Parental Subjective Well-Being, Gender Preference, and Parity Progression in Taiwan

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Abstract

Given the low fertility rate in Taiwan, this research examines the factors behind parity progression with a focus on both parental subjective well-being around the birth of a child and gender preference. Making use of Panel Study of Family Dynamics (PSFD) data, we estimate Cox proportional hazard models on the event of a second birth and conditional models on the event of third or fourth birth, respectively. Our empirical results show that the relative happiness level around the first birth positively relates to the event of a second birth, while the average happiness level before the first birth positively relates to the event of a third or fourth birth in two-child families. These findings also vary with parents' age and education level. The results suggest that the determinants to predict a second child are not the same as those predicting a third or fourth one, and so we recommend that the event of a second birth be estimated separately from the event of parity three and four.

Keywords: Parity Progression, Parental Subjective Well-Being, Gender Preference, Fertility

JEL Classification: J13, J18, J19

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1. Introduction

According to World Bank data, the global total fertility rate has been falling from 5.0 children per woman in the 1960s to just half of that in 2009, and the drop is expected to continue further and reach the replacement level in the future (United Nations, 2020). The declining trend first began with Western countries, followed by the East Asia and Pacific region about a decade later, and then the rest of the world. Governments with population decline and aging concerns have been adopting policies to hopefully raise the fertility level in their countries (United Nations, 2021).

There is an ample amount of studies looking into the reasons behind low fertility. Schleutker (2014) organizes a chronological review by four different theorical arguments: economic theory, value change theory, the role of family policies, and preference theory. She points out the need to incorporate all arguments for a fully comprehensive explanation of low fertility. Balbo et al. (2013) provide another review that classifies the determinants of low fertility into micro-level, meso-level, and macro-level. Micro-level determinants are those that relate to individual and/or couple decision-making, such as partnership and marital status, division of labor within the household, socio-economic circumstances, and fertility intentions and preferences. Examples of meso-level determinants include personal network, social pressure, and places of residence, whereas macro-level determinants contain trends of macroeconomic indicators, culture and institutional settings, as well as contraceptive and reproductive technologies. In this paper we use Taiwan data to discuss all relevant factors when appropriate variables are available to us with a focus on parental subjective well-being and gender preference.

How happiness relates to fertility outcomes is a topic that does not draw very much attention, probably because of the endogeneity nature of subjective well-being and reproductive decision (Aassve et al., 2012; Balbo et al., 2013). Previous evidence presents both that people are happier as parents (Kohler et al., 2005; Aassve et al., 2012) and that happier individuals are more likely to become parents (Billari, 2009; Cetre et al., 2016). It is also found that the relationship between happiness and fertility varies by age, gender, and number of children (Umberson et al., 2010; Margolis and Myrskylä, 2011; Baranowska and Matysiak, 2011) and that subjective well-being level of parents changes over time (Umberson et al., 2010; Baetschmann et al., 2016).

Extended from the findings above, some studies investigate how individuals' previous experiences influence the decision on more children (e.g., Luppi and Mencarini, 2018). Newman (2008) conducts qualitative research on parents of small and large families and finds that the experience of going through the birth of a first child plays a significant role on fertility intentions and behavior in the future. Margolis and Myrskylä (2015) and Luppi (2016) provide empirical evidence that supports Newman (2008). The former finds that a drop in parents' subjective well-being over the transition to parenthood decreases the likelihood of a second child; while the latter shows that parents' subjective satisfaction with both work and housework following the birth of a first child negatively predicts the timing of a second birth. Our analysis follows these studies and aims to reveal how parents' subjective happiness relates to the decision of having an additional child.

In addition to subjective well-being over the transition to parenthood, we include gender of the older child(ren) as another main variable of interest. The gender of existing child(ren) is found to determine parity progression in low fertility countries (Gray and Evans, 2005; Guilmoto, 2017; Fuse, 2019). Studying low fertility in Taiwan with a historical preference for a son (Yu and Su, 2006; Basten and Verropoulou, 2015), we would like to know if this preference remains by verifying whether it plays a role in future reproductive behavior. Inspired by Margolis and Myrskylä (2016) who make the link between gender of children and parental happiness, we also test whether the interaction between subjective happiness and gender of children has any implication on parity progression to second births and beyond.

To extend the literature, we separately study parity progression to the second birth versus the third or more births. Our findings provide empirical evidence of recent fertility determinants in Taiwan that consider birth order heterogeneity. They could serve as references for fertility promoting policies.

The remaining paper is organized as follows. Section 2 describes the data. Section 3 introduces our methodology. Section 4 presents our empirical results. Section 5 concludes.

