Exercise 2

ETC4420 Microeconometrics

Task A

Figure 1 Histogram investigating the relationship between 'logincome' with 'GP visits'



Question 1

Table 1 Linear regression model

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Linear regression model | | | | | |
| GP visits | Coefficients | Standard Deviation | T-stats | P-value | 95% CI |
|  |  |  |  |  |  |
| age3039 | -0.001 | (0.018) | -0.029 | 0.977 | -0.036 0.035 |
| age4049 | -0.003 | (0.018) | -0.161 | 0.872 | -0.039 0.033 |
| age5059 | 0.014 | (0.019) | 0.747 | 0.455 | -0.023 0.052 |
| age6069 | 0.095\*\*\* | (0.021) | 4.595 | 0.000 | 0.055 0.136 |
| age70up | 0.194\*\*\* | (0.021) | 9.461 | 0.000 | 0.154 0.235 |
| male | -0.084\*\*\* | (0.011) | -7.510 | 0.000 | -0.105 -0.062 |
| logincome | 0.003 | (0.007) | 0.441 | 0.659 | -0.011 0.017 |
| mcity | 0.027\*\* | (0.011) | 2.324 | 0.020 | 0.004 0.049 |
| poor | 0.459\*\*\* | (0.028) | 16.562 | 0.000 | 0.405 0.513 |
| fair | 0.297\*\*\* | (0.020) | 14.617 | 0.000 | 0.257 0.337 |
| good | 0.094\*\*\* | (0.016) | 5.714 | 0.000 | 0.062 0.127 |
| verygood | 0.023 | (0.016) | 1.483 | 0.138 | -0.007 0.054 |
| Constant | 0.152\*\*\* | (0.047) | 3.247 | 0.001 | 0.060 0.244 |
|  |  |  |  |  |  |

Table 2 Poisson Regression model

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Poisson regression | |  | Number of obs=10,000 | | |  |  |
|  |  |  | LR Chi2=785.60 | |  |  |  |
|  |  |  | Prob>Chi2=0.00 | |  |  |  |
| log likelihood=-6464.3469 | | | Pseudo R2=0.0573 | | |  |  |
|  |  |  |  |  |  |  |  |
| GP visits | Coef. | Std. Err. | z | P>|z| | ME | Std. Err. | z |
|  |  |  |  |  |  |  |  |
| age3039 | 0.011 | (0.071) | 0.150 | 0.881 | 0.003 | 0.020 | 0.150 |
| age4049 | 0.008 | (0.071) | 0.107 | 0.915 | 0.002 | 0.020 | 0.107 |
| age5059 | 0.090 | (0.072) | 1.246 | 0.213 | 0.026 | 0.021 | 1.246 |
| age6069 | 0.344\*\*\* | (0.072) | 4.790 | 0.000 | 0.099\*\*\* | 0.021 | 4.790 |
| age70up | 0.544\*\*\* | (0.068) | 8.028 | 0.000 | 0.157\*\*\* | 0.020 | 8.028 |
| male | -0.297\*\*\* | (0.039) | -7.657 | 0.000 | -0.086\*\*\* | 0.011 | -7.657 |
| logincome | 0.003 | (0.025) | 0.128 | 0.898 | 0.001 | 0.007 | 0.128 |
| mcity | 0.088\*\* | (0.039) | 2.268 | 0.023 | 0.025\*\* | 0.011 | 2.268 |
| poor | 1.199\*\*\* | (0.079) | 15.207 | 0.000 | 0.345\*\*\* | 0.024 | 15.21 |
| fair | 0.941\*\*\* | (0.069) | 13.579 | 0.000 | 0.271\*\*\* | 0.021 | 13.58 |
| good | 0.434\*\*\* | (0.066) | 6.588 | 0.000 | 0.125\*\*\* | 0.019 | 6.588 |
| verygood | 0.135\*\* | (0.066) | 2.023 | 0.043 | 0.039\*\* | 0.019 | 2.023 |
| Constant | -1.801\*\*\* | (0.173) | -10.405 | 0.000 |  |  |  |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 | | | |  |  |  |  |

