# ECON 2515 Intermediate Applied Econometrics II

SCHOOL OF ECONOMICS AND PUBLIC POLICY · UNIVERSITY OF ADELAIDE · S2 2026

Full guide + ask Sia about ECON 2515

SIDE 1/2 · CLOSED-BOOK MEMORY SHEET · RECITE + CHECK · DEFINITIONS → FORMULAS → DECISIONS · Final priorities · methods before detail

## 0 · Exam map

COURSE.JSON · BRIEF

ASSESSMENT WEIGHTS · SUBJECT TO CONFIRMATION

**Components:** Quizzes 1–4 · group written report · group video presentation · final examination. Exact weights are not stated in the supplied course data.

"Closed book" — ECON 2515 Final Exam Information page, MyUni 2026 (MD_Final_Exam_Information_Intermediate_Applied_Eco…)

| FINAL, SUBJECT TO CONFIRMATION | MARKS SHOWN |
|---|---|
| Part A · 15 MCQ | 2 each = 30 |
| Part B · 2 worked answers | 40 total |
| Mode | 2 h · face-to-face |

**RECALL ORDER →** *form → assumption → statistic → df/tail → decision → interpretation → causal caveat.*

## 1 · Data + causality

CH 1 · MCQ / CRITIQUE

| STRUCTURE | RECOGNITION / BITE |
|---|---|
| Cross-section | many units, one time; random-sample logic |
| Time series | one unit through time; order, trend, serial correlation |
| Pooled | different units in repeated cross-sections |
| Panel | same units over time; fixed traits can be removed |

*Ceteris paribus* = change x while holding every relevant other factor fixed. A significant observational slope can reflect x→y, y→x, a confounder→both, or chance. Association is not causation.

**CAUSAL CHECKPOINT**

```
E[u|x] = 0 ⇒ exogenous ⇒ β̂ unbiased;
defend with design/controls
E[u|x] ≠ 0 ⇒ endogenous ⇒ β̂ biased; name
omitted variable, reverse causality or
measurement error
```

## 1b · First-read classifier

CH 1 · EXAM MOVES

**Before modelling:** name the goal — estimate a relationship, test a theory, forecast, or evaluate policy — then name the data structure and plot it. Use a histogram for one variable's distribution, a scatter plot for two continuous variables, a time-series plot when order matters, and a bar chart for categories. Look for outliers, skew, missingness, non-linearity, trend and seasonality before trusting a regression.

| PROMPT CLUE | IMMEDIATE ANSWER MOVE |
|---|---|
| "same firms each year" | panel, not pooled |
| "new sample each year" | pooled cross-sections |
| "national quarterly total" | time series; independence doubtful |
| "areas with more x have more y" | association; name a concrete confounder |

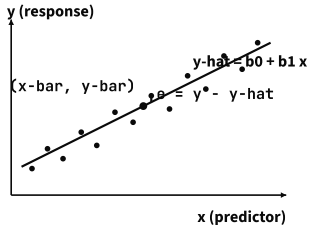
## 2 · OLS: symbols + objective

CH 2 · WORKED ANSWER

**PRF:** $y = \beta_1 + \beta_2 x + u$; β is fixed unknown truth, u is the unobserved gap to the population line. **SRF:** $\hat{y} = \hat{\beta}_1 + \hat{\beta}_2 x$; $\hat{\beta}$ changes by sample, $\hat{u} = y - \hat{y}$ is observable.

**LEAST SQUARES**

```
choose β̂₁,β̂₂ to minimise Σû₁² =
Σ(y₁-ŷ₁)²
β̂₂ = Σ(x₁-x̄)(y₁-ȳ) / Σ(x₁-x̄)²
β̂₁ = ȳ - β̂₂x̄ · fitted line passes
through (x̄,ȳ)
```




OLS squares vertical residuals; the fitted line passes through (x̄, ȳ). Source: Ch 2 figure.

**Mechanical checks:** with an intercept, $\Sigma\hat{u}_i = 0$ and sample mean fitted value = ȳ. Residuals are vertical, not perpendicular. Interpret $\hat{\beta}_2$ in y-units per one x-unit; treat $\hat{\beta}_1$ cautiously if x=0 lies outside the sample.

