10.2

(a):

(WAGE): Positive

Higher hourly wages generally incentivize women to supply more labor hours because the opportunity cost of not working increases. Thus, we expect a positive sign.

(EDUC): Positive

More years of education are typically associated with higher earning potential and better employment opportunities, encouraging greater labor supply.

(AGE): Negative

As age increases, it may become difficult to participate in the labor force.

(KIDS6): Negative

A higher number of young children increases household responsibilities, likely reducing the number of hours a woman is willing or able to work.

(NWIFEINC): Negative

Greater non-wife income reduces the financial necessity for the woman to work, thereby lowering her labor supply.

(b)

The primary reason is endogeneity. WAGE is likely endogenous because unobserved factors such as innate ability, motivation, or preferences for work may simultaneously influence both the hourly wage and the number of hours worked. As a result, WAGE may be correlated with the error term e, violating one of the key OLS assumptions (the exogeneity condition). Consequently, the OLS estimates would be biased and inconsistent.

(c)

Instrumental variables must satisfy two conditions:

1. Experience (EXPER) and its square (EXPER²) are strongly related to WAGE because individuals with more labor market experience typically earn higher wages. Therefore, these variables should have a strong predictive power for WAGE.

2. Conditional on education, age, number of young children, and non-wife income, experience variables are assumed not to affect HOURS directly. Their influence on labor supply operates solely through their impact on WAGE. Therefore, they should not be correlated with the error term.

(d)

We have two instrumental variables (EXPER and EXPER²) and one endogenous regressor (WAGE). Since the number of instruments is greater than or equal to the number of endogenous regressors (and the instruments are valid and relevant as discussed), the model satisfies the order condition for identification. Thus, the labor supply equation is identified.

(e)

The two-stage least squares (2SLS) procedure involves the following steps:

1. First Stage:

Regress WAGE on the instrumental variables (EXPER and EXPER²) along with the other exogenous variables (EDUC, AGE, KIDS6, NWIFEINC). Obtain the fitted values of WAGE from this regression, denoted as \(\widehat{WAGE}\).

2. Second Stage:

Regress HOURS on the predicted values \(\widehat{WAGE}\) and the other exogenous variables (EDUC, AGE, KIDS6, NWIFEINC).

3. Adjustment for Standard Errors:

Use standard errors that account for the two-stage estimation process, ensuring correct inference.

10.3

(a)

x = γ₁ + θ₁z + ν

E(x) = γ₁ + θ₁E(z)

(x − E(x)) = θ₁(z − E(z)) + ν

(z − E(z))(x − E(x)) = θ₁((z − E(z))²) + (z − E(z))ν

E((z − E(z))(x − E(x))) = θ₁E((z − E(z))²)

θ₁ = E[(z − E(z))(x − E(x))] / E[(z − E(z))²]

(b)

y = π₀ + π₁z + u

E(y) = π₀ + π₁E(z)

(y − E(y)) = π₁(z − E(z)) + u

(z − E(z))(y − E(y)) = π₁((z − E(z))²) + (z − E(z))u

E((z − E(z))(y − E(y))) = π₁E((z − E(z))²)

π₁ = E[(z − E(z))(y − E(y))] / E[(z − E(z))²]

(c)

y = β₁ + β₂x + e

= β₁ + β₂(γ₁ + θ₁z + ν) + e

= β₁ + β₂γ₁ + β₂θ₁z + β₂ν + e

= π₀ + π₁z + u

π₀ = β₁ + β₂γ₁

π₁ = β₂θ₁

u = β₂ν + e

(d)

π₁ = β₂θ₁

β₂ = π₁ / θ₁

(e)

Using the Law of Large Numbers:

(β̂₂ = π̂₁ / θ̂₁) → (π₁ / θ₁ = β₂)