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YU-HAN JAO AND JUI-CHUNG ALLEN LI

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Yu-han Jao

Department of Sociology,

National Taiwan University

and

Jui-Chung Allen Li

Institute of European and American Studies and

Institute of Sociology, Academia Sinica; and

Population Research Center, RAND Corporation

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ABSTRACT

Using data from eleven waves of Women's Marriage, Fertility, and Employment Survey, we examine trends in labor force participation among married mothers of preschool-aged children in Taiwan. The estimates indicate an upward period trend and an unexpected downward cohort trend. The results show that (1) changes in the population composition of women's education and (2) changes in behavior for women of different levels of education, both associated with educational expansion, as well as (3) changes in economic opportunities in the labor market help explain the trends. However, changes in gendered family norms, as indicated by husband's education, and changes in family composition factors, are largely independent of the trends. We also find that the unexpected cohort trend may be due to sample selection—women in recent birth cohorts who chose to marry and have children tend to be less committed to employment than their counterparts in earlier birth cohorts on whom the cultural constraints imposed greater pressure for them to stay home. We conclude that two major social changes—educational expansion, and industrial and economic developments—are associated with the increase in employment among married mothers of preschool-aged children in Taiwan from 1983 to 2006.

Trends in the Employment of Married Mothers of Preschool-Aged Children in Taiwan

The population in Taiwan is aging rapidly. Each individual between ages 15 and 64 currently supports about 0.4 dependent persons, and official projections peg this "dependency ratio" at more than 0.9 five decades down the road (Wang *et al.* 2009). Policy makers and the public alike are concerned about the economy's ability to support this dependent population, and they focus exclusively on potential workers between 15 and 64 years of age in their search for solutions. This paper addresses this concern from a slightly different perspective, focusing on a unique feature of the Taiwanese population: the relatively low rates of labor force participation among Taiwanese women. While approximately 60% of American women are either employed or looking for work, less than half of Taiwanese women are in the labor force (DGBAS 2009; Bureau of Labor Statistics 2010). If a policy effectively raises the female labor force participation rates in Taiwan to, say, the level seen in the United States, we may expect that the economic burden a Taiwanese worker has to shoulder to support children and the elderly will substantially decrease. Hence, we believe understanding factors that affect women's employment decisions will help provide a broader base of potential workers to support the dependent population and ameliorate the problems of rapid population aging, especially in the Taiwanese context.

While prior studies have focused on explaining trends in the employment among *all* women (Tan and Yu 1996; Cheng 1999; Guo 2008; cf. Huang, Weng, and Huang 2009), the labor force participation rates for all women increased only by 13% between 1983 and 2006 (44% to 57%, authors' calculations based on the Manpower Survey of Taiwan). In this study, we focus instead on the employment of married mothers of preschool-aged children, whose rates of labor force participation almost doubled from 34% to 62% during this period. Not only has the change in their employment behaviors been dramatic in both absolute and relative (to the overall change for all women) terms, marriage and childbearing have also been the most oft cited reasons for which Taiwanese women leave the labor force (Yi and Chien 2001). Such an interruption in employment during this life stage negatively affects women's subsequent careers and earnings (Mott and Shapiro 1983; Lu and Hu 1997; Waldfogel 1997) and may, in turn, exacerbate economic inequality by gender.

In this paper, we attempt to address the limitations of prior studies on trends in the employment behaviors of Taiwanese women. Prior studies have usually assumed that the observed trend was driven by either cohort or period mechanisms, rather than testing such assumptions against data (c.f., Guo 2008); nor have those previous studies examined carefully the theoretical mechanisms that might help explain the trends. We document

trends in labor force participation among married mothers of preschool-aged children in Taiwan using a variant of the classic Age-Period-Cohort (APC) model (Mason *et al.* 1973). Following the empirical strategy of Leibowitz and Klerman (1995), which is also in line with the mechanisms-based approach to identifying the APC effects (Winship and Harding 2008), we examine a number of factors that might help explain the trends. Like Leibowitz and Klerman, we are particularly interested in understanding the relative effects of husband's versus wife's earnings opportunities in the local labor markets on women's employment decisions. We also pay particular attention to the role of education in our analysis, by virtue of both compositional and behavioral changes associated with recent educational expansion and by virtue of how economic opportunities in the labor market have changed over time. The investigation of the effects of these potential factors will not only be informative in its own right, but also strengthen our confidence in the APC estimates—which are inevitably based on somewhat arbitrary statistical assumptions—regarding whether or not the documented trends are indeed driven by the period or cohort mechanisms.

Trends in Female Labor Force Participation in Taiwan

Whereas several important studies have examined trends in employment among the

married mothers of young children in the United States (Leibowitz and Klerman 1995; Lu 1998; Edwards 2001), few prior studies have looked at trends in the labor force participation of women during this critical life stage in Taiwan; Nor has any – save one – prior study empirically examined whether cohort or period effects were driving this trend.

Tan and Yu (1996) argued that, compared to men, women often had greater difficulties to enter the primary labor market that offered higher wages and better benefits, but such difficulties were reduced gradually over time. Using data from two waves of the Manpower Utilization Survey conducted in 1978 and 1992, they showed that reductions in gender inequality within the primary labor market led to an increase in labor force participation among women aged 20 to 64 in Taiwan. Cheng (1999) applied an econometric method derived from the Granger causality to time series data in Taiwan and found that period changes in fertility were not causally associated with period changes in the overall female labor force participation rates. Huang *et al.* (2009) decomposed period trends in labor force participation of Taiwanese women between ages 25 and 54 (regardless of marital and childbearing status), and found that both compositional and behavioral changes in educational level, marital status, and family structure helped explain the trends.

Following Sørensen's (1983) typology, Li and Yang (2004) examined cohort trends

in employment patterns for three successive cohorts of married women born between 1931 and 1960 in Taiwan. They found that the increase in married women's labor force participation was mainly due to a decline in the proportion of women who had never worked throughout their lives, presumably associated with delayed marriage and childbearing. Chien (2004) compared married women in Taiwan surveyed in 1993 and 2000, and found that the time they spent out of the labor force due to marriage and childbearing had been shortened. While those surveyed in 1993 were more likely to exit the labor force upon marriage and to return at a later time after childbearing, those surveyed in 2000 were more likely to postpone the exit until their first birth and to return at an earlier time after childbearing. Hsueh (2000) explored whether the effects of factors predicting the reentry into labor market following marriage and childbearing had changed between two periods of 1983 and 1993, and found that educational differentials increased in the ten-year period. Compared to less educated women, more educated women were even more likely to return to the labor market in 1993 than in 1983.