2. Data

This study makes use of data collected under the Panel Study of Family Dynamics (PSFD) project initiated in 1998 to foster interdisciplinary research on the patterns and changes of families in Taiwan. The survey draws one main (adult) respondent out of each family and extends to include the respective child(ren) after 16 years of age. As a result, we only observe one of the spouses in every household. The longitudinal survey has been conducted annually until 2012 and biennially afterward. Since 2007, the survey has consistently included questions on the main respondents' subjective well-being, which serves as one of our main variables of interest. This study therefore uses data of the years 2007 to 2012, 2014, 2016, 2018, and 2020 (Kan, 2011; Kan, 2012a, 2012b; Kan, 2013a, 2013b; Kan, 2016; Chang, 2016; Yu, 2018; Yu, 2019; Yu, 2022).

Among those ten waves of survey, we observe 1,201 transitions to parenthood that fit the purpose of our study. To ensure a better proxy variable that represents a parent's subjective well-being level, we exclude samples where the transition to parenthood occurs in and after 2014, when the survey was first conducted biennially. After dropping respondents with twins and missing values, our analytical sample consists of 305 individuals with 1,987 observations.[1]

We create three variables from the survey question: "How was life in the past year, good or bad?" Responses range from 1 (very bad) to 7 (very good).[2] The first variable calculates the average responses by respondent over

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1 Among the 1,201 transitions to parenthood, we observe 48 parents reporting two children born in the same month and year, which we assume are twins. We drop all 338 observations of these parents, because family with twins may behave differently in parity progression from other families.

2 The other survey question on the main respondents' subjective well-being asks: "Do you feel happy recently?" Since a child can be born any time in a year, answers to this

all years of non-missing reported values before the birth of the first child and name this as *Average SWB* (average subjective well-being level). The other two variables aim to reflect changes in respondents' subjective well-being around the birth of a child. Specifically, we name the response to the above question recorded in the year when the first child and the second child were first reported as *SWB of First* (subjective well-being of the first-born) and *SWB of Second* (subjective well-being of the second-born), respectively, and create two variables named *SWB Deviation of First* (deviation in subjective well-being of the first-born) and *SWB Deviation of Second* (deviation in subjective well-being of the second-born) by subtracting *Average SWB* from *SWB of First* and *SWB of Second*, respectively. These three variables, *Average SWB*, *SWB Deviation of First*, and *SWB Deviation of Second*, make up the first set of main explanatory variables in our analysis.

The second set of main explanatory variables considers gender of the child. Given the historical preference for a son in Taiwan, we use binary variables of *First-born Boy* (having a first-born boy), *Second-born Boy* (having a second-born boy), and *First Two Boys* (having first two boys) to explore possible remaining gender preference.

Other covariates include three time-invariant variables: gender of the respondent, age of the respondent when the first child was reported, and a binary variable indicating the respondent had completed 16 or more years of education (i.e., completed a four-year college or university) when the first child was reported.[3] We also include three time-varying variables measured at each wave of survey: a binary variable marking whether both the respondent and the spouse have paid jobs, named *Dual-earner family*; the natural log of household income that equals the sum of incomes of both the respondent and the spouse, if applicable; and a binary variable that equals 1 when the respondent's current address is in a city or county that has universal maternity

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question do not necessarily consider the event of a child birth, especially when the survey date is further away from the date of the child's birth.

3 We also try including a set of education levels (as reported in Tables of descriptive statistics) in the estimation of hazard models, and they give similar results. We choose to report only 16 or more years of education for easier comparison with models that further consider interaction terms.

benefits and 0 otherwise.[4] We do not control for marital status, which is commonly included in previous literature, because all of our analytical samples are married.

3. Methodology

We explore how subjective well-being around a child birth and gender of the child are relevant to parity progression by estimating: 1) the relative hazard of a second birth with a Cox proportional hazard model and 2) the (possible) multiple events of third and fourth births with the conditional model proposed by Prentice et al. (1981), also known as the conditional risk set model. Both approaches relate the time until observing a birth event to the independent variables specified in Section 2, while allowing for censored observations (Therneau and Grambsch, 2000; Cleves et al., 2008). Analysis in the second approach is stratified by an event order; i.e., a third versus fourth birth. Therefore, observations in the first approach to predict second birth are used from the year of the first birth until the year of the second birth or censored at the last wave of the participated survey. The second approach is used to predict third and fourth births with observations from the year of the second birth until the last wave of the participated survey, taking into account the fact that a fourth birth can only occur after observing a third birth. Our analytical sample as a result is further restricted to 283 individuals with 762 observations in approach 1 and 199 individuals with 537 observations in approach 2.

