Birth Spacing and Women's Labor Supply: An Empirical Analysis*

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Abstract

This study investigates the relationship between birth spacing and women's labor supply. With the increase in marriage age, women have less time to become pregnant. With longer birth spacing, the number of births becomes fewer. This study uses multiyear cross-sectional data and 3-stage regressions to examine the effects between birth spacing and women's labor supply. The empirical results reveal that longer birth spacing has a nonnegative impact on the labor supply, and labor market participation positively corresponds with birth spacing. We recommend that fertility policies consider the labor supply effects of birth spacing to encourage women to shorten their birth spacing through an incentive design.

Key words

Fertility rate, birth spacing, labor supply, logit model, survival rate

Introduction

Raising the fertility rate requires effective policies. Numerous governments have implemented various public policies to encourage childbearing-age women to give birth or to have more children. However, most such policies lack incentives. The governments must address the occurrence of late marriages.[1] With late marriages, the time for women to give birth is limited. If a delayed marriage is coupled with longer

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[1] In the United States, in 2013 the average age for a married woman to give birth to her first child was 27 years, which is 4 years older than the age of married women who had their first child 20 years earlier. The average marriage age in Taiwan was 29.8 years.

birth spacing, the fertility rate worsens substantially. Therefore, fertility policies must contain an incentive to shorten this spacing to increase the opportunities for women to become pregnant.

In 2010, Taiwan had the lowest global fertility rate (i.e., 0.97) and the birth spacing between marriage age and the birth of the first child was approximately 18.82 months. The spacing between the birth of the first and second child was approximately 31.96 months. Moreover, the spacing between the second and third child was approximately 41.04 months. Compared with the 1990 observation, the spacing between giving birth to the first and third children was 16 months longer. The prolonged birth spacing is correlated with the women's participation in the labor market (Fig. 1). Figure 1 displays the average birth spacing, the average marriage age, and the labor force participation of childbearing-age women from 1983 to 2010 in Taiwan. The figure shows that longer birth spacing corresponds to greater labor market participation by childbearing-age women, whereas shorter birth spacing corresponds to less participation. Some studies have reported a negative correlation between birth spacing and the labor supply because of the substitutive effects of childbirth on women's labor supply, which predominates the income effect (e.g., Becker, 1960; Bowen & Finegan, 1969; Kasarda, 1971; Becker & Lewis, 1973). When an employed woman becomes pregnant, the opportunity costs of giving birth exceed those incurred by unemployed women in similar circumstances (Mincer, 1963). Becker (1981) noted that rising participation in the labor force by women has led to a substantial decline in fertility rates because women have less time available for childcare, and their wages become childcare opportunity costs. Some studies have found that the number of children women bear and the age of their children exert a substantial effect on the female labor supply (Cain, 1966; Heckman, 1974; Schultz, 1978). Chun and Oh (2002) indicated that having children reduced labor force participation by married women in South Korea by 27.5%.

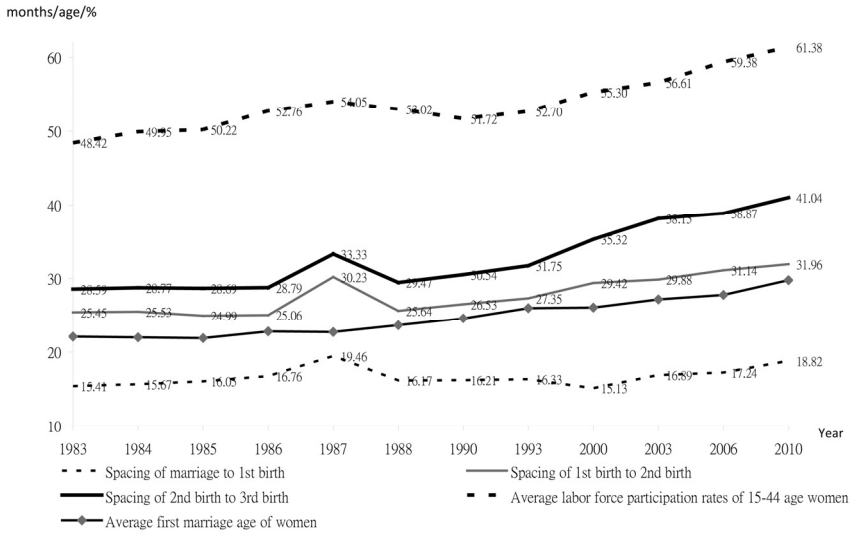

Figure1. *Married women's birth spacing, marriage age, and labor force participation rate in Taiwan*

However, most related studies have ignored the heterogeneous effects of fertility. These heterogeneous effects are generated by variations in birth spacing. If the heterogeneous effects are disregarded, the influence of subsequent childbirth on women who do not want more children could be underestimated or overestimated. Hotz and Miller (1988) found that parents adjust the spacing between births according to the time intensiveness of child rearing. This time intensiveness tends to decrease as the children mature. Some studies have indicated that birth spacing is associated with the mother's age; in other words, women who give birth at a younger age tend to prefer shorter birth spacing than those who give birth at a more advanced age (e.g., Bumpass, Rindfuss, & Janosik, 1978; Coombs & Freedman, 1970; Finnas & Hoem, 1980; Trussell & Menken, 1978).

Merrigan and St. Pierre (1998) considered birth spacing in their empirical analysis, and found that the opportunity costs of giving birth extended birth spacing, consequently reducing fertility rates. Miller and Xiao (1999) analyzed the effects of birth spacing on the labor supply of married women and single mothers. Their empirical results revealed that the number of children had a negative effect on women's labor

supply. Moreover, they found that longer birth spacing exerted a substantial effect on women's labor supply because they invested considerable time in child rearing. If long birth spacing exerts a substantial effect on women's labor supply, women of childbearing age in the labor market tend to reduce their birth spacing, thereby mitigating the problems generated when progressively declining fertility rates have an inverse correlation with birth spacing. However, this result is inconsistent with the phenomenon displayed in Figure 1, which shows that longer birth spacing corresponds to higher labor force participation.

Therefore, for this study, we attempted to identify a nonnegative relationship of birth spacing and women's labor supply and developed an incentivized fertility policy. If a nonnegative relationship exists between the labor supply and birth spacing, women with shorter birth spacing sustain higher reproductive costs. The fertility policy should consider this spacing and offer varying amounts of maternity allowances in accordance with the spacing. Women with shorter birth spacing should be allocated higher maternity allowances, whereas those with longer birth spacing should be offered less. Hence, the maternity allowance incentivizes accelerating the birth rate. Many current maternity allowances are based on the birth number, and do not consider birth spacing. Women have not been encouraged to shorten these intervals through incentives, and it is currently difficult to increase the fertility rate.