## 2b · Precision

CH 2 · INFERENCE BASE

```
Var(β̂₂)=σ²/Σ(x₁-x̄)²
σ̂²=Σû₁²/(n-k) in SLR notation where
k counts parameters
se(β̂₂)=√[σ̂²/Σ(x₁-x̄)²]
```

More noise raises variance; more spread in x and a larger sample lower it. Unbiased means $E[\hat{\beta}]=\beta$ across repeated samples, not that this sample hits the truth.

## 2c · OLS recall checks

CH 2 · COMMON TRAPS

| OBJECT | POPULATION | SAMPLE |
|---|---|---|
| coefficient | β: fixed, unknown | $\hat{\beta}$: statistic, varies by sample |
| vertical gap | u: to true PRF, unobserved | $\hat{u}=y-\hat{y}$: to fitted SRF |
| line | $E[y\|x]=\beta_1+\beta_2 x$ | $\hat{y}=\hat{\beta}_1+\hat{\beta}_2 x$ |

**SLR.1** linear in parameters: $\beta_1+\beta_2\ln(x)$ is allowed; squaring β is not. **SLR.2** random sampling supports repeated-sample reasoning. **SLR.3** requires variation in x: if every x is identical the slope denominator is zero. **SLR.4** $E[u|x]=0$ buys unbiasedness and a causal interpretation. **SLR.5** $\mathrm{Var}(u|x)=\sigma^2$ validates the conventional variance formula.

## 3 · Assumption ladder

CH 2, 4, 10

- **MLR.1 linear in β → OLS estimable**
- **MLR.2 random sampling**
- **MLR.3 no perfect collinearity**
- **MLR.4 E[u|x]=0 → unbiased / causal**
- **MLR.5 Var(u|x)=σ² → BLUE + usual SEs**
- **MLR.6 normal u → exact small-n t/F**

Recite the assumption and the precise guarantee it buys.

| FAILURE | WHAT ACTUALLY BREAKS |
|---|---|
| MLR.3 perfect | coefficient cannot be estimated |
| MLR.4 | $\hat{\beta}$ biased; causal reading fails |
| MLR.5 | usual SEs wrong; $\hat{\beta}$ still unbiased |
| MLR.6 | exact small-sample t/F lost; CLT may rescue large n |

## 3b · Fit decomposition

CH 3 · CALCULATIONS

**ADELAIDE / WWLJ LETTERS**

```
SST = SSE + SSR
Total = Explained + Residual
R² = SSE/SST = 1 - SSR/SST · 0≤R²≤1
```

Say: "the model explains 100R²% of variation in y." Low $R^2$ does not rule out a real slope. Raw $R^2$ never falls as regressors are added; compare model sizes with adjusted $R^2$ or an F-test.

```
R̄² = 1 - (1-R²)(n-1)/(n-k-1)
```

## 3c · MLR properties by casualty

CH 4, 8–10

**Gauss–Markov:** under MLR.1–5, OLS is BLUE — best (minimum variance) among linear unbiased estimators. Normality is not needed for unbiasedness; it supplies exact small-sample distributions for inference. In large samples, the CLT can make t/F approximations useful without normal errors.

**MLR.3 distinction:** perfect collinearity makes estimation impossible; high but imperfect collinearity leaves estimation possible and unbiased but raises variance. Including an intercept plus every category dummy creates perfect collinearity because the dummies sum to one.

**MLR.4 distinction:** a relevant omitted variable causes bias only when it also correlates with an included regressor. If either channel is zero, the classic OVB product is zero. Reverse causality and measurement error are alternative routes to $E[u|x]\neq 0$.

## 4 · Functional-form decoder

CH 3 · PART A/B

| LEVEL–LEVEL | LOG–LINEAR |
|---|---|
| y = … + βx<br>+1 x → β units y | ln y = … + βx<br>+1 x → ≈100β% y |
| **LINEAR–LOG** | **LOG–LOG** |
| y = … + β ln x<br>+1% x → β/100 y | ln y = … + β ln x<br>β = elasticity (%/%) |

Spot which variable is logged before saying what β means.

| FORM | MARGINAL EFFECT / EXAM LINE |
|---|---|
| $\beta_1 x+\beta_2 x^2$ | $\partial y/\partial x=\beta_1+2\beta_2 x$; $x^*=-\beta_1/(2\beta_2)$ |
| $\beta_1 x+\beta_2 D+\beta_3 xD$ | effect of x=$\beta_1+\beta_3$D; $\beta_3$ is slope gap |
| dummy D only | $\beta_2$ is intercept gap vs omitted base |

**Quadratic sign:** $\beta_2<0$ gives a hump; $\beta_2>0$ gives a U. Always differentiate and plug in the stated x.

Elasticity generally = $(\partial y/\partial x)(x/y)$.