Table 3 Negative binomial model

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Negative binomial regression | | | Number of obs=10,000 | | |  |  |
|  |  |  | LR chi2(12)=718.40 | |  |  |  |
| Dispersion=mean | |  | Prob>chi2=0.0000 | |  |  |  |
| Log likelihood=-6459.9093 | | | Pseudo R2=0.0527 | |  |  |  |
| gpvisit | Coef. | Std. Err. | z | P>|z| | ME | Std. Err. | Z |
| age3039 | 0.010 | 0.072 | 0.14 | 0.889 | 0.003 | 0.021 | 0.14 |
| age4049 | 0.006 | 0.072 | 0.08 | 0.936 | 0.002 | 0.021 | 0.08 |
| age5059 | 0.089 | 0.073 | 1.21 | 0.225 | 0.026 | 0.021 | 1.21 |
| age6069 | 0.344 | 0.073 | 4.7 | 0 | 0.099 | 0.021 | 4.68 |
| age70up | 0.548 | 0.069 | 7.91 | 0 | 0.158 | 0.020 | 7.81 |
| male | -0.300 | 0.040 | -7.56 | 0 | -0.086 | 0.012 | -7.47 |
| logincome | 0.003 | 0.026 | 0.12 | 0.904 | 0.001 | 0.007 | 0.12 |
| mcity | 0.089 | 0.040 | 2.22 | 0.027 | 0.026 | 0.012 | 2.21 |
| poor | 1.202 | 0.081 | 14.83 | 0 | 0.346 | 0.024 | 14.21 |
| fair | 0.940 | 0.071 | 13.3 | 0 | 0.271 | 0.021 | 12.85 |
| good | 0.432 | 0.067 | 6.47 | 0 | 0.124 | 0.019 | 6.42 |
| verygood | 0.133 | 0.067 | 1.98 | 0.048 | 0.038 | 0.019 | 1.98 |
| \_cons | -1.799 | 0.177 | -10.18 | 0 |  |  |  |
| /lnalpha | -1.992 | 0.361 |  |  |  |  |  |
| alpha | 0.136 | 0.049 |  |  |  |  |  |
| Likelihood-ratio test of alpha=0: | | | chibar2(01)=8.88 | | Prob>=Chibar2=0.001 | | |

Question 2

Table 4 Prediction using Poisson model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Poisson Model |  |  |  |  |  |  |
|  | Variable | obs | Mean | Std. Dev. | Min | Max |
|  |  |  |  |  |  |  |
| Observed mean count | gpvisit | 10,000 | 0.288 | 0.572 | 0 | 3 |
| Predicted mean count | p\_gpvisit | 10,000 | 0.288 | 0.166 | 0.124 | 1.053 |
|  |  |  |  |  |  |  |
| Observed prob of count | 0 | 7,634 | 0.763 | 0.004 |  |  |
|  | 1 | 1,952 | 0.195 | 0.004 |  |  |
|  | 2 | 316 | 0.032 | 0.002 |  |  |
|  | 3 | 98 | 0.010 | 0.001 |  |  |
| Predicted prob of count | p\_visitspr0 | 10,000 | 0.759 | 0.109 | 0.349 | 0.883 |
|  | p\_visitspr1 | 10,000 | 0.201 | 0.066 | 0.110 | 0.368 |
|  | p\_visitspr2 | 10,000 | 0.034 | 0.034 | 0.007 | 0.194 |
|  | p\_visitspr3 | 10,000 | 0.005 | 0.009 | 0.000 | 0.068 |