For our empirical analysis, we adopted multiyear cross-sectional data from the Taiwan Women's Marriage, Fertility, and Employment (WMFE) survey. Considering the endogenous effect of childbirth on the labor supply, our empirical strategy comprised three stages: (1) Estimating the intention of women to participate in the labor force; (2) estimating women's labor supply decisions by considering endogenous birth spacing; and (3) employing the duration model to investigate the labor supply effects on birth spacing. The empirical findings revealed that high participation in the labor market might lengthen birth spacing, and longer spacing corresponds to a higher labor supply. These results complemented the related literature regarding the heterogeneity effects of fertility on women's labor supply.

The remainder of this study is organized as follows: Section 2 introduces the theoretical background; Section 3 presents the empirical strategy and data; Section 4 provides a discussion of the estimation results; and finally,

Section 5 offers a conclusion and policy recommendations.

Table 1.
Sample Statistics Description- Married Sample

	Mean	S. d.	Min.	Max.
Wives'				
Age	33.7601	6.6514	15	45
Education	9.0369	3.8573	0	23
Employment	0.5077	0.4999	0	1
Wages(weekly)	2321.52	7942.51	0	26,000
Work hours(weekly)	23.0121	23.8322	0	120
Marriage age	22.4532	3.5050	15	45
Children Number	2.3471	1.2656	0	10
Full-time employees	0.4056	0.4910	0	1
Employer	0.0091	0.0950	0	1
Self-Employed	0.0472	0.2120	0	1
Part-time employees	0.0443	0.2058	0	1
Ideal Children Number	3.5143	1.6278	0	16
Work Months Before Marriage	42.4828	29.4869	0	304
Husbands'				
Age	36.4186	11.0043	15	86
Education	9.6873	4.1360	0	23
Wages(weekly)	5,652.60	11,991.95	0	899,999
Work hours(weekly)	42.9014	17.8499	0	120
Age difference with wife	2.6585	9.0068	-15	49
Full-time employees	0.5824	0.4984	0	1
Employer	0.0755	0.2642	0	1
Self-Employed	0.2273	0.4191	0	1
Part-time employees	0.0366	0.1876	0	1
Year	1991.6060	8.2518	1983	2010

Observations=119,402.

Economic perspective

The relationship between birth spacing and women's labor supply can be inferred through the female labor supply and the principle of equal marginal utility. Regarding the female labor supply, if the income effect dominates the substitution effect, female workers increase their leisure hours in response to any wage increases. Conversely, if the substitution effect dominates the income effect, female workers reduce their leisure

hours in response to increased wages. Based on the highly positive correlation of wages and participation in the labor market, a backward-bending phenomenon has not been found in women's labor supply in any country. Thus, we can infer that women are motivated to increase their labor market participation as their wages increase.

Table 2.
Birth Spacing and Employment Status

	Child number	Full Sample	Full-time employees	Part-time employees	Employers	Self-employed	Non-employed
1983~2010	=1						
	Spacing 1	22.35	25.07	22.87	23.66	22.35	21.73
	=2						
	Spacing 1	18.01	18.26	18.00	17.82	17.54	17.77
	Spacing 2	36.19	37.66	35.70	40.87	38.00	35.79
	=3						
	Spacing 1	15.42	15.54	15.27	15.42	15.13	15.33
	Spacing 2	29.91	30.06	29.92	30.45	30.37	29.88
	Spacing 3	37.07	37.90	35.98	41.37	36.59	36.27
The 1980s	=1						
	Spacing 1	21.40	23.57	20.30	16.43	21.04	20.30
	=2						
	Spacing 1	16.86	16.98	17.24	17.33	16.57	16.77
	Spacing 2	35.42	35.67	34.71	36.80	35.38	34.30
	=3						
	Spacing 1	15.10	15.22	15.17	14.87	14.83	15.05
	Spacing 2	29.55	29.47	29.78	29.77	29.94	29.53
	Spacing 3	35.36	35.15	34.65	38.72	35.01	34.59
The 1990s	=1						
	Spacing 1	23.30	25.06	23.21	24.43	25.11	22.34
	=2						
	Spacing 1	17.77	17.58	18.58	15.19	17.96	17.94
	Spacing 2	38.53	38.36	40.98	45.31	39.38	38.23
	=3						
	Spacing 1	15.40	15.56	14.77	14.26	15.06	15.56
	Spacing 2	30.28	29.97	30.24	31.38	30.40	30.52
	Spacing 3	39.86	39.16	37.37	39.39	36.60	37.61
The 2000s	=1						
	Spacing 1	26.65	30.53	26.73	32.72	23.28	25.64
	=2						
	Spacing 1	20.57	21.68	19.62	20.84	19.08	20.14
	Spacing 2	39.05	39.88	38.38	43.31	41.95	39.88
	=3						

Child number	Full Sample	Full-time employees	Part-time employees	Employers	Self-employed	Non-employed
Spacing 1	17.55	17.82	17.23	17.98	17.23	17.29
Spacing 2	31.73	32.75	31.44	31.43	33.26	31.76
Spacing 3	45.14	47.88	44.76	50.30	47.17	44.18

Unit: Months.
'Spacing 1' represents the spacing from marriage to the first birth.
'Spacing 2' represents the spacing from the first birth to the second birth.
'Spacing 3' represents the spacing from the second birth to the third birth.

Regarding the principle of equal marginal utility, the marginal product of labor (MPL) is equal to the marginal production at home (MPH) when personal utility is maximized. Thus, MPL = MPH when women must choose between participation in the labor market and investing time in family care. As wages increase (i.e., MPL > MPH), more time is allocated to the labor market. The time devoted to household work (denoted as H) declines because a decrease in H causes an increase in MPH until equilibrium is achieved (i.e., MPL = MPH). When wages are lower (i.e., MPL < MPH), more time is allocated to the household. The time devoted to the labor market (denoted as L) declines because a decrease in L causes an increase in MPL, until equilibrium is achieved. Consequently, women become motivated to reduce their leisure time as wages increase.

Accordingly, married women who are employed must choose between labor market participation and childbirth spacing. If a woman were to delay giving birth, this might indicate a strong commitment to the labor market and high wages. Based on the principle of equal marginal utility, to maintain maximum utility, the time committed to the labor market cannot decrease substantially. Thus, the effect of childbirth on the labor supply is limited. If a woman were to give birth with shorter spacing, this would imply that her commitment to the labor market is relatively limited, and her wages might be low. A substantial portion of time committed to the labor market is reallocated from leisure time to maximize utility. This result implies that when women's participation in the labor market increases, modifying their original lifestyle becomes increasingly difficult. Moreover, because of the high opportunity costs, which subsequently reduce the demand for childbearing, parents regard their children as both a luxury and public goods, and childcare is shifted toward the use of social resources (e.g., daycare centers and nurseries). By con-

trast, with a declining participation by women in the labor market, childbearing behavior can easily cause changes to their original lifestyle. In these circumstances, because of the low opportunity costs, raising the demand for childbearing tends to influence parents to care for their children. In this case, they may regard their children as normal goods.

