行政院國家科學委員會專題研究計畫 期末報告

台灣女性家庭權力與夫妻共同就業決定(GM01)

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公 開 資 訊 ：本計畫涉及專利或其他智慧財產權，2 年後可公開查詢

中 華 民 國 102 年 10 月 31 日

中 文 摘 要 ： 本計畫探討家事分工與家庭成員共同就業決定間的關係如何影響個人在勞動市場的參與。我們認為由於妻子與先生在面對就業選擇時所面對的不同機會成本，雙方的勞動參與選擇會有顯著的不同。本研究提出該機會成本的不同係由性別在社會傳統觀念、子女生育及養育、以及家庭生產力中角色的不同所造成，進而影響儒家社會中家庭權力結構分配與西方家庭的不同。我們使用台灣的資料來檢驗這個假說。首先，我們估計配偶就業對個人家事分擔的影響。分析的結果能夠告訴我們典型台灣家庭中的權力分佈狀況，以及性別在其中的影響。我們接著估計配偶就業的選擇對個人就業的影響。該結果能夠說明在已知家庭權力分佈的考量下，夫妻如何共同決定就業，以及性別在此決定中的影響。由於配對效果(assortative mating)的考量，實證上將遭遇內生性的問題。我們使用華人家庭動態資料庫中的追蹤資料結構來解決這個問題，並使用數種追蹤資料方法來探討性別在家庭環境中的角色與影響。

中文關鍵詞： 共同就業決定； 家事分工； 家庭權力結構分配； 性別差異；離散追蹤資料模型, 追蹤資料固定效果模型

英 文 摘 要 ：

英文關鍵詞：

Why Asian Women Do Not Want to Get Married: Couple's Joint Decisions on Work and Home Production*

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Abstract

This study investigates how spousal employment status affects personal employment decisions and the division of family chores. We apply Bresnahan and Reiss's (1991) empirical cooperative-game model to estimate household aggregate preference for a dual-earner family, and extend their model to identify the individual preferences of husbands and wives by using the share of family chores as an empirical proxy. The proposed empirical framework was tested by using data from the Panel Study of Family Dynamics survey in Taiwan. The empirical results show that an average household in the sample does not prefer a dual-earner family. The estimates of individual preferences indicate that this aversion comes mainly from the husbands. These results suggest that the gender gap in labor force participation and earnings has reduced at a faster rate than the social norm change toward the role of women in family, which explains the recent trends of women marrying later and less in Asian countries.

Keywords: Division of family chores; Empirical discrete games; Employment decisions

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1. Introduction

> "What is unusual about Asia is that women seem to bear an unusually large share of the burden of marriage, reducing the attractiveness of family life compared with work...People generally assume they will continue to be so, even though many women have paid jobs outside the home."
>
> -*The Economist*, "The Flight from Marriage," August 20^{th}, 2011

This quote from *The Economist* (2011) reveals a salient feature of the traditional Asian family system, and how it causes work-family conflicts for contemporary women in Asian countries. In particular, Asian families typically adopt a male-dominated system that requires women to share more responsibilities at home, such as being the sole caregiver for children and elderly parents. Although the rapid economic growth during recent decades has increased Asian women's education level and employment rate, public attitudes and expectations regarding a woman's family role has barely changed (Hwang, 2012). A woman's share of home production therefore does not reduce much as her share of work production increases.[1] This conflict between work and home production for Asian women significantly affects their attitude toward marriage, resulting in a dramatic change in the marriage market among Asian countries.

Recent studies have found empirical evidence supporting that social norms affect women's marriage and labor market decisions. For example, Hwang (2012) documented the aforementioned *The Economist* report as the "Gold Miss" phenomenon. She showed that men's attitudes toward women's roles in work and home are transmitted intergenerationally, which in turns affects educated women's marriage prospects. Using the relative income within households as a proxy for gender identity, Bertrand et al. (2013) also found that this identity norm significantly affects the rate and quality of women's marriages as well as their work and home production decisions. Because their data is mainly from the United States, the results suggest that the "Gold Miss" phenomenon may exist outside Asian countries. These studies agree that the gender gap in labor force participation and earnings has reduced at a faster rate than the social norm change toward the role of women in family, which explains why women are marrying later and less.

[1] For example, surveys in Japan have shown that women who work full-time typically spend 30 hours a week doing family chores, whereas their husbands contribute only 3 hours (*The Economist*, 2011).

This study extended these previous studies by estimating the preferences of husbands and wives regarding their own and spousal work and home production decisions. We stress that these decisions were made jointly by husbands and wives, in contrast with the previous studies that assumes family members act as a single unit. In particular, previous studies have reported that household decision-making processes are generally conducted by a single agent who maximizes the representative utility of the family (e.g., Blundell and Walker, 1986). This unitary model assumes that this representative agent makes all of the decisions and ignores which family member generates a higher income or has greater access to resources (Blau, Ferber, and Winkler, 1986). This view has been challenged by recent studies that have found evidence favoring a collective model of family rather than one that is unitary (e.g., Chiappori et al., 2002). The cooperation within households should therefore be considered when investigating labor supply decisions, particularly those regarding female labor supply (Knowles, 2013).

This study adopted a novel approach to model these joint decisions by using the cooperative-game framework proposed by Bresnahan and Reiss (1991, hereafter BR). Although the BR framework is unable to identify the preferences of husbands and wives separately, this study extended their framework by using the share of family chores as a proxy for their discrete indirect utility. This strategy facilitates directly estimating the preferences of husbands and wives regarding their joint employment decisions, thus enabling the prediction of a representative family's joint work and home production decisions by using both the male and female samples. This strategy also extends the findings of studies that have examined the division of family chores and marital satisfaction. For example, Oshio et al. (2013) found that the effect of dual-earnings on marital satisfaction varies among men, women, and Asian countries. They also found that a wifes' share of household chores is similar regardless of her employment status. Using data from the United States, Bertrand et al. (2013) also found that wives share more family chores when they earns more than their husbands do.

This study tested the proposed empirical framework by using data from the Panel Study of Family Dynamics (PSFD) survey in Taiwan. As Tsay and Chu (2005) mentioned, family studies that have focused on Eastern society have often chosen Taiwan as the focus of analysis because of its high data quality.[2] Another advantage

[2]For example, Tsay and Chu (2011) showed that a significant portion of women in Taiwanese families behave differently than their Western counterparts in making decisions of coresidence with in-laws, labor force participation, and birth duration.

of using data from PSFD is its panel structure. Because spousal employment is endogenous due to potentially positive assortative mating among couples, this study applied two unobserved effect panel data models: a bivariate probit model with a binary endogenous explanatory variable, and a sample selection panel data model.

The empirical results of this study suggest that an average household in the sample does not prefer a dual-earner family. The analysis using the share of family chores as an empirical proxy for the latent utility of husbands and wives suggests that this aversion comes mainly from husbands. The results indicate that the majority of men in the sample did not change their views toward women's family roles regardless of women's advances in economic and social status during recent decades. These results are consistent with those reported in literature showing that the traditional value toward women's family roles is still prevalent among Asian countries.

The remainder of this paper is organized as follows. Section 2 proposes an empirical framework based on the BR theoretical model. Section 3 presents a discussion on the data, and Section 4 provides econometric details of the empirical model. Section 5 presents the empirical results, and Section 6 concludes this paper.