Guo (2008) applied the classic APC model (Mason *et al.* 1973) to examine the labor force participation among all women aged 15 and above, using data from the 1978-2006 waves of the Manpower Survey of Taiwan. She found both an upward cohort trend and an upward period trend, net of curvilinear age-specific rates of labor force participation.

Her exploratory analyses—through a set of cross-tabulations of period and cohort, respectively, by marital status and by education—suggested that changes in compositions in marital status and education might be responsible for a small proportion of the identified trends. While it is a real contribution to document these important facts on the labor force participation for women of all ages, she did not examine the interactions between age, period, and cohort effects. Thus, we would not expect her findings to necessarily hold for married mothers of preschool-aged children (Glenn 2005). Although we use an APC model similar to hers to identify the trends, we apply a strategy akin to that in Leibowitz and Klerman (1995) to examine mechanisms.

Factors to Explain Trends among Married Mothers of Preschool-Aged Children

We focus on trends in labor force participation among married mothers of preschool-aged children in Taiwan and discuss both compositional and behavioral changes in factors that may help explain the observed trends.

Compositional and Behavioral Changes Associated with Educational Expansion. In 1968, the Taiwanese government extended the duration of compulsory education to nine years. In 1972, regulations strictly limiting the establishment of private schools were removed. Furthermore, over the past half century, the number of institutions of

higher education in Taiwan increased more than five fold, from 27 to over 150. Benefitting from this long period of educational expansion, women's educational attainment has improved substantially (Tsai 2004). This change in the educational landscape may have affected trends in the behavior of Taiwanese women regarding employment in the following ways: The upward shift in the population composition of educational attainment may have increased women's labor force participation without altering the employment effects of educational attainment (Lichter and Costanzo 1987; Huang *et al.* 2009); Also, with more and more women pursuing higher education, cultural norms that kept highly educated women from working may have weakened, leading more of these women into the labor force (Goldin 1990; Yi and Chien 2001). Thus, the effects of educational attainment on women's employment may have become larger (Leibowitz and Klerman 1995). We might expect that changes in the population composition of women with regards to educational attainment due to educational expansion would affect the behaviors of all women born in the same year, and thus exert cohort effects, but other changes discussed above might have affected all women at the same time, regardless of their birth cohort and age, and thus have exerted period effects.

Changes in Gender Role Ideologies. Not only have Taiwanese women's gender role ideologies become more liberal as women became more educated, Taiwanese men may

have become less conservative in their gender role ideologies (Lu and Yi 2003). We argue that such an attitudinal shift in gender role ideologies among men may have been driven by educational expansion because more highly educated men tend to hold less traditional gender role attitudes (Mason and Lu 1988; Brewster and Padavic 2000). The husband's education, taken as a proxy for his gender role ideologies, may explain a portion of the trends in the labor force participation among married mothers of preschool-aged children via both period effects and cohort replacement mechanisms (Ciabattari 2001).

Changes in Economic Opportunities in the Labor Market. In the period we study, Taiwan experienced substantial economic development, with real GDP growing at a rate constantly above 5% from 1983 to 2000 (DGBAS 2010). Goldin (1990) showed that, in the United States during the 1920s and 1930s, younger, less experienced, unmarried women were more likely to be hired than older, more experienced, married women. Due to the subsequent fertility decline and educational expansion that kept more women in school for a longer period of time, employers needed to adapt to the shrinking supply of young women in the 1950s by considerably altering whom they were willing to hire. Older, more experienced, married women—who had left the labor market earlier upon marriage, by now past their childbearing ages—were suddenly facing substantially

improved labor markets in the 1950s, and many were able and decided to return to work.

In line with Goldin's study, Yu (2005, 2009) compared female employment in Taiwan and Japan in the 1990s. She argued that, after World War II, the increase in labor demand in Taiwan was greater than that in Japan, so Taiwanese employers needed to provide better incentives to attract women into the labor market than did Japanese employers. The industrial structure had also shifted from labor-intensive industries to skill- and capital-intensive industries by the 1980s, and the demand for highly educated and highly skilled workers continued to rise (see also Tan and Yu 1996). While concerned exclusively with explaining cross-national differences in married women's employment between Taiwan and Japan, her arguments should hold true for our purpose in explaining changes in employment for married mothers of preschool-aged children. Consistent with Yu's arguments, Tan and Yu found that women were more likely to work in the primary labor market of 1992, which demanded higher skills and paid better wages, than in that of 1978. Hence, we hypothesize that changes in economic opportunities—a result of increases in educational attainment and changes in industrial structure—may have drawn more women into the labor force.

Changes in economic opportunities may not benefit women only, but men as well. Increases in husbands' wages, however, may have affected married women's employment

in the opposite direction of increases in women's own wages, because women married to higher earning husbands had a weaker incentive to generate a second household income (Mott and Shapiro 1983; Lu and Hu 1997). The extent to which changes in the economic opportunities available to men may have offset changes in the economic opportunities for women in shaping the employment behaviors of married mothers of preschool-aged children remains an open, empirical question.

Family Composition Factors. Less than a third of Taiwanese children aged 3 to 5 were enrolled in preschool or kindergarten, and more than two-thirds of them were either at home or in other types of childcare facilities during the period we study (Li 2009). Younger children demand a greater amount of care, and paid childcare is more expensive for younger children than for older ones. Mothers of younger children are therefore less likely to work than are mothers of older children. Similarly, mothers with more children to care for are also less likely to work than mothers with fewer children to care for (Waite 1980; Lu and Hu 1997). While the presence of preschool-aged children may increase the demand for childcare and reduce women's likelihood of working, the presence of additional adults in the household may provide a needed helping hand and increase the likelihood that these women will work (Tienda and Glass 1985; Tan and Yu 1996). We argue, however, that the effects of additional adults in the household on women's

participation in the labor force may not be monotonic. One or two additional adults should provide sufficient help in childcare, and relieve the mother of her childrearing duties, freeing her for employment. Coresidence with three or more additional adults may provide the couple with limited extra childcare assistance and thus remove little barrier for the mother to work. Such a living arrangement is often the extended-family living arrangement, and is indicative of the influence of traditional patriarchal cultural norms (Thornton and Lin 1994). Hence, we expect that mothers of preschool-aged children living with three or more additional adults may be less likely to work than those in other living arrangements.