Table 3.
Multinomial-logit Regression Results [a]

Variables	Full Time	Employer	Self-Employed	Part Time
Age	−0.0892***	−0.3175***	−0.1668***	−0.2235***
	(0.0046)	(0.0124)	(0.0059)	(0.0082)
Age2	0.0020***	0.0060***	0.0034***	0.0037***
	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Education	0.0740***	0.0656***	−0.0321***	0.0281***
	(0.0043)	(0.0119)	(0.0062)	(0.0076)
Number of Children	−0.0980***	−0.0046	0.0764***	0.1362***
	(0.0084)	(0.0313)	(0.0150)	(0.0160)
Husband's:				
Age	−0.0028**	−0.0813***	−0.0093	0.0500***
	(0.0030)	(0.0108)	(0.0053)	(0.0066)
Age2	−0.0001	0.0006**	−0.0001***	−0.0008***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Education	−0.0013	0.0927***	−0.0074**	−0.0286***
	(0.0026)	(0.0121)	(0.0050)	(0.0061)
Wage	−0.0228***	−0.0507***	−0.0201	0.0158
	(0.0055)	(0.0143)	(0.0080)	(0.0093)
Work hour	0.1462***	0.1113***	0.0260***	−0.0009
	(0.0086)	(0.0308)	(0.0153)	(0.0144)
Employer	−0.3512	0.4024***	−0.9260***	−0.4505
	(0.0358)	(0.1270)	(0.0777)	(0.0668)
Self-employed	−0.3642***	−1.8115***	1.3312***	0.3099***
	(0.0431)	(0.1689)	(0.0864)	(0.0918)
Full-time employees	−0.1318***	−0.4202***	−0.3655***	0.5827***
in private sector	(0.0429)	(0.0888)	(0.0421)	(0.0461)
Full-time employees	−0.1896***	−0.3128***	0.0895***	−0.3104
in public sector	(0.0432)	(0.1233)	(0.0652)	(0.0579)
Part-time employees	0.5967***	0.3415*	0.0008	−1.4839***
	(0.0480)	(0.2040)	(0.0868)	(0.0714)
Year dummy	P	P	P	P
County dummy	P	P	P	P

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Empirical strategies and data

Empirical strategies

In this study, we estimated the relationship between labor supply and birth spacing by estimating the following three variables: (1) employment choices; (2) labor supply decisions; and (3) decisions pertaining to birth spacing. We assumed that the labor supply and birth spacing are mutually and concurrently determined for an married female worker.

(1) Employment choice: Correcting women's self-selection bias

Women's employment choices affect their labor supply (working hours) and birth spacing, and hence, self-selection biases exist in women's choice of employment. To correct these biases, we adopted a multinomial logit model to identify the employment choices of the workers we surveyed. We define f_{it} as the determining variable for employment status. An individual selects an employment status if $f_{it}^{j} > f_{it}^{q}$ $(q \neq j,)$, where f_{it}^{j} is endogenous and unobservable (j = 0 indicates unemployed women; 1 represents full-time employees; 2 represents the employers; 3 represents self-employed workers; and 4 represents part-time employees). We estimated $\widehat{f_{it}^{j}}$ by examining the observable characteristic variable Z_{it}, which includes all of the individual characteristics related to employment selection (including age, education, number of children, husband's age, education, wage, working hours, and employment status; Table 3):

$$f_{it}^{j} = Z_{it}^{j}\beta_{j} + \mu_{it}^{j}, \text{ and } j = 0, 1, 2, 3, 4. \quad (1)$$

By solving Eq. (1), we obtained the probabilities of securing each employment status. Next, the inverse Mill's ratios $\gamma = \frac{\varphi}{\Phi}$ can be estimated, in which φ is the standard normal density function and Φ is a cumulative bivariate normal probability of the probabilities in each employment status.[2]

(2) Labor supply regressions

After applying the multinomial logit model, we input $\widehat{\gamma_{it}^{j}}$ into the labor

[2] We estimate the multi-logit model by using the command "mlogit" in STATA.

supply equation based on our employment observations, and then divided it by four employment statuses: full-time employees ($j = 1$), employers ($j = 2$), self-employed workers ($j = 3$), and part-time employees ($j = 4$). The involvement of the labor market is displayed in wages as inferred in Section 2, and we thus used the wages to indicate the degree of the labor supply.

Considering the existence of the endogenous problem between birth spacing and the labor supply, we adopted the instrumental variable (IV) method to specify the linear labor supply regression equation:

$$Labor\ supply = \alpha_0 + \alpha_1 X_i + \alpha_2 Space_i + 1_{j=1(}\beta_1\widehat{\gamma_{it}^1} + v_i^1) + 1_{j=2(}\beta_1\widehat{\gamma_{it}^2} + v_i^2) + 1_{j=3(}\beta_1\widehat{\gamma_{it}^3} + v_i^3) + 1_{j=4(}\beta_1\widehat{\gamma_{it}^4} + v_i^4) + \varepsilon_i. \quad (2)$$

where X_i includes the IV, age, education, working hours, husband's age, education, wage work hours, employment status, and the estimated inverse Mill's ratios $\hat{\gamma}$ (Table 4). We chose an IV for birth spacing ($Space_i$) and examined the fitness of the IV. The IV must be highly correlated with birth spacing and uncorrelated with the labor supply, to avoid the endogenous problem of birth spacing and the labor supply. We adopted a variable to construct the birth spacing IV: the inverse value of "ideal number of children."[3] We assumed that women reaching their ideal number of children would result in a shortening of their birth spacing. We expected a positive relationship between birth spacing and the IV, which had no direct relation with labor supply. The correlation between IV and the first birth spacing is 0.5900, the second birth spacing is 0.7101, and the third birth spacing is 0.8610. The inverse value had a high correlation with birth spacing, and could provide a strong explanatory power for birth spacing. We conducted the Dubin-Wu- Hausman (DWH) test on the orthogonality of the IV with the labor supply. The results were nearly significant (Table 4 to Table 5-4), except for the DWH test on employer samples.[4] This revealed non-endogeneity between the IV and women's labor supply; therefore the IV was found be effective.

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[3] To avoid missing the value of the inversed value as the "ideal number of children" is zero, we added 1 to the "ideal number of children."

[4] This may result from insufficient observations of female employers. To secure consistent estimations for all employment identities, we still use the IV to estimate employer observations.

Table 4.

