1.18 Measuring Income and Wealth Inequality: The Lorenz Curve and Gini Coefficient

Total Marks

AQA 7136 · Calculators not allowed · about 85 minutes · Write-in edition

Name: _____ Date: ____ / ____ / _____

Answer all questions. Write full sentences for questions worth 4 marks or more. Do not use a calculator; all percentages are rounded for ease. Time guidance: 85 minutes.

1 Explain how a more bowed Lorenz curve relates to the income share of the top 10% and the bottom 50% of the population, using the fictional country data from Question 4 as a reference point for the bottom 50% share.

(Total for Question 1 is 4 marks)

2 Short calculation. Using the fictional country data from Question 4, what percentage of total income does the richest 20% of the population receive? Show your working using the cumulative income percentages given.

(Total for Question 2 is 4 marks)

3 Evaluate the view that the Gini coefficient is a reliable and sufficient measure of inequality in an advanced economy such as the UK.

(Total for Question 3 is 25 marks)

4 Data and task, all figures rounded for ease. A small country publishes a table of cumulative percentage of population and cumulative percentage of total income, to be used to draw a Lorenz curve and estimate the Gini coefficient. Table: Cumulative population %: 0,10,20,30,40,50,60,70,80,90,100. Corresponding cumulative income %: 0,2,5,9,15,22,32,45,64,86,100. Using this data for the fictional country, draw a Lorenz curve on an axes where the horizontal axis is cumulative population % and the vertical axis is cumulative income %. On your diagram, show the line of perfect equality and mark the initial equilibrium point at 50% population. Then estimate the Gini coefficient from the data using a simple trapezoid or grid-square method and give the value to two decimal places, explaining your method. This is a data-response task for this fictional country.

(Total for Question 4 is 9 marks)

5 Using the same fictional country data from Question 4, show the calculation steps to find the area under the Lorenz curve for the first three segments (0-10, 10-20, 20-30 cumulative population), giving the numerical area values you use in the trapezoid method. This is a short calculation checking question.

(Total for Question 5 is 4 marks)

6 Interpret the following change in the Lorenz curve for the fictional country: over five years, the Lorenz curve becomes slightly less bowed (moves closer to the diagonal) and the computed Gini coefficient falls from 0.34 to 0.29. Explain what this shift indicates about income distribution, state two possible reasons why it might have happened (without discussing policy), and note one limitation of using only the Gini change to judge social progress.

(Total for Question 6 is 8 marks)

Mark scheme · 1.18 Measuring Income and Wealth Inequality: The Lorenz Curve and Gini Coefficient

Question 1

states that a more bowed Lorenz curve indicates the top shares are larger and bottom shares are smaller	**M1**
applies to the fictional data: the bottom 50% receive 22% of income, so a more bowed curve would mean the bottom 50% receive even less than 22%	**A1**
states that the top 10% share rises when the curve is more bowed	**M1**
connects the two by explaining that as the bottom share falls, the excess income accrues disproportionately to the top decile or top percentiles	**A1**

Answer: A more bowed curve means the bottom 50% get a smaller share and the top 10% a larger share; e.g. in our data the bottom 50% get 22% of income, so increased bowing would reduce that bottom share and raise top-10 shares.

Question 2

recognises that richest 20% corresponds to the top quintile, so subtract cumulative income at 80% population from cumulative income at 100% population: 100 - 64	**M1**
gives calculation 100 - 64 = 36	**A1**
states the richest 20% receive 36% of total income	**B1**
briefly notes this shows concentration of income at the top relative to perfect equality	**B1**

Answer: Top 20% income share = 100% - 64% = 36% of total income.

Question 3

Level 1 Basic assertions about what the Gini measures and a one-sided view. Limited application to the advanced economy context and little or no evaluation.	**1-5**
Level 2 Clear explanation of how the Gini coefficient measures inequality with an attempt to apply to an advanced economy. Some valid limitations are identified but evaluation is thin or unbalanced.	**6-10**
Level 3 Good analysis showing how the Gini is constructed and used, with several limitations and strengths discussed and applied to an advanced economy context. Some evaluative comment about sufficiency, with limited use of supporting examples or comparisons.	**11-15**
Level 4 Thorough analysis, including accurate explanation of the area ratio definition, sensitivity to changes across the distribution, and discussion of comparability over time and between countries. Balanced evaluation, weighing strengths and limitations with clear examples and implications for policy or social assessment.	**16-20**
Level 5 Highly developed evaluation that considers technical strengths and weaknesses, robustness issues, and alternative or complementary measures. Draws on examples relevant to an advanced economy, examines how the Gini handles income versus wealth and demographic effects, and reaches a well supported judgement about reliability and sufficiency.	**21-25**

Indicative content:

