Assignment 2:

Estimating the Value of a Statistical Life

1. Objective

This assignment is aimed at showing you how Value(s) of a Statistical Life can be estimated, how to interpret them, and for you to form an opinion on the strengths and weaknesses of the Hedonic Pricing Method – whether it is suited to inform policy makers about the benefits of (environmental) policies that help to protect lives, whether the technique may only be useful to estimate the value of, say, clean air (when regressing the sales prices of homes on a variety of attributes including local air quality), or whether the technique is just not able to measure any value – not the value of clean air, let alone the value of a statistical life.

2. Approach

Download the data set (ProjectVSL_Data.dta) from canvas modules, and also the R do file (AssignmentVSL_Code.R). The do file gives you example codes for most of the Tasks described below.

3. How to calculate the Value of a Statistical Life

As explained in class, the value of a statistical life (VSL) is determined as $VSL = \frac{dwage}{drisk}$ x unit_risk^{-1}.

Here, $\frac{dwage}{drisk}$ is the marginal willingness to pay (MWTP) to reduce risk by one unit, or the willingness to accept to have risk being increased by one unit. As shown in class, if some assumptions are met, the MWTP can be derived by regressing *wage* on some measure of risk of dying in the workplace (using some specific functional form, like linear-linear (*wage* regressed on *risk*), log-linear (regress *ln(wage)* on *risk*), or log-log (regress *ln(wage)* on *ln(risk)*). If *risk* is defined by the probability of dying in a work-related accident per year, some steps need to be taken to derive the *VSL*. For example, suppose that the *risk* is measured as the number of work-related deaths per 4000 workers, per year. Given this definition of risk, a *marginal* change in risk is *risk* decreasing (or increasing) by 1/4000. Such a change in risk implies that in a group of 4000 workers, one additional life is expected to be saved. If we then obtain the MWTP from the wage-risk regression, we have to (i) adjust the value for the time unit (it should be in a value per year; if not, we need to change it into an annual amount), and (ii) multiply that amount by 4000. So if wages are measured per month and risk is measured in the number of deaths per year, the MWTP needs to be multiplied by 12. And then that amount needs to be multiplied by 4000, because the change in risk is the decrease of the probability of dying by one in 4000. In a group of 4000 workers, one additional life would be saved, and hence the sum of the MWTPs of all 4000 workers is the value of saving one additional life in that group (in expectation). If, from the wage-risk regression we can derive the *mean* MWTP per year, we can simply multiply that number by 4000 to find the Value of a Statistical Life.

4. How to calculate the VSL in this assignment

Risk in this assignment is measured as the expected number of people dying in the workplace, per year and for a number of specific sectors, per 4000 workers. The wage rate (see variable *realwage*) is the wage rate that the respondent in the survey receives per hour. Because risk is measured per year, the hourly wage rate needs to be translated into annual income. As the number of hours worked per year is 2000, the annual wage rate is equal to 2000 times the per-hour wage rate.

Suppose you run the following regression:

$$\text{wage} = c_1 + c_2 \text{ risk} + c_3 \text{ UNION} + \ldots + \varepsilon, \tag{1}$$

Then dwage/drisk = c_2, and the VSL = 2000 x 4000 x c_2.[1]

If you decide to run the following regression:

$$\ln(\text{wage}) = v_1 + v_2 \text{ risk} + v_3 \text{ UNION} + \ldots + \varepsilon, \tag{2}$$

then $\frac{\partial \ln(wage)}{\partial risk} = v_2$. You can then derive dwage/drisk by noting that $\frac{\partial \ln(wage)}{\partial risk} = \frac{\partial \ln(wage)}{\partial wage}\frac{dwage}{drisk}$ $= \frac{1}{wage}\frac{dwage}{drisk}$. So then $\frac{1}{wage}\frac{dwage}{drisk} = v_2$, and hence $\frac{dwage}{drisk} = c_2$ x *wage.* That means that, for the log-linear specification, we have VSL = 2000 x 4000 x v_2 x realwage.

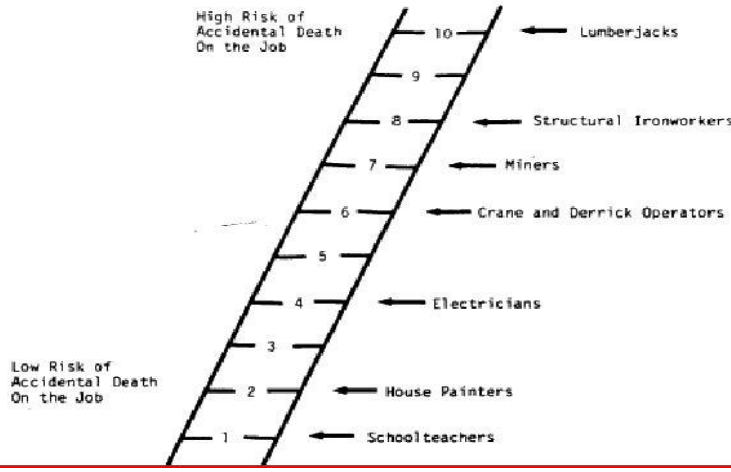
5. How the data were gathered

The data were gathered by means of a survey that was sent to more than 1000 employed individuals throughout the United States. There are 715 valid responses.

Risk was explained by means of a Risk Ladder:

[1] If you want to run this regression, use e^{lnwage} to create the hourly wage rate in levels. Do NOT use realwage, because this is slightly different from e^{lnwage} because of adjustments for local prices.