We estimate the following models for the two approaches, respectively:

$$\lambda\{t|\mathbf{x}_j, \mathbf{x}_{jt}\} = \lambda_0(t)\exp\{\mathbf{x}_j\beta_{1x} + \mathbf{x}_{jt}\beta_{2x}\}, \tag{1}$$

$$\lambda\{t|\mathbf{x}_j, \mathbf{x}_{jt}, s\} = \lambda_{0s}(t)\exp\{\mathbf{x}_j\beta_{1x} + \mathbf{x}_{jt}\beta_{2x}\}, \tag{2}$$

4 There is currently a total of 22 local (city or county) governments in Taiwan. Most cities and counties had restricted maternity benefits for low-income families before universal maternity benefits became available in different years (Lou, 2017). Among the 22 local governments, only Pingtung County had not adopted universal maternity benefits by the last survey year included in our analysis.

where $\mathbf{x}_j$ is a vector of variables that do not change with time that includes the subjective well-being variables and gender of children variables, $\mathbf{x}_{jt}$ is a vector of time-varying variables, s denotes the stratification by birth order for an ordered multiple event in the conditional model, and β_{1x} and β_{2x} are vectors of the estimated coefficients for $\mathbf{x}_j$ and $\mathbf{x}_{jt}$, respectively.

To compare parity progression by birth order (second versus third and fourth), we apply the two approaches to estimate the same set of covariates in the next section. For the two sets of main explanatory variables, we consider the average subjective well-being level before first birth (i.e., *Average SWB*), *SWB Deviation of First*, and having a first-born boy in predicting the second birth. We examine the complete sets of subjective well-being variables (i.e., *Average SWB*, *SWB Deviation of First*, and *SWB Deviation of Second*) as well as the gender of children variables (*First-born Boy*, *Second-born Boy*, and *First Two Boys*) for two-child families in predicting the third and fourth births. In addition, we include interaction terms between the two sets of main explanatory variables and two other covariates (i.e., age and education level at first birth) in the last part of the analysis. In our preferred specifications, we also control for survey year fixed effects and current city/county fixed effects to capture possible systematic differences across years and locations (Kulu, 2013).

4. Empirical Results

4.1 Descriptive Statistics

Table 1 and Table 2 present descriptive statistics of the sample to predict second birth and of the sample to predict third and fourth births by observed parity, respectively. Note that not all of the 207 respondents with an observed second birth can be used in the analysis to predict third and fourth births. We lose another 8 respondents in the sample, mostly because the second birth was reported in the last participated wave of the survey, and some of them have missing values. Given these analytical samples, about 27% of parents who reported a first child in Table 1 do not have another child reported by the end of the survey, while among those who had reported two children in Table

2, about 86% remain at parity two during the observed window.[5]

Table 1 Descriptive Statistics of the Analytical Sample to Predict 2nd Birth

	Total	Observed One	Observed 2nd	*t*-test
Average SWB	5.26 (0.99)	5.34 (0.90)	5.23 (1.02)	
SWB Deviation of First	0.18 (1.12)	−0.11 (1.26)	0.28 (1.04)	**
First-born Boy (= 1)	0.51 (0.50)	0.49 (0.50)	0.52 (0.50)	
Male Respondent (= 1)	0.57 (0.50)	0.55 (0.50)	0.58 (0.49)	
Age at First Birth	29.52 (2.64)	30.20 (2.97)	29.27 (2.48)	**
Highest Education Level at First Birth:				
High School and Below (= 1)	0.20 (0.40)	0.21 (0.41)	0.20 (0.40)	
Five-year and Three-year Colleges (= 1)	0.19 (0.40)	0.20 (0.40)	0.19 (0.40)	
Four-year Colleges and Universities (= 1)	0.47 (0.50)	0.41 (0.49)	0.49 (0.50)	
Graduate School (= 1)	0.14 (0.35)	0.18 (0.39)	0.12 (0.33)	
Dual-earner family[a] (= 1)	0.68 (0.47)	0.74 (0.44)	0.66 (0.48)	
ln Household Income[a]	11.19 (0.52)	11.30 (0.60)	11.16 (0.48)	*
Universal Maternity Benefits[a] (= 1)	0.72 (0.45)	0.71 (0.46)	0.72 (0.45)	
Number of Respondents	283	76	207	

Note: Standard deviations are in parentheses. [a] Time-varying variable, where summary statistics are evaluated at first birth. * and ** indicate that the differences between columns "Observed One" and "Observed 2nd" are significant at the 5% and 1% levels, respectively.

[5] The average durations from the first to the second birth are 2.90 years and 2.85 years for the analytical sample in Table 1 and Table 2, respectively, and that from the second to the third birth is 3.13 years.