Data

We use data from eleven waves of the Women's Marriage, Fertility, and Employment Survey (WMFES). The WMFES are repeated cross-sectional surveys of nationally representative samples of women aged 15 and above residing in Taiwan, and administered via face-to-face interview in 1983, 1984, 1985, 1986, 1987, 1988, 1990, 1993, 2000, 2003 and 2006. These surveys include a wealth of information on women's labor force behaviors, educational attainments, marriages (and spouses) and childbearing histories, as well as household compositions. Our primary effort to document trends in

labor force participation among married mothers of preschool-aged children is based on the WMFES.

To test the hypothesis on economic opportunities in the labor market, we pool data from the 1981-2005 waves of the Survey of Family Income and Expenditure (SFIE) to estimate the age-, education-, and year-specific earnings potentials in the local labor market of each county in Taiwan. We repeat the same exercise for the respondents and their husbands. We then merge the estimated earnings potentials based on the SFIE into the WMFES main analysis to test the hypothesis. The SFIE are a series of annual repeated cross-sectional surveys of nationally representative samples containing information on each respondent's age, education attainment, and earnings; and thus will allow us to perform the estimation tasks that the WMFES will not.

Variables

We follow the official definition of the Ministry of Interior Affairs of Taiwan to construct a binary dependent variable to indicate the respondent's labor force participation. The respondent is considered to be in the labor force (coded 1) if she is over 15 years of age, either working for pay or unemployed. Those women who are not working and do not intend to find a job are considered as being out of the labor force

(coded 0). To examine the hypotheses discussed earlier, we construct the following set of explanatory variables.

Period and Cohort Trends. We specify two continuous variables to indicate the trends: one for period using the calendar year of the survey (centered on 1983), and the other for cohort using the calendar year in which the respondent was born (centered on 1960).

Age. We use a set of dummy variables to indicate the respondent's years of age in three categories: 15-24, 25-34 (reference group), and 35-64. The last category has a wider range because there are only a very small number of cases at extended ages in our sample of married mothers of preschool-aged children.[1]

Family Composition. We operationalize family composition factors using the following variables: (a) a continuous specification of the number of children based on the respondent's answer to the question "How many children do you have now;" (b) a set of dummy variables to indicate the age of the respondent's youngest child in six categories: 0-6 months, 7-12 months, 13-18 months, 19-24 months, 25-30 months, and 31-36 months (reference category); and (c) a set of dummy variables to indicate the number of

[1] There are four respondents reporting ages 50 and above. While we are somewhat dubious about the data quality of these cases, we decide to keep them in the sample.

additional adults aged 15 and over in the household other than the respondent and her husband—no additional adults (reference category), 1 to 2 adults, 3 to 4 adults, and 5 or more adults.

Educational Attainment. We use years of schooling to indicate a respondent's educational attainment.[2] The main effect of years of schooling will capture the compositional change in educational attainment. We also add an interaction effect between years of schooling and survey year to indicate behavioral changes in employment for women of different levels of education (Leibowitz and Klerman 1995). The husband's educational attainment, also expressed in a linear specification of years of schooling, is used as a proxy for changes in man's gender role ideologies with regards to his wife's employment.

Economic Opportunities in the Local Labor Market. We use data from 25 waves of the SFIE (1981-2005) to estimate women's economic opportunities in the local labor market based on Mincer's (1962) earnings equation:

$$\ln y_{jk} = b_0 + b_1 edu + b_2 exp + b_3 (exp)^2 + \sum_j b_{4j} cty_j + \sum_k b_{5k} year_k , \qquad (1)$$

[2] We also experiment with a dummy-variable specification of educational attainment. The alternative specification yields results that are qualitatively the same, but the continuous specification is more comprehensible and uses fewer degrees of freedom (see Appendix B).

where mean logged earnings $(\ln y_{jk})$ specific to the labor market in county *j* and survey year *k* are a function of a linear specification of years of schooling, *edu*, and a quadratic specification of the so-called Mincer's experience, $exp = (age - edu - 6)$.

Specifically, our approach is a nonparametric version of the Mincer's method (see, e.g., Tsai and Xie 2008). While calculating the earning potential of these women, we include only women with earnings, either from part-time work or from full-time work, and with no missing data on their age, educational attainment, and county of residence. Earnings from all sources of work are summed up in total annual earnings for a given year. We first group the 25-year SFIE data into five-year periods to indicate when the survey took place: 1981-1985, 1986-1990, 1991-1995, 1996-2000 and 2001-2005; Mincer's experience into 11 groups: 0-3, 4-7, 8-11, 12-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-50 and 51-60. For each five-year period, we then compute the mean logged earnings for each education-experience group in each county-specific labor market. The logged earnings are adjusted for inflation using the consumer price index (CPI) and expressed in 2006 dollars. The nonparametric specifications allow us to capture potential nonlinear effects in the Mincer's equation. These estimated earnings are linked to the WMFES data for those respondents of the same age and educational level

residing in the same county in the same five-year period.[3]

A major advantage of this approach is that the predicted logged earnings are independent of a particular woman's personal preferences for work and family, and thus capture the expected effect of educational attainment and work experience on her economic opportunities in the local labor market (Leibowitz and Klerman 1995).

Income Effect. There is no information on husband's earnings in the WMFES until 1988, so we apply the same Mincer's-equation method to construct potential earnings opportunities for the respondent's husband. The husband's earnings potential is used to indicate the income effect that may affect a married woman's labor market decision.

