INTRA-HOUSEHOLD GENDER WAGE GAP IN CHINA: EVIDENCE FROM THE CHINA HEALTH & NUTRITION SURVEY

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ABSTRACT

This paper analyzes the intra-household wage gap and wage determination of husbands and wives under the urban-rural dual economic structure in China. A two-step estimation procedure was used to determine the factors that are related to living in urban or rural areas by employing the probit model. Additionally, the effects of different factors affecting gender wage across regimes and between husbands and wives was examined using the seemingly unrelated regression estimation (SURE) model. It was found that the intra-household gender wage gap is larger in rural areas than in urban areas. At different percentiles, the gender wage gap is also different. There is a larger gender wage gap between low income earners than higher income earners. The largest gender wage gap is in the 10th percentile in rural areas with a wife–husband wage ratio of 67%. The wage determination pattern between spouses is different in urban and rural areas. Except for human capital impact, urban-rural dual economic structure and family factors, spousal factors also effect the intra-household wage gap.

Contribution/Originality: This study contributes to the econometric modeling and empirical investigation of the intra-household gender wage gap in China. This paper constructs a two-step econometric model to estimate the effects of different explanatory variables on the intra-household gender wage gap under the urban-rural dual economic structure, and this new econometric model is potentially applicable to other related research.

1. INTRODUCTION

Households are the main basic units in society all around the world. The intra-household wage gap is an important aspect of the gender wage gap. A lot of studies have focused on gender wage gap, but few of them relate to income inequality between spouses in the same household. Due to the economic reform and marketization in China, researchers are paying more attention to China's gender-related income gap. Gustafsson & Li (2000) were the first to estimate the gender earning gap in China and they showed that the gap in urban China is relatively small compared to other countries while the gap tends to broaden in urban China. Shi, Jin, & Xiaochuan (2011) showed that gender wage gap increased significantly between 2002–2007 in urban China. A meta-analysis conducted by Iwasaki & Ma (2020) shows that in China, the gender wage gap has been increasing rapidly in recent years. Using the gaps between men and women regarding economic participation and opportunity, educational attainment, health and survival, and

political empowerment, The Global Gender Gap Report 2015 (World Economic Forum) ranks China's gender gap at 91 out of 145 countries (the higher the ranking, the narrower the gender gap). China's gender gap score was 0.681 (1.00 being equality) in 2015. The scores in 2016 and 2017 were 0.676 and 0.674, respectively, which indicates that the gender gap has widened in China in recent years. Hughes & Maurer-Fazio (2002) revealed that the gender wage gap is larger between married people. In addition, Xiulan (2012) showed that couple's intra-household income gap is greater than the social gender income gap in China, and the unexplained proportion of the gender income gap between couples is larger than the social gender income gap. This leads to the consideration that there might be some factors that influence intra-household wages for couples, such as household maintenance and childcare related activities. Yu & Xie (2018) showed that a motherhood wage penalty exists among women, and each additional child lowers hourly wages by about 12%.

Literature on China's inequality almost universally shows that disparity between urban and rural household incomes in China is large and has increased over time (Binkai & Yifu, 2013; Chao & Shen, 2014; Teng, Yue, & Bjorn, 2007; Yang, 1999). According to China (2018), the ratio of urban individuals' disposable income over their rural counterparts was 2.71 in 2017, and with 58.5% of the population living in urban areas and 41.5% living in rural areas, this constitutes China's urban-rural dual economic structure. When analyzing the gender wage gap, researchers commonly use the Mincer earnings function and the Blinder–Oaxaca decomposition technique (Arulampalam, Booth, & Bryan, 2007; Blinder, 1973; Lo Sasso, Armstrong, Forte, & Gerber, 2020; Mincer, 1974; Oaxaca, 1973; Sax et al., 2017), and they mainly consider human capital factors that influence the pay gap. For the intra-household gender income gap, there might be some common factors (family factors) and some spousal factors influencing the pay gap. This comes from the fact that most households make labor supply decisions collectively rather than a single household member deciding on their own, according to the collective model of labor supply (Chiappori, 1992; Donni, 2008; Gayle & Shephard, 2019; Michaud, Van Soest, & Bissonnette, 2020). As the study by Papps (2010) suggests, women's working hours are positively related to spousal education at the time of marriage and then fall over time after getting married, especially among women with educated husbands. As there is little research that has examined the effects of family and spousal factors on intra-household wages empirically, this has led to a research gap which this study aims to fill.