Table 2 Descriptive Statistics of the Analytical Sample to Predict 3rd Birth and 4th Birth

	Total	Observed Two	Observed 3rd	*t*-test
Average SWB	5.22 (1.02)	5.17 (1.00)	5.59 (1.09)	*
SWB Deviation of First	0.28 (1.04)	0.33 (1.03)	0.00 (1.11)	
SWB Deviation of Second	0.06 (1.10)	0.07 (1.12)	0.00 (0.98)	
First-born Boy (= 1)	0.52 (0.50)	0.52 (0.50)	0.52 (0.51)	
Second-born Boy (= 1)	0.50 (0.50)	0.51 (0.50)	0.41 (0.50)	
First Two Boys (= 1)	0.24 (0.43)	0.23 (0.42)	0.26 (0.45)	
Male Respondent (= 1)	0.58 (0.50)	0.59 (0.49)	0.48 (0.51)	
Age at First Birth	29.23 (2.36)	29.28 (2.31)	28.93 (2.69)	
Highest Education Level at First Birth:				
High School and Below (= 1)	0.20 (0.40)	0.20 (0.40)	0.19 (0.40)	
Five-year and Three-year Colleges (= 1)	0.19 (0.39)	0.17 (0.38)	0.33 (0.48)	*
Four-year Colleges and Universities (= 1)	0.49 (0.50)	0.52 (0.50)	0.33 (0.48)	†
Graduate School (= 1)	0.12 (0.33)	0.12 (0.32)	0.15 (0.36)	
Dual-earner family[a] (= 1)	0.65 (0.48)	0.66 (0.47)	0.59 (0.50)	
ln Household Income[a]	11.29 (0.58)	11.29 (0.59)	11.29 (0.50)	
Universal Maternity Benefits[a] (= 1)	0.90 (0.30)	0.89 (0.31)	0.96 (0.19)	
Number of Respondents	199	172	27	

Note: Standard deviations are in parentheses. [a] Time-varying variable, where summary statistics are evaluated at first birth. † and * indicate that the differences between columns "Observed Two" and "Observed 3rd" are significant at the 10% and 5% levels, respectively.

Table 1 shows that those who choose to have a second child are largely comparable, in terms of the observable variables, to their counterparts from whom we only observe one child except that they show statistically significant higher deviation in their reported subjective well-being level at firth birth, they are of a statistically significant younger age at first birth, and they have lower average household income at the 5% significant level. Table 2, on the other hand, shows that those who choose to have and not have more than three children are more similar in terms of the summary statistics of the independent variables than those who choose to have a second child or not in Table 1. Respondents reporting more than three children have a higher average subjective well-being level before the birth of their first child, more of them have completed five-year or three-year colleges, and marginally less of them have completed four-year colleges or universities.

The summary statistics in these two tables support our speculation of heterogeneous parity progression by birth order. We next move on to survival analysis in the following subsections.

4.2 Predicting Second Birth

Table 3 presents the estimated coefficients from Cox proportional hazard models to predict second birth. We first include only our main variables of interest (i.e., *Average SWB*, *SWB Deviation of First*, and *First-born Boy*) separately in columns (1) to (3), two at a time in columns (4) to (6), and all three of them in column (7). These columns show that only *SWB Deviation of First* significantly relates to the probability of having a second birth.

Based on the estimated coefficient in column (7), a one-unit higher subjective well-being level at first birth than the average subjective well-being level before first birth (ranging from -4 to 3.33 in this 283-respondent sample) raises the hazard of a second birth by 18.18%.[6] This effect slightly decreases to as low as 15.60% as we include more covariates in the following

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6 We interpret the estimated results by taking an exponential of the estimated coefficient and comparing its distance to 1. For example, the estimated coefficient for *SWB Deviation of First* in column (7) of Table 3 is 0.167 and exp(0.167) = 1.1818. The hazard of a second birth thus rises 18.18%.

Table 3 Coefficients from Cox Proportional Hazard Models to Predict 2nd Birth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Average SWB	−0.054 (0.058)			0.033 (0.068)	−0.053 (0.058)		0.034 (0.069)	0.032 (0.067)	0.073 (0.068)	0.104 (0.072)
SWB Deviation of First		0.152** (0.051)		0.166** (0.060)		0.152** (0.051)	0.167** (0.060)	0.169** (0.060)	0.183** (0.060)	0.145* (0.065)
First-born Boy (= 1)			−0.032 (0.123)		−0.025 (0.123)	−0.031 (0.121)	−0.034 (0.122)	−0.012 (0.122)	−0.016 (0.121)	−0.007 (0.130)
Male Respondent (= 1)								0.106 (0.125)	0.096 (0.125)	0.142 (0.135)
Age at First Birth								−0.068** (0.023)	−0.055* (0.022)	−0.069* (0.027)
≥ *16 Yrs of Edu. at 1st Birth* (= 1)								0.071 (0.124)	0.180 (0.127)	0.222 (0.142)
Dual-earner family[a] (= 1)									−0.109** (0.035)	−0.147*** (0.041)
ln Household Income[a]									−0.026 (0.032)	−0.053 (0.035)
Universal Maternity Benefits[a] (= 1)									−0.082 (0.070)	−0.051 (0.103)
Survey year fixed effects	no	no	no	no	no	no	no	no	no	yes
Current city/county fixed effects	no	no	no	no	no	no	no	no	no	yes
Log pseudolikelihood	−1072	−1070	−1073	−1070	−1072	−1070	−1070	−1066	−1061	−1035

Note: Number of subjects = 283. Number of observations = 762. Robust standard errors are in parentheses. [a] Time-varying variable.

