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台灣擁有學齡前兒童的已婚婦女之勞動參與行為趨勢

**Trends in the Labor Force Participation among  
Married Women with Preschool Children in Taiwan**



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# 台灣擁有學齡前兒童的已婚婦女之勞動參與行為趨勢

## 中文摘要

近年來台灣婦女的勞動參與率持續提升，而主要變化集中於處於婚育階段的婦女。為檢視這群婦女的勞動參與趨勢，本研究使用婦女婚育與就業調查 1983 至 2006 年共 11 波的資料，並將樣本限定為擁有學齡前兒童的已婚婦女。

使用 APC 模型，本研究企圖分解這群婦女勞動參與趨勢的年齡(Age)、時期(Period)與世代(Cohort)的效果。本研究發現時期(Period)對婦女勞動參與趨勢有正向的效果，世代(Cohort)則有一個負向的效果。進一步，本研究企圖指認出時期與世代的效果分別是透過哪些機制影響這群婦女的勞動參與趨勢。研究發現，晚期台灣技術、資金密集的產業結構使地區性勞動市場提供更多誘因給教育程度較高的已婚婦女，並使他們更願意進入勞動市場。這些較高教育程度婦女的行為改變解釋了時期(period)的上升趨勢。另外，初步的分析顯示樣本選擇偏誤的問題可能解釋了世代的負向趨勢。不同世代間工作承諾感的差異使這些婦女進入樣本的機率不同，而造成世代的向下趨勢。

**關鍵字：**婦女勞動參與、趨勢、APC 模型、教育、產業結構

# **Trends in the Labor Force Participation among Married Women with Preschool Children in Taiwan**

## **ABSTRACT**

Using eleven waves of the Women's Marriage, Fertility, and Employment Survey, I examine trends in the labor force participation among married women with preschool children from 1983 to 2006 in Taiwan. The first aim of my research is to decompose the observed trends into cohort and period effects, net of age effects. Applying a variant of the Age-Period-Cohort (APC) model proposed by Mason et al. (1973), I find an upward period trend and a downward cohort trend. The second aim is to examine the empirical validity of competing theoretical mechanisms responsible for the trends. I find that neither family composition factors nor husband's characteristics help explain the period or cohort trends. Instead, the results show that behavioral changes across educational groups and the changing preference of the local labor market help explain the period trend. The results are also consistent with the sample selection argument that cohort differences in work commitment may partly explain the unexpected downward cohort trend among married women with preschool children.

**KEYWORD:** female labor force participation, industrial structure, trends, education, APC model

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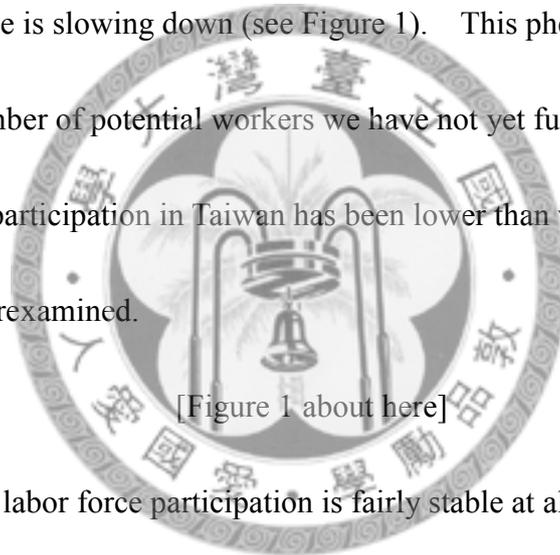
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# CHAPTER 1 INTRODUCTION

## 1.1 Motivation and Research Questions

Female labor force participation has been a recent concern regarding the development of domestic economy in Taiwan. Unlike the United States and European countries, the female labor force participation rates, despite increasing, have never exceeded 50% in Taiwan, and the increase is slowing down (see Figure 1). This phenomenon implies that there is still a large number of potential workers we have not yet fully “exploited.” Why the female labor force participation in Taiwan has been lower than western countries, however, remains underexamined.



[Figure 1 about here]

Unlike men, whose labor force participation is fairly stable at all ages, labor force participation varies substantially across different stages in a woman’s life course. Thus, understanding female labor force participation helps shed light on the issue of gender inequality in such domains like the family and the labor market. Previous studies have shown that over half of the Taiwanese women who were employed before marriage would leave the labor market either after marriage or after having a baby (Chien and Hsueh, 1996). In 2006, the labor force participation rates of the never married men and never married women were about the same level, but the difference between married men and married

women was 40% (see Figure 2).

