**PA 5033 University of Minnesota**

**Multivariate Techniques PROBLEM SET 1**

**DUE:**March 31st, 2021

USING MULTIVARIATE TECHNIQUES FOR POLICY ANALYSIS AND RECOMMENDATIONS

An important goal of the problem sets is to use multivariate statistical analysis to help “policy advisors” provide guidance to policy makers.

***The Case***

**The Minimum Wage in Puerto Rico[[1]](#footnote-1)**

Brief History

The minimum wage was first established in Puerto Rico in 1938, at the same time that it was instituted in the continental United States. In both Puerto Rico and the continental United States it was set at $.35 per hour at that time. It soon became evident that $.35 per hour minimum was inducing substantial unemployment in Puerto Rico. Thus, the U.S. minimum was rescinded in Puerto Rico and instead separate minima were established by industry. The minima varied by industry wage level and were set to avoid adverse employment effects, typically lower in low-wage and higher in high-wage industries. In 1974, the U.S. Congress passed legislation requiring that the Puerto Rican minimum be raised over time to the continental U.S. level. It is now at the U.S. level which was raised from $3.35 to $3.80 per hour in 1990, to $4.25 per hour in 1991, to $4.75 per hour in 1996, and to $5.15 per hour in 1997. In 2007, the minimum wage was increased to $5.85 per hour, went to $6.55 in 2008, and $7.25 in 2009. There are current proposals in Congress to again raise the U.S. minimum wage between $10.00 to $15.00 per hour. Also, in September 2010, President Obama signed a bill delaying the full implementation of the U.S. minimum wage on the U.S. Territory of American Samoa.

Policy Issue and Analysis

The Governor of Puerto Rico is concerned that being required to pay the U.S. minimum wage is causing substantial unemployment, but that it may also raise the earnings of workers on the island. The governor is considering petitioning the U.S. Congress to allow a lower minimum, similar to the recommendation of the Governor of American Samoa that led to a delay in the implementation of the U.S. minimum for that U.S. territory. The Governor of Puerto Rico wants to learn about the benefits and costs of the legislation. In addition, policy makers on the mainland want to learn if the minimum wage has unintended consequences for those directly impacted.

You are to advise the Governor of Puerto Rico on whether to proceed with the petition to request a delay in meeting the minimum wage requirements. You should consider who is likely to be affected by the minimum. In addition, you are to advise mainland policy makers on the consequences of the U.S. national minimum wage being applied to Puerto Rico.

Most policy analysts using economic theory as applied to wage determination think that as wages go up unemployment increases and employment declines. This is based on a theory of a downward sloping demand curve for labor. For the Governor, a decrease in employment would cause political problems for potential reelection in the short run, and harm the workers on the Island who have the fewest labor market skills and opportunities. On the other hand, wage increases for workers would provide a strong political platform for reelection.

Statistical Issues

The policymakers and the analysts who advise them have concerns about statistical issues associated with the data analysis you have been asked to comment upon. The data described are attached in STATA file ***PRtime data*** on the Canvas site. Hand in the appropriate statistical output that supports your answers to the questions below in the form of a log file organized by question.

**(A)** For all of part A, include in your regression estimates **only** the variables listed in the questions.

1) Estimate the impact of average minimum wage (avemin; see below for a definition) over time (yrn) on the Puerto Rican Unemployment Rate (prunemp) and average wage in manufacturing (mfgwag) by running two separate regressions. In the first, regress avemin and yrn as the independent variables on prunemp as the dependent variable. In the second, regress mfgwag as the dependent variable and avemin and yrn as the independent variables. Do not include any other independent variables in the models other than those listed above. Explain your results. (Interpret each coefficient regardless of whether you think the coefficient to be significant, comment on the significance of the t-scores, the significance of the F-score, and the adj-R2. You do NOT need to run hypothesis tests, but it is helpful, though not required, to reference significance for critical values.)  
  
2) What if employers were slow to adjust to changes in the minimum wage? Estimate the impact of the kaitz index (kaitz; see below for a definition) and average minimum wage both lagged one period and two periods on the Puerto Rican prunemp. and average wage in manufacturing. You should have two separate regressions, one with Puerto Rican prunemp as the dependent variable and another with average wage in manufacturing as the dependent variable. What are the pros and cons relative to the models in part (1)?

3). Estimate a one-period dynamic lag into the Puerto Rican Unemployment Rate and average wage in manufacturing equations while using average minimum wage as another independent variable. What do your results now show? Compare them to your initial analysis in part (1). What are the potential pros and cons of this statistical approach? **Be specific**.

4) What if the Puerto RicanUnemployment Rate and average wage in manufacturing equations are jointly determined? Estimate a two-stage least squares model (2SLS) choosing an instrumental variable to identify the system of equations. Be sure to state your instrumental variable and **the reason(s) for choosing it**. What are the pros and cons relative to part (1)? (Be sure to show all your STATA output for using two-stage least squares.) The discussion of all of part A must be no longer than 3 double-spaced pages using standard 12 font (not including the output from your STATA estimates).