*, **, and *** indicate $p < .05$, $p < .01$, and $p < .001$, respectively.

columns in Table 3. Among the time invariant variables that we include starting from column (8), only age at first birth significantly lowers the chance to observe a second birth. Specifically, a one-year older age at first birth reduces the hazard of a second birth by 6.67% from column (10). Among the time-varying variables, on the other hand, the only significant estimated coefficient is on the binary indicator, *Dual-earner family*, and it predicts a 13.67% lower chance to observe a second birth in column (10).

The results are consistent with previous literature that links subjective well-being of first-time parents to the decision of having more children (Margolis and Myrskylä, 2015; Luppi, 2016). Our finding of no significant association between gender of the first birth and the observation of a second birth also echoes Fuse (2019) who does not find evidence of gender preference on fertility at parity two in Japan.

4.3 Predicting Third and Fourth Births

In Table 4 we estimate the same specifications as in Table 3, except including both *SWB Deviation of First* and *SWB Deviation of Second* and all three gender of children variables. The results show that, among the three subjective well-being variables, only the average subjective well-being level before first birth significantly relates to the hazard of a third or fourth birth. The estimated coefficients vary from 0.146 to 0.310 when we include different sets of covariates and is the highest at 0.479 (61.45%) when also controlling for survey year and location fixed effects in column (10), which is only significant marginally. This implies that the systematic differences from survey years and location of the respondents relate to the probability of third and fourth births and to *Average SWB* in opposite directions. That is when some survey years or locations show higher chances to observe a third or fourth birth, they happen to correspond to a lower average subjective well-being level before first birth, and vice versa.

We note contrarily that being a male respondent and having completed 16 or more years of education at first birth are significantly negative only in column (10) of Table 4, possibly implying overestimations of their coefficients before including survey year and location fixed effects. These

Table 4 Coefficients from Conditional Models to Predict 3rd Birth and 4th Birth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Average SWB	0.146*			0.255*	0.172*		0.304**	0.310**	0.272*	0.479†
	(0.069)			(0.118)	(0.077)		(0.110)	(0.106)	(0.111)	(0.259)
SWB Deviation of First		0.043		0.138		0.022	0.141	0.138	0.076	0.211
		(0.096)		(0.103)		(0.093)	(0.101)	(0.100)	(0.135)	(0.275)
SWB Deviation of Second		−0.082		0.066		−0.084	0.096	0.081	0.128	0.142
		(0.073)		(0.088)		(0.079)	(0.087)	(0.115)	(0.177)	(0.323)
First-born Boy (= 1)			0.027		−0.102	−0.010	−0.062	−0.082	−0.072	0.049
			(0.172)		(0.210)	(0.222)	(0.184)	(0.189)	(0.251)	(0.612)
Second-born Boy (= 1)			0.037		0.053	0.094	−0.022	0.021	0.061	0.191
			(0.215)		(0.184)	(0.198)	(0.188)	(0.220)	(0.240)	(0.809)
First Two Boys (= 1)			−0.378		−0.350	−0.392	−0.345	−0.399	−0.470	0.014
			(0.322)		(0.305)	(0.324)	(0.305)	(0.357)	(0.297)	(0.711)
Male Respondent (= 1)								0.072	0.125	−0.770*
								(0.131)	(0.182)	(0.370)
Age at First Birth								−0.011	−0.012	0.107
								(0.043)	(0.044)	(0.086)
≥ *16 Yrs of Edu. at 1st Birth* (= 1)								0.159	0.171	−1.062**
								(0.214)	(0.227)	(0.395)
Dual-earner family[a] (= 1)									0.059	0.162
									(0.086)	(0.190)
ln Household Income[a]									0.023	0.284
									(0.092)	(0.245)
Universal Maternity Benefits[a] (= 1)									0.173	−1.469
									(0.183)	(0.000)
Survey year fixed effects	no	no	no	no	no	no	no	no	no	yes
Current city/county fixed effects	no	no	no	no	no	no	no	no	no	yes
Log pseudolikelihood	−80.44	−80.70	−80.52	−80.22	−80.07	−80.44	−79.84	−79.76	−79.52	−69.81

Note: Number of subjects = 199. Number of observations = 537. Robust standard errors are in parentheses. [a] Time-varying variable.
†, *, and ** indicate $p < .10$, $p < .05$, and $p < .01$, respectively.

two coefficients can be translated into a 53.70% decrease in the hazard of a third or fourth birth for a male respondent and a 65.42% decrease when having more than 16 years of education. Since we only observe one adult in each household from the PSFD survey, the former most likely reflects the selection of respondent gender in our analytical sample, while the latter may suggest the quantity-quality trade-off of children for better educated parents.