[Figure 2 about here]

Although some of those women who left the labor market due to marriage or childbearing would return to work after their children reached school age, the interruption of their career would presumably still have a negative effect on their earnings (Chien, 1997; Lu and Hu 1997). This negative effect, known as “the motherhood penalty,” suggests that after controlling for education, work experience, and full-time/part-time work status, the average wage of mothers is less than the average wage of non-mothers (Fuchs, 1990; Waldfogel, 1997). Recent studies have shown that motherhood penalty has not declined over time in the United States (Avellar and Smock, 2003; Fuchs, 1990). One might expect to find a similar or even stronger motherhood penalty in Taiwan since the gender-role attitudes are more “traditional” in Asian societies than in the Western societies (Tsai et al., 1994). Hence, I argue that understanding women’s labor force participation, especially during the period of childbearing and childrearing, would contribute to our understanding of gender inequality within the family and the labor market.

In this thesis, I document and seek to explain trends in the labor force participation among married women with preschool children from 1983 to 2006, a 23-year period in which the overall labor force participation rates for women have increased from 42% to

47%.<sup>1</sup>

## 1.2 Trends in Female Labor Force Participation in Taiwan, Period or Cohort?

The overall female labor force participation rates have increased substantially in recent decades. If we decompose the age-specific trends, we observe a clear pattern by birth cohort. In Figure 3, for the cohort born between 1952 and 1961, labor force participation rates follow the pattern of an M-shape. This pattern indicates a relatively high labor force participation rate around age 20; the rate goes down when women reach their marriage and childbearing ages, and subsequently the rates bounce back when their children reach school age. For the youngest cohort (i.e. the cohort born between 1962 and 1967), however, the concave is filling up. The pattern is approaching an inverse U-shape, which is similar to the patterns of female labor force participation in other developed countries. This pattern means that these women stop leaving the labor force when they reach their primary marriage and childbearing ages. Changes in age pattern of female labor force participation in both Taiwanese and Western Societies are often interpreted as evidence for a cohort effect (Tsay, 1988; Li and Yang, 1996; Yi and Chien, 2001; Goldin, 1990; Fischer and Hout, 2006; Guo, 2008). However, previous studies have also documented evidence for a period effect

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<sup>1</sup> The figures are calculated by the author from the Women's Marriage, Fertility and Employment Survey (1983, 2006).

behind the trend in female labor force participation in the United States (Oppenhiemer, 1982; Lu, 1998).

[Figure 3 about here]

Most studies in Taiwan have not attempted to identify the distinct cohort effect versus the period effect responsible for the observed trends in female labor force participation.<sup>2</sup> Hence, they may have misattributed a period trend to a cohort trend for failing to consider both possibilities in the same analysis. Observed trends in female labor force participation often involve effects of age, period, and cohort that are difficult to distinctly identify (Oppenhiemer, 1982). Age effects are those factors related to an individual's age, which are often a manifestation of family life cycle factors. Period effects refer to the influences of specific events or social forces in a historical period on the behavior of all cohorts across all ages—for example, an economic recession may inflict an effect on the labor force participation of all women regardless of their age and birth cohort. Cohort effects are those tied to a particular birth cohort and influence the behavior of the entire cohort.

A standard linear regression including independent variables of age, period and cohort as continuous covariates cannot identify these distinct effects because these covariates are linearly dependent on each other, which constitutes a classic example of perfect collinearity

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<sup>2</sup> One exception is a study done by Guo (2008). Though she identified the period and cohort effects of trends in female labor force participation in Taiwan, Guo (2008) did not attempt to find factors that help explain the trends.

(Glenn, 2005). The classical approach to the problem of identifying the distinct age, period, and cohort effects is proposed by Mason et al. (1973). They suggest that one conduct a multiple regression with recoded age, period and cohort into sets of dummy variables to avoid the aforementioned linear dependence problem. This solution assumes that at least two adjacent age groups, time periods, or birth cohorts have identical effects on the dependent variable, which is usually not a substantial distortion of reality (Oppenheimer, 1982; Glenn 2005).

The Mason et al. solution has been criticized since its publication, and several statistical alternatives have been proposed (see Glenn 2005 for a review), but none—as a general solution to the Age-Period-Cohort identification issue—has performed more satisfactorily than theirs until perhaps recently (e.g., Yang, Fu, and Land 2004). Glenn (2005) suggests that there are underlying assumptions on parametric restrictions for each solution, and acceptance of these assumptions must not be selected haphazardly. Instead, whenever possible, the analyst should try to provide theoretical justification and substantive information to supplement the statistical results.