In this study, we extend the Mincer earnings function with a collective model under different regimes (the urban-rural dual structure) to measure China's intra-household gender wage gap, and the following questions are used: (i) Aside from the human capital factors, do family and spousal factors influence intra-household wages? (ii) If they do, what is the extent of the effects? (iii) Is there any difference between the effects on husband's and wife's wages? (iv) Are the effects different between urban and rural areas? This study classifies three types of factors: self, family, and spousal. By using the three types of factors, their effects can be measured in two steps: (i) determining the factors that relate to living in urban or rural areas, (ii) measuring the effects of different factors on gender wage across the regimes and between husbands and wives.

2. METHODOLOGY

2.1. Model

The binary variable I indicates the urban-rural dual structure,

$$I = \begin{cases} 1, & urban \\ 0, & rural. \end{cases}$$

Where $I = 1$ for households in urban areas and $I = 0$ for households in rural areas. The binary variable I signifies two different regimes for one couple's living area. Vector Z denotes socioeconomic variables that influence the wages of the husband and wife in a family. Then, given Z, the conditional probability of a household living in urban areas can be written as:

$$\Pr(I = 1|Z) = F(Z^T \gamma), \tag{1}$$

Where $F(\cdot)$ is a known cumulative distribution function and γ is its parameter vector. This equation helps to determine the factors that relate to the area a family lives in (urban or rural).

Y_j denotes the husband's or wife's wage in a family, $j = h, w$, which means that Y_h is the husband's wage and Y_w is the wife's wage. Given Z, an econometric model is used, which allows conditional expectation of Y_h and Y_w under the two different regimes denoted by the binary variable I. Also, given Z, the conditional expectations of a husband's and wife's wage can be written as,

$$E(Y_j|Z) = E(Y_j|Z, I = 1)\Pr(I = 1|Z) + E(Y_j|Z, I = 0)[1 - \Pr(I = 1|Z)],$$
$$j = h, w. \tag{2}$$

Given covariate Z and binary variable I, the conditional expectations of Y_h and Y_w are in linear form with different coefficients β_{j1} and β_{j0} with $j =$ h,w as follows:

$$E(Y_j|Z, I = 1) = Z^T\beta_{j1},$$
$$E(Y_j|Z, I = 0) = Z^T\beta_{j0},$$
$$j = h, w. \tag{3}$$

Therefore, Equation 2 is equal to the weighted averages of the two in Equation 3.

2.2. Estimation

Given Equation 3, Equation 2 can be rewritten as:

$$E(Y_j|Z) = (Z^T\beta_{j1})\Pr(I = 1|Z) + (Z^T\beta_{j0})[1 - \Pr(I = 1|Z)]$$
$$= (Z^T\beta_{j1})\,p + (Z^T\beta_{j0})(1 - p),$$
$$j = h, w. \tag{4}$$

Where
$$p = \Pr(I = 1|Z) = \Phi(Z^T\gamma), \tag{5}$$

and $\Phi(\cdot)$ is the cumulative distribution function of standard normal distribution. Now γ, β_{j1} and β_{j0} are parameter vectors that need to be estimated. Two steps were taken to achieve this goal. First, a probit model was used to estimate γ (Equation 5), and second, using the result of the first step, a seemingly unrelated regression estimation (SURE) model was used to estimate β_{j1} and β_{j0} (Equation 4). The selection of the SURE estimation method is based on the fact that the disturbance terms for the husband's and wife's wage equations are probably correlated within households (Srivastava & Dwivedi, 1979; Zellner, 1962). The use of SURE means that the estimation can be precisely compared to the usually used conventional ordinary least squares (OLS) estimation.