Missing Data and the Analytic Sample. Our main analysis is limited to married mothers with children six years of age or younger ($N = 47,235$). After list-wise deletion of those 3.4% of respondents with missing data on the dependent variable and explanatory variables, the size of the analytic sample is 45,609.

Age-Period-Cohort Model: A Variant of the Classic Approach

Prior research has provided relatively little evidence regarding whether changes in

[3] Earnings potentials for respondents in the 2006 WMFES are imputed using the 2001-2005 SFIE estimates.

female labor force participation in Taiwan follow a cohort trend or a period trend. In this study, we combine the classic approach proposed by Mason *et al.* (1973) and the recent development discussed in Winship and Harding (2008) in an attempt to identify separately the cohort and period effects, net of age effects.

It is well known that the distinct cohort and period trends, net of age effects, cannot be identified under a linear specification because these three covariates are perfectly collinear. The classic solution to this identification problem proposed by Mason *et al*. (1973) suggests that one may recode age, period, and cohort into sets of dummy variables to avoid the aforementioned collinearity. This solution assumes that at least two adjacent age groups, time periods, or birth cohorts have identical effects on the dependent variable. This identification assumption usually seems to be not a substantial distortion of reality (Oppenheimer 1982), even though other researchers have criticized the approach and proposed other alternatives (e.g., Yang, Fu, and Land 2004). Glenn (2005) pointed out that each approach imposes certain parametric restrictions, which correspond to different underlying assumptions that may or may not corroborate reality. Thus, he advised that, whenever possible, the analyst should try to provide theoretical justification and substantive information to supplement the statistical results.

Some researchers (e.g., O'Brien 2000) have proposed using proxies for the specific

mechanisms (e.g., cohort size) underlying the observed trends, rather than the covariates of cohort and period, because cohort and period are poorer proxies if these specific mechanisms are indeed the driving forces behind the observed trends. The problem with using better proxies for the specific mechanisms to identify the age, period, and cohort model is that there may be unobserved mechanisms, so that omitted variables would produce biases in the estimated effects. As a remedy to this problem, while following a similar line of reasoning, Winship and Harding (2008) have proposed an alternative in Pearl's (2000) framework of causality. They suggest that the analyst estimate a model with age, period, cohort effects—as well as specific intervening mechanisms—in a set of structural equations. One can then aggregate back the unidentified APC effects from the full structural equations model. We will adapt the Winship-Harding idea into a relatively straightforward regression framework using a variant of the classic Mason *et al*. identification strategy. Specifically, we first estimate an age-period-cohort model, with age entered as a set of dummy variables:

$$\log\left(\frac{\Pr(y=1)}{1-\Pr(y=1)}\right) = b_0 + \sum_k b_{1k} \cdot age_k + b_2 \cdot cohort + b_3 \cdot year\,, \qquad (2)$$

where y indicates labor force participation; age is transformed into dummy variables; cohort and survey year are both entered as continuous variables. Eq. (2) is a variant of the classic Mason *et al*. (1973) approach with a smaller set of parametric restrictions.

We then add each set of the explanatory variables indicating specific theoretical mechanisms reviewed earlier to Eq. (2), and examine how the coefficients for cohort (b_2) and period effects (b_3) change with the inclusion of these explanatory variables. If, by adding any set of the explanatory variables, (b_2) and/or (b_3) approaches zero, we interpret this result as supporting the claim that this set of explanatory variables helps explain the cohort and/or period effects behind observed trends in the labor force participation of married mothers of preschool-aged children. Using this strategy, we not only become more confident in the estimated (b_2) and (b_3) in Eq. (2), but also in their substantive interpretation in the same vein as in Winship and Harding.

Results

In Table 1, we present two sets of descriptive statistics: one for the entire sample of married mothers of preschool-aged children, and the other restricted to the first wave and the last wave of data to provide a snapshot of trends in female labor force participation and its potential explanatory factors. In 1983, only one-third (34%) of married mothers of preschool-aged children were in the labor force, and the percentage nearly doubled (to 62%) in 2006.

[Table 1 about here]

Married mothers of preschool-aged children had an average of 2.4 children in 1983, but only 1.8 children in 2006. Because the demand for childrearing and the demand for work often compete for a woman's limited time and energy, women with fewer children would be more likely to participate in the labor force. In the same period, the average age of married mothers of preschool-aged children rose from 28.0 to 31.7 years old—indicative of delayed marriage and delayed childbearing. Women who married and became mothers at an older age tended to have more accumulated work experience and to earn higher earnings than those who married and became mothers at a younger age. Consistent with this reasoning, the average woman had slightly less than a junior-high-school education (8.25 years) in 1983, and more than a senior-high-school education (12.67 years) in 2006. Their earnings potentials (in 2006 constant dollars) almost tripled in the same period, rising from approximately NT$154,400 a year to NT$431,800. Delayed marriage and childbearing, along with increased educational attainment and earnings potential, may provide greater incentives to work and inflict higher opportunity costs on those who stay home. Thus, these changes might help explain rising trends in the labor force participation of married mothers of preschool-aged children in Taiwan.

In terms of the characteristics of the husbands of these women, their average years

of schooling rose from 9.44 to 12.79, and annual earnings potentials from NT$300,100 to NT$648,400 between 1983 and 2006. The gender gaps in education and estimated earnings between husband and wife diminished substantially—with the difference in years of schooling attenuating from 1.19 years to .12 years and earnings ratio accentuating from .51 to .67. This reduced inequity between husband and wife might reflect increasing educational homogamy or declining gender gap in education in the population (Tsai and Kanomata 2010). Greater earnings of the husband might decrease the labor force participation of married mothers of preschool-aged children by reducing the need for them to contribute to the household income.

Married couples with preschool-aged children lived with fewer adults other than the couple themselves in the same household in 2006 than in 1983. Because we argue that the additional adults in the household may have a non-monotonic effect on the labor force participation of these women, it is unclear how changes in the average number of co-resident adults would affect the trends. There was an increase of 3.8 months in the age of the youngest child between 1983 and 2006, implying a minor change in women's child spacing behaviors and suggesting potentially a small increase in labor force participation.