**(B)** Develop and estimate **your “best specified” model(s)** of the impact of the measure of the minimum wage on the Puerto Rican Unemployment Rate and average wage in manufacturing in Puerto Rico using any of the data available in this case. Select your best specified model based on theory and the attached variable definitions (Hint: use the suggestions in the later part of Chapter 11 of the Studenmund text). What are the pros and cons of your “best specified” model relative to part (A1)? Make policy recommendations to the Governor and policy makers on the mainland on this policy issue based on these statistical models. Only give the “full treatment” to the best specified model from part B (i.e., at most a couple of pages), and just discuss the results of your model in comparison with the other models more generally and briefly (i.e., a couple of paragraphs). The discussion of part B must be no longer than 5 double-spaced pages using standard 12 font, not including the output from your STATA estimates. \*(See attached data descriptions).

DOCUMENTATION FOR PUERTO RICAN MINIMUM WAGE PRTIME.DTA SERIES DATA SET

Minimum Wage Related Variables:

**Average minimum wages (avemin):** is a weighted average of the minimum wages for 44 different industries in Puerto Rico (37 three-digit manufacturing and 7 one-digit industries). The data was gathered from the individual Department of Labor reports that record the industry minimums in the years when industry committees set minima. The reports usually give minima for very detailed occupations. To arrive at a single minimum wage for each industry the data had to be amalgamated. Because employment by occupation was unavailable we took a simple average of the occupational minimum.

**Economy-wide Coverage (Covt):** based on coverage figures for 1962, 1964, 1965, 1966, 1969, 1970, 1971, 1972, 1975, and 1976 from unpublished tabulation "Estimated number of nonsupervisory employees subject to the minimum wage provisions of the Fair Labor Standards Act in Puerto Rico, 1962-1976" (U.S. Department of Labor, Employment and Standards Administration (May 16, 1977)). We divided the figures by total employment to obtain the coverage number.

**Average Wage (avewag):** weighted average of the 44 industry average hourly earnings.

**Average Manufacturing Wage (mfgwag):** Is from the Yearbook of Labour Statistics, International Labour Office, Geneva, 1950-87.

**Kaitz minimum wage index (kaitz):** the employment-weighted average of coverage x minimum/hourly earnings: ∑ai(m/w)ici, where ai is the share of employment in industry i, mi is the minimum wage in industry i, wi is average hourly earnings in industry i and ci is the coverage in that industry. The index used the coverage, minimum, and hourly earnings figures described above.

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| Industries used in analysis | | |
| *37 three-digit manufacturing:* | | |
| footwear  women's & child clothing  men's & boy's clothing  misc. apparel  jewels & jewelry  alcoholic beverages  drugs  food  sawmills  cut stone & asbestos  sugar  rubber  machinery & transp. equip. | leather gloves  children's outerwear  leather handbags  misc. fab. textiles  costume jewelry  cigars  petroleum  household furniture  paper and allied products  port cement & pottery  textile mill products  footwear | electrical  corset & brassieres  women's outerwear  toys & athletic goods  office & art. supplies  tobacco  chemicals  other furniture  cement  glass  plastics  professional instr. |
| *7 one-digit industries:* | | |
| transportation  trades  public administration | construction  finance | services  agriculture |

Macro-economic variables:

**Puerto Rican Real Gross National Product (GNP) (prgnp):** Economic Report to the Governor. 1954 constant dollars (inflation adjusted). In millions of dollars. Puerto Rican gross national product is the total market value of all goods and services produced by the citizens of Puerto Rico (either in Puerto Rico or in a foreign land) in a particular year.

**Puerto Rican Employment to Population Ratio (prepop):** comes from the monthly household surveys done in Puerto Rico. The ratio of the number of individuals in the working-age population (ages 16-64) currently employed in Puerto Rico to the total working age population in Puerto Rico in a particular year.

**Puerto Rican Unemployment Rate (prunemp):** comes from the monthly household surveys done in Puerto Rico. The ratio of the number of individuals in Puerto Rico who are unemployed to the total number of individuals who are in the labor force (employed or actively seeking employment) in Puerto Rico.

**U.S. Real Gross National Product (GNP) (usgnp):** Economic Report to the President. 1954 constant dollars. In billions of dollars (inflation adjusted). United States gross national product is the total market value of all goods and services produced by U.S. residents (either in the U.S. or in a foreign land) in a particular year.

1. This case was adapted from the John F. Kennedy School of Government Case Project based on research by Alida Castillo Freeman and Richard B. Freeman entitled "Minimum Wages in Puerto Rico: Textbook Case of a Wage [↑](#footnote-ref-1)