB * fertilizer + e$$

	Dependent variable:			
	height			
	(1)	(2)	(3)	(4)
Constant		70.80***	79.78***	49.74***
		(2.05)	(2.05)	(2.05)
fertilizer	0.11***	-0.19***	0.003	0.51***
	(0.03)	(0.04)	(0.04)	(0.04)
dumA	74.51***	8.98***		30.03***
	(1.89)	(2.90)		(2.90)
dumB	70.09***	-21.05***	-30.03***	
	(1.89)	(2.90)	(2.90)	
dumC	55.72***		-8.98***	21.05***
	(1.89)		(2.90)	(2.90)
fertilizer:dumA		0.19***		-0.51***
		(0.05)		(0.05)
fertilizer:dumB		0.70***	0.51***	
		(0.05)	(0.05)	
fertilizer:dumC			-0.19***	-0.70***
			(0.05)	(0.05)
Observations	300	300	300	300
R^2	0.97	0.59	0.59	0.59
Note:				p<0.1; **p<0.05**; p<0.01

Effect of Fertilizer on Corn Growth: Three Hybrid Types