Figure 1 depicts the period trend, with a simple regression line overlaid, of the labor

force participation rates of married mothers of preschool-aged children across the eleven waves of WMFES. The proportions of these women in the labor force increased steadily from 1983 to 2006: a descriptive finding which should help justify the linear specification of period trend in our subsequent regression analysis. Figure 2 presents parallel results for the trend by birth cohort.[4] The overlaid regression line has a positive slope, indicating an upward cohort trend in labor force participation rates among these women. Although there seems to be some curvilinearity in the scatter plots, the APC model adding a quadratic term of birth cohorts does not better fit the data than the APC model with only a linear term of birth cohorts.[5] We thus conclude that there is no strong evidence against a linear specification of cohort trends.

[Figure 1 and Figure 2 about here]

Table 2 presents regression coefficients for the logistic APC model predicting the labor force participation of married mothers of preschool-aged children. The baseline

[4] We drop a handful of birth cohorts towards both extremes with a sample size of under 30, and use three-year moving averages because sample sizes for each birth cohort tend to be relatively small. The small sample sizes also cause a greater degree of noises in these estimates.

[5] In the APC model that includes a quadratic term of birth cohorts, the estimates for cohort and cohort-squared are, respectively, -.047 (p<.001) and -.00025 (n.s.). The likelihood ratio test comparing this model with Model 1 in Table 2 is also statistically insignificant ($\chi^2_{(1)} = 3.57, p < .10$).

model (Model 1) includes only dummy variables for the age pattern and continuous variables for trends of birth cohort and of period. Married mothers of preschool-aged children between ages 25 and 34 had a higher probability of participating in the labor force than both those who were older or younger. Net of age and birth cohort, married mothers of preschool-aged children participated more in the labor force in a later period than in an earlier period, with an annual 8% ($=(e^{.080}-1)\times 100\%$) rate of increase. This is consistent with the descriptive statistics we present in Table 1 contrasting 1983 and 2006, and the pattern shown in Figure 1. Inconsistent with what we would expect from the descriptive statistics and results presented in Figure 2 is the declining trend for successive birth cohorts of married mothers of preschool-aged children. We then include variables that serve as proxies for either period or cohort mechanisms, and observe how the coefficients for period and cohort trends change with their inclusion.

[Table 2 about here]

Model 2 adds family composition factors, including number of children, age of the youngest child, and number of additional adults in the household. Women were less likely to participate in the labor force if they had more children and if their children were younger due to the greater accompanying demand on their time and energy and higher childcare costs. While prior studies have assumed a monotonic relationship between

additional adults in the household and female labor market behaviors, we find that these women were more likely to participate in the labor force only if one or two additional adults were in the household to provide help. With three or more additional adults present in the household, women were less likely to participate in the household. Our interpretation is that households comprised of five or more adults (i.e., three or more adults in addition to the husband and wife) is reflective of an idealized living arrangement in patriarchal family system of Chinese societies (Thornton and Lin 1994). Thus, if women in these households embraced traditional gender role ideologies more so than women in other living arrangements, they would be less likely to work.

Compared to Model 1, the cohort effect in Model 2 remains unchanged, but the coefficient of survey year is reduced by 5% (from .080 to .076). This is consistent with the argument that declining fertility may explain a small, but perhaps negligible, proportion of the period trend in labor force participation among married mothers of preschool-aged children. Consistent with our theoretical discussion and descriptive results, we find no evidence for the hypothesis that other family composition factors lead to changes in labor force participation among these women.

Model 3 includes women's own years of schooling to examine if changes in the population composition of educational attainment due to a rapid expansion in secondary

and higher education explain trends in labor force participation. As expected, more highly educated women were more likely to participate in the labor force than less educated women. Compared with Model 1, women's years of schooling explain about 20% of the period trend (with coefficient dropping from .080 to .063) but do not affect the estimated cohort trend.

In Model 4, we interact women's years of schooling with survey year to examine if behavioral changes for women of different levels of education explain the trends, and find that the results are consistent with the hypothesis: More highly educated women were more likely to participate in the labor force than less educated women, and the differences were larger in recent years than in the past. The main effect of survey year is .053, compared to .080 in Model 1.[6] Thus, changes in behavior accounted for about a third of the period trend.

In Model 5, we introduce husband's years of schooling as an indicator of his gender ideology. Although women with more highly educated husbands were more likely to work than women with less educated husbands, the effect of the husband's education is independent of the trends. The husband's education washes out about 20% of the effect

[6] The main effect of survey year in this model can be calculated as $-.015 + .007 \times 9.75 = .053$, where 9.75 was the sample mean of the respondent's years of schooling. The main effect of survey year in the parallel model except education is specified in dummy variables is .048 (see Appendix B), which is similar.

of compositional change in woman's education (with coefficients for respondent's years of schooling changing from .070 in Model 4 to .055 in Model 5), but does not affect the effect of behavioral changes for women of different levels of education (i.e., the interaction of respondent's years of schooling and survey year).

In Model 6, we include logged county- and year-specific earnings potentials for women of different levels of educational attainment to examine whether changes in economic opportunities in local labor markets help explain the trends. Women with higher earnings potentials in the local labor market were much more likely to participate in the labor force than women facing lower earnings potentials, suggesting that women's labor market behavior was sensitive to economic incentives. Changes in economic opportunities in the local labor market explain about a third of the cohort trend (with coefficients moving from -.047 to -.031) and 60% of the period trend (with coefficients dropping from .080 to .032).

The theory we have reviewed suggests that higher husband's earnings increase household income and decrease the need for a second household income. Results in Model 7 show women whose husband's earnings were higher were less likely to work than those women whose husband's earnings were lower. Net of husband's earnings, the effect of earnings potentials of the woman is stronger in predicting her employment than

in Model 6, in which we do not take into account assortative mating by education and earnings. Moreover, the income effect due to the husband's earnings offsets the effect of the woman's own earnings potential in explaining both the period trend and cohort trend. Hence, diminishing gender inequity in earnings, along with the upward trend in educational endogamy (Wong and Lu 1999), may indeed have slowed the increase in labor force participation among married mothers of preschool-aged children.