2. An Empirical Framework

This paper proposes an empirical framework for examining the labor force participation decisions of husbands and wives. This framework applies the BR model and formulates these decisions as strategies of a cooperative game, which emphasizes that husbands and wives jointly make these decisions by maximizing their joint utility. Although the BR model identifies only the aggregate utility change of the couple, this framework considers the division of family chores between each couple as a proxy of their disutility. This empirical strategy extends the BR model by allowing separated identification of the preferences of husbands and wives toward a dual-earner family.

2.1. Household Joint Employment Decisions

With a slight modification of the BR model, this study denoted the utility functions of a husband and wife by U^h and U^w, respectively. Let $a^k = 1$ indicate that member k works, and $a^k = 0$ otherwise, where $k = h, w$. Because each member's utility depends on the spouse's decision, this study assumed that $\mathrm{U}^h = \mathrm{U}^h(a^i, a^j, \mathrm{Z})$ and

$\mathrm{U}^w = \mathrm{U}^w(a^i, a^j, Z)$, where Z represents characteristics of the household members. The husband and wife then choose their optimal solutions, a^h and a^w, by maximizing the sum of their joint utility functions, $W(a^i, a^j, Z)$=U^h+U^w, subject to the household budget constraint. As suggested by BR, the reduced-form labor supply functions of both the husband and wife can therefore be solved as functions of Z. Substituting the choice functions into the individual utility functions yields the following indirect utility functions for the husband and wife:

$$\mathrm{U}^h = \overline{\mathrm{U}}^h + \mathrm{a}^h\delta_1^h + \mathrm{a}^w\delta_2^h + \mathrm{a}^h\mathrm{a}^w\delta_3^h \tag{1}$$

$$\mathrm{U}^w = \overline{\mathrm{U}}^w + \mathrm{a}^w\delta_1^w + \mathrm{a}^h\delta_2^w + \mathrm{a}^w\mathrm{a}^h\delta_3^w. \tag{2}$$

In Eqs. (1) and (2), $\overline{\mathrm{U}}^k$ denotes the person k's baseline utility if neither the husband nor wife works, where $k = w, h$. This term captures the proportion of indirect utilities that is conditional on observable personal characteristics, such as age and education. δ_1^k denotes the change of person k's utility when only k works. BR argued that δ_1^k would be positive if k's income compensates for his/her foregone leisure. δ_2^k measures how spousal employment affects individual utility, which is independent of person k's employment status. This externality from spousal employment was critical to our framework, because a person's decision to work not only changes his/her utility, δ_1^k, but also brings this externality, δ_2^l, $k \neq l$, to the spouse. For example, a wife probably would want to work while her husband prefers her to stay at home. In such a case, the wife's δ_1^w would be positive but the husband's δ_2^h would be negative. In addition, δ_3^k measures individual preferences for a dual-earner family. BR suggested that the aggregate change of this effect, $\delta_3^h + \delta_3^w$, indicates the degree of complementarity between a couple's joint home and work production. For example, a negative δ_3^h indicates that the husband might consider his wife's home production as a complement to his employment.

Because people maximize the total payoff for the family when choosing their strategy in a cooperative game, there are four possible combinations of payoffs for both the husband and wife, conditional on the couple's employment decisions,

$W(a^h, a^w)$:

$$
\begin{aligned}
W(0,0) &= \overline{\mathrm{U}}^h + \overline{\mathrm{U}}^w && (3)\\
W(1,0) &= \overline{\mathrm{U}}^h + \overline{\mathrm{U}}^w + \delta_1^h + \delta_2^w && (4)\\
W(0,1) &= \overline{\mathrm{U}}^h + \overline{\mathrm{U}}^w + \delta_1^w + \delta_2^h && (5)\\
W(1,1) &= \overline{\mathrm{U}}^h + \overline{\mathrm{U}}^w + \delta_1^h + \delta_2^h + \delta_3^h + \delta_1^w + \delta_2^w + \delta_3^w. && (6)
\end{aligned}
$$

To explain how people make simultaneous decisions, the following strategic form is helpful:

		Wife	
		Unemployment	Employment
Husband	Unemployment	$W(0,0)$	$W(0,1)$
	Employment	$W(1,0)$	$W(1,1)$

Because payoffs are the same for both the husband and wife, their maximization strategies coincide. For example, if $W(1,0)$ is the best outcome for the family, then it must be the case that $W(1,0)$ is greater than $W(0,0)$ for the husband to be employed; and $W(1,0)$ is greater than $W(1,1)$ for the wife to choose unemployment. Similarly, if $W(1,1)$ is the best outcome for the family, then it must be the case that $W(1,1)$ is greater than $W(0,1)$ for the husband to be employed; and $W(1,1)$ is greater than $W(1,0)$ for the wife to be employed. The observability of the total payoff, therefore, coordinates the decisions of the husbands and wives, which stresses that couples make their decisions jointly. These decision rules can be summarized as follows:

$$
\begin{aligned}
\mathrm{a}^h &= 1[\delta_1^h + \delta_2^w + \mathrm{a}^w(\delta_3^h + \delta_3^w) \geq 0] && (7)\\
\mathrm{a}^w &= 1[\delta_1^w + \delta_2^h + \mathrm{a}^h(\delta_3^h + \delta_3^w) \geq 0]. && (8)
\end{aligned}
$$

This model provides an economic justification for the standard bivariate discrete choice model.[3] Similar to the BR model, this study assumed that $\delta_3^h + \delta_3^w$ is a constant to be estimated, which is invariant across households. The term $\delta_1^k + \delta_2^l$ contains unobserved household preferences to be estimated, where $k \neq l$. This

[3]This is not an incomplete econometric model discussed in the econometric literature, such as Tamer (2003), because both equations estimate $\delta_3^h + \delta_3^w$. Unlike the non-cooperative game structure that is addressed in much of the literature, this econometric model is economically justified by a cooperative game.

study assumed that $\delta_1^k + \delta_2^l$ is a linear function of observables and individual heterogeneity, $\delta_1^k + \delta_2^l = X^k\beta^k + \eta_i^k - v^k$, where X^k includes the observed individual and household characteristics, and β^k are coefficients to be estimated. η_i^k is a time-invariant unobservable variable that may be correlated with X^k, and v^k captures the unobservables that are normally distributed conditional on X^k. This assumption implies that the incremental utility for a household with only one worker can be explained by the worker k's observable individual and household characteristics, as well as by unobservables that vary across households but not time.[4] Although X^k includes the vectors of observable variables connected to household characteristics, including the unobserved heterogeneity η_i may break the correlation between X^k and the unobserved error term, v^k. This study assumed that X^k becomes exogenous after controlling for this unobserved, time-invariant individual heterogeneity. Consequently, the structural equations determining the equilibria of this game can be formulated as follows:

$$\mathrm{a}^h = 1[X^h\beta^h + \mathrm{a}^w(\delta_3^h + \delta_3^w) + \eta_i^h - v^h \geq 0] \tag{9}$$

$$\mathrm{a}^w = 1[X^w\beta^w + \mathrm{a}^h(\delta_3^h + \delta_3^w) + \eta_i^w - v^w \geq 0]. \tag{10}$$

2.2. Individual Preference for Spousal Employment

As BR mentioned, their model identifies only the aggregate preference of a husband and wife to a dual-earner family, δ_3^k+δ_3^l, and is unable to identify individual preferences for spousal employment, δ_2^k and δ_3^k. This study extended the BR model by considering the division of family chores between a husband and wife as a proxy for their (dis)utlities. Specifically, Eqs. (1) and (2) were replaced by empirical proxies and linear unobserved effects: for a randomly drawn cross-section observation i,

$$\mathrm{U}_{it}^k = \overline{\mathrm{U}}_{it}^k + \delta_1^k\mathrm{Employed}_{it} + \delta_2^k\mathrm{SEmployed}_{it} + \delta_3^k\mathrm{Employed}_{it} \times \mathrm{SEmployed}_{it} + \eta_i^k. \tag{11}$$

where $\mathrm{Employed}_{it}$ and $\mathrm{SEmployed}_{it}$ are empirical proxies for a^k in the previous model, which indicates whether a person i and his/her spouse are employed at period t, respectively.

