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Requirements: You have 90 minutes. The last two pages are marked scrap: you must detach them. There are no aids allowed. Please keep these papers face-up and closed on your desk until the start of the test is announced. Only test pages 4 – 6 and not scrap pages will be marked. Write your final answer on pages 4 and 5. No additional paper is provided beyond page 6: your answer must fit. You must write legibly.

Background: These sources – announced ahead of time – prepare you for this test: (1) Lectures 4 & 5, HW 4 & 5 (“Describing Associations & Association versus Causality” & “Linear Regression”), (2) Chapters 6 & 7 of our textbook (“Scatterplots, Association, and Correlation” & “Introduction to Linear Regression”), (3) SW11 (“Economic Questions and Data,” *Introduction to Econometrics, 3rd ed.*, pp. 1 – 13), (4) SW11-Chap8 (“Nonlinear Functions of a Single Independent Variable,” *Introduction to Econometrics, 3rd ed.*, pp. 265 – 272), (5) *The World Happiness Report* (2013) edited by John Helliwell, Richard Layard, and Jeffrey Sachs: “Introduction” and “World Happiness: Trends, Explanations and Distribution,” pp. 1 – 37, (6) *The World Happiness Report* (2012) edited by John Helliwell, Richard Layard, and Jeffrey Sachs: “Introduction” and “The Causes of Happiness and Misery,” pp. 1 – 9, 58 – 89, (7) “Money and happiness” from *The Economist*.¹

Structure: This test gives quantitative results that you must interpret. A single main question is followed by supporting questions that help guide you towards a full answer to the main question.

Guide to answering effectively:

- Directly and fully address the question. **[Required to earn points]**
 - To give a complete answer to the main question, address the supporting questions.
- To answer the questions, *apply* relevant course concepts to the quantitative results given. **[45 points]**
 - Critically evaluate the results.
- Write your answer using complete sentences and well-organized paragraphs. **[5 points]**
 - Use complete sentences throughout.
 - Answer with multiple well-structured paragraphs that coherently answer the main question.
 - Your response is expected to be about 1 ½ pages long (handwritten).
 - Spend about 45 minutes considering/outlining your arguments and about 45 minutes writing.
 - Use the scrap pages for a first draft/outline.

Student #:

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|-----------------------|----------|---------|-----------|------------------------------------|
| | Analysis | Writing | Raw Score | Your Mark (out of 100%) |
| <i>Point Value:</i> | 45 | 5 | 50 | |
| Points Earned: | | | | |

¹ Sources beyond textbook are on the portal or at http://unsdsn.org/files/2013/09/WorldHappinessReport2013_online.pdf, <http://www.earth.columbia.edu/sitefiles/file/Sachs%20Writing/2012/World%20Happiness%20Report.pdf>, and <http://www.economist.com/node/21013336>.

The World Happiness Report 2013 documents and analyzes individual well-being across countries and over time. It provides the happiness data in the analysis below. The *Penn World Table Version 8.0* measures relative income over time and across countries.² It provides the GDP data. 178 countries appear across all data. However, not all data are available for all countries, which is why observations vary in the analysis below.

| Variable name | Description |
|-------------------------|--|
| mean_happy_10_12 | Mean reply in a country to “Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?” asked in 2010, 2011, and 2012 ³ |
| real_gdp_ppp_2011_pc | Real GDP per capita at current PPP (purchasing power parity) in 2011 \$1,000s US |
| ln_real_gdp_ppp_2011_pc | Natural logarithm of real_gdp_ppp_2011_pc |
| c_happy_05_07_to_10_12 | Difference (change) in mean happiness from 2005 – 2007 to 2010 – 2012 (= mean_happy_10_12 – mean_happy_05_07) |
| c_06_11_gdp_ppp_pc | Difference (change) in GDP per capita from 2006 to 2011 (= real_gdp_ppp_2011_pc – real_gdp_ppp_2006_pc) |

| Variable | obs. | mean | median | s.d. | min. | max. |
|-------------------------|------|--------|--------|--------|--------|---------|
| mean_happy_10_12 | 156 | 5.419 | 5.326 | 1.102 | 2.936 | 7.693 |
| real_gdp_ppp_2011_pc | 167 | 14.252 | 8.368 | 16.912 | 0.288 | 120.172 |
| ln_real_gdp_ppp_2011_pc | 167 | 1.968 | 2.124 | 1.291 | -1.245 | 4.789 |
| c_happy_05_07_to_10_12 | 130 | 0.082 | 0.094 | 0.444 | -1.153 | 1.438 |
| c_06_11_gdp_ppp_pc | 167 | 1.207 | 0.765 | 2.966 | -9.995 | 26.810 |

OLS Regression Results:

Regression 1: $\text{mean_happy_10_12_hat} = 4.8004 + 0.0452 * \text{real_gdp_ppp_2011_pc}$, $n = 145$, $R^2 = 0.4517$