The Labor Supply Results- Full Sample [a]

	The 1st Birth	The 2nd Birth	The 3rd Birth
constant	0.9990 (2.5237)	−4.8772*** (1.2153)	−2.7651** (1.2802)
Age	0.3065* (0.1570)	0.4691*** (0.1166)	0.2875*** (0.0833)
Age2	−0.0013 (0.0030)	−0.0063*** (0.0014)	−0.0039*** (0.0011)
Education	0.0183 (0.0342)	0.0213 (0.0144)	0.0244 (0.0179)
Work hours	−0.7137 (0.7160)	0.6761*** (0.1268)	0.9055*** (0.1228)
Birth Spacing(IV)	0.3316 (0.2152)	0.0950** (0.0438)	0.0796** (0.0255)
Husband's:			
Age	0.0463 (0.0646)	−0.0755*** (0.0123)	−0.0838*** (0.0149)
Age2	−0.0011 (0.0012)	0.0011*** (0.0002)	0.0013*** (0.0002)
Education	−0.0292 (0.0532)	0.0518*** (0.0132)	0.0264* (0.0148)
Wage	0.4652*** (0.0211)	0.4253*** (0.0064)	0.3660*** (0.0072)
Work hour	0.0254 (0.1378)	−0.1007** (0.0415)	−0.1702*** (0.0428)
Employer	−1.1274** (0.4877)	−0.6974*** (0.1844)	−0.4732** (0.1974)
Self-employed	−0.9532** (0.4671)	−1.0434*** (0.1546)	−0.9818*** (0.1666)
Full-time employee in private sector	−0.6383 (0.4047)	−0.3525** (0.1483)	0.2522 (0.1623)
Full-time employee in public sector	−0.2172 (0.4307)	−0.0216 (0.1587)	0.3178* (0.1796)
Part-time employee	0.3315 (0.5277)	0.2327 (0.1551)	0.0309 (0.1552)
$\widehat{\gamma_{it}^{J}}$ (J=1)	0.1612*** (0.4815)	1.0293*** (0.3938)	0.6835** (0.3224)
$\widehat{\gamma_{it}^{J}}$ (J=2)	0.0204 (0.5247)	−0.2213 (0.1383)	0.4346*** (0.1440)
$\widehat{\gamma_{it}^{J}}$ (J=3)	−0.2980 (0.6257)	−0.2863* (0.1723)	0.6306*** (0.1657)
$\widehat{\gamma_{it}^{J}}$ (J=4)	−0.1492 (0.5100)	−0.4864*** (0.1719)	0.3924** (0.1715)
CPI	−4.1922*** (0.5667)	−4.0565*** (0.3593)	−4.7455*** (1.0290)
Growth rate	0.283 (0.0389)	−0.0201 (0.0137)	−0.0336*** (0.0125)
DWH test (x^2)	139.77***	499.28***	370.16***
Observations	9,121	20,176	16,651

[a] Standard errors are in parentheses. *** represents significance at the 1% level. ** represents significance at the 5% level. * represents significance at the 10% level.

Table 5.
The Labor Supply Results by Periods and Spacing Length- Full Sample [a]

	The 1st Birth	The 2nd Birth	The 3rd Birth
The 1980s			
Birth Spacing	−0.2943 (0.4958)	0.0359 (0.0462)	0.0391 (0.0382)
Observations	4,644	9,375	10,581
DWH test	289.00***	373.51***	323.23***
The 1990s			
Birth Spacing	0.1262 (0.0951)	0.1528** (0.0703)	0.1258 (0.0968)
Observations	1,663	4,364	3,159
DWH test	123.62***	292.52***	235.59***
The 2000s			
Birth Spacing	0.0633** (0.0261)	0.0293* (0.0169)	0.0266*** (0.0047)
Observations	2,814	6,437	2,911
DWH test	323.07***	120.36***	366.47***
Short Spacing			
Birth Spacing	−1.2601 (4.0216)	−0.6281 (8.0550)	0.3752 (0.2478)
Observations	6,241	4,771	3,391
DWH test	115.75***	76.15***	113.29***
Long Spacing			
Birth Spacing	0.0670 (1.4933)	0.1044** (0.0522)	0.1654*** (0.0230)
Observations	2,880	15,405	13,260
DWH test	49.10***	363.23***	121.07***

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level. * represents significance at the 10% level.

Table 5-1.
The Labor Supply Results by Periods and Spacing Length - Full-time Employees

	The 1st Birth	The 2nd Birth	The 3rd Birth
The 1980s			
Birth Spacing	−0.0083 (0.1660)	0.0479 (0.0574)	0.0504 (0.0507)
Observations	3,956	7,355	7,918
DWH test	247.33***	303.48***	242.24***
The 1990s			
Birth Spacing	−0.1652 (0.1549)	0.1408* (0.0804)	0.1627 (0.1599)
Observations	1,458	3,602	2,492
DWH test	98.17***	271.32***	154.43***
The 2000s			
Birth Spacing	0.1400* (0.0237)	0.2254* (0.2070)	0.1318*** (0.0053)
Observations	2,537	5,517	2,348
DWH test	391.67***	188.72***	332.29***
Short Spacing			
Birth Spacing	−1.3949 (1.5332)	−0.2047 (1.1438)	−0.1337 (0.3305)
Observations	5,430	3,884	2,614
DWH test	265.77***	109.33***	117.03***
Long Spacing			
Birth Spacing	1.2338 (4.0489)	0.4137* (0.0666)	0.3670** (0.0284)
Observations	2,521	12,590	10,144
DWH test	12.79	301.57***	234.12***

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 5-2.
The Labor Supply Results by Periods and Spacing Length - Employers

	The 1st Birth	The 2nd Birth	The 3rd Birth
The 1980s			
Birth Spacing	−0.5574 (1.9073)	−0.0057 (0.1335)	−0.0462 (0.0726)
Observations	69	203	176
DWH test	18.29	131.78***	138.56***
The 1990s			
Birth Spacing	0.0958 (0.1074)	2.9282 (77.4897)	−0.2236 (0.3285)
Observations	23	114	67
DWH test	21.97*	0.60	10.89
The 2000s			
Birth Spacing	0.2806 (0.2060)	−0.0690 (0.1133)	1.0633 (15.4147)
Observations	53	132	79
DWH test	8.90	8.98	3.60
Short Spacing			
Birth Spacing	0.1931 (0.3976)	−1.3916 (1.5467)	−0.5970 (0.9015)
Observations	97	83	56
DWH test	42.89***	8.29	22.17*
Long Spacing			
Birth Spacing	2.6705 (2.7799)	2.3727 (5.9559)	1.1876 (0.7696)
Observations	48	366	266
DWH test	0.15	13.00	51.84***

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 5-3.
The Labor Supply Results by Periods and Spacing Length - Self-employed

	The 1st Birth	The 2nd Birth	The 3rd Birth
The 1980s			
Birth Spacing	0.1938 (0.1793)	0.1013 (0.3683)	0.3387 (0.8502)
Observations	262	863	1,308
DWH test	70.66***	303.91***	130.16
The 1990s			
Birth Spacing	0.0958 (0.1534)	−0.1290 (0.1365)	0.1022 (0.1472)
Observations	83	335	346
DWH test	9.68	33.12***	43.60***
The 2000s			
Birth Spacing	1.0115** (0.5810)	0.0715 (0.0761)	0.1113 (0.2570)
Observations	125	454	307
DWH test	100.00***	34.33***	26.89*
Short Spacing			
Birth Spacing	−0.1673** (0.0838)	−2.2407 (4.9173)	0.4631 (0.4794)
Observations	332	387	374
DWH test	161.16***	24.30*	100.38***
Long Spacing			
Birth Spacing	2.0770 (0.0928)	2.2417 (0.1441)	0.0999 (0.1468)
Observations	138	1,265	1,587
DWH test	42.50***	140.91***	257.61***

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 5-4.
The Labor Supply Results by Periods and Spacing Length - Part-time Employees