DISCUSSION

We are interested in studying the employment of married mothers of preschool-aged children because the period between a first pregnancy/birth and the time when the youngest child attends school is the life stage causing many women to leave the labor force and some to never return (Desai and Waite 1991; Chang and Wu 2009). Between 1983 and 2006, the increase in the labor force participation among this group of women was pronounced (rising from 34% to 62%, compared to 44% to 57% for all women aged 15 to 64). The increase seemed steady and followed almost a linear trend, be it by period or by cohort.

Like Leibowitz and Klerman's (1995) analysis of the U.S. data, we seek to explain trends in employment of married mothers of preschool-aged children in Taiwan. While

prior Taiwanese studies have provided little hint as to whether the trends were driven by period or cohort effects, we apply an age-period-cohort model that combines Mason *et al*.'s (1973) identification rationale and the mechanism-based approach proposed by Winship and Harding (2008). Our empirical analysis first documents an upward period trend and a downward cohort trend, and then examines a number of potential mechanisms that may help explain the trends. The results show that much of the period trend may be attributed to changes in labor market behaviors for women of different levels of education and changes in economic opportunities in the local labor markets; whereas a small proportion of the period trend may be accounted for by changes in the population composition of educational attainment due to educational expansion. Changes in economic opportunities in the local labor markets also explain some of the cohort trend. Rising earnings among the husbands, coupled with increasing educational and earnings endogamy, however, may have rendered married mothers of preschool-aged children less attached to the labor force than they otherwise would have been. Neither changes in family composition factors nor changes in the husband's educational attainment are responsible for changes in the labor force participation among these women.

In essence, our findings suggest that two major social changes were associated with the increase in employment among married mothers of preschool-aged children in Taiwan

from 1983 to 2006: educational expansion, and industrial and economic developments. Educational expansion improved the educational attainment of the average Taiwanese woman. More highly educated women embraced less traditional gender role ideologies and thus were more likely to work than were less educated women. Educational expansion produced more highly educated women, reinforced the cultural shift in gender role ideologies and drove up labor force participation even further. Behavioral and compositional changes due to educational expansion, on the supply side, may help explain trends in the labor force participation among married mothers of preschool-aged children.

Economic developments after the 1980s led to a dramatic transition from labor-intensive industries to skill- and capital-intensive industries in Taiwan (Yu 2009). During the transition, the demand for highly educated women in the labor market increased and employers found it necessary to provide better incentives to attract women into the labor force (Goldin 1990; Brinton, Lee, and Parish 1995). Changes in the economic opportunities associated with industrial and economic developments, therefore, may have increased employment rates among highly educated women. This is the demand-side explanation for trends in labor force participation among married mothers of preschool-aged children.

While prior studies have noted that husband's earnings that drive up household income may suppress female employment (Mott and Shapiro 1983; Lu and Hu 1997), they have not considered how increases in husband's earnings, in parallel with increases in women's earnings, may have affected trends in female labor force participation. Nor have they considered the impact of increases in educational and earnings endogamy on such trends. Our findings suggest that trends in labor force participation among married mothers of preschool-aged children may have been more pronounced if there were only increases in women's educational attainment and earnings potentials and no parallel increases in their husband's earnings or educational/earnings endogamy.

The downward cohort trend in regression results seems puzzling. This finding is inconsistent with the descriptive pattern in Figure 2. We suspect that this somewhat unexpected finding may reflect a sample selection issue (Berk 1983). As more Taiwanese women participated in the labor force, even at the expense of forgoing marriage and childbearing (Chang and Li 2010), the composition of married mothers of preschool-aged children in later cohorts may have become more selective of women with weak work commitments than in earlier cohorts. The finding that the respondent's earnings potentials explain about a third of the cohort trend provides some evidence for this speculation because this indicator tests how changes in economic opportunities may

draw women into the labor market. In Appendix A, we repeat the same APC analysis on an unselected sample of all women between ages 15 and 64, regardless of their marital and childbearing status, and find the expected upward cohort trend. This exercise provides indirect evidence for the sample selection argument for the cohort trend.

A central motivation for our research is to explore female employment as a potential macro-level solution to problems associated with a rapidly aging population in Taiwan. While current policy discourses have focused exclusively on raising fertility, we note that women in Taiwan, with low rates of labor force participation have not yet "held up half the sky" as in the Chinese proverb. We have identified factors that may help explain trends in the employment of women in a crucial life stage—marriage and childbearing—during which they were most likely to leave the labor force and many never returned to work.

Nonetheless, one could argue that increases in female employment might, in turn, depress fertility (Waite and Stolzenberg 1976), and thus worsen the problems of an aging population. Such incompatibility between women's work and childrearing, however, tends to be the result of traditional cultural norms that place an unequal share of the family care burden on women (Brewster and Rindfuss 2000). If increases in the employment of married mothers of preschool-aged children were driven by the liberation

of women's gender role ideologies, as our findings imply, we would not expect low fertility to be an unintended consequence of increasing female labor force participation. In fact, our contention is in line with Lu and Hu's (1997) finding that motherhood and employment had increasingly become complements rather than substitutes across successive cohorts of Taiwanese women (see also Mott and Shapiro 1983). While our optimism remains, future research will provide further evidence either for or against our position on increasing the employment of married mothers of preschool-aged children to support an increasing elderly population in Taiwan. Future research will also illuminate the role of ideational changes behind changes in the interrelationship between marriage, childbearing, and the employment behaviors of women.