3. DATA

3.1. CHNS Data

The data used in this paper is from the 2011 China Health and Nutrition Survey (CHNS). The survey took place in 15 provinces and municipal cities that vary substantially in geography, economic development, public resources, and health indicators. The survey was first carried out in 1989 and the latest available data set is for 2011.

3.2. Sample and Variables

The original sample for 2011 includes 5812 households with 23,057 individuals and includes adults and children. We selected a subsample of married working couples, which includes wives aged between 18–55 and husbands (household heads) aged between 18–60. In this dataset, it was found that married men who are under 22 years of age are all from rural areas, and married women who are under 20 years old are also from rural areas. This is in accordance with the phenomenon that in rural regions of China, young people tend to get married early, even if they are below the minimum legal age for marriage.

The variables investigated in this study are grouped by individual and family factors. Individual factors (for both husbands and wives) include annual wage (wage and bonus from one's main job), education, potential experience (we set potential experience, age − years of schooling − 6 and others), and a control variable for occupation. Family factors

include a dummy variable for region (urban or rural), number of young children (age 6 and younger; we calculated the number of children and their ages from the birth history of ever-married women and excluded children who died before the survey year), a dummy variable for house ownership, and province (classified as east, central, west, and northeast according to the economic regional divisions by the National Bureau of Statistics of China). The subsample selection and the exclusion of missing or incomplete information and merging with other data sets gave a final sample of 696 households.

The descriptive statistics of the sample are shown in Table 1. The mean annual wage for husbands is 33,892 Chinese Yuan (CNY), and 27,916 CNY for wives. The mean age for husbands is 42, and the wives' mean age is 40. In addition, husbands also hold a higher mean for education and work experience. This result shows that marriage gradient may exist in China's households. According to the marriage gradient, males tend to marry females who are younger and have a lower income and education (Kalmijn, 2013). Regarding domestic work, more than half of husbands do housework, whereas almost all wives do housework.

Table 1. Descriptive statistic of the sample.

Variable	Mean	St. Dev.
Husband's wage	33,892.34	23,351.23
Wife's wage	27,916.24	22,336.39
Husband's age	42.10	7.55
Wife's age	40.08	7.40
Husband's education	13.23	4.43
Wife's education	12.73	4.62
Husband's experience	22.87	9.56
Wife's experience	21.34	9.75
Husband's housework	0.63	0.48
Wife's housework	0.94	0.23
Number of young children	0.29	0.48
Own house (dummy variable)	0.86	0.33
Region (dummy variable)	0.48	0.50

To further investigate the wage differences related to education, children and region, the mean wages for wives and husbands by group are contained in Table 2. Several observations emerged from Table 2. Households in which the wife has a higher education tend to have a smaller intra-household wage gap. Under the Education section, when the husband has a higher education than his wife, the mean annual wage for the wife is 25,672 CHY, the mean annual wage for the husband is 33,022 CHY, and the ratio of mean wage between the wife and husband is 0.78.

Table 2. Comparison of couple's wages by group.

Group	Sub-group	Wife	Husband	Ratio
Group	Mean	27,916	33,892	0.82
Education	Husband has higher education	25,672	33,022	0.78
	Equal education	27,294	33,805	0.81
	Wife has higher education	32,381	35,347	0.92
Children	No young children	26,771	32,924	0.81
	One young child	31,728	37,060	0.86
	Two young children	17,982	26,382	0.68
Region	Urban	36,215	43,548	0.83
	Rural	24,837	30,873	0.80

If a couple has an equal level of education, the mean wage for the wife is 27,294 CHY and the ratio of the mean wage between wife and husband is 0.81. If a wife has a higher education than her husband, the mean annual wage for the wife is 32,381 CNY and the ratio of the mean wage between wife and husband is 0.92. The Children panel shows that when couple has one young child, both the wife and husband earn more and the intra-household wage gap gets smaller compared to a couple who have no young children. Whereas if a couple has two young children, both the wife

and husband earn less and the intra-household wage gap gets larger. The Region panel shows that the rural intra-household wage gap is larger than in urban areas.

