The Causal Effects of Wages on Labour Supply for Married Women — Evidence from American Couples

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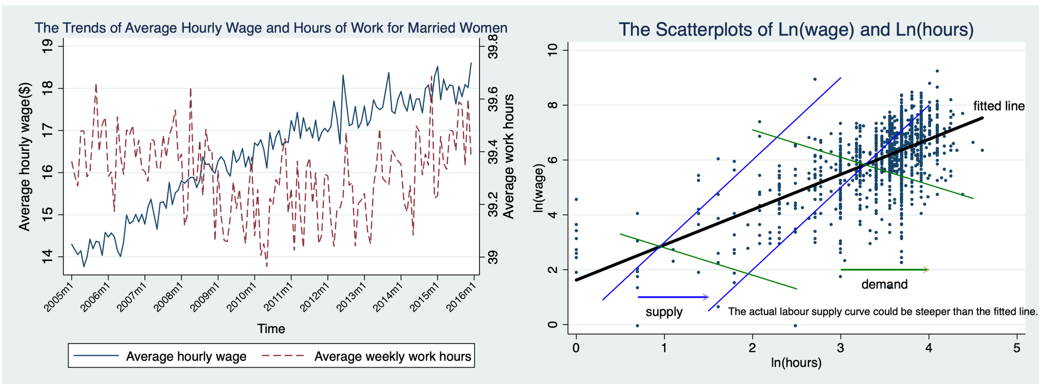
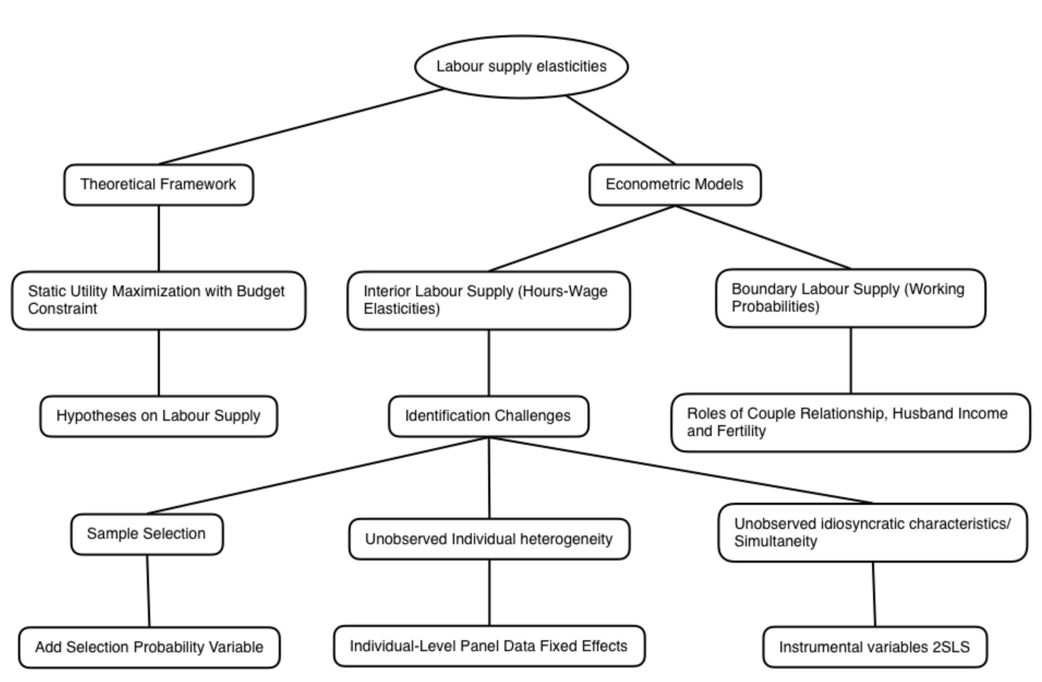
Motivation

- The seemingly uncorrelated trends of the wage rates and the labour supply for married women over time (the left figure) is misleading. The fitted line of the scatter plots of wage rates and hours of work (the right figure) may not represent the actual labour supply curve.