**TRAP →** *All these remain linear in the parameters. Logs, squares and products of x do not violate MLR.1.*

## 4b · Multiple regression + OVB

CH 4 · CORE JUDGEMENT

```
y=β₀+β₁x₁+…+βₖxₖ+u
βⱼ = effect of xⱼ holding all other
included regressors fixed
df=n-k-1 · k counts slopes, then
subtract 1 for intercept
```

*Partialling-out:* strip the other regressors from both y and $x_j$; regress the residualised y on residualised $x_j$. That slope is $\hat{\beta}_j$. Thus a multiple-regression coefficient uses only the variation in $x_j$ that the other x's do not explain.

**OMITTED-VARIABLE BIAS**

```
true: y=β₀+β₁x+β₂z+u · omit z
Bias(short slope)=β₂×δ
δ = slope from z on x =
Cov(x,z)/Var(x)
```

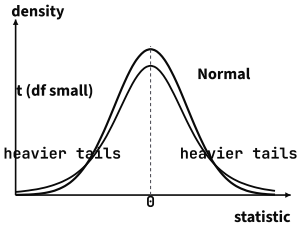
| SIGN $B_2$ | SIGN Δ | BIAS |
|---|---|---|
| + | + | upward |
| − | − | upward |
| + | − | downward |
| − | + | downward |

Direction needs **both** signs: z's effect on y and z's relationship with included x. Same signs overstate the short-model slope; opposite signs understate it. Omitting z puts it in the new error, and correlation with x violates MLR.4. Adding irrelevant regressors can reduce precision; raw $R^2$ still rises, so do not use it alone to choose.

## 5 · Single-parameter inference

CH 5–6 · WORKED ANSWER

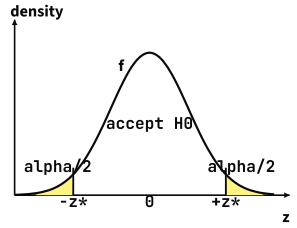
```
t = (β̂ₖ-c)/se(β̂ₖ) ~ t(n-k-1)
CI = β̂ₖ ± tα/2,n-k-1 · se(β̂ₖ)
```




Estimated σ gives heavier t tails; use df = n−k−1. Source: Ch 5 figure.

**SIX VISIBLE STEPS**

1. Write $H_0$ with null value c.
2. Write directional $H_1$.
3. Choose α, df and critical value.
4. Compute t against c, not automatically 0.
5. Apply tail-specific rule.
6. Conclude statistically and in economic units.




Two-sided α splits α/2 per tail; one-sided puts all α in the named tail. Source: Ch 5 figure.

**Decision:** two-sided reject if $|t|>t^*$; right-sided if $t>t^*$; left-sided if $t<-t^*$. A two-sided CI gives the same decision for $H_0$:β=c. "Fail to reject" ≠ "prove no effect".

## 5b · Output-to-conclusion routine

CH 5–6, 10

| OUTPUT ITEM | READ / RECONSTRUCT |
|---|---|
| Estimate | $\hat{\beta}$: sign and magnitude in correct form |
| Std. Error | estimated sampling spread |
| t value | Estimate/SE only for null c=0 |
| Pr(>\|t\|) | two-sided p for c=0 |
| Residual SE | √MSE, error-scale estimate |
| overall F | $H_0$: every slope=0 jointly |

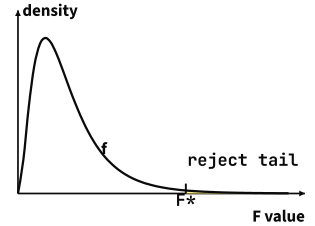
## 6 · p, F + diagnosis

CH 6–9 · HIGH YIELD

**p-value:** P(a statistic at least this extreme | $H_0$). Reject when p≤α. Software Pr(>|t|) is two-sided for c=0. For a one-sided claim, halve only if $\hat{\beta}$ points in $H_1$'s direction; otherwise p is near 1. Small p says distinguishable, not important.