Table 3 summarizes the various percentiles of wage distribution for Regime 1 (urban) and Regime 0 (rural). It reveals that as wives' and husbands' wages increase, the intra-household wage gap gets smaller, but when the wage increases to a super high level (95th percentile for urban areas, 90th for rural areas), the intra-household wage gap gets larger. At the lower wage level, (e.g., the 10th percentile), the rural intra-household wage gap is the largest across the distribution, while for urban areas, the intra-household wage gap is smaller at lower wage levels.

Table 3. Percentile distribution of wage by regime.

Percentiles	Regime 1 (Urban)			Regime 0 (Rural)		
	Wife	Husband	Ratio	Wife	Husband	Ratio
Mean Percentiles	36,215	43,548	0.83	24,837	30,873	0.80
10th	11,160	14,400	0.78	4,800	7,200	0.67
25th	18,000	24,000	0.75	13,000	18,000	0.72
50th	27,600	36,000	0.77	20,800	26,400	0.79
75th	42,000	50,000	0.84	30,000	36,000	0.83
90th	63,000	72,000	0.88	42,000	52,000	0.81
95th	81,300	96,000	0.85	52,000	66,000	0.79

4. RESULTS

To investigate the determinants of wage for husbands and wives in different regimes, the probit model and the seemingly unrelated regression estimation (SURE) model were used to estimate the parameters with the paired couple data from the CHNS.

4.1. Probit Model

Table 4 provides the key parameter estimates of the probit model. The covariates are classified into three groups (Husband, Wife and Family) to show their effects on the likelihood of Regime 1 (living in urban areas). The results show that for husbands, higher education and potential experience will increase the probability of living in an urban area. The average number of years of schooling for husbands in urban areas is 14.6 years and 12.2 years for husbands in rural areas. The Wife panel shows that their higher education also increases the probability of living in an urban area, although the effect is smaller compared to husbands. The average years of schooling for wives in urban areas is 14.4 years and 11.4 years for wives in rural areas. The Family panel shows that owning a house will decrease the likelihood of Regime 1, which suggests that rural couples tend to have their own house compared to urban couples.

Table 4. Probit regression.

(Regime 1 | Covariates)			
Group	Variable	Coef.	Std. Err.
Husband	Education	0.078(***)	0.026
	Potential Experience	0.080(**)	0.039
	Experience Square	-0.000	0.000
Wife	Education	0.045(*)	0.027
	Potential Experience	-0.006	0.039
	Experience Square	-0.001	0.000
Family	Own House (dummy)	-0.413(**)	0.166
	Young Children	0.052	0.147

Note: (***), (**) and (*) denote that the parameter is statistically significant at the 1%, 5% and 10% levels, respectively.

4.2. SURE Model

Table 5 presents the parameter estimates of the SURE model over the two regimes in Equation 4. The dependent variable is log wage. The key explanatory variables' coefficients and standard errors of wages for husbands and wives for Regimes 1 and 0 are grouped into Self, Family and Spouse, and are reported respectively.

Table 5. SURE results for Regimes 1 and 0.