[4]This is another extension from the BR model, which allowed no time-invariant, unobservable effect.

To estimate the δ^k's, this study used the chore share of person i with gender k at period t, CShare_{it}^k, as a proxy for person i's indirect disutility, $-\text{U}^k$. Therefore, the left-hand side of Eq. (11) was replaced by $\text{U}_{it}^k = -(\text{CShare}_{it}^k + u_{it}^k)$, where u_{it}^k represents the proportion of utility that is not captured by person i's share of chores in a linear fashion. Substituting this equation into Eq. (11) yields

$$\begin{aligned} -\text{CShare}_{it}^k = \overline{\text{U}}_{it}^k + \delta_1^k \text{Employed}_{it} + \delta_2^k \text{SEmployed}_{it} \\ + \delta_3^k \text{Employed}_{it} \times \text{SEmployed}_{it} + \eta_i^k + u_{it}^k. \end{aligned} \tag{12}$$

Assume that $\overline{\text{U}}_{it}^k$ can be explained by a list of observed individual characteristics, X_{it}, and the idiosyncratic error, v_{it}^k. In this case, $\overline{\text{U}}_{it}^k = X_{it}^k \beta^k + v_{it}^k$, and Eq. (12) becomes

$$\begin{aligned} \text{CShare}_{it}^k = X_{it}^k(-\beta^k) + (-\delta_1^k)\text{Employed}_{it} + (-\delta_2^k)\text{SEmployed}_{it} \\ + (-\delta_3^k)\text{Employed}_{it} \times \text{SEmployed}_{it} - \eta_i^k - \varepsilon_{it}^k, \end{aligned} \tag{13}$$

where $\varepsilon_{it}^k = (u_{it}^k + v_{it}^k)$.

Based on Eq. (13), straightforward analysis regresses the share of family chores share on personal and spousal employment status, the interaction terms of these employment indicators, and other control variables. However, this regression includes multiple endogenous variables associated with the individual employment indicator, which was simultaneously determined with chore share. This study addressed this problem by splitting sample based on person i's employment status. Specifically, this study estimated Eq. (13) by using two subsamples (e.g., Subsample (1) and Subsample (2)). The person i in Subsample (1) is not employed ($\text{Employed}_{it} = 0$), and person i in Subsample (2) is employed ($\text{Employed}_{it} = 1$). Restricted to Subsample (1) and Subsample (2), Eq. (13) becomes

$$\text{CShare}_{it}^k = X_{it}^k(-\beta_0^k) + (-\delta_2^k)\text{SEmployed}_{it} - \eta_{i0}^k - \varepsilon_{it0}^k, \tag{14}$$

$$\text{CShare}_{it}^k = X_{it}^k(-\beta_1^k) + (-\delta_1^k) + [(-\delta_2^k) + (-\delta_3^k)]\text{SEmployed}_{it} - \eta_{i1}^k - \varepsilon_{it1}^k, \tag{15}$$

where β_0^k and β_1^k are coefficients to be estimated using Subsamples (1) and (2), respectively. This strategy deliberately fixes the effect of the person i' employment status and allows the movement of a spouse's employment decisions, SEmployed_{it}, in both Eq. (14) and Eq. (15). Whereas Eq. (15) estimates the aggregate preference for a dual-earner family, $\widehat{[(-\delta_2^k) + (-\delta_3^k)]}$, $\hat{\delta}_3^k$ can be identified using an estimate of

$\hat{\delta}_2^k$ from Eq. (14). Finally, η_{ij}^k and ε_{itj}^k, where $j = 0, 1$, represent the unobserved time-invariant effects and disturbance of the family chore share CShare_{it}^k in these subsamples.

Using the estimates from Eq. (14) and Eq. (15), a family's total payoff changes described from Eqs. (3) to (6) can be reformulated as follows:

$$\widehat{W}(0,0) = X_0^h\widehat{\beta_0^h} + X_0^w\widehat{\beta_0^w} \tag{16}$$

$$\widehat{W}(1,0) = X_1^h\widehat{\beta_1^h} + X_0^w\widehat{\beta_0^w} + \widehat{\delta_2^w} \tag{17}$$

$$\widehat{W}(0,1) = X_0^h\widehat{\beta_0^h} + X_1^w\widehat{\beta_1^w} + \widehat{\delta_2^h} \tag{18}$$

$$\widehat{W}(1,1) = X_1^h\widehat{\beta_1^h} + X_1^w\widehat{\beta_1^w} + \widehat{\delta_2^h} + \widehat{\delta_2^w} + \widehat{\delta_3^h} + \widehat{\delta_3^w}. \tag{19}$$

The empirical counterpart of equilibrium conditions Eqs. (7) and (8) can thus be derived as

$$\mathrm{a}^h = 1[X_1^h\widehat{\beta_1^h} - X_0^h\widehat{\beta_0^h} + \widehat{\delta_2^w} + \mathrm{a}^w(\widehat{\delta_3^h} + \widehat{\delta_3^w}) \geq 0] \tag{20}$$

$$\mathrm{a}^w = 1[X_1^w\widehat{\beta_1^w} - X_0^w\widehat{\beta_0^w} + \widehat{\delta_2^h} + \mathrm{a}^h(\widehat{\delta_3^h} + \widehat{\delta_3^w}) \geq 0]. \tag{21}$$

These conditions then predict individual employment decisions conditional on spousal employment and other characteristics. Note that this framework requires samples from both men and women to estimate Eqs. (20) and (21), respectively, for obtaining the predictions of a representative family's joint work and home production decisions. In addition, the difference between $X_1^k\widehat{\beta_1^k}$ and $X_0^k\widehat{\beta_0^k}$ provides an estimate of the personal utility gain from employment, δ_1^k. This identification is based on the assumption that, after controlling for the effects of the observables in X_{it}^k and spousal employment status, individual employment status is the only source of variation that explains the difference between the predicted family chore share with and without individual employment.

3. Data and Summary Statistics

This study used data from the Panel Study of Family Dynamics (PSFD) to test the proposed model. The PSFD contains detailed information on Taiwanese families, including individual demographic characteristics, family structure, health condi-

tions, income, and employment characteristics.[5] Panel information is available in several periods starting from 1999, and this study analyzed information on married respondents from three waves of two-year panel data in the PSFD. These waves include RI2000 & RII2001, RII2000 & RIII2001, and RI2003 & RII2004. We were mainly interested in the division of household chores among Taiwanese families. The respondents in these three waves were asked "How many hours do you spend on household work in a week on average?" and "How many hours does your spouse spend on household work in a week on average?". Pooling these waves yielded a two-period panel, which enabled investigating household joint employment decisions by using panel data methods.