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FIGURES

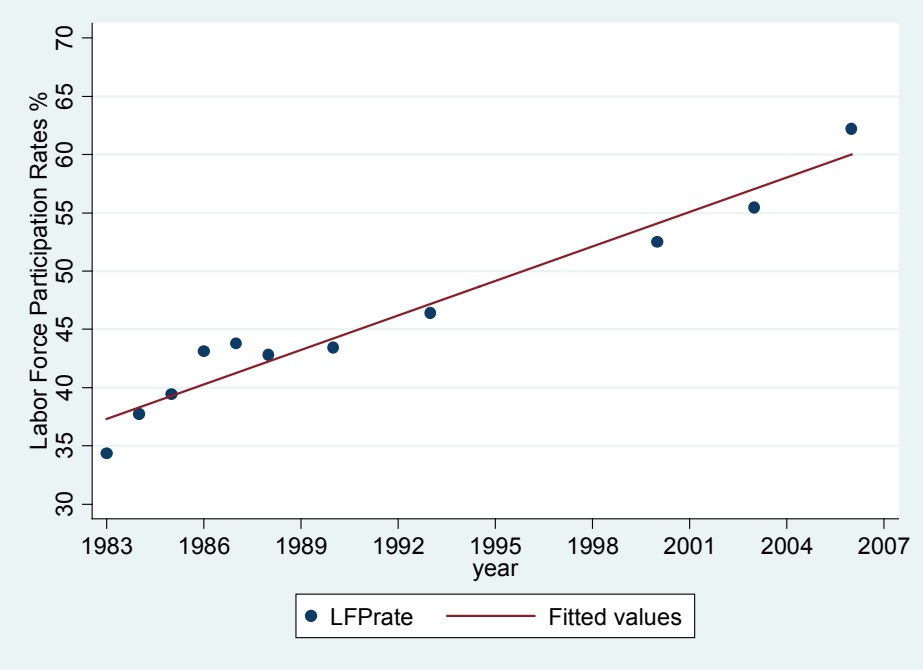

Figure 1. Period Trend in Labor Force Participation of Married Mothers of Preschool-Aged Children.

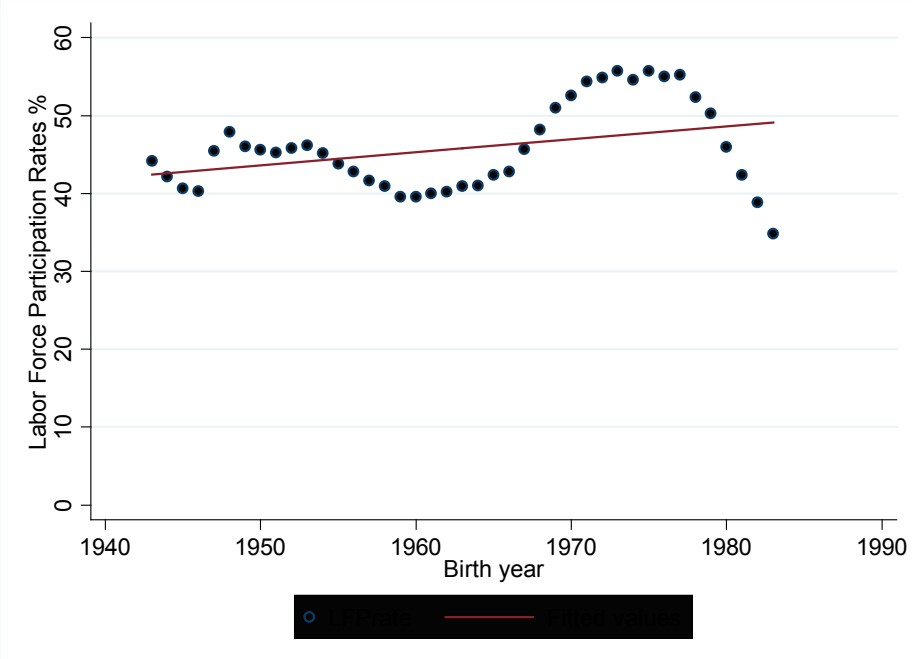

Figure 2. Cohort Trend in Labor Force Participation of Married Mothers of Preschool-Aged Children.

TABLES

Table 1. Descriptive Statistics (Means and Standard Deviations)

	1983-2006	1983	2006
Labor Force Participation	.44	.34	.62
Age	29.09	28.01	31.73
	(4.74)	(4.54)	(4.88)
Number of Children	2.20	2.40	1.84
	(1.06)	(1.23)	(.81)
Years of Schooling	9.75	8.25	12.67
	(3.23)	(3.46)	(2.31)
Earnings Potentials	245.5	154.4	431.8
(thousands dollars)	(126.8)	(54.7)	(151.9)
Husband's Years of Schooling	10.54	9.44	12.79
	(3.30)	(3.55)	(2.39)
Husband's Earnings Potentials	432.3	300.1	648.4
(thousands dollars)	(178.6)	(84.5)	(217.5)
Husband's Age	32.58	31.89	34.95
	(5.79)	(6.25)	(5.53)
Age of Youngest Child (years)	2.88	2.77	3.09
	(1.59)	(1.53)	(6.46)
Number of Additional Adults	1.69	1.93	1.51
	(2.11)	(2.37)	(1.70)
N	45,609	5,010	2,166

Note: Standard deviations are in parentheses.

Table 2. Logistic Regressions Predicting Labor Force Participation of Married Mothers of Preschool-Aged Children

	Model 1	Model 2	Model 3	Model 4
Age				
15-24 years	-.160 ***	-.153 ***	-.111 ***	-.112 ***
	(.038)	(.038)	(.038)	(.038)
25-34 years	---	---	---	---
35-64 years	-.247 ***	-.236 ***	-.212 ***	-.207 ***
	(.042)	(.043)	(.043)	(.043)
Survey Year (centered on 1983)	.080 ***	.076 ***	.063 ***	-.015 **
	(.004)	(.004)	(.004)	(.008)
Birth Cohort (centered on 1960)	-.047 ***	-.048 ***	-.049 ***	-.048 ***
	(.004)	(.004)	(.004)	(.004)
Number of Children		-.167 ***		
		(.010)		
Age of Youngest Child				
00-12 months		-.417 ***		
		(.040)		
13-24 months		-.397 ***		
		(.035)		
25-36 months		-.349 ***		
		(.035)		
37-48 months		-.212 ***		
		(.036)		
49-60 months		-.145 ***		
		(.037)		
61-72 months		---		
Additional Adults in Household				
0		---		
1 – 2		.043 *		
		(.025)		
3 – 4		-.065 **		
		(.027)		
5 +		-.138 ***		
		(.033)		
Years of Schooling			.102 ***	.070 ***
			(.003)	(.004)
Years of Schooling × Year				.007 ***
				(.0006)
Husband's Years of Schooling				
Logged Earnings Potentials				
Husband's Logged Earnings Potentials				
Constant	-.070 ***	-.021	-1.599 ***	-1.251 ***
	(.027)	(.047)	(.040)	(.048)
Log likelihood	-30,611.913	-30,389.233	-30,103.603	-30,026.219
N		45,609		