Regime 1 (Urban)						
	Husbands' Wages			**Wives' Wages**		
Group	**Variable**	**Coef.**	**Std. Err.**	**Variable**	**Coef.**	**Std. Err.**
Self	Education	0.093(***)	0.033	Education	0.071(**)	0.036
	Potential Experience	−0.010	0.043	Potential Experience	0.056	0.042
	Experience Square	0.001	0.000	Experience Square	−0.001	0.000
	Housework	−0.123	0.156	Housework	−0.386	0.391
	Firm type			Firm type		
	State-owned	−0.496(*)	0.292	State-owned	−0.150	0.293
	Collective	−0.584	0.395	Collective	−0.687	0.432
	Private	−0.605(**)	0.293	Private	0.043	0.313
Family	Young Children	−0.025	0.234	Young Children	0.016	0.256
	Own House	0.093	0.197	Own House	0.103	0.201
	Province			Province		
	East	1.264(***)	0.243	East	0.716(***)	0.252
	Central	0.701(**)	0.294	Central	0.377	0.304
	West	0.779(***)	0.287	West	0.280	0.304
Spouse	Education	0.035	0.026	Education	0.054(**)	0.026
	Housework	−0.179	0.369	Housework	0.017	0.160
Regime 0 (Rural)						
	Husbands' Wages			**Wives' Wages**		
Group	**Variable**	**Coef.**	**Std. Err.**	**Variable**	**Coef.**	**Std. Err.**
Self	Education	−0.071	0.089	Education	0.061(*)	0.032
	Potential Experience	0.017	0.032	Potential Experience	0.026	0.031
	Experience Square	−0.001(*)	0.001	Experience Square	−0.001	0.000
	Housework	0.060	0.148	Housework	−0.219	0.310
	Firm type			Firm type		
	State-owned	0.747(**)	0.303	State-owned	−0.188	0.336
	Collective	0.412	0.310	Collective	−0.404	0.325
	Private	0.506(*)	0.287	Private	−0.540(*)	0.306
Family	Young Children	−0.026	0.209	Young Children	0.007	0.224
	Own House	−0.000	0.207	Own House	−0.351	0.287
	Province			Province		
	East	−1.250(***)	0.271	East	−0.992(***)	0.283
	Central	−1.482(***)	0.290	Central	−1.303(***)	0.299
	West	−1.327(***)	0.292	West	−0.789(***)	0.304
Spouse	Education	0.035	0.024	Education	−0.049(**)	0.024
	Housework	−0.124	0.294	Housework	0.160	0.152
	R² of Husband's Wage	0.495(***)		R² of Wife's Wage	0.546(***)	

Note: (***), (**) and (*) denote that the parameter is statistically significant at the 1%, 5% and 10% levels, respectively.

4.3. "Self" Factors

The Self panels show that education plays different roles in both regimes. In Regime 1, it reveals that husbands benefit more from education than wives in urban areas. While in Regime 0, it reveals that wives benefit more from education than husbands in rural areas. This is a little different from previous studies which state that a return to education is always more beneficial for women than for men (Carnoy & Marenbach, 1975; Dougherty, 2005; Gwartney & Long, 1978; Psacharopoulos, 1985). Across both regimes, it reveals that education impacts husbands' and wives' wages more in urban areas than in rural areas.

The firm type variable also impacts husbands' and wives' wages differently among regimes. In Regime 1, a husband's wage is statistically significantly impacted by firm type. Working in a state-owned or private enterprises decreases a husband's wage with -49.6 or -60.5 log points, respectively, compared to foreign-related companies and others (the default firm type variable) in urban areas. While firm type does not significantly impact wives' wages in urban areas, in rural areas, husbands' wages are significantly and positively related to firm type. Working in state-owned or private enterprises increase husbands' wages, with 74.7 or 50.6 log points, respectively, compared to foreign-related companies and others in rural areas. Working in a private enterprise decreases a wife's wage with -54

log points compared to foreign-related companies and others in rural areas. Across regimes, it was revealed that working in state-owned or private enterprises has a negative effect on husbands' wages in urban areas, while it has positive effect on husbands' wages in rural areas. This might be because, in urban areas, enterprise types and economic units are diverse, thus people have more opportunity to choose higher paid jobs rather than conventional jobs. In rural areas, enterprise types and economic units are relatively lacking in diversity so people tend to choose conventional jobs, such as working in state-owned enterprises that guarantee job security, which is referred to as "iron rice bowl".