	The 1st Birth	The 2nd Birth	The 3rd Birth
The 1980s			
Birth Spacing	−0.4687 (1.4903)	0.0034 (0.0638)	−0.0085 (0.0504)
Observations	357	954	1,179
DWH test	113.10***	277.78***	293.81***
The 1990s			
Birth Spacing	−0.4714 (0.4230)	0.2476 (0.1734)	0.0266 (0.0618)
Observations	99	313	254
DWH test	59.88***	22.78*	46.86***
The 2000s			
Birth Spacing	0.2635 (2.1814)	0.3043 (0.3108)	−0.0330 (0.8894)
Observations	99	334	177
DWH test	34.17***	88.30***	127.57***
Short Spacing			
Birth Spacing	−0.5003 (0.5454)	−0.1257 (0.4055)	0.0776 (0.3544)
Observations	382	417	347
DWH test	54.08***	163.85***	80.17***
Long Spacing			
Birth Spacing	0.1134 (0.4044)	0.2561*** (0.0150)	0.4131*** (0.0072)
Observations	173	1,184	1,263
DWH test	22.45*	82.80***	296.64***

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

(3) Duration model for birth-spacing

At this stage, we adopted a duration model to examine the effects of labor market participation on birth spacing. The survival function is critical for duration analysis. We used the predicted value of labor supply from Eq. (2). The predicted labor supply is controlled for the endoge-

nous effects on birth spacing, and thus the regression coefficient represents the pure exogenous effects of labor supply on birth spacing.

We denote $T \geq 0$ as the birth space duration, with t being a particular value of T. Because we collected the Taiwanese birth data by employing a stock sampling method, and because the majority of observed birth spaces were right-censored, the censored T was specified as T = min(t*, c) where t* represents the length of actual birth spacing, and c is the length of the observed censored birth-spacing duration. The cumulative distribution function (cdf) of T is $F(t) = \Pr(T \leq t)$, $t \geq 0$.

Let $F(t)$ be continuous and differentiable. The probability of surviving past time t is the survival function, which is defined as

$$S(t) = \Pr(T > t) = 1 - F(t), \tag{3}$$

where the density of T is denoted by. $f(t) = (df / dt)\, t$. For $\Delta t > 0$, $P(t \leq T < t+\Delta t \mid T \geq t)$ is the probability of leaving the initial state in the interval [t, t + Δt] based on survival until time t. The hazard function of T is defined as

$$\lambda(t) = \lim_{h \to 0^+} \Pr(t \leq T < t + \Delta t | T \geq t) / \Delta t = f(t)/S(t) \tag{4}$$

The hazard function can be applied to estimate a conditional probability. The derivative of $S(t)$ is $-f(t)$, and thus, $\lambda(t) = - d \log S(t) / dt$. The estimated hazard for log-normal distribution can be evaluated as follows:

$$\lambda = \frac{f(\ln(T) - \bar{x}\hat{\beta})/\sigma}{(1 - F(\ln(T) - \bar{x}\hat{\beta})/\sigma)\sigma T} .$$

By using $F(0) = 0$, $F(t)$ can be integrated as $F(t) = 1 - \exp[-\int_0^t \lambda(s)ds], t \geq 0$, and $f(t) = \lambda(t)\exp[-\int_0^t \lambda(s)ds]$. All of the probabilities can be computed using a hazard function. We denote d_i as an indicator variable for right-censoring ($d_i = 0$, which is $c \leq t^*$) and uncensored ($d_i = 1$, which is $c = t^*$). The likelihood of the i^{th} observation is $f(t_i|x_i,\beta)^{d_i}[1 - F(t_i|x_i,\beta)]^{1-d_i}$, and the likelihood function for all instances of i is

$$L(\beta) = \prod_{i=1}^{n} \{f(t_i|x_i,\beta)^{d_i}[1 - F(t_i|x_i,\beta)]^{1-d_i}\}. \tag{5}$$

We estimated the effects by employing maximum-log-likelihood estimation with a log- likelihood function

$$\ln L(\beta) = \sum_{i=1}^{n} \{ d_i \ln f(t_i | x_i, \beta) + (1 - d_i) \ln [1 - F(t_i | x_i, \beta)] \}, \quad (6)$$

where x_i includes the marriage age, previous spacing length, ideal number of children, months worked before marriage, the age difference, and the prediction values of the labor supply (Table 6), which are estimated using Eq. (2). The positive effects of the labor supply on birth spacing increase the survival rate, which is the probability of retaining the employment status.[5]

Table 6.
Survival Rate - Full Sample

	The 1st Spacing	The 2nd Spacing	The 3rd Spacing
Constant	2.2479*** (0.0430)	3.6994*** (0.0271)	3.8870*** (0.0324)
Labor Supply (predicted)	0.0882*** (0.0018)	0.1122*** (0.0034)	0.1275*** (0.0025)
Marriage Age	0.0294*** (0.0019)	−0.0006 (0.0011)	−0.0023* (0.0012)
Previous Spacing	-	0.0021* (0.0012)	0.0006*** (0.0002)
Ideal Children Number	−0.1041*** (0.0394)	−0.0107 (0.0243)	−0.0228 (0.0239)
Months Worked before Marriage	0.0013* (0.0002)	−0.0001 (0.0001)	0.0001 (0.0002)
Age Difference (Husband − Wife)	−0.0017** (0.0007)	−0.0015*** (0.0003)	0.0005 (0.0004)
Sigma	0.5320 (0.0087)	0.3558 (0.0045)	0.3837 (0.0049)
Log pseudo-likelihood	−6905.29	−7773.15	−7657.56
Observations	8,766	20,157	16,608

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

[5] See Wooldridge (2009). We then estimate the duration regression by using the command "streg" in STATA.

Data

To analyze the relationship between the labor supply and birth spacing, we adopted the WMFE survey of Taiwan, which is a supplementary survey of the Human Resource Survey, and has been conducted since 1978. In 1987, WMFE survey was collaterally processed for 2 consecutive years in August, but was discontinued in 1989, until it was reprocessed in 1990, 1993, 2000, 2003, 2006, and 2010. The survey participants were women residing in Taiwan, who were older than 15 years, and were free to engage in economic activities. The survey excluded women who were enlisted in the military labor force or incarcerated. Approximately 20,000 households were interviewed for each survey.

The WMFE survey comprised three parts. The first part primarily investigated the basic characteristics of women in the labor market. The second part included the marriage age of the women, the current number of children, their reasons for not having children, the gender and age distribution of their children, and approaches to childcare for the youngest child. The third part entailed the labor force status of the husbands, including their basic characteristics and employment status. For the present study, we used data from the surveys conducted in 1983–1988, 1990, 1993, 2000, 2003, 2006, and 2010 (spanning 12 years) to perform our empirical analysis. Compared with previous related studies, the advantage of using the WMFE survey to investigate the relationship is the abundance of information regarding employment and childbirth. In addition, the observations we relied on comprised a large amount of data spanning a 30-year period across two centuries. Therefore, we were able to estimate the average conditions during these three decades, and to examine changes in the relationship between birth spacing and women's labor supply throughout these three decades.