This study collected information from married couples in which one spouse was aged between 28 and 55 to help distinguish unemployment from retirement. Responses from male and female respondents were separated into two samples to distinguish the potential differences arising from respondents of different genders. After missing values and observations with possible coding errors were deleted,[6] the sample included 2,494 observations in which 1,317 respondents were male and 1,177 respondents were female. Table 1 presents the variables used in this study, and Table 2 presents the pooled descriptive statistics of male and female respondents and their spouses, including the division of family chores, human capital, job, and family characteristics.

Table 2 shows preliminary information of the data. There is no significant difference in the division of family chores between the male and female samples, where the husbands' share is approximately 20% and the wives' share is approximately 80%. Table 3 presents the frequency of housework hours in several ranges. Among the 1,317 male and 1,177 female respondents, 22.93% of the male respondents and 36.36% of the husbands of the female respondents shared no family chores. This shows that women share most of the family chores. The husbands of the female respondents have a lower average education level than their wives do, but they have a higher employment rate. One possible explanation is that, because the men in this subgroup are older than the others (50.619), they might not have gone to school be-

[5]Full descriptions of the PSFD dataset are available at http://psfd.sinica.edu.tw/. The survey data are collected annually to develop a panel data set for Chinese society. Several studies have used the data to study issues related to Taiwanese families including Kan (2004), Kan and Tsai (2005), Tsay and Chu (2005), Tsay (2005), and Kan (2006).

[6]In particular, a few respondents had spouses earning more than NT$1 million (US$33,400) per month, which is unrealistic and were excluded from the sample.

cause the Compulsory Schooling Law in Taiwan took effect after 1968.[7] Men in the male sample are younger than those in the female sample by 7 to 8 years. The male sample also exhibits a greater education difference between husbands and wives. Although the male and female respondents may represent different age and education categories, their shares of family chores are almost the same. This suggests that the division of household work based on gender changes slowly.

Table 2 also presents the average job characteristics of the respondents. Based on the age differences, these statistics suggest that there may be significant differences between the labor supply decisions of husbands and wives as they age. The labor force participation rate decreases for older men yet increases for older women. It is plausible that women leave employment to have children and re-enter the labor market as their children grow up. This life-cycle interpretation fits the traditional expectation of an Asian family, in which the husband is the main breadwinner and the wife is the caretaker of the children. Summary statistics of earning differences also indicate that women tend to "marry up;" that is, husbands have higher average earnings than their wives do. These patterns in our sample are consistent with the findings of Bertrand et al. (2013), in which the social norms or family values in Taiwan may not change according to economic growth in Taiwan. This observation is further supported by another pattern in the sample, in which the male respondents have a higher earning difference and a lower rate of spousal labor force participation.

4. Econometric Methods

This section provides the econometric details of estimating the proposed empirical framework. First, this study applied a bivariate probit model to estimate the effects of spousal employment on personal employment, which is economically justified by the proposed cooperative-game framework. The model also addresses the potential endogenous spousal employment decision, which is a binary variable and is coordinately decided regarding personal employment. Second, this study used a panel data sample selection model to correct for the selection bias in estimating the effect of spousal employment on the division of family chores, because a significant portion of men in the sample did not share any family chores. The proposed econometric methods also involve using the PSFD panel data to construct time-invariant

[7]The Compulsory Schooling Law requires every citizen to finish elementary school.

variables and control various unobserved individual heterogeneity.

4.1. Household Joint Employment Decisions

The principle challenge in estimating the effects of spousal employment on personal employment is identification. These employment decisions are correlated for various reasons (e.g., positive assortative mating between husbands and wives). Thus, the observed association between spousal employment status and personal employment status is not necessarily causal, and may cause spousal employment status to be endogenous. Because employment status is a binary outcome variable, this study adopted a binary response model containing an endogenous binary explanatory variable. As discussed in Section 2, this model is also economically justified by a cooperative-game framework.

Set both Employed_{it} and SEmployed_{it} as binary outcomes indicating that person i and his/her spouse is employed, respectively. Start with the following econometric model:

$$\text{Employed}_{it} = 1\left(\mathbf{x}'_{it1}\delta_1 + \delta_S \text{SEmployed}_{it} + \eta_{i1} + v_{it1} > 0\right), \tag{22}$$

$$\text{SEmployed}_{it} = 1\left(\mathbf{x}'_{it}\delta_2 + \eta_{i2} + v_{it2} > 0\right), \tag{23}$$

with

$$v_{it1} \Big| \mathbf{x}_{it1}, \text{SEmployed}_{it}, \eta_{i1} \sim \text{Normal}(0,1), \tag{24}$$

$$v_{it2} \Big| \mathbf{x}_{it}, \eta_{i2} \sim \text{Normal}(0,1). \tag{25}$$

This bivariate probit model was applied to estimate Eq. (9) and Eq. (10), separately. In particular, $1(\cdot)$ is an indicator function, $\mathbf{x}_{it} = (\mathbf{x}_{it1}, \mathbf{x}_{it2})$, where $\mathbf{x}_{it1}$ is a vector of exogenous variables that may affect a person's own employment status. $\mathbf{x}_{it2}$ is also a set of exogenous variables related to the spouse's employment status, and $\eta_i = (\eta_{i1}, \eta_{i2})$ captures the effects of unobserved characteristics or omitted variable. This study used a bivariate probit model to account for unobserved heterogeneity and endogeneity in a panel data setting.[8] Moreover, the parameter δ_S in Eq. (22) measures the effects of spousal employment status on personal employment status by holding other factors fixed. In this bivariate probit model, instrument variables for the potential endogenous variable SEmployed_{it} is $\mathbf{x}_{it2}$ in Eq. (23). This model

[8] A detailed discussion of the models appears in Sections 15.7.3 and 15.8.5 in Wooldridge (2010).

provides not only a consistent estimate of the parameter of interest δ_S, but also the average partial effect (APE), which determines the effect of spousal employment status on the response probability of personal employment status.

To allow unobservables η_i to be correlated with some elements of $\mathbf{x}_{it}$, this study adopted the correlated random effect approach proposed by Chamberlain (1982, 1984). Let $\mathbf{x}_i = (\mathbf{x}_{i1}, ..., \mathbf{x}_{iT})'$, where $\bar{\mathbf{x}}_i$ contains the time averages of these strictly exogenous variables. The strategy is to replace η_{i1} and η_{i2} with the following correlated random effect modeling of η_i:

$$\eta_{i1}|\mathbf{x}_i \equiv \bar{\mathbf{x}}_i'\psi_1 + a_{i1}, \text{ and } \eta_{i2}|\mathbf{x}_i \equiv \bar{\mathbf{x}}_i'\psi_2 + a_{i2}, \tag{26}$$

where $\bar{\mathbf{x}}_i' = (1, \bar{x}_{i1}, \bar{x}_{i2}, ..., \bar{x}_{iK})$, and $\psi_j' = \left(\psi_{j0}, \psi_{j1}, \psi_{j2}, ..., \psi_{jK}\right)$ for j=1,2. Therefore, the bivariate probit model can be written as