**JOINT F**

```
F = [(SSR_R-SSR_U)/q] /
[SSR_U/(n-k-1)]
~ F(q,n-k-1) · q = restrictions ·
upper tail only
SSR_R ≥ SSR_U · q=1 ⇒ F=t²
```

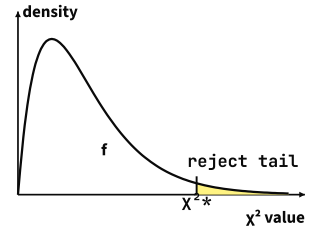



F is non-negative and upper-tailed: only a large loss of fit rejects $H_0$. Source: Ch 7 figure.

| QUESTION | TOOL |
|---|---|
| one coefficient / one restriction | t |
| q restrictions / block / overall slopes | F |
| sum or difference | t with Var(a±b)=Var(a)+Var(b) ±2Cov(a,b) |

**HETEROSKEDASTICITY LM**

```
auxiliary: û² on x's · LM=nR²_aux ~
χ²(m)
m = auxiliary slopes · upper tail ·
fix: robust SEs
```




Breusch–Pagan LM uses the $\chi^2$ upper tail, not t or F. Source: Ch 9 figure.

| PROBLEM | CASUALTY · RESPONSE |
|---|---|
| OVB / endogeneity | $\hat{\beta}$ biased · control/design/instrument/panel |
| Multicollinearity | SE inflated · VIF=1/(1−$R^2_j$); collect data/combine carefully |



**Forward this to your tutorial group**

V2 · 2026-10-24

Your exam is closed book: nothing printed goes in. Use this sheet to revise and self-test, not to carry.

University of Adelaide Semester 2 examination period, November 2026 (check your personal exam timetable).

# ECON 2515 Worked drills, judgement cards and traps

INTERMEDIATE APPLIED ECONOMETRICS II · UNIVERSITY OF ADELAIDE

Full guide + ask Sia about ECON 2515

SIDE 2/2 COVER THE ANSWER · SHOW THE PATH · SAY THE CONCLUSION

5-MINUTE DRILLS

numbers preserved from the guide

## 7 · Drill 1: hand OLS

CH 2 WORKED EXAMPLE

**Data:** (x,y)=(2,18),(3,21),(4,30),(6,39),(5,27), where x is hundreds of passers-by and y loaves sold.

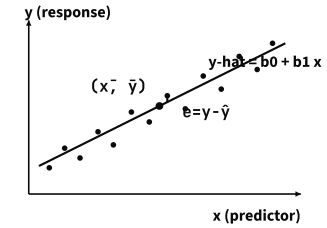
| X−X̄ | Y−Ȳ | PRODUCT | SQUARE |
|---|---|---|---|
| −2 | −9 | 18 | 4 |
| −1 | −6 | 6 | 1 |
| 0 | 3 | 0 | 0 |
| 2 | 12 | 24 | 4 |
| 1 | 0 | 0 | 1 |
| **Σ** | | **48** | **10** |

$\bar{x}=4$ · $\bar{y}=27$

$\hat{\beta}_2=48/10=\mathbf{4.8}$

$\hat{\beta}_1=27-4.8(4)=\mathbf{7.8}$

$\hat{y}=7.8+4.8x$




Check: the fitted line must pass through (4,27). Source: Ch 2 figure.

At x=4: ŷ=27; û=30−27=**+3**. Sentence: each additional 100 passers-by is associated with about 4.8 more loaves. Intercept 7.8 is an anchor outside the observed range.