To ensure accuracy in our empirical analysis and to avoid biased predictions resulting from interfering factors, we selected the following conditions to filter the samples: (a) We eliminated samples associated with government-related sectors because women employed in government organizations receive more benefits (e.g., maternity and employment security); (b) we selected women of childbearing age (15–45 years) as the observation sample; and (c) we eliminated observation values that were based on illogical number of children and employment information.

We defined the variables according to the questions in the WMFE survey. We asked the question "What was your exact age when you first got married?" to determine the first marriage age, and "Have you ever given birth?" to determine the birth spacing. We subsequently used these two variables to calculate the time of first childbirth and the intervals between births. The questionnaire surveyed only up to four childbirth experiences. In addition, we input related variables from the extant literature to achieve a comprehensive estimate. Therefore, the empirical variables in this study included three dimensions: the socioeconomic characteristics of married women (e.g., age, education level, working hours, and work type); family characteristics; and the socioeconomic characteristics of their husbands. This included the years of education, age, wage, working hours, job identity (employer, self-employed, employee, and unemployed), and current employment status (employed or unemployed). It also covered the following issues: resignation following marriage ("Did you resign from your job because of the marriage?"); intention to have (additional) children ("How many children do you want to have?"); resignation because of childbirth ("Have you ever resigned because of childbirth?"), and time elapsed before returning to work after childbirth ("How much time did you take maternity leave?"). We tabulated the commitment to the labor force before childbirth (i.e., months worked by the respondents before childbirth), area of residence, family income, the number of children, and the socioeconomic characteristic variables of the husbands, which included their education level, age, wages, working hours, employment identity, and current employment status. The design of each item was identical for both the husbands and wives.

Table 1 summarizes the sample descriptions of the data. Almost half of the sampled married women were unemployed ("Employment" = 0.5077), but most of the employed women worked full time, and represented approximately 40.6% of the sample. Less than 1% of respondents were employers, and those who were self-employed as well as part-time employees each comprised approximately 5% of the sample. Wives received lower wages and had fewer working hours compared with their husbands, and the husbands tended to be 2.65 years older than their wives. The total number of observations recorded was 119,402.

Table 2 lists the average birth spacing for each employment status. We separated employees into two status types: full-time employees (>35 hr/week) and part-time employees (<35 hr/week). We found that women who had given birth once exhibited long birth spacing, whereas women who had given birth three times exhibited the shortest spacing compared with those who had given birth once or twice. This implies a negative correlation between the number of births and birth spacing, regardless of the employment status of mothers. Moreover, the difference in birth spacing in the 1980s was shorter than in the 1990s and the 2000s. This result is consistent with the information displayed in Figure 1, which shows that birth spacing increased with greater participation by women in the labor force. Regarding employment status, full-time employees had the longest birth spacing.

We considered that birth spacing could represent women's birthing inertias. Using all the data pertaining to married women's birth spacing in our sample, we estimated the correlation coefficient for two births between the previous and the following spacing, which was 0.3112, whereas it was 0.4108 for three births. In other words, a long previous spacing might result in long future spacing. Accordingly, we generated the variable of previous birth spacing, and included it in our empirical analyses, as shown in Section 4.

Empirical Results

Employment Choice

Table 3 summarizes the results of the multinomial-logit regressions (base group = non-employment). The results revealed that higher-educated married women had a strong preference for being full-time employees and employers. The number of children exerted a negative effect on women becoming full-time employees. An increase in the number of children led to the women preferring part-time jobs or self-employment. This was consistent with most of the findings in the literature. In addition, it is understandable that the husband's employment affected the employment choices for these women. If the husbands were employers or self-employed, their wives also tended to be employers or self-employed. By contrast, if the husbands were part-time

employees, the likelihood that their wives would also be part-time employees was low. When the husbands were full-time employees (with the implication of long working hours), their wives tended to work part time or were self-employed, so that they could have sufficient time to care for their families.

Labor supply results

Table 4 lists the labor supply results of married women for each number of births.[6] We found that the second and third birth spacing had positive effects on the labor supply, with a significant level of 0.05; they were 0.0950 and 0.0796, respectively. This shows that longer birth spacing corresponded to greater labor market participation, and the result of the first birth spacing was no significant. We divided the sample further by period (the 1980s, the 1990s, and the 2000s) and length (shorter and longer), as shown in Table 5. We found that birth spacing had a positive effect on the labor supply, particularly after the 1990s. For women's first birth, birth spacing exerted an effect of 0.0633 on the labor supply in the 2000s. By contrast, for women's second birth, birth spacing exerted an effect of 0.1528 on the labor supply in the 1990s, and 0.0293 in the 2000s. For the third birth, birth spacing exerted an effect of 0.0266 in the 2000s.

We separated birth spacing by *short* and *long*. A spacing of fewer than 24 months was considered *short*, whereas *long* birth spacing was regarded to be more than 24 months.[7] The women's first birth did not have a significant effect on birth spacing or the labor supply. However, the second and third births had significantly positive effects on the labor supply because the spacing was longer. Longer spacing exerted an effect of 0.1044 on the labor supply for the women's second birth, and had an effect of 0.1654 for the third birth. These results were consistent with our inferences in Sections 1 and 2 (i.e., once married women give birth, long birth spacing has a positive effect on the labor supply because of

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[6] We determined the natural log on weekly wages and hours.

[7] According to medical reports, the baseline spacing was 2 years (24 months) for a woman to give birth. If we separated the spacing by group means or modes, the standards moved and increased by year, and the effects were biased.

high labor market wages (MPL)).

Tables 5-1 to 5-4 list the results grouped by the women's employment status. For the full-time employees listed in Table 5-1, the birth-spacing effects on the labor supply were positive in recent decades (except in the 1980s), and the effects were higher and more significant for the second and third births. In addition, longer birth spacing corresponded to a greater labor supply, whereas shorter spacing had negative effects, but was no significant. For the women who were employers and self-employed (Tables 5-2 and 5-3), the birth-spacing effects on the labor supply were nearly negligible. This indicates that these workers had greater flexibility than did full-time employees for adjusting the allocation of time between work and family. Although shorter spacing had no significant effects on the labor supply for part-time employees in Table 5-4, women with longer birth spacing had positive effects on the labor supply, particularly for the second and third births

Birth-spacing results

After estimating the labor supply equations, the predicted values of the labor supply were input into the duration regressions of birth spacing to estimate the survival rate of the labor supply on birth spacing (Table 6). Greater labor market participation corresponds to longer birth spacing. The survival probabilities were all positive, with a significance level of 0.05. Marriage age had positive effects for the first birth spacing. This may be due to older married couples generally having greater labor market participation, which would lead to longer birth spacing. However, the birth of a third child appeared to have negative effects. Previous spacing had positive effects on the following spacing. However, this may be due to birth inertia. The ideal number of children had negative effects on spacing, particularly for the first birth. Longer working months before marriage increased by 0.13%, increasing the first birth spacing. The survival rates of birth spacing decreased with age differences between husbands and wives for the first and second births.