$$\begin{aligned}
\text{Employed}_{it} &= 1[\mathbf{x}_{it1}'\delta_1 + \delta_S \text{SEmployed}_{it} + \bar{\mathbf{x}}_i'\psi_1 + a_{i1} + v_{it1} > 0], && (27)\\
&= 1[\mathbf{x}_{it1}'\delta_{1a} + \delta_{Sa} \text{SEmployed}_{it} + \bar{\mathbf{x}}_i'\psi_{1a} + e_{it1} > 0], && (28)\\
\text{SEmployed}_{it} &= 1[\mathbf{x}_{it}'\delta_2 + \bar{\mathbf{x}}_i'\psi_2 + a_{i2} + v_{it2} > 0]. && (29)\\
&= 1[\mathbf{x}_{it}'\delta_{2a} + \bar{\mathbf{x}}_i'\psi_{2a} + e_{it2} > 0], && (30)
\end{aligned}$$

where $e_{itj} = (a_{ij} + v_{itj})/(1 + \sigma_{a_{ij}}^2)^{1/2}$ for $j = 1, 2$, each e_{itj} has a standard normal distribution conditional on $\mathbf{x}_i$, and the subscript a denotes standardized parameters. In addition, the joint error term, $e_{it} \equiv (e_{it1}, e_{it2})$, is assumed to be independent of $\mathbf{x}_{it}$, $\bar{\mathbf{x}}_i$, and SEmployed_{it}. The MLE method can consistently estimate these re-scaled parameters. Finally, denote $\hat{\delta}_{1a}$, $\hat{\delta}_{Sa}$, and $\hat{\psi}_{1a}$ as coefficients estimated using the MLE method and Φ as the standard normal CDF. The APE of spousal employment status on personal employment status can be calculated as

$$\Phi\left(\mathbf{x}_{it1}'\hat{\delta}_{1a} + \hat{\delta}_{Sa} + \bar{\mathbf{x}}_i'\hat{\psi}_{1a}\right) - \Phi\left(\mathbf{x}_{it1}'\hat{\delta}_{1a} + \bar{\mathbf{x}}_i'\hat{\psi}_{1a}\right). \tag{31}$$

4.2. Individual Preference for Spousal Employment

As Table 3 shows, there is a potential sample selection problem when estimating Eqs. (14) and (15), because many people do not share any of their family chores at home. Furthermore, unobserved individual heterogeneity also systematically biases the resulting estimates. For example, people with the same observable characteristics may have different levels of productivity and preferences for family chores.

Thus, this study adopted a linear panel data model correcting for the sample selection bias and unobserved, time-invariant individual heterogeneity. More detailed discussion of this model is available in Wooldridge (2010).

This study estimated Eqs. (14) and (15) by applying the following regression:

$$\text{CShare}_{it} = X_{it}(-\beta) + (-\delta)\text{SEmployed}_{it} - \eta_i - \varepsilon_{it}, \tag{32}$$

where CShare_{it}^{k} denotes the natural logarithm of the share of family chores for person i.[9] The variable of interest is SEmployed_{it} and the covariate $X_{1it} \subset \mathbf{x}_{it}$ indicates demography variables including age, health status, education, and earning difference. Because both the division of family chores and spousal employment status are affected by unobserved factors, such as time-invariant personal taste for family chores, the inclusion of the error term η_i controls for this correlation. In this case, estimation is biased only when using a cross section sample selection model.

Denote T as the time dimension of the panel data. Let $\mathbf{s}_i \equiv (s_{i1}, ..., s_{iT})'$ denote the $T \times 1$ vector of binary selection indicators: $s_{ij} = 1$ if a person j has shared some family chores, and zero otherwise. Define the time average of some explanatory variables, $\bar{\mathbf{x}}_{2i} \equiv \frac{1}{T}\sum_{t=1}^{T} \mathbf{x}_{2it}$. Suppose that, for each period, s_{it} is determined by the probit equation:

$$s_{it} = 1\left(\bar{\mathbf{x}}_{2i}\delta_t + v_{it} > 0\right) \qquad v_{it}|\bar{\mathbf{x}}_{2i} \sim \text{Normal(0,1)}, \tag{33}$$

where $1(\cdot)$ is an indicator function. Following the assumptions in Wooldridge (2010), this study imposed the following linearity condition:

Assumption 4.1. *Let* $\boldsymbol{x}_i = (\boldsymbol{x}_{i1}, ..., \boldsymbol{x}_{iT})'$. *Assume*

$$E(\varepsilon_{it}|\boldsymbol{x}_i, v_{it}) = E(\varepsilon_{it}|v_{it}) = \rho_t v_{it} \tag{34}$$

$$E(\eta_i|\boldsymbol{x}_i, v_{it}) = \bar{\boldsymbol{x}}_{2i}'\psi + \phi_t v_{it}, \tag{35}$$

where $\bar{\boldsymbol{x}}_{2i} = (\bar{x}_{i1}, ..., \bar{x}_{iK})'$ *and* $\psi = (\psi_0, \psi_1, ..., \psi_K)'$.

This assumption specifies a linear relationship of the error term ε_{it} and unobserved heterogeneity η_i conditional on the error term of the selection process v_{it} in

[9] The proposed econometric method relies on the normality assumptions of error terms. Using a logarithmic functional form allows the dependent variable to satisfy the normality assumption closely.

Eq. (34) and Eq. (35), respectively. Combining the linearity assumption with Eq. (32) leads to

$$\begin{aligned} E(CShare_{it}|\mathbf{x}_i, v_{it}) &= E(X'_{1it}(-\beta) + (-\delta)\text{SEmployed}_{it} - \eta_i - \varepsilon_{it}|\mathbf{x}_i, v_{it}) \\ &= X'_{1it}(-\beta) + (-\delta)\text{SEmployed}_{it} - \bar{\mathbf{x}}'_{2i}\psi - \gamma_t v_{it}, \end{aligned} \tag{36}$$

where $\gamma_t = \phi_t + \rho_t$. Because s_{it} is a function of $(\bar{\mathbf{x}}_{2i}, v_{it})$, this equation can be written as

$$E(\text{CShare}_{it}|\mathbf{x}_i, v_{it}, s_{it} = 1) = X'_{1it}(-\beta) + (-\delta)\text{SEmployed}_{it} - \bar{\mathbf{x}}'_{2i}\psi - \gamma_t v_{it}. \tag{37}$$

The normality assumption of v_{it} in the condition (33) simplifies the equation further:

$$\begin{aligned} E(y_{it}|\mathbf{x}_i, s_{it} = 1) &= E(y_{it}|\mathbf{x}_i, \bar{\mathbf{x}}_{2i}\delta_t + v_{it} > 0) \\ &= X'_{1it}(-\beta) + (-\delta)\text{SEmployed}_{it} - \bar{\mathbf{x}}'_{2i}\psi - \gamma_t \lambda(\bar{\mathbf{x}}_{2i}\delta_t), \end{aligned} \tag{38}$$

where $\lambda(\bar{\mathbf{x}}_{2i}\delta_t) = E(v_{it}|v_{it} > -\bar{\mathbf{x}}_{2i}\delta_t)$ is the inverse Mills ratio.