SELF-TEST → *Can you recover the means, two sums, line, centroid check, fitted value and signed residual without looking?*

## 7b · Drill: classify + defend

CH 1 WORKED EXAMPLE

A cycleway study has: (i) cycling shares for all **120 council areas in one quarter**; (ii) the national quarterly share for **15 years**; (iii) the **same 120 areas** each quarter for **six years**.

| SET | STRUCTURE | WHY |
|---|---|---|
| (i) | cross-section | many areas, one time |
| (ii) | time series | one national unit, ordered quarters |
| (iii) | panel | same areas repeatedly |

Claim: areas with more bike shops cycle more, therefore shops drive cycling. **Reject the causal leap:** density, wealth and bike-friendly culture can raise both. The correlation predicts high-cycling areas but does not hold those factors fixed.

### OLS ANSWER CHECKLIST

## 8 · Drill 2: quadratic + log

COURSE / CH 3 WORKED

### EARNINGS CURVE

**Model:** EARN=−150+28.5EDUC+11.2EXPER−0.160EXPER².

```
EDUC: +$28.50 weekly per added year,
holding experience fixed
ME_EXPER=11.2+2(-0.160)EXPER=11.2-0.32EXPER
at 6: 11.2-0.32(6)=$9.28/week
turn: 11.2-0.32x=0 ⇒ x*=35 years
```

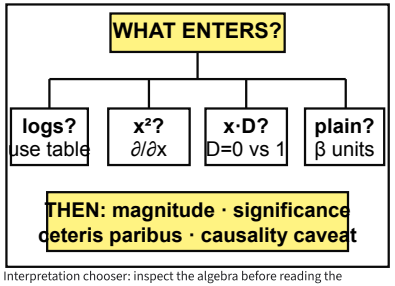
Negative squared term ⇒ hump: earnings rise, flatten at 35, then decline. Never interpret 11.2 alone when EXPER² is present.

### DEMAND ELASTICITY

**ln(SALES)=9.1−1.25ln(PRICE), $R^2$=0.58, n=120.**

```
β̂=-1.25 is elasticity: +1% price → ≈-1.25% sales
+4% price → -1.25×4%=-5%
R²: 58% of variation in ln(SALES) explained
```

Do not compare this $R^2$ with a model whose dependent variable is SALES in levels.




Interpretation chooser: inspect the algebra before reading the coefficient.

## 8b · Drill: sign OVB

CH 4 WORKED EXAMPLE

**True:** SALARY=$\beta_0+\beta_1$EXPER+$\beta_2$ABILITY+u, with $\beta_2>0$. **Short:** SALARY=$\alpha_0+\alpha_1$EXPER+v. In the sample, experience and ability are positively correlated.

```
Bias(α̃₁)=β₂×δ
δ=Cov(EXPER,ABILITY)/Var(EXPER)
(+ effect on salary)×(+ relation with exper)=upward bias
```

$\tilde{\alpha}_1$ overstates the true return to experience because it absorbs some salary gain due to ability. Ability moves into v and remains correlated with EXPER, so E[v|EXPER]≠0: MLR.4 fails.

| SELF-TEST VARIATION | RESULT |
|---|---|
| $\beta_2>0$, $\delta<0$ | downward |
| $\beta_2<0$, $\delta<0$ | upward |
| $\beta_2=0$ or $\delta=0$ | no classic OVB through z |

### FUNCTIONAL-FORM ORAL DRILL

## 9 · Drill 3: t and p

CH 5–6 WORKED EXAMPLES

### CLAIM AGAINST C≠0

Training claim: $\hat{\beta}_2=3.8$, se=0.55, n=210, k=3; "more than 3".

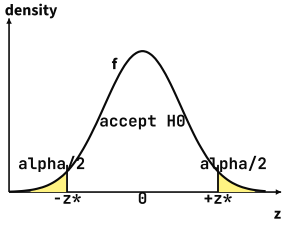
```
H₀:β₂≤3 vs H₁:β₂>3
t=(3.8-3)/0.55=1.45 · df=206
t*≈1.65 at 5% right-tail
1.45<1.65 ⇒ fail to reject
```

Not enough evidence that the training effect exceeds 3 units. The point estimate being above 3 is not enough.

### PRINTED TWO-SIDED P

Demand output: ln(price) $\hat{\beta}$=−1.80, se=0.35, p<0.001; promo $\hat{\beta}$=0.06, se=0.04, two-sided p=0.13.

| QUESTION | PATH | VERDICT |
|---|---|---|
| price ≠0 | p<.001≤.05 | reject |
| promo ≠0 | .13>.05 | fail to reject |
| promo >0 | sign agrees; .13/2=.065 | .065>.05, fail |




p is tail area beyond observed |t|; two-sided evidence lives in both tails. Source: Ch 6 figure.