The noticeable differences between the results in Table 3 and Table 4 imply that parents' fertility behavior is not the same when it comes to second birth versus third and higher births. The differences again assure that analysis of time to birth events of parity two and parities beyond two should be estimated separately.

4.4 Predicting Future Births with Interaction Terms

To further explore whether parental subjective well-being and gender of children relate to parity progression differently between subgroups, we include interaction terms in the estimation. Table 5 and Table 6 present the results for analytical samples of one-child and two-child families, respectively, when each of the two sets of variables of interest interacts with age and education level at first birth one at a time, as well as interaction terms of the main explanatory variables themselves.

Following the significantly negative coefficients of age at first birth in Table 3, Table 5 shows that older age at first birth continues to lower the chances of having a second child, yet the reduced probability is smaller for parents with higher average subjective well-being level before first birth. The probability of observing the second birth even turns positive ($0.189 + (-0.081) = 0.108$ for a one-unit increase in *SWB Deviation of First*) for parents aged 30 or older at first birth when they have higher subjective well-being level at first birth compared to the average level before first birth. In fact, parents aged 30 or older might largely account for the significantly positive associations between *SWB Deviation of First* and the event of a second birth. The average age of first mother in Taiwan has been increasing for more than a decade and has passed 30 years old since 2012. Our results suggest policies that facilitate the transition to parenthood may be helpful in promoting the

Table 5 Coefficients from Cox Proportional Hazard Models to Predict 2nd Birth with Interaction Terms

	Covariates to interact with main regressors:							
	Age ≥ 30 *at First*	≥ *16 Edu. at First*	*Age* ≥ 30 *at First*	≥ *16 Edu. at First*	*Age* ≥ 30 *at First*	≥ 16 *Edu. at First*		
Average SWB × {covariate in column title}	0.118** (0.041)	−0.086 (0.130)						
SWB Deviation of First × {covariate in column title}			0.189† (0.111)	0.099 (0.114)				
First-born Boy × {covariate in column title}					0.121 (0.246)	0.665* (0.279)		
{covariate in column title}	−0.163*** (0.043)	0.667 (0.700)	−0.081** (0.030)	0.195 (0.148)	−0.079* (0.036)	−0.103 (0.200)		
Average SWB × *First-born Boy*							0.026 (0.115)	
SWB Deviation of First × *First-born Boy*								−0.049 (0.109)
Average SWB	0.074 (0.072)	0.158 (0.118)	0.105 (0.073)	0.104 (0.072)	0.103 (0.072)	0.138† (0.073)	0.091 (0.086)	0.103 (0.072)
SWB Deviation of First	0.154* (0.066)	0.146* (0.065)	0.077 (0.071)	0.085 (0.098)	0.148* (0.066)	0.170* (0.068)	0.146* (0.065)	0.172* (0.087)
First-born Boy	−0.027 (0.131)	−0.020 (0.131)	0.007 (0.131)	−0.005 (0.131)	−0.048 (0.155)	−0.423† (0.225)	−0.143 (0.624)	0.007 (0.138)
Log pseudolikelihood	−1032	−1034	−1034	−1034	−1034	−1032	−1035	−1035

Note: Number of subjects = 283. Number of observations = 762. Robust standard errors are in parentheses. All models also control for the same set of other explanatory variables as in Column (10) of Table 3. †, *, **, and *** indicate $p < .10$, $p < .05$, $p < .01$, and $p < .001$, respectively.

Table 6 Coefficients from Conditional Models to Predict 3rd Birth and 4th Birth with Interaction Terms

	Covariates to interact with main regressors:						
	Age ≥ 30 *at First*	≥ *16 Edu. at First*	*Age* ≥ 30 *at First*	≥ *16 Edu. at First*	*Age* ≥ 30 *at First*	≥ *16 Edu. at First*	
Average SWB × {covariate in column title}	−0.428** (0.131)	−1.180* (0.501)					
SWB Deviation of First × {covariate in column title}			0.216 (0.827)	2.089*** (0.558)			
SWB Deviation of Second × {covariate in column title}			0.445 (0.296)	0.386 (0.466)			
First-born Boy × {covariate in column title}					2.040* (0.998)	−16.555** (6.277)	
Second-born Boy × {covariate in column title}					2.765 (1.964)	5.917 (4.331)	
First Two Boys × {covariate in column title}					−1.034 (3.015)	−3.883 (2.485)	
{covariate in column title}	0.451*** (0.112)	5.043† (2.650)	0.156 (0.105)	−2.281*** (0.491)	−0.260 (0.189)	1.216 (0.875)	
Average SWB × *First-born Boy*							4.010*** (1.188)
Average SWB × *Second-born Boy*							−1.375 (1.067)
Average SWB × *First Two Boys*							−4.365* (1.750)