A two-step estimation procedure provides consistent estimators for these parameters. First, s_{it} is regressed on $\bar{\mathbf{x}}_{2i}$ using a pooled probit model, where the estimated coefficient $\widehat{\delta}$ and the inverse Mill's ratio, $\lambda(\bar{\mathbf{x}}'_{2i}\widehat{\delta})$, are obtained for all i and t. Second, pooled OLS regression is applied to the selected sample ($s_{it} = 1$) as follows:

$$\text{CShare}_{it} \text{ on } X'_{1it}, \text{SEmployed}_{it}, \bar{\mathbf{x}}'_{2i}, \lambda(\bar{\mathbf{x}}'_{2i}\widehat{\delta}). \tag{39}$$

5. Estimation Results

5.1. Household Joint Employment Decisions

To estimate the preference of a husband and wife for a dual-earner family, this study estimated Eqs. (28) and (30) jointly by using the pooled probit IV model discussed in the previous section. The control variables $\mathbf{x}_{it1}$ include age, health status, race (i.e., whether the person is Fukienese), and gender. Family characteristics are also included: the size of the family, the education and family wage, and whether the person lives with his/her parents. Finally, the regression also controls for the regional employment rate and region dummies. As discussed in Section 4, this study controlled for the time-invariant unobserved effects η_i by applying Cham-

berlain's correlated random effect approach.[10] The possible endogeneity of spousal employment status was mediated through the controls of the time-invariant unobserved effects. Finally, the spouse's education level was applied as the excluded instruments, $\mathbf{x}_{it2}$.

[Insert Table 4 here.]

Table 4 presents the results of the pooled probit IV regressions. The empirical results show that spousal employment status is negatively related to the probability of personal employment, indicating a negative estimate of $\delta_3^h + \delta_3^w$ in Eqs. (9) and (10). As discussed in Section 2, these results show that the average household in the sample does not prefer a dual-earner family. The APE results of *Spousal employment* show that these estimates are different for male and female respondents. Whereas the male respondents were 13.4% less likely to be employed if their wives already had a job, the female respondents were 5.4% less likely to be employed if their husbands were already employed. Although the results suggest that the family of male respondents had stronger preferences against a dual-earner family than the family of female respondents, their results are not comparable because of the distinguished sample. The inability to separately estimate the individual preferences of husbands and wives for a dual-earner family also prevents further identification of the source of this aversion. As discussed in Section 2, these negative estimates of $\delta_3^h + \delta_3^w$ suggest that the aggregate utility of a family generated from person k's employment, δ_1^k+δ_2^l, must be adequately large enough to prevent the aggregate disutility loss from becoming a dual-earner family.

The estimates of the other covariates are also consistent with those reported in the literature. In particular, the female respondents with more education are less likely to work. This result is similar to the findings by Bertrand et al. (2013), showing that a more capable wife is less likely to work because of the social expectation on a woman's role in a family. This study showed a similar pattern among Taiwanese families. In addition, the regression results indicate a positive relationship between the total wage of a family and individual employment status.

[10]The regression controls for the time averages of age, health status, living with parents, regional employment rates, and regional dummies. The time averages of time-invariant control variables are not included.

5.2. Individual Preference to Spousal Employment

Although the previous estimation determined only the aggregate preferences of husbands and wives for a dual-earner family, this section presents the empirical estimates of the individual preference for spousal employment. Tables 5 and 6 show the results using samples from female and male respondents, respectively. As discussed in Section 2, these samples were further split by individual employment status to identify individual preference estimates. To control for the potential sample selection bias, the determinants of participation in family chores are listed in the "Participation" columns. The dependent variable is a dummy variable indicating whether a person performed some household chores. The determinants of the chore share of husbands and wive are listed in the "CShare" columns.

Regarding the unemployed respondents, Table 5 shows the estimates of husband's and wife's preference for spousal employment are 0.107 and -0.017, respectively. The results indicate that the wives' employment probably brought positive externality to their unemployed husbands, because their employment further reduced the husbands' share of family chores. Husband employment, by contrast, increased the unemployed wife's share of family chores. These estimates are statistically insignificant for both the female and male respondents, likely because of the small sample size of the unemployed respondents, especially the male sample.[11] Therefore, we cannot reject the hypothesis that these unemployed men and women are indifferent to their spouses' employment; that is, $\hat{\delta_2^w}$=$\hat{\delta_2^h}$=0. Furthermore, the sample selection problem is unimportant for the female respondents because 98% of them shared their family chores. Although over 20% of the unemployed male respondents did not perform any household work, the total sample of these unemployed is small.

Regarding the employed respondents, the "Participation" equation in Tables 5 and 6 reveal that *Family size* has opposite effects on husbands and wives. A larger family size reduces the husbands' probability to perform household chores but increases the wives' probability. These estimates suggest that the traditional pattern of the roles of a husband and wife in a family is more stringent in larger families. In addition, the male respondents were more likely to share family chores if they were non-Fukienese, living with their parents, and had more education. The results indicate that the respondents with those characteristics shared less traditional points of view of a husband's role in a family.

[11]The p values for $H_0 : \widehat{\delta_2^w} = 0$ and $H_0 : \widehat{\delta_2^h} = 0$ are 0.571 and 0.675, respectively.

The employed respondents' estimates from the "CShare" equations in Tables 5 and 6 show that the effects of *Age* and *Education* are negative on the chore share of female respondents but positive on the male ones. The results show that the traditional gender inequality on the allocation of household chores were more prevalent in families whose husbands and wives were younger and less educated. Although the male respondents' time-invariant, unobserved effect is statistically significant as the test statistics suggests, the same effect is statistically insignificant among female respondents. These statistics suggest that wives' chore shares are less related to their personal characteristics, because they are expected to share a certain level of family chores regardless of their preference, as reported in *The Economist* (2011). The results also show that the female respondents' health status is negatively related to their share of chores. Furthermore, because 284 male respondents shared no chores at home, whereas only 15 female respondents did; hence, the sample selection problem is relevant only for the male respondents. The statistically significant estimate of the inverse Mills ratio supports this observation.

Regarding the variable of our primary interest, Tables 5 and 6 show that the employed husbands' and wives' share of family chores is affected by their spousal employment. In particular, because $\hat{\delta_2^w}$=$\hat{\delta_2^h}$=0, the empirical results show that the husbands' average utility from joint employment ($\widehat{\delta_3^h}$) is -0.132, whereas the wives' average utility from joint employment ($\widehat{\delta_3^w}$) is -0.061.[12] These estimates are similar to the estimates of aggregate preferences shown in Table 4 (-0.134 and -0.054), suggesting that the results from using family chores as a proxy for latent utility is consistent with the results from using a bivariate probit model. These estimates further facilitate combining the results by using both the male and female respondent sample, because separate identification of the preferences of husbands and wives for a dual-earner family is achieved using the proposed framework. In particular, the results indicate that the employed husbands suffered from spousal employment twice as much as the employed wives did on average, because these husbands would have to have shared more family chores if their wives were going to work. The employed wives, by contrast, had no strong preferences against their husbands' employment because their share of chores did not increase as much as that of the employed husbands did. The results imply that men's preferences toward a single-earner family

[12]If we ignore the statistical insignificance, the estimates obtained from the unemployed show that $\widehat{\delta_2^w} = -0.017$ for the female respondents. Because $-(\widehat{\delta_2^w} + \widehat{\delta_3^w}) = 0.061$, the estimates indicate $\widehat{\delta_3^w} = -0.061 - \widehat{\delta_2^w} = -0.061 - (-0.017) = -0.044$. Similarly, because $-(\widehat{\delta_2^h} + \widehat{\delta_3^h}) = 0.132$ and $\widehat{\delta_2^h} = 0.107$, the estimates indicate $\widehat{\delta_3^h} = -0.132 - \widehat{\delta_2^h} = -0.132 - (0.107) = -0.239$.

is stronger than those of women.

[Insert Figure 1 here.]