Table 7 lists the results of the survival rates on birth spacing, divided by periods and the number of births. The survival rates of the labor supply on birth spacing were nearly significantly positive, except for the first birth spacing before the 2000s. This finding suggests that a greater

labor supply has corresponded with longer birth spacing in recent decades. For the first birth spacing in the 1990s, one more labor supply unit lengthened the spacing by a probability of 22.02%. For the second birth spacing, this probability decreased to 11.73%, and to 13.08% for the third birth spacing. By contrast, for the first birth spacing in the 2000s, one more labor supply unit lengthened the spacing by a probability of 38.13%. For the second birth spacing, the probability increased to 70.13%, and to 76.75% for the third birth spacing. The effects were higher after the year 2000. In addition, women who spaced their births for longer periods also exhibited positive and higher survival rates compared with women who waited for shorter periods to give birth again. Furthermore, marriage age had a negative effect on shorter spacing for the full sample, particularly for the third birth spacing. This is because people who want to have more children may tend to shorten their spacing. The positive effects of marriage age on longer birth spacing represent couples who marry later in life and may have greater labor market participation, and this would explain the longer birth spacing.

Tables 7-1 to 7-4 list additional results concerning the full-time employees, employers, self-employed, and part-time employees. For full-time employees, the effects were all positive throughout the three decades. Women with long spacing had positive and higher survival rates as the labor supply increased compared with their counterparts with short spacing. Based on these results, we can infer that fertility and the labor supply exhibit a negative relationship because of the positive correspondence between birth spacing and the labor supply of the women who were full-time employees in the labor market. Although the results pertaining to employers, self-employed, and part-time employees did not reveal a consistent pattern, the survival rates of the self-employed and part-time employees with longer birth spacing were nonnegative. This finding showed that the effects of labor supply on longer birth spacing still exhibited a nonnegative relationship, even for the women with flexible working hours.

Regarding the effects of previous birth spacing, as shown in Table 7, the birth spacing were found to have a positive relationship with the following birth spacing. Longer previous birth spacing results in longer following birth spacing when women are motivated to have more children, suggesting that this fertility pattern is indicative of inertia for most

couples when the other conditions keep constant.

Table 7.
Survival Rate by Periods and Spacing Length - Full Sample

	The 1st Spacing	The 2nd Spacing	The 3rd Spacing
The 1980s			
Labor Supply	−0.0922*	0.0511***	0.0690***
	(0.0026)	(0.0025)	(0.0026)
Previous Spacing	-	0.0012***	0.0003
		(0.0003)	(0.0003)
Marriage Age	0.0321	−0.0027	−0.0083***
	(0.0027)	(0.0017)	(0.0019)
The 1990s			
Labor Supply	0.2202***	0.1173***	0.1308***
	(0.0081)	(0.0017)	(0.0018)
Previous Spacing	-	0.0004*	0.0008***
		(0.0002)	(0.0002)
Marriage Age	0.0434***	0.0085***	−0.0092***
	(0.0054)	(0.0015)	(0.0025)
The 2000s			
Labor Supply	0.3813***	0.7013***	0.7675***
	(0.0168)	(0.0013)	(0.0289)
Previous Spacing	-	−0.0001	0.0024***
		(0.0002)	(0.0006)
Marriage Age	0.0306	0.0048***	0.0037
	(0.0036)	(0.0013)	(0.0030)
Short Spacing			
Labor Supply	−0.0435***	−0.0193***	0.0876***
	(0.0005)	(0.0005)	(0.0049)
Previous Spacing	-	0.0003	0.0010***
		(0.0002)	(0.0003)
Marriage Age	−0.0119***	−0.0036***	−0.0105***
	(0.0011)	(0.0009)	(0.0020)
Long Spacing			
Labor Supply	0.0249***	0.0910***	0.1050***
	(0.0004)	(0.0031)	(0.0025)
Previous Spacing	-	0.0004***	0.0004***
		(0.0002)	(0.0001)
Marriage Age	0.0110***	0.0012***	0.0016
	(0.0014)	(0.0004)	(0.0012)

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 7-1.
Survival Rate by Periods and Spacing Length - Full-time Employees

	The 1st Spacing	The 2nd Spacing	The 3rd Spacing
The 1980s			
Labor Supply	−0.0081*	0.0587***	0.0830***
	(0.0047)	(0.0025)	(0.0028)
Previous Spacing	-	0.0012***	−0.0001
		(0.0003)	(0.0003)
Marriage Age	0.0022	−0.0032	−0.0081***
	(0.0044)	(0.0020)	(0.0021)
The 1990s			
Labor Supply	−0.1802***	0.1223***	0.1061***
	(0.0077)	(0.0018)	(0.0016)
Previous Spacing	-	0.0005*	0.0009***
		(0.0002)	(0.0002)
Marriage Age	0.0411***	0.0086***	0.0142***
	(0.0065)	(0.0017)	(0.0028)
The 2000s			
Labor Supply	0.4775***	0.6917***	0.7420***
	(0.0366)	(0.0017)	(0.0259)
Previous Spacing	-	−0.0001	−0.0020***
		(0.0002)	(0.0006)
Marriage Age	0.0261***	0.0073***	0.0073**
	(0.0046)	(0.0015)	(0.0035)
Short Spacing			
Labor Supply	−0.0679***	−0.0709***	0.0789***
	(0.0008)	(0.0041)	(0.0060)
Previous Spacing	-	−0.0006**	−0.0014***
		(0.0003)	(0.0005)
Marriage Age	0.0130***	−0.0073***	−0.0121***
	(0.0013)	(0.0019)	(0.0026)
Long Spacing			
Labor Supply	0.0131***	0.2873***	0.3074***
	(0.0002)	(0.0036)	(0.0027)
Previous Spacing	-	−0.0001	0.0001
		(0.0002)	(0.0002)
Marriage Age	0.0116***	0.0039***	0.0041***
	(0.0015)	(0.0009)	(0.0014)

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 7-2.
Survival Rate by Periods and Spacing Length - Employers

	The 1st Spacing	The 2nd Spacing	The 3rd Spacing
The 1980s			
Labor Supply	−0.0886***	0.0073	−0.0273***
	(0.0104)	(0.0126)	(0.0099)
Previous Spacing	-	0.0005	0.0026
		(0.0017)	(0.0025)
Marriage Age	−0.0253	−0.0197	−0.0003
	(0.0239)	(0.0121)	(0.0139)
The 1990s			
Labor Supply	−0.0040	0.0065***	−0.0822**
	(0.0359)	(0.0004)	(0.0049)
Previous Spacing	-	0.0012	0.0046**
		(0.0021)	(0.0020)
Marriage Age	−0.0469*	0.0166	0.0339***
	(0.0274)	(0.0104)	(0.0095)
The 2000s			
Labor Supply	0.0708***	−0.2330***	0.0169***
	(0.0083)	(0.0191)	(0.012)
Previous Spacing	-	−0.0033	0.0017
		(0.0028)	(0.0014)
Marriage Age	0.0495	0.0060	0.0115
	(0.0340)	(0.0114)	(0.0153)
Short Spacing			
Labor Supply	0.1290***	−0.0576***	−0.0063
	(0.0318)	(0.0095)	(0.0094)
Previous Spacing	-	0.0022	0.0021
		(0.0017)	(0.0020)
Marriage Age	0.0243	−0.0300*	−0.0128
	(0.220)	(0.0162)	(0.0127)
Long Spacing			
Labor Supply	0.0055***	0.0032***	0.0721***
	(0.0004)	(0.0001)	(0.0023)
Previous Spacing	-	0.0002	0.0005
		(0.0004)	(0.0009)
Marriage Age	0.0020	0.0110***	0.0083*
	(0.0158)	(0.0027)	(0.0050)