Table 5 Prediction using Negative Binomial model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NegBin2 Model |  |  |  |  |  |  |
|  | Variable | obs | Mean | Std. Dev. | Min | Max |
|  |  |  |  |  |  |  |
| Observed mean count | gpvisit | 10,000 | 0.288 | 0.572 | 0 | 3 |
| Predicted mean count | p\_gpvisit | 10,000 | 0.288 | 0.167 | 0.124 | 1.063 |
|  |  |  |  |  |  |  |
| Observed prob of count | 0 | 7,634 | 0.763 | 0.004 |  |  |
|  | 1 | 1,952 | 0.195 | 0.004 |  |  |
|  | 2 | 316 | 0.032 | 0.002 |  |  |
|  | 3 | 98 | 0.010 | 0.001 |  |  |
| Predicted prob of count | nb\_visitspr0 | 10,000 | 0.764 | 0.105 | 0.371 | 0.884 |
|  | nb\_visitspr1 | 10,000 | 0.194 | 0.061 | 0.108 | 0.345 |
|  | nb\_visitspr2 | 10,000 | 0.035 | 0.033 | 0.007 | 0.181 |
|  | nb\_visitspr3 | 10,000 | 0.006 | 0.010 | 0.000 | 0.071 |

Task B

Figure Histogram of 'wscei' looks like exponential distribution instead of normal



Figure Histogram of log(wscei) looks more like normal distribution than 'wscei'



Question 1

Table 6 Heckman sample selection model two-step

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Heckman selection model--two-step estimates | | | | | Number of obs=7,773 | | |
| (regression model with sample selection) | | | | | Censored obs=3,188 | | |
|  |  |  |  |  | Uncensored obs=4,585 | | |
|  |  |  |  |  | Wald chi2(13)=1520.84 | | |
|  |  |  |  |  | Prob>chi12=0.000 | | |
|  |  | Coef. | Std. Err. | z | P>|z| | 95% CI |  |
| wscei |  |  |  |  |  |  |  |
|  | age1819 | 20.991 | 91.965 | 0.23 | 0.819 | -159.258 | 201.239 |
|  | age2021 | 171.343 | 87.004 | 1.97 | 0.049 | 0.817 | 341.868 |
|  | age2224 | 314.053 | 96.150 | 3.27 | 0.001 | 125.603 | 502.504 |
|  | age2534 | 485.439 | 86.325 | 5.62 | 0 | 316.246 | 654.633 |
|  | age3544 | 653.017 | 80.330 | 8.13 | 0 | 495.573 | 810.461 |
|  | age4554 | 636.744 | 83.339 | 7.64 | 0 | 473.402 | 800.086 |
|  | age5564 | 693.607 | 56.373 | 12.3 | 0 | 583.118 | 804.095 |
|  | age6574 | 728.428 | 234.068 | 3.11 | 0.002 | 269.663 | 1187.193 |
|  | a75above | 473.485 | 420.102 | 1.13 | 0.26 | -349.900 | 1296.870 |
|  | male | 414.516 | 29.142 | 14.22 | 0 | 357.399 | 471.632 |
|  | bachabv | 476.812 | 72.075 | 6.62 | 0 | 335.548 | 618.077 |
|  | dipcert | 83.872 | 54.600 | 1.54 | 0.125 | -23.143 | 190.887 |
|  | year12 | 31.120 | 51.832 | 0.6 | 0.548 | -70.469 | 132.708 |
|  | \_cons | 279.403 | 217.158 | 1.29 | 0.198 | -146.218 | 705.024 |
| working |  |  |  |  |  |  |  |
|  | age1819 | 0.473 | 0.102 | 4.65 | 0 | 0.274 | 0.673 |
|  | age2021 | 0.403 | 0.105 | 3.84 | 0 | 0.197 | 0.608 |
|  | age2224 | 0.595 | 0.099 | 6.01 | 0 | 0.401 | 0.789 |
|  | age2534 | 0.561 | 0.084 | 6.7 | 0 | 0.397 | 0.725 |
|  | age3544 | 0.539 | 0.084 | 6.43 | 0 | 0.375 | 0.703 |
|  | age4554 | 0.544 | 0.081 | 6.73 | 0 | 0.386 | 0.703 |
|  | age5564 | -0.136 | 0.080 | -1.69 | 0.091 | -0.293 | 0.022 |
|  | age6574 | -1.422 | 0.095 | -15.01 | 0 | -1.608 | -1.237 |
|  | a75above | -2.219 | 0.149 | -14.89 | 0 | -2.512 | -1.927 |
|  | male | 0.193 | 0.033 | 5.93 | 0 | 0.129 | 0.257 |
|  | bachabv | 0.562 | 0.048 | 11.69 | 0 | 0.468 | 0.657 |
|  | dipcert | 0.381 | 0.044 | 8.69 | 0 | 0.295 | 0.467 |
|  | year12 | 0.323 | 0.053 | 6.04 | 0 | 0.218 | 0.427 |
|  | married | 0.075 | 0.039 | 1.92 | 0.054 | -0.001 | 0.151 |
|  | depkid | -0.200 | 0.043 | -4.65 | 0 | -0.285 | -0.116 |
|  | \_cons | -0.219 | 0.064 | -3.41 | 0.001 | -0.345 | -0.093 |
| mills |  |  |  |  |  |  |  |
|  | lambda | -354.234 | 228.668 | -1.55 | 0.121 | -802.415 | 93.947 |
|  | rho | -0.540 |  |  |  |  |  |
|  | sigma | 655.902 |  |  |  |  |  |

