

Honors General Exam  
Part 1: Microeconomics  
(33 points)

Harvard University

April 9, 2014



**QUESTION 2.** (9 points)

Two players are engaged in a game of Matching Pennies. There are two possible actions, Heads and Tails. If both players choose Heads or if both players choose Tails, then the row player receives a payoff of 1 and the column player receives a payoff of  $-1$ . If either player chooses Heads and the other player chooses Tails, then the row player receives a payoff of  $-1$  and the column player receives a payoff of 1.

(a) Draw the payoff matrix. (2 points)

(b) Identify all pure strategy equilibria, if any exists. (2 points)

(c) Identify all mixed strategy equilibria, if any exists. (5 points)

**QUESTION 3.** (9 points)

Pete and Dud live in a two-commodity world. Pete's utility function is  $U^P(a_P, b_P) = a_P^{\frac{1}{3}}b_P^{\frac{2}{3}}$ . Dud's utility function is  $U^D(a_D, b_D) = a_D^{\frac{1}{3}}b_D^{\frac{2}{3}}$ . Pete is initially endowed with 3 units of commodity  $a$  and 2 units of commodity  $b$ . Dud is initially endowed with 3 units of commodity  $a$  and 7 units of commodity  $b$ . What is the competitive equilibrium (i.e. price and allocation)?

**QUESTION 4.** (9 points)

Xavier, Yvette, and Zachary share the same collection of songs downloaded from iTunes (they share one computer). Each song costs \$1. If Xavier downloads  $x$  songs, Yvette  $y$  songs, and Zachary  $z$  songs, their collection will contain  $S = x + y + z$  songs.

The utility functions of Xavier, Yvette, and Zachary are given by

$$\begin{aligned}u_x(x, S) &= 100 \ln(x + S) - x \\u_y(y, S) &= 100 \ln(y + S) - y \\u_z(z, S) &= 100 \ln(z + S) - z.\end{aligned}$$

- (a) Find the optimal number of downloads  $x$  by Xavier (his best response) for any choice of  $y$  by Yvette and  $z$  by Zachary. (4 points)

- (b) Find the number of downloads by Xavier, Yvette, and Zachary in the Nash equilibrium.  
(5 points)

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Honors General Exam  
Part 2: Macroeconomics  
(33 points)

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**QUESTION 1.** (18 points)

The value of the stock market is one of the most closely watched economic variables in the United States. This question asks you some basic questions about the stock market and how movements in stock prices can either cause or reflect changes in other economic variables. Remember that stocks, or equities, represent shares of ownership in business firms.

- (a) How do most economists believe that stock prices are determined? In other words, what are the “fundamental” long run determinants of stock prices in mainstream economic theory? (3 points)

- (b) In practice, future movements in stock prices are difficult to forecast. How does modern economic theory explain this fact? (3 points)

- (c) Do difficulties in forecasting near-term movements in stock prices prove that these prices are always very close to their fundamental values? Why or why not? (3 points)

- (d) Assume that the value of the stock market has risen. In a closed economy, how would we expect this increase to be related to changes in the individual components of GDP? Discuss short run effects only. For clarity, you should analyze the effects of the stock-market increase on each GDP component in isolation, not all at once. You should also relate your answer to an economic model. (4 points)

- (e) From August 2000 to February 2003, the value of the S&P 500 stock-price index fell by 43.6 percent. This decline was accompanied by a mild recession. From October 2007 to March 2009, the S&P declined by comparable amount (50.8 percent), but the later decline accompanied the worst recession since the Great Depression of the 1930s. Why do you think that the recession of 2007-09 was so much worse than the recession of 2001? Specifically, was the 2007-09 recession related to other asset markets besides the equity market, and if so, how? (5 points)

**QUESTION 2.** (18 points)

This question includes a set of statements about the Solow Model that you should label as either “true,” “false,” or “uncertain.” You should assume that the Solow Model in this question is calibrated in the standard way; for example, that the capital share  $\alpha$  is greater than zero but less than one. Capital depreciates exogenously at rate  $\delta$ . Additionally, technical progress is reflected in exogenous growth in labor-augmenting technical progress  $E$  at rate  $g$ . The population growth rate  $n$  is also exogenous. Most importantly, you should provide an explanation for your answer, because your explanation is the most important determinant of your grade.

- (a) In the steady state of the Solow Model, neither the growth rate of aggregate output  $Y$  nor the growth rate of output per worker  $\frac{Y}{L}$  depends on the savings rate  $s$ . (3 points)
- (b) In the steady state of the Solow Model, the capital-output ratio  $\frac{K}{Y}$  does not depend on the saving rate  $s$ . (3 points)

(c) An increase the rate of technical progress  $g$  is generally bad for future living standards, because it lowers the steady state value of capital per efficiency unit of labor,  $k = \frac{K}{EL}$ . (3 points)

(d) The recovery of living standards in Germany and Japan after World War II is easy to explain with the Solow Model. (3 points)

(e) Many economists believe that living standards in different countries around the world are not converging (that is, incomes per capita of poor countries are not growing faster than those of rich countries). If true, then this fact alone means that we have to change the basic Solow Model in fundamental ways. (3 points)

(f) The Solow Model predicts that output  $Y$  depends on capital  $K$ , labor  $L$ , and labor-augmenting technology  $E$ . Therefore, the Solow Model is inconsistent with idea that the cross-country income distribution is driven in part by cross-country differences in geography and climate, in economic institutions, or in cultures. (3 points)

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Honors General Exam  
Part 3: Econometrics  
(34 points)

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## IMMIGRATION AND WAGES

Do immigrants to the United States earn less than workers born in the United States? If so, what are the reasons behind these differences? In this section of the exam you will discuss empirical strategies that could be used to investigate these questions.