To combine the estimates from male and female respondents, the decisions of husbands and wives are predicted as follows:

$$\mathrm{a}^h = 1[X_1^h \widehat{\beta_1^h} - X_0^h \widehat{\beta_0^h} - \mathrm{a}^w(0.193) \geq 0] \tag{40}$$

$$\mathrm{a}^w = 1[X_1^w \widehat{\beta_1^w} - X_0^w \widehat{\beta_0^w} - \mathrm{a}^h(0.193) \geq 0], \tag{41}$$

where the aggregate disutility to a dual-earner family, 0.193, is obtained by adding up $\widehat{\delta_3^h}$ and $\widehat{\delta_3^w}$. Specifically, if one's spouse does not have a job, then these equations predict individual employment with their positive utility from work ($\widehat{\delta_1^h} > 0$ or $\widehat{\delta_1^w} > 0$); however, if the spouse already has a job, then the husband or wife would also work when their utility from work is greater than 0.193. Figure 1 shows a graph of these interaction effects. Regardless of spousal employment status, the husband and wife would choose to work if it would yield a positive utility greater than 0.193. The probability of a dual-earner family thus intersects at the upper-right corner of the figure. The lower-left corner of the figure, however, denotes the scenario when both husband and wife prefer to stay unemployed because their utility from work is negative. The rest of the figure indicates the probability of a single-earner family, where the relative size between $\widehat{\delta_1^h}$ and $\widehat{\delta_1^w}$ determines who will work. Although the empirical framework does not identify these values, the data suggest that $\widehat{\delta_1^h}$ is greater than $\widehat{\delta_1^w}$ in most of the families in the sample. This is because 30% of the sample families had husbands as their single earner, but less than 4% of the families had wives as their sole-earner. This argument is consistent with the estimates of the employed husbands' strong preferences against their wives' employment.

6. Conclusion

This study investigated the joint decision-making of married couples by examining the effects of spousal employment status on individual employment decisions and the share of family chores. Using the cooperative-game framework proposed by Bresnahan and Reiss (1991), this study estimated the degree of complementarity between couples' joint home and work production decisions. Because the BR framework's inability to identify the individual preferences of husbands and wives

for this complementarity, this study contributes to the literature by using the division of family chores as a proxy for individual utility. This strategy facilitates identifying the individual preferences of husbands and wives for a dual-earner family, thereby enabling the prediction of a representative family's work and home production decisions.

Obtaining unbiased estimates of these effects is complicated by the possibility of positive assortative mating among couples, causing spousal employment status to be endogenous. This study analyzed the PSFD data from Taiwan by using two unobserved effect panel data models: a bivariate probit model with a binary endogenous explanatory variable and a sample selection panel data model. The empirical results show that an average household in both the male and female samples did not prefer a dual-earner family. Regressions using the family chore shares of husbands and wives' show that this aversion comes mainly from husbands. These results suggest a strong negative effect of spousal employment on personal employment decisions, and a positive effect of spousal employment on individual family chore shares. The empirical results also reveal other crucial determinants of the allocation of family chores, such as age and education. These results are consistent with those reported in *The Economist* (2011), that a woman's share of family chores tends to remain constant regardless of her employment status.

As mentioned in the Introduction, marriage is becoming less attractive to Asian women because of their unbalanced share of work and family chores. This paper shows that marriage may also be unattractive to their male counterparts, because the wife's employment significantly increases their load of family chores. For example, *The Economist* (2011) reported that Asian men prefer to have a wife with less education and lower-income, because they may feel intimated by women's earning power and education level. Therefore, the results of this study suggest other potential factors behind the recent growth trends of marriage age and the percentage of unmarried people in Asian countries, and the increasing number of foreign brides in Taiwan. Because we focused on the families in Taiwan, comparing the findings of current study with those of another study applying the same framework to data from other Asian or Western societies is a potential direction for future research.

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Table 1: Variable Definitions

Variable	Definition
Proxy Variables	
Chore share	Personal housework time divided by the sum of housework time
Employment Status	
Employed	Dummy variable =1 if the individual has a job, =0 otherwise
Human Capital Characteristics	
Age	Age of a person
Education	Number of years of education of a person
Fukienese	Ethnicity dummy variable =1 if a person is a Fukienese, =0 otherwise (Hakka, Mainlander)
Poor health	Dummy variable =1 if the person reports his/her health as being good, fair or poor,=0 otherwise[A]
Income Characteristics	
Earning difference	Individual's spousal earning minus his/her own earning[B]
Family wage	The sum of individual and his/her spousal monthly salary
Family Characteristics	
Family size	Number of persons in the household
Live together	Dummy variable =1 if the person live with his/her parents,=0 otherwise
Education	Individual's education
Employment rate (%)	Regional employment rate for region in which the household resides
Region Dummy Variables	
North	Dummy variable =1 if a person resides in North Census Region, =0 otherwise
Central	Dummy variable =1 if a person resides in Central Census Region, =0 otherwise
South	Dummy variable =1 if a person resides in South Census Region, =0 otherwise
East	Dummy variable =1 if a person resides in East Census Region, =0 otherwise

A: questions were asked in five categories: excellent, very good, good, fair, and poor. B: Earning is the sum of all personal income components.

Table 2: Sample Statistics by Gender

	Male sample	Spouse of male	Female sample	Spouse of female
Household Work				
Personal Chore				
	5.631	20.964	19.089	5.389
	(7.151)	(15.952)	(13.367)	(8.014)
Chore share				
	0.229	-	0.789	-
	(0.215)	-	(0.230)	-
Human Capital Characteristics				
Age				
	42.674	39.140	45.630	50.619
	(6.632)	(7.421)	(5.203)	(8.825)
Education				
	11.412	8.920	9.626	7.937
	(3.417)	(5.115)	(4.021)	(5.879)
Fukienese				
	0.755	0.581	0.753	0.544
	(0.430)	(0.494)	(0.432)	(0.498)
Poor health				
	0.319	-	0.428	-
	(0.466)	-	(0.495)	-
Job Characteristics				
Employed				
	0.938	0.619	0.661	0.845
	(0.240)	(0.486)	(0.474)	(0.362)
Monthly salary				
	46.889	18.071	20.889	41.875
	(41.396)	(37.109)	(28.712)	(44.811)
Working hours				
	47.721	29.192	30.590	41.321
	(19.799)	(26.158)	(25.400)	(23.120)
Earning difference				
	-28.818	-	20.9859	-
	(47.214)		(45.929)	
Family Characteristics				
Family size				
	4.216	-	4.602	-
	(1.010)	-	(0.988)	-
Live together				
	0.372	-	0.244	-
	(0.484)	-	(0.430)	-
Number of observations	1,317		1,177	

Table 3: Housework Hours by Gender

Hours	Male sample	Spouse of male	Female sample	Spouse of female
0	302	29	23	428
1-5	517	136	118	331
6-10	315	213	210	258
11-15	102	241	243	79
16-20	29	135	96	21
21-25	29	197	194	27
26-30	9	120	135	15
30 above	14	246	158	18
Number of observations	1,317	1,317	1,177	1,177

Table 4: Pooled Probit IV Regressions: Dependent Variables (Employed status)

	Male Sample	Female Sample
Spousal employment	-3.129^{***}	-2.524^{*}
	(0.290)	(1.429)
Age	-0.028	-0.061
	(0.235)	(0.180)
Poor health	-0.024	0.092
	(0.098)	(0.102)
Fukienese	-0.119	-0.080
	(0.115)	(0.138)
Education1	-0.033	-0.646^{***}
	(0.058)	(0.062)
Education2	-0.024	-0.647^{***}
	(0.055)	(0.060)
Family size	-0.246	-0.062
	(0.246)	(0.218)
Live together	-0.263	0.040
	(0.249)	(0.436)
ln(family wage)	0.979^{***}	1.166^{***}
	(0.147)	(0.319)
Employment rate	0.060	-0.069
	(0.052)	(0.050)
APE for spousal employment	-0.134	-0.054
Region dummies	Yes	Yes
Test of time-invariant unobserved effects^{A}	22.25	227.79
	(0.035)	(0.000)
Sample size	1317	1177

Robust standard errors are presented in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Region dummies include North, Central, South, and East. A: p-values are reported in parentheses.
These unobserved effects include Fukienese and the time averages of Spousal work, Age, Poor health, Education, and Employment rate.
Education1, and Education2 are interactions of Education with time dummies.