Table 7 Heckman sample selection model MLE

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Heckman selection model--MLE estimates | | | | | Number of obs=7,773 | | |
| (regression model with sample selection) | | | | | Censored obs=3,188 | | |
|  |  |  |  |  | Uncensored obs=4,585 | | |
|  |  |  |  |  | Wald chi2(13)=1793.60 | | |
| Log | likelihood= | -39939.52 |  |  | Prob>chi12=0.000 | | |
|  |  | Coef. | Std. Err. | z | P>|z| | 95% CI |  |
| wscei |  |  |  |  |  |  |  |
|  | age1819 | 100.770 | 64.800 | 1.56 | 0.12 | -26.236 | 227.777 |
|  | age2021 | 239.596 | 66.143 | 3.62 | 0 | 109.957 | 369.234 |
|  | age2224 | 405.472 | 61.454 | 6.6 | 0 | 285.024 | 525.919 |
|  | age2534 | 568.352 | 54.814 | 10.37 | 0 | 460.919 | 675.786 |
|  | age3544 | 727.348 | 53.363 | 13.63 | 0 | 622.759 | 831.937 |
|  | age4554 | 716.491 | 53.024 | 13.51 | 0 | 612.567 | 820.415 |
|  | age5564 | 681.452 | 54.226 | 12.57 | 0 | 575.171 | 787.733 |
|  | age6574 | 457.078 | 92.591 | 4.94 | 0 | 275.602 | 638.554 |
|  | a75above | 9.760 | 210.475 | 0.05 | 0.963 | -402.764 | 422.283 |
|  | male | 441.839 | 18.569 | 23.79 | 0 | 405.444 | 478.234 |
|  | bachabv | 558.458 | 30.506 | 18.31 | 0 | 498.667 | 618.248 |
|  | dipcert | 142.108 | 28.099 | 5.06 | 0 | 87.036 | 197.181 |
|  | year12 | 80.950 | 32.221 | 2.51 | 0.012 | 17.797 | 144.103 |
|  | \_cons | 16.864 | 61.329 | 0.27 | 0.783 | -103.338 | 137.066 |
| working |  |  |  |  |  |  |  |
|  | age1819 | 0.474 | 0.102 | 4.65 | 0 | 0.274 | 0.673 |
|  | age2021 | 0.403 | 0.105 | 3.85 | 0 | 0.198 | 0.608 |
|  | age2224 | 0.597 | 0.099 | 6.03 | 0 | 0.403 | 0.791 |
|  | age2534 | 0.560 | 0.084 | 6.69 | 0 | 0.396 | 0.724 |
|  | age3544 | 0.538 | 0.084 | 6.42 | 0 | 0.374 | 0.702 |
|  | age4554 | 0.542 | 0.081 | 6.7 | 0 | 0.384 | 0.701 |
|  | age5564 | -0.139 | 0.080 | -1.73 | 0.084 | -0.296 | 0.019 |
|  | age6574 | -1.426 | 0.095 | -15.05 | 0 | -1.612 | -1.241 |
|  | a75above | -2.223 | 0.149 | -14.91 | 0 | -2.515 | -1.931 |
|  | male | 0.194 | 0.033 | 5.95 | 0 | 0.130 | 0.258 |
|  | bachabv | 0.565 | 0.048 | 11.71 | 0 | 0.470 | 0.659 |
|  | dipcert | 0.380 | 0.044 | 8.68 | 0 | 0.294 | 0.466 |
|  | year12 | 0.322 | 0.053 | 6.03 | 0 | 0.217 | 0.427 |
|  | married | 0.081 | 0.039 | 2.07 | 0.039 | 0.004 | 0.157 |
|  | depkid | -0.204 | 0.043 | -4.75 | 0 | -0.289 | -0.120 |
|  | \_cons | -0.219 | 0.064 | -3.42 | 0.001 | -0.345 | -0.094 |
| mills |  |  |  |  |  |  |  |
|  | /athrho | -0.117 | 0.073 | -1.59 | 0.111 | -0.261 | 0.027 |
|  | /lnsigma | 6.413 | 0.011 | 567.82 | 0 | 6.391 | 6.435 |
|  | rho | -0.117 | 0.072 |  |  | -0.2554224 | 0.027 |
|  | sigma | 609.701 | 6.886 |  |  | 596.3531 | 623.348 |
|  | lambda | -71.117 | 44.507 |  |  | -158.3493 | 16.116 |
| LR test of | Indep. | eqns. | (rho=0): | Chi2(1) | =1.22 | Prob>chi2 | =0.269 |

