4.2 Growth and productivity

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

KEY WORDS total factor productivity • rule of 70 70

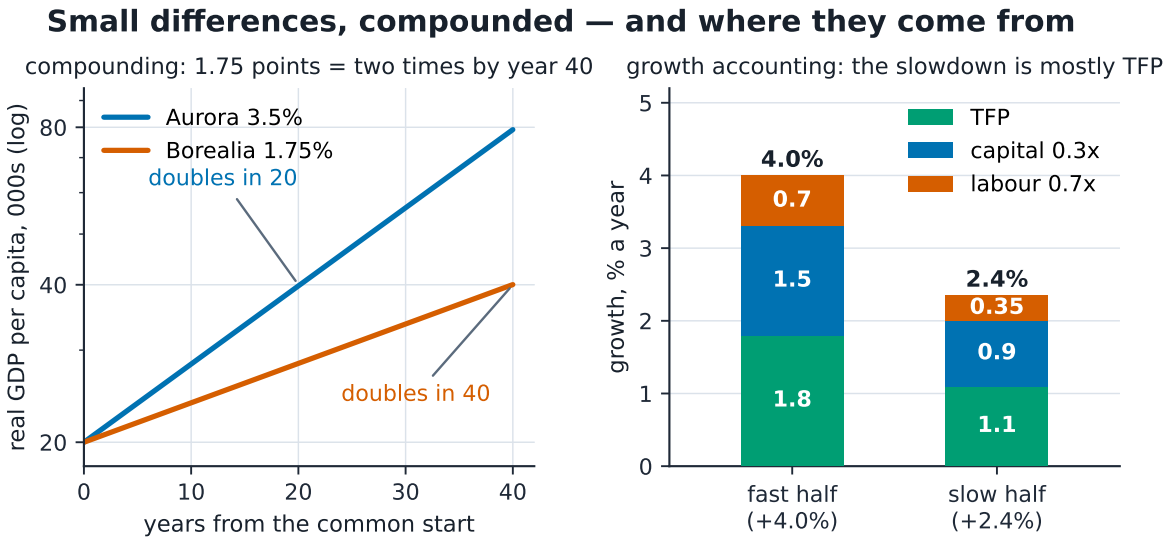
Objective

Decompose growth into TFP, capital and labour; turn growth rates into doublings with the rule of 70; compound honestly; classify proximate and fundamental causes.

1 Key knowledge and worked examples

■ The decomposition and the clock

$\Delta Y/Y = \Delta A/A + 0.3\,\Delta K/K + 0.7\,\Delta L/L$ – weights are income shares; the residual is **total factor productivity** . The **rule of 70** 70 : at g% a year, doubling takes $70/g$ years.



Small differences, compounded – and where they come from

■ Worked example. Aurora's halves

Fast: $4.0 - 1.5 - 0.7 = 1.8\%$ TFP ✓. Slow: $2.4 - 0.9 - 0.35 = 1.15\%$ ✓ – the slowdown is mostly TFP. 3.5% a year doubles in 20 years; 1.75% in 40; after 40 years one economy is twice the other ✓.

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2 Practice

2.1 Output grows 5.5% with capital +7.0% and labour +1.5% ($\alpha = 0.3$). Compute TFP growth. [2]

2.2 At 2.5% a year, roughly how long until income doubles? And at 7%? [2]

2.3 Income of 10,000 compounds at 7% for 10 years. Compute the ending value to the nearest hundred (use $1.07^{10} \approx 1.97$). [2]

2.4 A country's capital stock grows 6%, labour 2%, TFP 0.4%. Compute output growth, then say which contributor is largest. [3]

2.5 For each of – (a) firms install robots, (b) courts speed up contract enforcement, (c) participation of older workers rises – say PROXIMATE (and which term) or FUNDAMENTAL. [3]

2.6 A finance minister says "our 3% growth is entirely a technology story". Write the one-line check you would run before believing it. [2]

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Solutions

2.1

- $\Delta A/A = 5.5 - 0.3(7.0) - 0.7(1.5) = 5.5 - 2.1 - 1.05$.
- $= \mathbf{2.35}\%$.

2.2

- $70/2.5 = \mathbf{28}$ years.
- $70/7 = \mathbf{10}$ years.

2.3

- $10{,}000 \times 1.97 = \mathbf{19{,}700}$.
- Nearly a doubling in ten years – the rule of 70 in action.

2.4

- $\Delta Y/Y = 0.4 + 0.3(6) + 0.7(2) = 0.4 + 1.8 + 1.4$.
- $= \mathbf{3.6}\%$.
- Largest contributor: capital deepening (1.8 points), then labour (1.4) – not TFP.

2.5

- (a) Proximate – capital (and its efficiency lands in TFP).
- (b) Fundamental – institutions.
- (c) Proximate – labour input.

2.6

- Run growth accounting: attribute the 3% to $0.3\Delta K/K + 0.7\Delta L/L$ and inspect the residual.
- Only if inputs explain little is it a technology story; the residual also carries measurement error, so say "TFP", not "technology".

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