Table 5: Sample Selection Models: Dependent Variables: (Chores Share of Female Respondents)

	Unemployed		Employed	
	Participation	CShare	Participation	CShare
	(1)	(2)	(3)	(4)
Age	-0.515^{**}	0.001	-0.084	-0.002^{*}
	(0.206)	(0.001)	(0.028)	(0.002)
Poor health	-0.346	0.016	0.392	0.021^{*}
	(0.606)	(0.011)	(0.266)	(0.011)
Fukienese	-6.270	0.052^{***}	-4.876	0.011
	(2869.358)	(0.014)	(2153.965)	(0.013)
ln(family wage)	0.960	-0.004	0.021	0.029
	(1.367)	(0.012)	(0.246)	(0.020)
Live together	-1.597^{*}	0.068	-0.236	0.015
	(0.851)	(0.060)	(0.288)	(0.042)
Education1	0.088	-0.001	-0.013	-0.003^{*}
	(0.103)	(0.002)	(0.041)	(0.002)
Education2	0.065	-0.002	-0.009	-0.005^{**}
	(0.092)	(0.002)	(0.041)	(0.002)
Family Size	-0.162	–	0.312^{**}	–
	(0.291)	–	(0.155)	–
Spousal	–	0.017	–	0.061^{**}
employment	–	(0.031)	–	(0.025)
Inverse Mills ratio	–	-0.432^{***}	–	0.019
	–	(0.088)	–	(0.178)
Region dummies	Yes	Yes	Yes	Yes
Test of time-invariant		3.10		5.28
unobserved effects^{A}		(0.541)		(0.152)
Sample size	399	391	778	763

Note: robust standard errors are presented in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Education1, and Education2 are interactions of Education with time dummies.
Region dummies include North, Central, South, and East.
A: p-values are reported in parentheses. These unobserved effects include Fukienese and the time averages of Spousal employment, Age, Poor health, and Education.

Table 6: Sample Selection Models: Dependent Variables: (Chores Share of Male Respondents)

	Unemployed		Employed	
	Participation	CShare	Participation	CShare
	(1)	(2)	(3)	(4)
Age	0.081**	0.002	0.006	0.002**
	(0.038)	(0.003)	(0.073)	(0.001)
Poor health	0.468	0.040	0.013	0.001
	(0.456)	(0.039)	(0.089)	(0.010)
Fukienese	0.322	−0.003	−0.188*	−0.017
	(0.650)	(0.056)	(0.103)	(0.015)
ln(family wage)	0.461	0.052	−0.035	−0.001
	(0.806)	(0.084)	(0.072)	(0.010)
Live together	−0.994**	0.125	0.242***	−0.048
	(0.473)	(0.092)	(0.088)	(0.044)
Education1	0.329***	0.014	0.078***	0.012***
	(0.092)	(0.017)	(0.014)	(0.005)
Education2	0.363***	0.012	0.073***	0.011**
	(0.100)	(0.018)	(0.014)	(0.004)
Family Size	0.159	–	−0.140***	–
	(0.248)	–	(0.048)	–
Spousal	–	−0.107	–	0.132***
employment	–	(0.255)	–	(0.023)
Inverse Mills ratio	–	−0.149	–	0.270**
	–	(0.108)	–	(0.134)
Region dummies	Yes	Yes	Yes	Yes
Test of time-invariant		4.90		21.12
unobserved effects[A]		(0.297)		(0.002)
Sample size	81	63	1236	952

Note: robust standard errors are presented in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Education1, and Education2 are interactions of Education with time dummies.
Region dummies include North, Central, South, and East.
A: p-values are reported in parentheses. These unobserved effects include Fukienese and the time averages of Spousal employment, Age, Poor health, and Education.

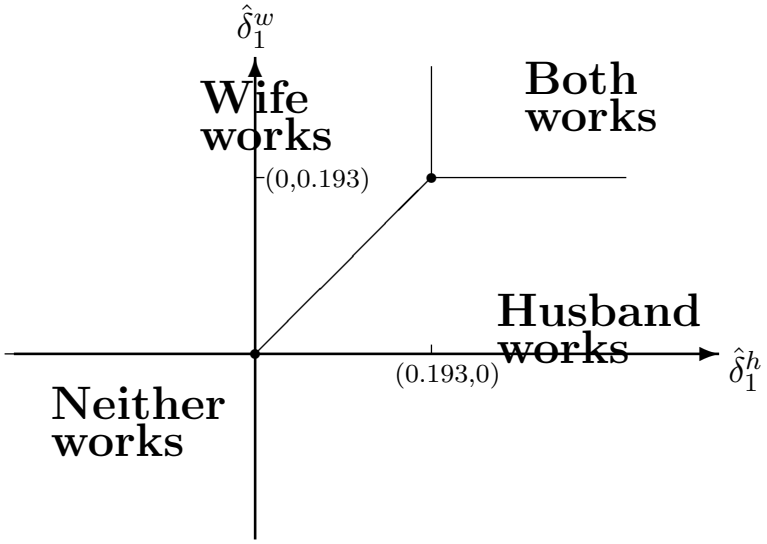

Figure 1: Cooperative Household Employment Decisions

國科會補助計畫衍生研發成果推廣資料表

日期:2013/07/02

國科會補助計畫	計畫名稱: 台灣女性家庭權力與夫妻共同就業決定(GM01)
	計畫主持人: 徐吉良
	計畫編號: 101-2629-H-194-003- 學門領域: 數理與數量方法

無研發成果推廣資料

101 年度專題研究計畫研究成果彙整表

計畫主持人：徐吉良	計畫編號：101-2629-H-194-003-
計畫名稱：台灣女性家庭權力與夫妻共同就業決定(GM01)	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	在 2012 The American Economic Association Annual Meeting China Meeting of Econometric Society 2013 發表

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：□已發表 ■未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：(以 100 字為限)

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）(以 500 字為限)

In this paper, we ask how the link between family chore and employment affects labor market outcomes such as labor force participation. To understand the effect of the incentives embedded in the Taiwan society, we study the joint decision-making of married couples that determines the household's family chore and labor force participation. First, we estimate the effect of the spousal employment status on his/her family chore share controlling individual heterogeneity. Then, we investigate how spouse's employment status affects own employment status. Obtaining unbiased estimates of these effects are complicated by the potential positive assortative mating among couples which make spouse's employment status to be endogenous. Our innovation is to utilize panel data structure of Panel Study of Family Dynamics (PSFD) by two different unobserved effect panel data models, the fixed effect 2SLS estimation and a bivariate probit model with binary endogenous explanatory.