Question 2

Table 8 Marginal effect for E('wscei') based on MLE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Marfinal effect for E('wscei') based on MLE | | | |  |  |  |
|  | Std. Err. | z | P>|z| | [95% | Conf. | Interval] |
| age1819 | 100.770 | 64.800 | 1.56 | 0.12 | -2624% | 227.776 |
| age2021 | 239.596 | 66.143 | 3.62 | 0 | 109.9574 | 369.233 |
| age2224 | 405.472 | 61.454 | 6.6 | 0 | 285.024 | 525.919 |
| age2534 | 568.352 | 54.814 | 10.37 | 0 | 460.919 | 675.786 |
| age3544 | 727.348 | 53.363 | 13.63 | 0 | 622.759 | 831.937 |
| age4554 | 716.491 | 53.024 | 13.51 | 0 | 612.567 | 820.415 |
| age5564 | 681.452 | 54.226 | 12.57 | 0 | 575.171 | 787.733 |
| age6574 | 457.078 | 92.591 | 4.94 | 0 | 275.602 | 638.554 |
| age75above | 9.760 | 210.475 | 0.05 | 0.963 | -402.764 | 422.283 |
| male | 441.839 | 18.569 | 23.79 | 0 | 405.444 | 478.234 |
| bachabv | 558.458 | 30.506 | 18.31 | 0 | 498.667 | 618.248 |
| dipcert | 142.108 | 28.099 | 5.06 | 0 | 87.036 | 197.181 |
| year12 | 80.950 | 32.221 | 2.51 | 0.012 | 17.797 | 144.103 |