- Explain how the Gini coefficient is computed as an area ratio from the Lorenz curve and why it is useful as a single summary statistic ranging from 0 to 1
- Strengths: provides a compact summary allowing comparisons over time and between countries; sensitive to transfers across the whole distribution rather than a single percentile; widely understood and available in many statistical releases
- Limitations: loses information about where inequality changes occur (top, middle, bottom), so identical Gini values can correspond to very different distributions; insensitive to absolute income changes, so a falling Gini could coincide with falling incomes for the poor
- Wealth versus income: Gini typically calculated for income; wealth inequality is often much larger and differently distributed, so relying on income Gini alone can understate overall economic inequality in an advanced economy with high asset concentration
- Comparability issues: differences in data sources, incomes measured (pre-tax vs post-tax, market vs disposable), household equivalisation and sampling at the top can affect comparability; measurement error at the top can bias the Gini
- Technical points: the Gini is more influenced by changes around the median than at the extremes; small sample sizes or undercoverage of top incomes can understate true inequality
- Alternatives and complements: Palma ratio, top decile or top 1% shares, median-to-mean ratios, poverty rates, Lorenz curve visual analysis, and measures of wealth distribution should be used alongside Gini
- Application to an advanced economy: examples such as rising asset prices boosting wealth concentration, demographic changes, or tax/benefit systems that affect disposable income, showing why a single Gini may miss important trends
- Evaluation and judgement: conclude whether the Gini is reliable for quick summaries and comparisons but insufficient alone to fully assess inequality in an advanced economy; recommend combining Gini with other distributional statistics and contextual data

Question 4

Level 1 Basic use of the data: plots a small number of points correctly and shows the diagonal line of perfect equality, with minimal or no attempt to estimate the Gini coefficient. Answer contains descriptive statements about inequality but limited numerical accuracy.	**1-3**
Level 2 Good plotting of most Lorenz points and the diagonal, and a reasonable method to estimate the Gini coefficient using trapezoids or grid squares. Numerical estimate is attempted and roughly correct, with some working shown.	**4-6**
Level 3 All Lorenz points are accurately plotted and labelled, the line of perfect equality is drawn, and the student correctly computes the area under the Lorenz curve using trapezoids or grid squares and derives the Gini coefficient accurately to two decimal places with clear working and a brief interpretation.	**7-9**

Indicative content:

- Plot points (0,0), (10,2), (20,5), (30,9), (40,15), (50,22), (60,32), (70,45), (80,64), (90,86), (100,100) on cumulative population vs cumulative income axes
- Draw the diagonal line from (0,0) to (100,100) labelled line of perfect equality
- Mark the median point at 50% population, which on the Lorenz curve corresponds to 22% of income in this data set, showing inequality at the median
- Estimate area under Lorenz curve using trapezoidal rule with equal width segments of 10 percentage points: compute each trapezoid area as (y_i + y_{i+1})/2 x 10
- Sum of trapezoid areas = 3300 percent-squared, total area under diagonal = 0.5 x 100 x 100 = 5000, area between diagonal and Lorenz = 1700
- Gini = area between diagonal and Lorenz divided by total triangle area = 1700 / 5000 = 0.34, reported as 0.34
- Interpretation: a Gini of 0.34 indicates a moderate degree of income inequality; the Lorenz curve bowed below the diagonal shows the bottom 50% receive only 22% of income

Question 5

uses trapezoid formula for 0-10: (0 + 2) / 2 x 10 = 10	**M1**
uses trapezoid formula for 10-20: (2 + 5) / 2 x 10 = 35	**M1**
uses trapezoid formula for 20-30: (5 + 9) / 2 x 10 = 70	**M1**
gives the three numeric areas as 10, 35 and 70 respectively	**A1**

Answer: Areas: 0-10: (0+2)/2*10 = 10; 10-20: (2+5)/2*10 = 35; 20-30: (5+9)/2*10 = 70.

Question 6

identifies that a Lorenz curve moving closer to the diagonal and a falling Gini indicate a reduction in measured income inequality	**M1**
explains that more of the national income is accruing to lower and middle segments of the population, e.g. the bottom 50% now receive a larger share than before	**A1**
gives two plausible non-policy reasons: for example, changes in labour market composition such as rising wages in lower-paid sectors, or demographic shifts like an increase in employment among prime-age workers	**M1**
develops each reason briefly, e.g. rising relative wages in formerly low-paid sectors increases incomes at the bottom; demographic shifts raise labour force participation and income shares for groups that previously had low income	**A1**
identifies a limitation of the Gini change, e.g. it does not show where in the distribution the change occurred or whether absolute incomes rose for the poorest	**M1**
develops limitation: a falling Gini could be driven by losses at the very top rather than substantial gains at the bottom, so social welfare judgments require additional information like poverty rates or median income	**A1**
links back with a concise judgement that the observed shift indicates an improvement in measured equality but that this alone is insufficient to conclude clear social progress	**B1**
uses numerical change in Gini (0.34 to 0.29) as supporting evidence for the interpretation	**B1**

Answer: The movement of the Lorenz curve toward the diagonal and Gini falling from 0.34 to 0.29 indicates measured income inequality has decreased; reasons could include rising wages in lower-paid sectors or demographic increases in employment; however, the Gini does not reveal which parts of the distribution changed or whether absolute incomes of the poorest rose, so further measures are needed to judge social progress.