Table 6 Coefficients from Conditional Models to Predict 3rd Birth and 4th Birth with Interaction Terms (continued)

	Covariates to interact with main regressors:							
	Age ≥ 30 *at First*	≥ *16 Edu. at First*	*Age* ≥ 30 *at First*	≥ *16 Edu. at First*	*Age* ≥ 30 *at First*	≥ *16 Edu. at First*		
SWB Deviation of First × *First-born Boy*								−1.416*
								(0.635)
SWB Deviation of Second × *Second-born Boy*								5.371***
								(1.453)
Average SWB	0.337	0.923**	0.613†	0.471	1.300**	0.011	2.071***	0.868*
	(0.315)	(0.352)	(0.365)	(0.368)	(0.478)	(0.773)	(0.616)	(0.418)
SWB Deviation of First	−0.064	0.363	0.302	−0.359	0.739†	−0.319	1.418***	1.601*
	(0.241)	(0.267)	(0.273)	(0.233)	(0.423)	(0.281)	(0.322)	(0.708)
SWB Deviation of Second	0.037	0.581	0.141	0.701	0.316	−0.092	1.124**	−0.179
	(0.337)	(0.373)	(0.368)	(0.442)	(0.316)	(0.566)	(0.423)	(0.461)
First-born Boy	−0.341	−0.210	0.058	0.646	0.141	4.890*	−24.522***	−0.658
	(0.399)	(0.420)	(0.556)	(0.449)	(0.570)	(1.981)	(7.123)	(0.528)
Second-born Boy	0.718	0.501	−0.026	1.620†	−1.822	−0.944	6.162	−1.696*
	(0.803)	(0.747)	(1.140)	(0.883)	(1.530)	(2.381)	(5.174)	(0.792)
First Two Boys	−0.267	0.510	0.255	−0.080	0.662	7.493*	27.870**	2.855**
	(0.611)	(0.620)	(1.044)	(0.558)	(1.977)	(3.822)	(9.710)	(1.023)
Log pseudolikelihood	−68.94	−68.90	−69.60	−67.30	−68.39	−60.43	−66.41	−67.23

Note: Number of subjects = 199. Number of observations = 537. Robust standard errors are in parentheses. All models also control for the same set of other explanatory variables as in Column (10) of Table 4. †, *, **, and *** indicate $p < .10$, $p < .05$, $p < .01$, and $p < .001$, respectively.

fertility rate if they prompt older first-time parents to be more willing to have a second child.

We next note that the estimated coefficient on *First-born Boy* × *Age* ≥ *30 at First* is not statistically significant, implying how age at first birth relating to the hazard of a second birth does not differ significantly by gender of the first child. Gender of the first child, however, does differ in its association with the likelihood of observing a second birth by parents' education level. Specifically, parents with a first-born boy are 27.38% (calculated from exp(0.665 + (−0.423)) − 1) more likely to have a second child if the parent completed more than 16 years of education at first birth, while parents of a boy are 34.49% (calculated from 1 − exp(−0.423)) less likely to become parents of two children if they are less educated. This implies that if there is any remnant of son preference for one-child families in our analytical sample, then it is more prevalent among less educated parents.

The interaction terms of the main explanatory variables in Table 6 are grouped as how the main explanatory variables are presented in Table 4. The first two columns of Table 6 show that the marginally positive relationship between *Average SWB* and the likelihood of a third or a fourth birth in column (10) of Table 4 is offset by parents who are older than 30, but is marginally enlarged when the parents have more than 16 years of education. The fourth column of Table 6 suggests that the reduced probability of having three or four children for better educated parents weakens if parents are happier in the year when their first child is reported.

Turning to gender of children, the fifth column of Table 6 implies only gender of the first child associates with the hazard of a third or a fourth child differently when comparing older versus younger first-time parents. The sixth column of Table 6 shows that more educated two-child parents of a first boy and a second girl are less likely to have a third or a fourth child (significant coefficients = −16.555 + 4.890 = −11.665) than their less educated counterparts, while this lowered probability weakens when the parents have two boys (significant coefficients = −16.555 + 4.890 + 7.493 = −4.172). On the other hand, for less educated two-child parents, having two boys makes it more likely for them to have a third or a fourth child (significant coefficients

= 4.890 + 7.493 = 12.383) than their better educated counterparts. This increased probability weakens for parents of a first boy and a second girl (significant coefficients = 4.890). The findings imply that two-child families in our analytical sample tend to prefer mixed genders of children.