4.4. Family Factors

In both regimes, the province variable significantly impacts husbands' and wives' wages, and the impact is larger for husbands than for wives. In Regime 1, living in the east, central, or west regions of China positively affect husbands' wages, with 126.4, 70.1, or 77.9 log points, respectively, compared to the northeast region (the default province variable). For wives, living in east region positively affects wages, with 71.6 log points, compared to the northeast region, while living in the central or west regions does not have a statistically significant difference. In Regime 0, living in the east, central, or west regions negatively affects husbands' wages, with -125, -148.2 or -132.7 log points, respectively, compared to rural areas in the northeast region. For wives, living in the east, central, or west regions negatively affects wages, with -99.2, -130.3 or -78.9 log points, respectively, compared to the northeast region. Across both regimes, it was found that husbands' and wives' wages tend to be lower in the northeast compared to the east, central and west urban areas, while it is the opposite in rural areas. In rural areas, husbands' and wives' wages tend to be higher in the northeast compared to other regions. It was also revealed that the intra-household wage gap may have different characteristics among the different economic regions in China.

4.5. Spousal Factors

The Spouse panels show that spousal factors have different impacts on husbands' and wives' wages, and across regimes, spousal factors have different impacts on wives' wages. In both regimes, a wife's education or housework have no significant impact on a husband's wage, while for a wife in Regime 1, her spouse's education positively affects her wage with 5.4 log points. This confirms the educational classification in marriage (Schwartz, Robert, Schwartz, & Mare, 2005). In Regime 0, a husband's education negatively affects a wife's wage with -4.9 log points, which implies that as a husband becomes more educated, his wife tends to have reduced labor participation and a lower wage. This is in accordance with Papps (2010), who found that women's working hours are positively related to spousal education at the time of marriage and then fall over time among those with the most educated husbands. This study revealed that this pattern emerges in rural rather than urban areas in China.

5. CONCLUSION

In this research, the intra-household wage gap and wage determination of husbands and wives were analyzed under the urban-rural dual economic structure in China, and the effects of socioeconomic factors related to living in urban or rural areas was examined. As revealed in the probit model results, a husband's education, potential experience, and a wife's education are positively related to the likelihood of living in urban areas. The effect of education is larger for husbands than for wives, with coefficients of 0.078 versus 0.045, suggesting that husbands have an education premium. Owning a house has a negative effect on the probability of living in urban areas, suggesting that rural couples are more likely to have their own house. The wage determination pattern of husbands and wives is different between urban and rural areas. In urban areas, education has a positive effect on both husbands' and wives' wages, but the effect is higher for husbands. The return to education for husbands is 0.093, and 0.071 for wives. In rural areas, the effect of education on wages is higher for wives than for husbands. In urban areas, firm type significantly affects husbands' wages, while it is not significant for wives. In rural areas, firm type has more of an

effect on husbands' wages than wives' wages. This shows the importance of firm level in explaining the gender wage gap and is in accordance with Masso, Meriküll, & Vahter (2021) and Gustafsson & Wan (2020). It is surprising that the SURE estimate does not show the motherhood penalty when Table 2 in Section 3 shows that there might be a wage premium for a mother of one young child and a wage decrease for a mother with two young children. This is an area that should be examined in future research. The province variable reveals that there might be a difference in the intra-household wage gap in various economic regions of China, which indicates the importance of implementing a policy for dealing with the wage gap in different economic regions. Spousal factors have no significant impact on husbands' wages in both urban and rural areas. While husbands' education has a positive effect on wives' wages in urban areas, it has a negative effect on wives' wages in rural areas.

The intra-household wage gap was also examined by the percentile distribution of husbands' and wives' wages. The gap is larger in lower earnings groups than in the upper earnings groups both in urban and rural areas. The largest gap is in the 10th percentile in rural areas with a wife/husband ratio of 67%. This shows that policies that focus on lower earning females will be effective in narrowing the gender wage gap. In general, except human capital impact, urban-rural dual structure, family factors, and spousal factors also affect the intra-household wage gap and the wage determination of husbands and wives.

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