

Rebuttal: Clarifying Multiple Regression Analysis and a Reply to Ireland's Critique

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This reply addresses Thomas Ireland's comments on my paper "The Impact of Disability on Household Services: Evidence from the American Time Use Survey". The original article sought to provide a data-based approach to measuring the impact of partial disability on household services. It concludes by stating that it "represents the first contribution" in doing so. Ireland does not provide a better approach to measuring the impact of disability on household services, and instead, merely criticizes the first contribution to this important measurement while making misrepresentations about the interpretations available from multiple regression analysis.

It is noteworthy before addressing specific issues in Ireland's comment to mention that Dollar Value of a Day (DVD) is based upon cross-tabulations while the Crouse paper is based upon multiple regression analysis. This point alone addresses many of Ireland's comments.

It is unnecessary to provide a few hundred tables as in DVD because the goal of the analysis in the Crouse paper is to explore the partial effect of disability on the time spent performing household services. Multiple regression analysis is best suited in this particular instance for the several reasons, the most compelling of which is the sample size limitations that would preclude cross-tabulations as in DVD. The regression equations provided in the Crouse paper provide the answer to many of Ireland's critiques.

Ireland is incorrect in stating "Crouse's tables provide comparisons based on just three categories other than disability status: All persons, all males, and all females". The tables provided lend themselves to hundreds of possible comparisons. For instance, if an expert was interested in comparing the time spent on household services for a 40 year-old non-disabled female with no children who is employed and has a spouse, the regression equation in Table 4 could be utilized and solved to find:

$$\text{HHS} = 3.66(40) - 0.030(40^2) - 68.52(1) + 43.39(1) + 114.52(0) + 57.35 - 26.63(0)$$

$$\text{HHS} = 130.62 \text{ minutes per day}$$

It would imply that the average 40 year-old female with the aforementioned characteristics would spend 2.18 hours, or 130.62 minutes, per day performing

household services. This number is 15.24 hours per week which is a bit lower than the 17.14 hours that DVD 2013 shows for the closest grouping in Table 70 (Married females, under age 45, that work full-time, spouse-employed, no children under age 18). Comparisons cannot be made between the two numbers, however, since the Crouse study is based on multiple regressions and takes disability status into account and DVD is based on cross-tabulations. In this regard, the Crouse study is more specific as it pinpoints the likely number of hours performing household services by age rather than lumping all ages under 45 together. Multiple regression analysis is more amenable to *ceteris paribus* analysis because it allows one to explicitly control for many factors that simultaneously affect the dependent variable (Wooldridge, 2009).

Now if we assume the same female suffers from a severe mobility disability, the regression equation would be:

$$\text{HHS} = 3.65(40) - 0.030(40^2) - 67.66(1) + 44.24(1) + 4.54(0) + 56.43 - 52.27(1)$$

$$\text{HHS} = 78.74 \text{ minutes per day}$$

These numbers are only pertinent to age 40. As this female progresses throughout her lifespan, assumptions would have to be made as to whether she is currently employed, whether she still has a spouse, etc. All of these factors will affect the level of household services in a given year. This analysis is best completed utilizing an Excel spreadsheet.

Furthermore, Ireland neglects the paragraph in the Crouse paper that explains how regression analysis can be used in this manner. The Crouse paper states that "The regression equations can be used to determine both the pre- and post-injury values of household services over time . . . It may be preferable to use a statistical average across the lifespan". It is apparent that Ireland prefers not to use the statistical average across the lifespan, but he fails to realize that the three tables provided in the Crouse paper allow him to perform an analysis based on assumptions about the individual's employment, children, and spouse.

The "base values from which time reduction amounts are calculated" can be easily found by plugging the relevant values into the regression equations. For instance, one would plug in the individual's age, employ-

ment status indicator variable (=1 if employed, 0 otherwise), spouse indicator variable (=1 if spouse, 0 otherwise), kid(s) under 18 indicator variable (=1 if present, 0 otherwise), and disability dummy variable (=0 since we are interested in base values i.e. no disability). Once plugged into the regression equation and multiplied by the relevant regression coefficients, the constant is added and a base value can then be easily obtained for any analysis based on these variables. The percentage reduction is then straightforward to calculate.

An analyst would certainly not apply an 18% reduction to “all 99 other tables for household production by males in DVD 13” as Ireland suggests. If the analyst is not pleased with using the statistical average across the lifespan (as in Case Studies #1 and #2 in the Crouse paper), the analyst can easily use the regression equations provided in Tables 3 and 4 to be more specific and make assumptions about the individual.

While this author agrees with Ireland’s comment that “the amount of time an individual spends on household services depends at least in part on voluntary choices of that individual”, he disagrees with the notion that the reduction in hours providing household services is merely a numerical change without significance. It is obvious that the reduced hours must be expended in some other way if they are not utilized for household services. Nonetheless, it is most probable that the reduction in hours expended is due to a reduced capacity to provide household services. This, however, is a conservative estimate since it does not consider the likely productivity decline.

The three tables provided in the Crouse paper allow for hundreds of possible scenarios and comparisons. This approach requires neither extraordinary assumptions nor questionable steps unless applied inappropriately. A basic understanding of multiple regression analysis is necessary in order to properly apply and critique Tables 2-4 in the Crouse Paper. Chapter 3 from Wooldridge’s *Introduction to Econometrics* will help in this matter.

Author Notes

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