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 7-3.
Survival Rate by Periods and Spacing Length - Self-employed

	The 1st Spacing	The 2nd Spacing	The 3rd Spacing
The 1980s			
Labor Supply	0.1263***	0.0766***	0.0522***
	(0.0073)	(0.0046)	(0.0011)
Previous Spacing	-	0.0013	0.0005
		(0.0008)	(0.0004)
Marriage Age	0.0241***	0.0025	0.0002
	(0.0067)	(0.0049)	(0.0027)
The 1990s			
Labor Supply	0.2758***	−0.0397	0.1457***
	(0.0316)	(0.0249)	(0.0077)
Previous Spacing	-	0.0001	0.0007
		(0.0016)	(0.0007)
Marriage Age	−0.0138	−0.0031	−0.0071
	(0.0135)	(0.0132)	(0.0076)
The 2000s			
Labor Supply	−0.0015***	0.2550***	−0.1464***
	(0.0033)	(0.0117)	(0.0149)
Previous Spacing	-	−0.0001	−0.0025*
		(0.0007)	(0.0015)
Marriage Age	0.0134	−0.0189***	0.0011
	(0.0218)	(0.0053)	(0.0074)
Short Spacing			
Labor Supply	0.0237***	0.0304***	0.0642***
	(0.0010)	(0.0034)	(0.0107)
Previous Spacing	-	0.0005	−0.0008
		(0.0004)	(0.0008)
Marriage Age	0.0024	0.0052*	−0.0105**
	(0.0043)	(0.0028)	(0.0050)
Long Spacing			
Labor Supply	0.1029***	0.0640***	0.0687***
	(0.0114)	(0.0012)	(0.0018)
Previous Spacing	-	0.0005	0.0003
		(0.0003)	(0.0003)
Marriage Age	0.0126	−0.0022	0.0004
	(0.0088)	(0.0018)	(0.0019)

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Table 7-4.
Survival Rate by Periods and Spacing Length - Part-time Employees

	The 1st Spacing	The 2nd Spacing	The 3rd Spacing
The 1980s			
Labor Supply	−0.0596***	0.0304***	−0.0069***
	(0.0051)	(0.0088)	(0.0073)
Previous Spacing	-	0.0013	0.0012
		(0.0010)	(0.0008)
Marriage Age	0.0419***	−0.0030	−0.0036
	(0.0100)	(0.0047)	(0.0049)
The 1990s			
Labor Supply	−0.0599***	0.0783***	0.1285***
	(0.0094)	(0.0055)	(0.0195)
Previous Spacing	-	−0.0001	0.0012
		(0.0016)	(0.0013)
Marriage Age	0.0347**	0.0122***	−0.0216*
	(0.0162)	(0.0045)	(0.0122)
The 2000s			
Labor Supply	−0.0923***	0.0749***	−0.4795***
	(0.0078)	(0.0043)	(0.2604)
Previous Spacing	-	0.0010	−0.0002
		(0.0007)	(0.0013)
Marriage Age	0.0283**	0.0022	−0.0105
	(0.0130)	(0.0036)	(0.0075)
Short Spacing			
Labor Supply	−0.1554***	0.0287**	0.0773***
	(0.0088)	(0.0086)	(0.0132)
Previous Spacing	-	−0.0015	−0.0008
		(0.0012)	(0.0009)
Marriage Age	0.0059	−0.0026	−0.0026
	(0.0076)	(0.0042)	(0.0062)
Long Spacing			
Labor Supply	0.1033	0.0604***	0.0252***
	(0.0089)	(0.0022)	(0.0073)
Previous Spacing	-	0.0012***	0.0001
		(0.0002)	(0.0006)
Marriage Age	−0.0079	0.0090***	−0.0028
	(0.0093)	(0.0016)	(0.0038)

[a] Standard errors are in parentheses.
*** represents significance at the 1% level. ** represents significance at the 5% level.
* represents significance at the 10% level.

Conclusion

This study investigated the relationship between birth spacing and the labor supply of married women. Few studies have examined this relationship by considering the heterogeneity of birth spacing. Our findings revealed that high participation in the labor market might lengthen birth spacing, and thus, longer spacing corresponds to a higher labor supply. This issue has exerted negative effects on the fertility rates of many developing and developed countries.

We adopted the Taiwan WMFE survey data and employed three stages of regression to identify the employment choices of married women. We also estimated the labor supply of married women (with the application of self-selection bias correction) and birth spacing (with the application of an endogeneity correction mechanism). Our empirical results revealed that birth spacing and the labor supply had negative effects only for women with short birth spacing. Longer birth spacing corresponded to greater labor supply, and a high participation in the labor market lengthened birth spacing. This phenomenon was also significant after 2000, and for women who gave birth to more than two children. These results are inconsistent with the findings of previous studies, but are consistent with the actual birth-spacing trend.

Based on the results, we recommend that the government stimulate the fertility rate by considering the birth heterogeneity, particularly for the relationship between birth spacing and the labor supply. Because of women's recently developed socioeconomic characteristics, we considered the occurrence of late marriages. The government should thus incentivize shortening the birth spacing of employed women with an aim to increase the number of births. One of the most popular fertility policies is the provision of a maternity allowance, which has been adopted by Japan, Singapore, Germany, the United Kingdom, France, Russia, and Taiwan. Taiwan began offering maternity allowance in 2009. The allowance is allotted based on the number of births, and does not consider spacing; the allowance is identical for single-birth mothers and for those with two births. It is also identical for those with 1-year spacing and 5-year spacing. Therefore, women with a limited birth time are not incentivized to shorten their birth spacing.

Fertility policies should incorporate an incentive design, that is, wom-

en with shorter birth spacing, who are negatively affected by a larger labor supply, should accordingly receive larger subsidies or allowances. Women can be compensated and encouraged to have more children with shorter spacing through an incentive design. Even though the allowance is really few for most childbearing women, the allowance policies without incentive are ineffective.

Finally, this study tries to provide effective policy considerations based on economic empirical results. Fertility policies need long-term planning. Governments should design policies by considering the age of women getting married, the population structure, and even consider this from the nation's survival perspective. The issue is not oriented to only a single aspect and needs additional future research to explore all its facets and to generate more discussion.

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