The ladder below shows levels of job-related accidental risk of death. Each step shows the number of deaths per year for every 4,000 people in an occupation. The higher on the ladder, the more accidental "on the job" deaths there are each year for that occupation. A few example occupations are given and they are placed on the ladder according to their actual levels of risk. Note that schoolteachers have about one death per 4,000 workers and lumberjacks have about 10 deaths per 4,000 workers each year. Of course, your 1983 job does have a level of risk somewhere on the ladder even if it has not been listed as one of the examples. Questions 6 and 7 refer to this ladder.



People were then asked to assess which occupation hazard is closest to their own:

Q-6 Now, please think about your main job in 1983 for a minute. In your opinion, which step on the ladder comes closest to describing the risk of accidental death in your job. (Please circle the step number of your answer)

The answer to this question is the risk variable in the data set. The definition of the other variables in the data set are as follows:

Explanatory Variable	Definition
A. Risk Variable	
RISK	Perceived risk of a fatal accident at work. Takes on an integer value from 1 to 10 deaths per 4,000 workers annually.
B. Human Capital Variables	
SCHOOL 1	1 if schooling ended in grades 1–8; 0 otherwise.
SCHOOL 2	1 if schooling ended in grades 9–11; 0 otherwise.
SCHOOL 3	1 if schooling ended in grade 12; 0 otherwise.
SCHOOL 4	1 if schooling ended with a trade school program; 0 otherwise.
SCHOOL 5	1 if schooling ended with some college; 0 otherwise.
SCHOOL 6	1 if schooling ended with BS or BA and/or graduate training or degrees; 0 otherwise.
YRSPO	Years worked in present occupation.
YRSFT	Years worked full-time since age 18.
YRSPE	Years worked for present employer.
C. Work Environment Variables	
*RQSCHL*1	1 if 0–8 years of schooling are required for present job; 0 otherwise.
*RQSCHL*2	1 if 9–11 years of schooling are required; 0 otherwise.
*RQSCHL*3	1 if 12 years of schooling are required; 0 otherwise.
*RQSCHL*4	1 if some college is required; 0 otherwise.
*RQSCHL*5	1 if one or more college degrees are required; 0 otherwise.
WKEXP	1 if work experience or special training required for present job; 0 otherwise.
SUPER	Number of persons supervised on primary job.
GOVT	1 if public sector employee; 0 otherwise.
UNION	1 if union member; 0 otherwise.
YRSQUAL	Years required to become fully trained and/or qualified on primary job.
MILES	Road mileage from home to place of work.
NUMBER	Number of employees at primary work place.
CENTRAL	1 if primary job site is in a central city or suburban area; 0 otherwise.
SERVICE	1 if employed as a service worker; 0 otherwise.
LABOR	1 if employed as a laborer; 0 otherwise.
TRANS	1 if employed as a transportation operator; 0 otherwise.
EQUIP	1 if employed as an equipment operator; 0 otherwise.
CRAFT	1 if employed as a craft worker; 0 otherwise.
CLERIC	1 if employed as a clerical worker; 0 otherwise.
SALES	1 if employed as a sales worker; 0 otherwise.
MANAGE	1 if employed as a manager or administrator; 0 otherwise.
PROF	1 if employed as a professional or technical worker; 0 otherwise.

Explanatory Variable	Definition
D. Personal Characteristic Variables	
AGE	Years of age.
RACE	1 if white; 0 otherwise.
SEX	1 if male; 0 otherwise.
DISAB	1 if physical or nervous conditions limit amount or type of work that can be done; 0 otherwise.
VET	1 if respondent is veteran.
LIVE	1 if respondent lives in a central city or suburban area; 0 otherwise.
CONSTANT	

6. Tasks

First, read the original paper (Douglas Gegax, Shelby Gerking, and William Schulze (RESTAT 1991). Then have a look at the do file for this assignment; R_VSL2017.R. This code helps you on your way in implementing the requested tasks for this assignment. For example, it helps you read in the data

(VSL2017.dta), it shows you how to replicate the risk numbers for the various types of workers as presented in Table 1 of Gegax et al., it provides the code for running the key regression (as presented in Table 2 of Gegax et al.), and also how to run the sector-specific analyses (needed to calculate the MWTPs as presented in Table 3 of Gegax et al.). Using this do file, implement the following tasks:

- Task 1: Replicate all numbers in Table 1.
- Task 2: Who selects into what types of jobs?
    - 2A: Do "older people" select in the safer jobs?
    - 2B. Who selects into unionized jobs?
    - 2C. And are unionized jobs more risky that non-unionized jobs?
- Task 3: Estimate all the MWTPs of the different subsectors, as presented in Table 3 of Gegax et al. Do the outcomes make sense, also in view of the results of Task 2?
- Task 4: For all those subsamples for which the coefficient on risk was significant in Task 3, calculate the VSL.
- Task 5: Are some worker types (older, Caucasian, female, disabled, veteran) more averse to risk than others? In other words, do they have a significantly higher MWTP? Do these tests for the subset of blue-collar workers who are member of a labor union.
- Task 6: What about elderly males -- do they have a lower VSL than elderly females, or than younger males? And do public sector (government) employees tend to have a lower VSLs than private sector (non-government) employees?
- Task 7: Write up these results in a paper of **between 5 and 10 pages**. **Number of group members: 4; deadline: March 16, 10.30 am.**