Table 2. Logistic Regressions Predicting Labor Force Participation of Married Mothers of Preschool-Aged Children (Continued)

	Model 5	Model 6	Model 7
Age			
15-24 years	-.109 ***	-.152 ***	-.184 ***
	(.038)	(.038)	(.038)
25-34 years	---	---	---
35-64 years	-.205 ***	-.222 ***	-.248 ***
	(.043)	(.043)	(.043)
Survey Year (centered on 1983)	-.016 **	.032 ***	.041 ***
	(.008)	(.004)	(.005)
Birth Cohort (centered on 1960)	-.047 ***	-.031 ***	-.038 ***
	(.004)	(.004)	(.004)
Number of Children			
Age of Youngest Child			
00-12 months			
13-24 months			
25-36 months			
37-48 months			
49-60 months			
61-72 months			
Additional Adults in Household			
0			
1 – 2			
3 – 4			
5 +			
Years of Schooling	.055 ***		
	(.005)		
Years of Schooling × Year	.007 ***		
	(.001)		
Husband's Years of Schooling	.022 ***		
	(.004)		
Logged Earnings Potentials		.726 ***	.969 ***
		(.031)	(.042)
Husband's Logged Earnings Potentials			-.420 ***
			(.049)
Constant	-1.335 ***	-9.320 ***	-6.943 ***
	(.051)	(.369)	(.463)
Log likelihood	-30,011.284	-30,331.000	-30,294.782
N		45,609	

APPENDIX A

Analysis of a Sample with All Women Aged 15-64 Regardless of Marital Status

To examine the sample selection argument for the unexpected negative cohort trend, we conduct an auxiliary analysis based on a sample of all women aged 15 to 64, regardless of their marital status, in the Women's Marriage, Fertility, and Employment Survey. The size of this auxiliary analytic sample is 273,610.

Specifications of survey year and birth cohort in this auxiliary analysis are identical to the analysis in the main text, while specification of age is different. We add two additional age groups in this analysis to accommodate the fact that there are many more respondents aged 35 and above in this auxiliary analytic sample, with a total of four dummy variables included: 15-24, 25-34 (reference group), 35-44, 45-54 and 55-64.

We replicate the similar age-period-cohort model in this analytic sample for all women (see Table A). The results show both an upward period trend and an upward cohort trend in the labor force participation of all women.

In the downward cohort trend we find in married mothers of preschool-aged children, and the upward cohort trend in all women, we find a piece of indirect evidence for the sample selection explanation: it is the difference in work commitment among different birth cohorts that lead to the downward cohort trend in the selected sample of married

mothers of preschool-aged children in Taiwan.

APPENDIX B (for Reviewers Only)

Analysis Using Dummy Variables for Educational Attainment

We present results specifying educational attainment as years of schooling in the main text because the continuous-variable specification is more parsimonious and easier to interpret, but we show in this appendix that a dummy-variable specification of educational attainment leads to essentially the same conclusion. In the dummy-variable specification, we divide educational attainment into the following categories: 53.46% of respondents in our sample had an educational attainment of middle school or lower (i.e., 0-9 years of schooling, reference group), 33.35% of high school diploma (i.e., 12 years of schooling), 8.03% of some college (i.e., 14 years of schooling), and 5.17% of college degree or higher (i.e., 16 or more years of schooling). Compared to Model 3 in Table 2, the effects of educational attainment in a dummy-variable specification are monotonically increasing without the interaction (Model 1 in Table B). This suggests that a linear specification based on years of schooling may be a reasonable approximation to reality. Adding the interaction effect between educational attainment and survey year (Model 2 in Table B), the main effect of survey year indicating the period trend becomes .048,[7] which is comparable to the main effect of survey year (which is .053) in Model 4 of Table

[7] The main effect of survey year can be calculated following the same logic as for Model 4 of Table 2, i.e., $.042 + .000 \times 53.46\% + .015 \times 33.35\% + .006 \times 8.03\% + .004 \times 5.17\% = .048$.

2.

Table A. Logistic Regression Predicting Labor Force Participation of All Women Aged 15 to 64—Compared to Model 1 of Married Mothers of Preschool-Aged Children

	Married Mothers	**All Women**
Survey Year (centered on 1983)	.080 ***	.005 ***
	(.004)	(.001)
Birth Cohort (centered on 1960)	-.047 ***	.009 ***
	(.004)	(.0009)
Age		
15-24 years	-.160	-.548 ***
	(.038)	(.014)
25-34 years		---
35-44 years		.131 ***
		(.014)
45-54 years		-.226 ***
		(.021)
55-64 years		-1.056 ***
		(.030)
35-64 years	-.247 ***	
	(.042)	
Constant	-.070 ***	.256 ***
	(.027)	(.011)
Log likelihood	-30,611.913	-183,921.730
N	45,609	273,610

Table B. Logistic Regressions Predicting Labor Force Participation of Married Mothers of Preschool-aged Children Using Dummy Variables for Educational Attainment

	Model 1	Model 2
Age		
15-24 years	-.115 ***	-.115 ***
	(.038)	(.038)
25-34 years	---	---
35-64 years	-.175 ***	-.173 ***
	(.043)	(.043)
Survey Year (centered on 1983)	.051 ***	.042 ***
	(.004)	(.005)
Birth Cohort (centered on 1960)	-.034 ***	-.034 ***
	(.004)	(.004)
Years of Schooling		
0 – 9	---	---
12	.358 ***	.265 ***
	(.022)	(.031)
14	1.078 ***	1.068 ***
	(.039)	(.061)
16 +	1.522 ***	1.524 ***
	(.051)	(.080)
Years of Schooling × Year		
0 – 9 years × Year		---
12 years × Year		.015 ***
		(.004)
14 years × Year		.006
		(.005)
More than 16 years × Year		.004
		(.006)

Constant	-.809 ***	-.772 ***
	(.028)	(.030)
Log likelihood	-29,823.842	-29,814.700
N	45,609	45,609