Regression 2: $\text{mean_happy_10_12_hat} = 4.1519 + 0.6598 * \ln_real_gdp_ppp_2011_pc$, $n = 145$, $R^2 = 0.5987$

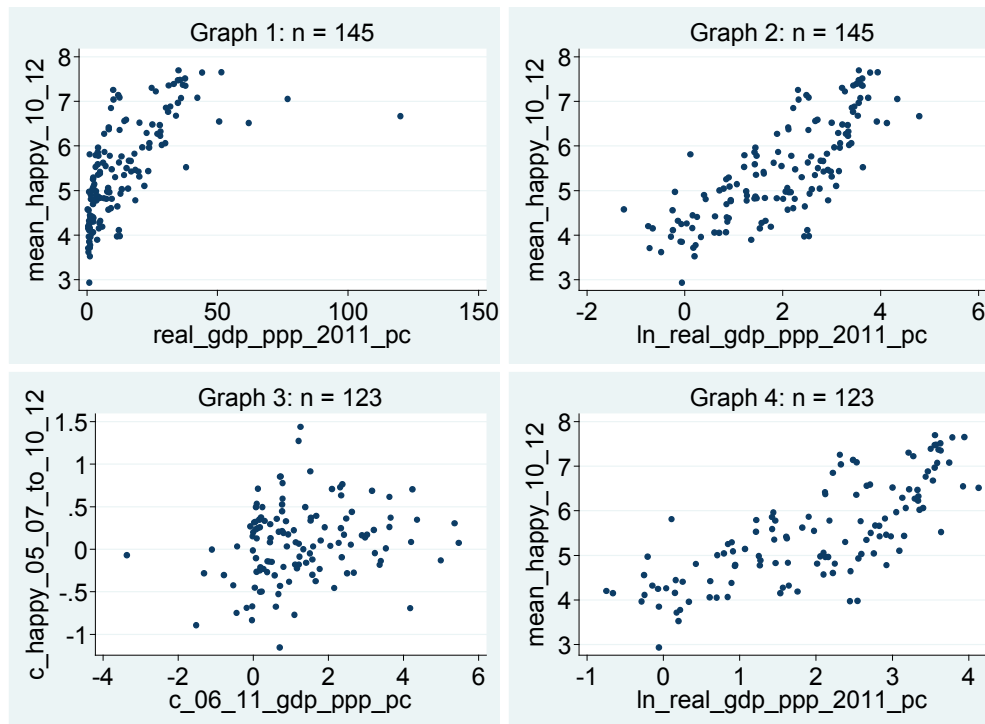
Regression 3: $\text{c_happy_05_07_to_10_12_hat} = -0.0003 + 0.0605 * \text{c_06_11_gdp_ppp_pc}$, $n = 123$, $R^2 = 0.0405$

Regression 4: $\text{mean_happy_2010_12_hat} = 4.1376 + 0.6799 * \ln_real_gdp_ppp_2011_pc$, $n = 123$, $R^2 = 0.5875$
(Note: Regression 4 re-runs Regression 2 but only for the 123 countries with non-missing data in Regression 3.)

On the next page, Graphs 1 through 4 show the data used for Regressions 1 through 4, respectively.

² These data by Robert Feenstra et al are at <http://www.rug.nl/research/ggdc/data/penn-world-table>.

³ “There is a necessary trade-off between sample size and the ability to identify the latest levels and trends. The Gallup World Poll, which still provides the most comparable data for a large group of countries, typically interviews 1,000 respondents per country in each survey year. We average the three most recent years (2010–12) in order to achieve a typical sample size of 3,000, thus reducing uncertainty in the resulting estimates of country averages. In looking for possible trends, we compare these most recent three years with average values in the earliest years (2005–07) of data available for each country” p. 9 of *The World Happiness Report 2013*.



Main question: What do the four sets of regression results mean?

Supporting questions: (These help guide you towards a full answer to the main question.)

- **Discussion of the data used in the regressions:**
 - Are the data observational or experimental? Explain.
 - For each regression, are the data cross-sectional, time series, or panel? Explain.
- **Discussion of regression results:**
 - Are any underlying conditions clearly violated in any of the regressions? Explain the impact.
 - Are wealth and happiness correlated, associated, neither? Do the regression results and graphs provide evidence consistent with diminishing marginal returns to wealth?
 - What are the *full interpretations* of the specific numbers – intercepts, slopes, and R^2 – for each of the four regression results? (Remember to specify the relevant units of measurement.)
 - How does Regression 1 compare with 2? Regression 3 with 4? Regression 2 with 4?
- **Critical interpretation of regression results:**
 - Does increased wealth lead to increased happiness?
 - What is confusing (paradoxical) about Graph 3, Regression 3 versus Graph 4, Regression 4?

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 - Use the scrap pages for a first draft/outline.

Write your final answer on these pages to be graded. Use scrap pages for a draft/outline that is not graded.

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