We lastly examine whether and how subjective well-being variables associate with gender of children variables in predicting future births. The last two columns of Table 5 show no significant findings for one-child families in predicting the second birth, but that is not the case for Table 6. The column before the last in Table 6 includes interaction terms of *Average SWB* with all three gender of children variables. The results show that two-child families with a first boy and a second girl are less likely to have more children, while those with two boys are more likely to have more children. Both of the predicted changes in probability fall with *Average SWB*. This again suggests that two-child families may prefer mixed genders of children, but not as much so if they are happier on average before having the first child.

In the last column of Table 6 we consider how self-reported happiness level in the year of a child birth interacts with the gender of that child in predicting a third or fourth child. The results show that a one-unit higher subjective well-being level at first birth, compared to the average subjective well-being level before first birth, increases the probability of a third or fourth birth, and this is more likely so for a first-born girl than for a first-born boy. On the contrary, though a one-unit higher subjective well-being level at second birth, versus the average subjective well-being level before first birth, also raises the probability of a third or fourth birth, it is only significant for a second-born boy.

5. Concluding Remarks

Concerning population decline and aging in Taiwan, which has a low fertility rate, this research examines the factors behind reproductive behaviors of parity two and beyond. In particular, we focus on the influences of parents' subjective well-being and gender of the children in predicting second and more births.

Our empirical results suggest the following. First, factors that predict the second birth are not the same as those predicting the third and fourth births, meaning that the event of a second birth should be estimated separately from the event of parity three and four. Second, a deviation of parental subjective well-being at first birth from average happiness level before first birth relates positively with the likelihood of a second birth, whereas the average happiness level before first birth marginally influences the likelihood of a third or a fourth birth. These findings differ between older versus younger parents as well as more educated versus less educated ones. Third, gender of children does not significantly predict future births by itself, but it relates to possible future births in different subgroups. The results imply a possible remnant of preference for a son in our one-child analytical sample for less educated parents and a preference for mixed genders of children in our two-child analytical sample.

Our empirical findings support the progressive maternity benefit by parity adopted in some cities and counties in Taiwan. They also suggest that policies to facilitate the transition to parenthood may help promote the fertility rate if they spur older first-time parents to be more willing to have a second child. As to continue the promotion of gender equality for children, more efforts should be directed at parents with less than a four-year college or university education.

There are some caveats in interpreting our findings. One is that our analytical sample is relatively small due to data limitation, and we also only have married couples. They constitute a selective sample of overall Taiwan society. Another caveat is that our parental subjective well-being is not accurately defined, because the survey was conducted every year, or even every other year after 2012, and so cannot correlate to within-year variations as cautioned by Margolis and Myrskylä (2015). Therefore, our subjective well-being related variables should be interpreted as the overall happiness level in the year reported along with the birth of a child, instead of the happiness level regarding the birth of a child itself. Possible measurement errors in the subjective well-being variables most likely result in coefficients that bias towards zero. Lastly, given the unbalanced panel data structure and limited sample size that we have, we only make use of the different timings of universal maternity benefits across cities and counties. However, the policy in fact also varies in eligibility and quality (e.g., the amount granted) by parity and by city/county. As a result, our coefficients regarding universal maternity benefits, though not statistically significant, are likely to be underestimated.

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台灣父母主觀福祉、子女性別偏好與生育胎次遞進

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摘 要

有鑑於臺灣低生育率的現狀，本研究探討生育胎次的遞進，特別著重於了解父母生育子女時的主觀福祉及子女的性別，如何影響第二胎以上的生育決策。我們使用家庭動態調查 (PSFD) 資料，以存活分析中的 Cox 比例風險模型 (Cox proportional hazard model) 與條件模型 (conditional model)，分別估計第二胎與第三或四胎子女的出生。我們的實證結果發現，首胎子女出生時父母的相對快樂程度，與第二胎子女的出生，有正向關聯；對於二孩家庭而言，則是父母在首胎子女出生前的平均快樂程度，與第三或第四胎子女的出生呈現正相關。這些關聯亦在不同父母年齡與教育程度間，存在差異。這樣的研究結果顯示，影響第二胎子女出生的因素，與影響第三或第四胎子女出生的因素，不盡相同。我們建議探討第二胎子女的出生，應與第三或第四胎子女的出生，分開估計。

關鍵詞：胎次遞進、父母主觀福祉、性別偏好、生育
JEL分類代號：J13, J18, J19

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