### QUESTION 1. The Determinants of Wages (15 points)

To investigate the extent to which immigrants earn less than US-born workers, a researcher takes a random sample of people living in the United States in 2014 and estimates a regression of the form:

$$\ln(\text{earnings}_i) = \beta_0 + \beta_1 \text{immigrant}_i + u_i \quad (1)$$

where  $\text{earnings}_i$  are the earnings of worker  $i$  in 2013 measured in thousands of dollars and  $\text{immigrant}_i$  is an indicator variable equal to one if the individual was born outside the United States.

- (a) An observer notes that the coefficient  $\beta_1$  may be biased because immigrants may have less education on average than US-born workers. Provide the sign of the bias associated with the omission of education in equation (1) assuming that the observer's assumption is correct. In predicting the sign of the bias, explain the role of (co)variances of the relevant variables. (3 points)

(b) Another observer worries that the relationship between earnings and immigrant is non-linear and suggests including  $\text{immigrant}_i^2$  in equation (1). Do you think this is a sensible strategy? Be specific. (3 points)

(c) One researcher is discouraged by the potential for omitted variables since she is interested in the causal effect of being an immigrant on earnings. Thus, this researcher suggests using distance from the Mexico-US border as an instrument for  $\text{immigrant}_i$  in equation (1). Assuming homogeneity across individuals, what are the two conditions that must hold for this distance to be a valid instrument? Do you think that they will hold in this context? Be specific. (4 points)

- (d) This researcher also considers gathering data on both sides of the Mexico-US border and running a specification of the form:

$$\ln(\text{earnings}_i) = \beta_0 + \beta_1 \text{distanceborder}_i + \beta_2 \text{US}_i + u_i, \quad (2)$$

where the relevant sample would be drawn from border regions on both the United States and Mexico,  $\text{earnings}_i$  measures the 2013 earnings of worker  $i$  in thousands of US dollars,  $\text{distanceborder}_i$  is the distance of worker  $i$ 's residence to the Mexico-US border (where these distances are defined as negative for locations in Mexico, i. e. the distances are multiplied by  $-1$ , and positive for those in the US) and  $\text{US}_i$  is an indicator equal to one if the individual's residence is in the United States. Do you think that an estimate of  $\beta_2$  in equation (2) would help uncover the causal effect of being a US resident on earnings? Provide one threat to the internal validity of such a strategy. Be specific. (5 points)

**QUESTION 2.** The Effects of Immigration on US Employment (19 points)

Does immigration increase unemployment among the existing residents of the host country? A variety of studies have investigated this question using population shocks. Imagine for the sake of this part of the exam that 55 cities on the east coast of the United States accepted 1.3 million refugees from the ongoing Syrian Civil War in 2014. Thus, these cities would have a surge in their labor forces in 2014. For the purposes of this part of the exam, let  $i$  denote city and  $t$  years. Furthermore,  $\text{refugee}_i$  is an indicator variable equal to one if city  $i$  received at least one Syrian refugee in 2014.

- (a) The researcher begins by estimating the following regression using cross-sectional data on 1324 US cities in 2015 and obtains:

$$\widehat{\text{unemployment}}_i = 0.079 - 0.003 \text{refugee}_i, \quad (3)$$

(0.001)            (0.003)

where  $\text{unemployment}_i$  is the unemployment rate in city  $i$  in 2015 and  $\text{refugee}_i$  is as explained above. Interpret both the intercept and the coefficient on  $\text{refugee}_i$  in equation (3). Do these results suggest that this population shock affected unemployment? (4 points)

- (b) An observer is frustrated by the zeros in front of the coefficients in equation (3). Suggest how you would modify regression (3) so that the each of the estimated coefficients are multiplied by one-hundred. (3 points)

- (c) The researcher decides to ignore the observer's frustrations, gathers data for all 1,324 cities for 2013 and estimates a regression of the form (using data from 2015 and 2013):

$$\widehat{\text{unemployment}}_{it} = 0.080 - 0.019 \text{refugee}_i + 2 \cdot 10^{-4} \text{year2015}_t + 0.015 \text{interaction}_{it}, \quad (4)$$

(0.001)      (0.003)                      (8·10<sup>-4</sup>)                      (0.004)

where the variables are as explained above and  $\text{interaction}_{it} = \text{refugee}_i \cdot \text{year2015}_t$ . Interpret all of the coefficients in equation (4). Do these results provide support for the claim that the Syrian population shock increased unemployment? (6 points)

- (d) Explain how you would use the coefficients in equation (4), to provide a point estimate of

$$E[\text{unemployment}|\text{refugee} = 1, \text{year} = 2015] - E[\text{unemployment}|\text{refugee} = 1, \text{year} = 2013].$$

Be specific. (6 points)

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