Price t=−1.80/.35=−5.14 and elasticity is −1.80: +1% price → about −1.8% sales. Report size and significance separately.

## 9b · Inference judgement cards

CH 5–6 · FAQ

| IF THE QUESTION SAYS… | WRITE / COMPUTE |
|---|---|
| "different from c" | $H_1$:β≠c; two tails; \|t\| |
| "greater than c" | $H_1$:β>c; right tail |
| "less than c" | $H_1$:β<c; left tail |
| 95% CI excludes c | reject two-sided 5% $H_0$ |
| printed Pr(>\|t\|) | two-sided c=0 only |

**Degrees of freedom:** n−k−1; k counts slope coefficients, not total coefficients. Compute before reading the t table. More regressors reduce df. For a non-zero null, ignore the printout t and p because software's coefficient row tests c=0.

**Confidence interval:** $\hat{\beta}\pm t^*$se is a repeated-sampling procedure. CI width shows precision; excluding c gives the matching two-sided rejection. Do not assign probability to the fixed β after observing the interval.

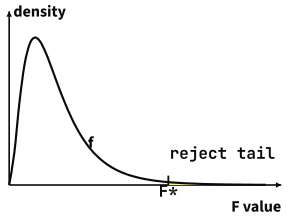
## 10 · Drill 4: joint F

CH 7 WORKED EXAMPLE

**Wage model:** n=88; unrestricted slopes educ, exper, south, urban; SSR_U=249. Drop south and urban: SSR_R=279. Given $F^*_{0.05}(2,83)=3.11$.

1. $H_0$:$\beta_3=\beta_4=0$; $H_1$:at least one ≠0.
2. q=2; k=4; denominator df=88−4−1=83.
3. Restricted must fit weakly worse: 279≥249.

```
F=[(279-249)/2]/[249/83]
=(30/2)/3=5.0
5.0>3.11 ⇒ reject H₀
```




The computed F=5.0 lies in the rejection tail beyond 3.11. Source: Ch 7 figure.

Conclusion: south and urban are **jointly significant** and stay, even if each t-statistic is insignificant. Correlated regressors can look weak one by one but matter as a block.

| FAST CHECK | CORRECT ANSWER |
|---|---|
| negative computed F? | R/U swapped |
| q? | count restrictions / equality conditions |
| tail? | upper only |
| q=1? | $F=t^2$, same p |
| overall F? | $H_0$: all slopes=0; restricted intercept-only |

MARK PATH → *hypothesis · q · models · SSR labels · df pair · arithmetic · upper-tail comparison · economic conclusion.*

## 10b · F-test variants

CH 7 · FAST RECALL

**Block exclusion:** $H_0$ sets several coefficients to zero; restricted model drops that block. **Overall significance:** $H_0$ sets every slope to zero; restricted model is intercept-only. **Linear restriction:** impose a relation among coefficients, substitute it into the model, and re-estimate the transformed restricted model.

Count q from restrictions, not unrestricted variables. Denominator df is n−k−1 from the unrestricted model. The numerator is fit lost per restriction. Always name both models.

## 11 · Drill 5: dummy × x

CH 8 WORKED EXAMPLE

**ln(salary) = 3.10 + 0.040exper + 0.150MBA + 0.012(exper×MBA).**

| GROUP | FITTED LINE | EXPER RETURN |
|---|---|---|
| MBA=0 | 3.10+0.040exper | ≈4.0%/yr |
| MBA=1 | 3.25+0.052exper | ≈5.2%/yr |

$\hat{\beta}_2=0.150$ is an ≈15% intercept premium at exper=0. $\hat{\beta}_3=0.012$ is the slope gap, ≈1.2 percentage points per experience-year, not the MBA slope itself.