- The reason is that other relevant factors behind labour supply are not held constant, and the endogeneity problems have not been taken into account. After modelling the interaction between the representative husband and wife, and alleviating sample selection, unobserved individual heterogeneity, and simultaneity bias, I find consistent, significant and positive causal effects of wages on labour supply.

Outline and Methods



Theoretical Framework

- Theoretical model: The representative married woman's utility is maximized subject to her budget constraint that is connected to her husband's labour income through the couple relationship variable.

$$\underset{\{c,f\}}{Max}\ U = \alpha lnc + \beta\frac{f^{1-\gamma}}{1-\gamma}, 0<\gamma<1, \alpha>0, \beta>0$$
$$s.t.\ c = w(1-f) + \theta w^H + v$$

where

- c: composite consumption;
- f: dedication to her family; time spent on housework, child care, household production; assume h+f=1 where h is the time of work;
- α: relative importance of consumption;
- β: relative importance of dedication to family;
- w: wife's wage rate;
- w^H: husband's wage rate;
- v: non-labour income and family wealth;
- θ: the proportion of husband's wages that goes to the wife; measure of couple relationship.

Comparative Statics and Hypotheses

- The FOCs give the optimal hours of work (h^*) equation:

$$\frac{\alpha}{\beta}w(1-h^*)^\gamma = wh^* + \theta w^H + v$$

Implicit differentiation yields:

- The partial effects of own wages on labour supply (hours-wage elasticity):

$$\frac{\partial lnh^*}{\partial lnw} = [\frac{\alpha}{\beta}(1-h^*)^\gamma - h^*]/\{h^*[1+\frac{\alpha}{\beta}\gamma(1-h^*)^{\gamma-1}]\}$$

The sign is uncertain. When h^* is low, it is positive; when h^* is high, it could be negative, i.e., a backwards-bending labour supply curve is possible.

- The partial effects of husband's wages on wife's labour supply (cross-wage elasticity):

$$\frac{\partial lnh^*}{\partial lnw^H} = -\theta w^H/\{wh^*[1+\frac{\alpha}{\beta}\gamma(1-h^*)^{\gamma-1}]\}$$

It is negative. It becomes smaller when the wifes wages dominate her husbands wages, or she works longer, or the couple relation gets worse.

- Hypotheses on married women's labour supply:
  - I : The labour supply curve could be backwards-bending.
  - II : The couple relation plays a vital role in the wife's labour supply decision and the partial effects of her husband's wages.

Empirical Analysis

- The data source is the PSID family surveys from 2005 to 2015. I construct a panel data set containing 3618 married women aged between 17 and 65 who lived with their husbands.

Variable	Source	Mean	Std. Dev.	Min	Max	Observations
Ln(work hours)	Overall	3.59	0.40	0	4.72	N=9748
	Between	3.59	0.39	0	4.72	n=2862
	Within	3.59	0.23	0.77	5.69	T-bar=3.41
Ln(wife_wage)	Overall	6.29	0.88	0.65	9.41	N=9748
	Between	6.29	0.87	0.65	9.35	n=2862
	Within	6.29	0.44	2.69	9.37	T-bar=3.41

Table: The between-individual variation, within-individual variation, and overall variation

- The baseline pooled OLS model (Model 1):

$$ln\_wife\_work\_hours_{it} = \beta_0 + \beta_1 ln\_wife\_wage_{it} + \mathbf{Z_{1it}}\alpha + \mu_{it}$$

where

- i: individual married woman; t: year.
- β_1: the coefficient of interest – the causal effects of wages on labour supply (Marshallian labour supply elasticity).
- $\mathbf{Z_{1it}}$: exogenous control variables suggested by the theoretical model.

$$\mathbf{Z_{1it}} = (husband\_wage_{it}, couple\_relation_{it}, wife\_wage\_type_{it}, family\_wealth_{it}, number\_children_{it}, age\_youngest_{it}, region_{it}, wife\_education_{it}, wife\_health_{it}, wife\_age_{it}, wife\_race_{it})$$