Table 9 Marfinal effect for E('wscei'|'working=1') based on MLE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Marfinal effect for E('wscei'|'working=1') based on MLE | | | | | |  |
|  | Std. | z | P>|z| | [95% | Conf. | Interval] |
| age1819 | 120.863 | 63.443 | 1.910 | 0.057 | -3.482 | 245.208 |
| age2021 | 256.705 | 65.130 | 3.940 | 0.000 | 129.052 | 384.358 |
| age2224 | 430.789 | 59.652 | 7.220 | 0.000 | 313.873 | 547.705 |
| age2534 | 592.103 | 53.154 | 11.140 | 0.000 | 487.924 | 696.283 |
| age3544 | 750.184 | 52.035 | 14.420 | 0.000 | 648.198 | 852.171 |
| age4554 | 739.496 | 51.448 | 14.370 | 0.000 | 638.660 | 840.332 |
| age5564 | 675.561 | 54.115 | 12.480 | 0.000 | 569.497 | 781.624 |
| age6574 | 396.561 | 82.194 | 4.820 | 0.000 | 235.463 | 557.658 |
| age75above | -84.554 | 197.774 | -0.430 | 0.669 | -472.184 | 303.076 |
| male | 450.062 | 18.074 | 24.900 | 0.000 | 414.637 | 485.486 |
| bachabv | 582.426 | 27.795 | 20.950 | 0.000 | 527.948 | 636.903 |
| dipcert | 158.248 | 26.539 | 5.960 | 0.000 | 106.232 | 210.263 |
| year12 | 94.616 | 31.207 | 3.030 | 0.002 | 33.451 | 155.781 |
| married | 3.418 | 2.823 | 1.210 | 0.226 | -2.115 | 8.952 |
| depkid | -8.675 | 5.810 | -1.490 | 0.135 | -20.062 | 2.711 |

Question 3

Table Tobit regression model (estimated coefficients are also the unconditional marginal effects)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Tobit regression | | | | Number of obs = 7,777 | | |
|  | | |  | LR chi2(13) = 3331.98 | | |
|  | | |  | Prob > chi2 = 0.0000 | | |
| Log likelihood = -39576.442 | | | | Pseudo R2 = 0.0404 | | |
|  |  |  |  |  |  |  |
| wscei | Coef. | Std. Err. | t | P>|t| | 95% | CI |
| age1819 | 309.327 | 77.961 | 3.970 | 0.000 | 156.503 | 462.1512 |
| age2021 | 371.498 | 79.753 | 4.660 | 0.000 | 215.161 | 527.8344 |
| age2224 | 591.760 | 73.261 | 8.080 | 0.000 | 448.148 | 735.3721 |
| age2534 | 698.556 | 63.260 | 11.040 | 0.000 | 574.550 | 822.5631 |
| age3544 | 787.563 | 61.543 | 12.800 | 0.000 | 666.923 | 908.2035 |
| age4554 | 802.252 | 60.800 | 13.190 | 0.000 | 683.068 | 921.4359 |
| age5564 | 362.418 | 62.510 | 5.800 | 0.000 | 239.882 | 484.9547 |
| age6574 | -889.164 | 76.80302 | -11.58 | 0.000 | -1039.719 | -738.6095 |
| age75above | -1723.344 | 132.6305 | -12.99 | 0.000 | -1983.336 | -1463.353 |
| male | 452.064 | 22.94049 | 19.71 | 0.000 | 407.094 | 497.0331 |
| bachabv | 762.844 | 34.27894 | 22.25 | 0.000 | 695.648 | 830.0399 |
| dipcert | 330.438 | 32.37492 | 10.21 | 0.000 | 266.975 | 393.902 |
| year12 | 242.583 | 38.91631 | 6.23 | 0.000 | 166.296 | 318.8691 |
| \_cons | -645.516 | 53.2248 | -12.13 | 0.000 | -749.851 | -541.1808 |
| /sigma | 897.773 | 10.0127 |  |  | 878.1457 | 917.401 |
| 3190 left-censored observations at wscei <= 0.000 | | | | |  |  |
| 4,587 uncensored observations | | |  |  |  |  |
| 0 right-censored observations | | |  |  |  |  |