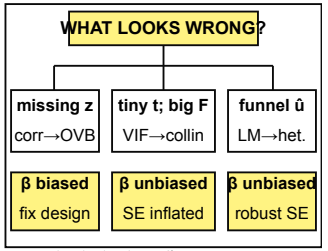
```
MBA premium at exper=10
=0.150+0.012(10)=0.270≈27%
```

### MULTICOLLINEARITY CARD

See high $R^2$/significant overall F but small individual t's, large SEs, unstable signs → suspect collinearity. Auxiliary regress $x_j$ on all other x's:

```
VIFⱼ=1/(1-Rⱼ²) · guide flags VIF>10
consequence: β̂ remains unbiased;
variance/SE inflated
```

Do not casually drop a theory-required regressor: that can exchange imprecision for omitted-variable bias. Dummy trap: with an intercept and m categories, include **m−1** dummies; the omitted category is the base.




Diagnose by what breaks: coefficient, precision, or conventional inference.

## 11b · Dummy / interaction traps

CH 8 · INTERPRETATION

**Dummy alone:** $y=\beta_0+\beta_1x+\beta_2D$. At D=0 the line is $\beta_0+\beta_1x$; at D=1 it is $(\beta_0+\beta_2)+\beta_1x$. Lines are parallel and $\beta_2$ is the intercept gap relative to the omitted base.

**Add xD:** $y=\beta_0+\beta_1x+\beta_2D+\beta_3xD$. At D=1 the line is $(\beta_0+\beta_2)+(\beta_1+\beta_3)x$. $\beta_3$ is the difference in slopes; the D=1 slope is $\beta_1+\beta_3$. The group gap at a particular x is $\beta_2+\beta_3x$, so it changes with x.

Keep the component terms x and D when including xD. Interpret $\beta_2$ at x=0; if zero is not substantively meaningful, centre x before interpreting the intercept gap. In a log-dependent model, 100β is the guide's approximate percentage interpretation.

| QUESTION | ANSWER EXPRESSION |
|---|---|
| base-group slope | $\beta_1$ |

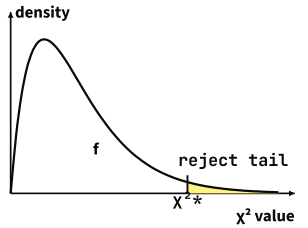
## 12 · Drill 6: BP + critique

CH 9–10 WORKED

### BREUSCH–PAGAN

House-price model n=250, regressors size, beds, age; squared residual plot fans out. Auxiliary $R^2$=0.048; $\chi^2_{*0.05,3}=7.81$.

```
û²=δ₀+δ₁size+δ₂beds+δ₃age+v
H₀:δ₁=δ₂=δ₃=0
LM=250(0.048)=12.0>7.81 ⇒ reject
evidence of heteroskedasticity;
report robust SEs
```




LM=12 is in the $\chi^2(3)$ upper-tail rejection region. Source: Ch 9 figure.

### HOUSING OUTPUT CRITIQUE

n=180; log(price): ROOMS 0.086 (se .022), DIST −.048 (.019), AGE −.0031 (.0014); $R^2$=.34; F(3,176)=30.2, p=.000.

- ROOMS: ≈8.6% higher price per room, holding DIST and AGE fixed; t≈3.9.
- Causality not secured: unobserved quality or neighbourhood may make E[u|ROOMS]≠0.
- $\beta_1+\beta_2$=.038; Var=.000605; SE=.0246; t=**1.55**<1.97 ⇒ fail to reject.
- $R^2$=.34 is fit; significant F is joint relevance—no contradiction.
- Claim ROOMS>10%: t=(.086−.10)/.022=**−.64**<1.65 ⇒ fail.

## 13 · Last-pass traps

ALL CHAPTERS

**Exam-morning rehearsal:** from memory write the form table, MLR.1–6 pay-offs, t/CI/F/LM formulas, OVB sign rule and three-diagnostic casualty table; solve one numerical path without notes. Stop adding material and practise conclusions.

## 13b · Heteroskedasticity final check

CH 9 · TRAPS

**Residual plot:** a flat band supports constant variance; a widening funnel suggests heteroskedasticity; a curve signals missed non-linearity. Plot residuals or $\hat{u}^2$ against fitted values/regressors.




Your exam is closed book: nothing printed goes in. Use this sheet to revise and self-test, not to carry.

University of Adelaide Semester 2 examination period, November 2026 (check your personal exam timetable).