Exogeneity assumption for consistent $\hat{\beta}_1$:

$$E(\mu_{it}|ln\_wife\_wage_{it}, \mathbf{Z_{1it}}) = 0$$

Identification Challenge I: Sample Selection

- We observed wages and hours of work only for the employed women who were self-selected into the labour force. The hours of work equation:

$$ln\_wife\_work\_hours_{it} = \begin{cases} \beta_0 + \beta_1 ln\_wife\_wage_{it} + \mathbf{Z_{1it}}\alpha + \mu_{it} & if\ wife\_lfp_{it} = 1 \\ unobserved & if\ wife\_lfp_{it} = 0 \end{cases}$$

- Whether or not we observed wages and hours of work depends on an individual's working decision. The selection equation:

$$wife\_lfp_{it} = 1 \quad if \quad \mathbf{M_{it}}\gamma + \nu_{it} > 0$$
$$i.e., Prob(wife\_lfp_{it} = 1|\mathbf{M_{it}}) = \Phi(\mathbf{M_{it}}\gamma)$$

where $\mathbf{M_{it}}$ include $\mathbf{Z_{1it}}$ and the excluded exogenous variables that determine the labor force participation choice.

- Adding the selection variable (the inverse Mill's ratio or the predicted value of working probability) into the hours of work equation helps to correct the sample selection bias (Model 2).

Identification Challenge II: Unobserved Individual Heterogeneity

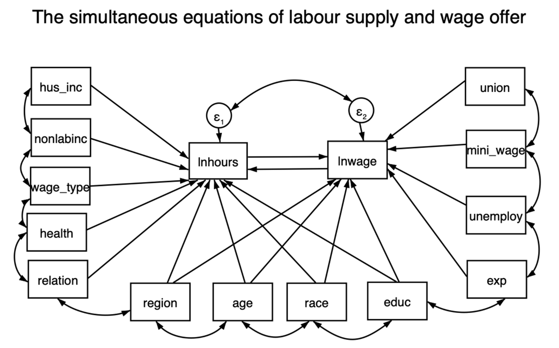
- The unobserved individual-specific and time-invariant characteristics, such as the preference for work, family tradition, and habits, could bias the estimated effects of wages on labour supply.
- The panel data fixed effects model controls for the individual heterogeneity by including the individual-level fixed effects component a_i in the model, and it could be eliminated by first-differencing or demeaning method. (Model 3)

$$ln\_wife\_work\_hours_{it} = \beta_0 + \beta_1 ln\_wife\_wage_{it} + \beta_2 selection\_variable_{it} + \mathbf{Z_{1it}}\alpha + a_i + \varepsilon_{it}$$

$$E(a_i|ln\_wife\_wage_{it}, selection\_variable_{it}, \mathbf{Z_{1it}}) \neq 0$$
$$E(\varepsilon_{it}|ln\_wife\_wage_{it}, selection\_variable_{it}, \mathbf{Z_{1it}}) = 0$$

Identification Challenge III: Idiosyncratic Error and Simultaneity

- What we observed in the labour market were the equilibrium wages and hours of work that are determined by the intersection of labour supply and labour demand curves. The shift of the labour demand is due to the unobserved individual idiosyncratic error, such as the competency and ability of married women. We need to separate labour supply from labour demand to identify the causal effects of wages on labour supply.
- I use demand shifters as instruments and run the two stage least squares regression (2SLS). (Model 4)



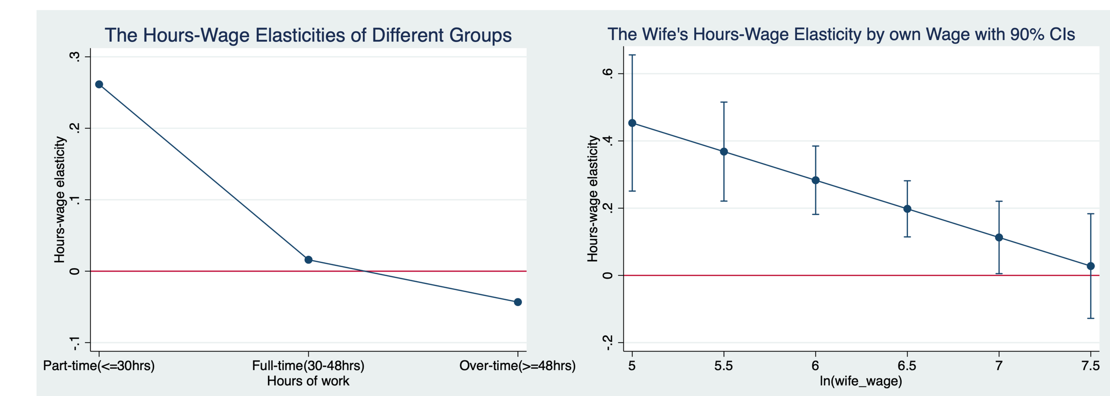
Finding I: Consistent Causal Effects of Wages on Labour Supply

Explanatory_Variables	Model 1: Pooled_OLS	Model 2: Pooled_OLS_Select	Model 3: Panel_FE	Model 4: Panel_FE_2SLS
Ln(wife's wage)	0.2749***	0.2749***	0.2686***	0.2114***
	(0.0087)	(0.0087)	(0.0148)	(0.0430)
Couple relation	-0.0064***	-0.0066***	0.0006	0.0005
	(0.0014)	(0.0017)	(0.0025)	(0.0025)
Husband's wage	-0.0534***	-0.0537***	-0.0032	-0.0036
	(0.0062)	(0.0062)	(0.0086)	(0.0086)
Sample Selection Correction	No	Yes	Yes	Yes
Individual fixed effects	No	No	Yes	Yes
Simultaneity Correction	No	No	No	Yes
Number of obs.	9748	9748	9748	9748

Notes: 1. Robust standard errors are in the parentheses. *p<0.05; **p<0.01; ***p<0.001
2. Other controls include: year dummies, wage type, wife's health, housework hours, education, race, age, region, family wealth, transfer income, number of children.

- After holding other factors constant and alleviating the endogenous problems caused by sample selection, individual heterogeneity, and simultaneity, a 1% increase in a married woman's wages raises her hours of work by 0.21% on average, which is smaller than the OLS estimate.

Finding II: Evidence of Backwards-bending Labour Supply Curves



- The evidence of a backwards-bending labour supply curve: the hours-wage elasticities approach zero or even negative when hours or wages are very high.

Extension: Dynamic Labour Supply

- First-differencing of the dynamic model leads to endogenous problem.

$$\Delta ln\_wife\_work\_hours_{it} = \beta_1 \Delta ln\_wife\_work\_hours_{i,t-1} + \beta_2 \Delta ln\_wife\_wage_{it} + \Delta\mathbf{Z_{1it}}\alpha + \Delta\varepsilon_{it}$$

$$Cov(\Delta ln\_wife\_work\_hours_{i,t-1}, \Delta\varepsilon_{it}) \neq 0$$

- Using the GMM-type instruments (the second lag of the dependent variable or the differencing of the second lag), I obtain the 2SLS estimate for the causal effects of own wages on labour supply that is similar to the static model.

Dependent Variable: Ln(wife_work_hours)	Specification 1: Panel FD	Specification 2: Panel FD 2SLS 1	Specification 3: Panel FD 2SLS 2
First lag of Ln(wife_work_hours)	-0.3072***	0.1131	0.0171
Ln(wife_wage)	0.2589***	0.2120*	0.1870*

Notes: Other control variables include: husband's wage, couple relation, number of children, wife's education, health, housework hours, age, family transfer income, family wealth. *p<0.05; **p<0.01; ***p<0.001