Recent studies have suggested that researchers should specify the underlying mechanisms behind the age, period, and cohort effects on the outcome variable. One example is the introduction of age-period-cohort-characteristic (APCC) models (O'Brien, 2000). These models include cohort characteristics, such as cohort size or other cohort

related characteristics concerning the outcome variable, instead of cohort itself. These models suggest that cohort is used as the proxy for the underlying cohort characteristics that affect the outcome variable. If we could find better proxies for these underlying cohort characteristics, why use cohort? This method could successfully estimate the effects of the selected cohort characteristics, but more often than not, fail to estimate the effects of age and period correctly. It is because one could hardly include all the cohort mechanisms underlying the cohort effect in the statistical models, and the remaining cohort effects will be confounded with the period and age effects, thereby making the period and age estimates unreliable (Glenn, 2005).

Winship and Harding (2008) have recently proposed an identifying strategy for the APC models that could avoid biased estimates resulting from unobserved age, period or cohort mechanisms. They not only estimate the age, period, and cohort effects on the outcome variable but also seek to identify the mechanisms intervening these distinct effects.

As mentioned above, the statistical results obtained from APC models are sensitive to different parametric restrictions so that analysts should not accept the assumptions haphazardly. Winship and Harding (2008) suggest that the acceptance of the assumptions should be theoretically motivated, and by specifying the mechanisms through which age, period, and cohort effects affect the outcome make the identification of APC model more reliable.

This is the strategy I follow, at least conceptually, in this thesis. I am going to apply the Mason et al. identification method as a baseline, supplemented with additional substantive analyses on the mechanisms.

From the discussion of Figure 1 and Figure 3, I argue that cohort and period effects together may have contributed to recent trends in female labor force participation in Taiwan. In this thesis, I seek to find mechanisms that help explain the cohort effect and period effect behind the trends in Taiwan. The conceptual framework adopted in this thesis is shown in

Figure 4.

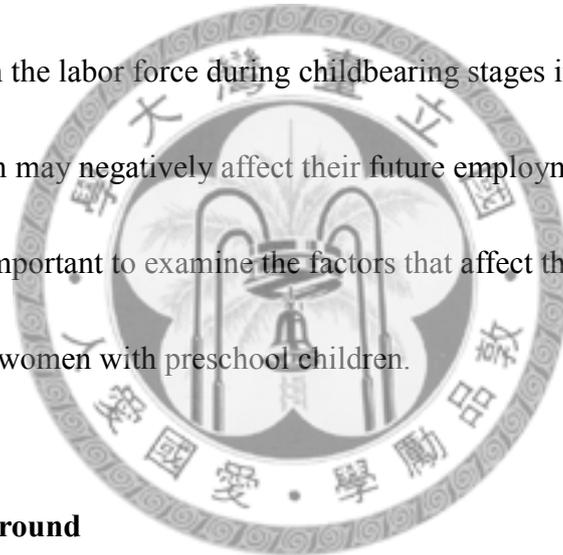


### 1.3 Why Focus on Married Women with Preschool Children?

As previous studies have proposed, labor force participation of women is closely related to their family life cycle (Oppenheimer, 1970; Oppenheimer, 1982; Waite, 1980). Glick (1947) describes six normative stages of the family life cycle: the first stage begins with marriage formation; the second stage begins with the birth of a first child; the third stage begins with the birth of a last child; and the following two stages begin, respectively, with the permanent departure of the first and the last child; and the sixth stage runs from the death of a spouse to the death of the other spouse, which marks the end of a “family.” The developments of the early stages depend largely on the ages and the number of children, and

an incompatibility between family and market work is known to exist during the childrearing years (Oppenheimer, 1982; Chien, 1997). Thus previous studies on female labor force participation often focus on the early stages of the family life cycle (Waite 1980).

There are several reasons to focus on the early stages while studying female labor force participation. First, the most rapid change in the patterns of female labor force participation has occurred among women with preschool children, that is, stages 2 and 3 of the family life cycle (Waite, 1980; Oppenheimer, 1970; Chen 1997). Second, decisions to stay in or withdraw from the labor force during childbearing stages interrupt the continuity of women's career which may negatively affect their future employment (Lu and Hu, 1997). For these reasons, it is important to examine the factors that affect the labor force participation of married women with preschool children.



#### **1.4 Theoretical Background**

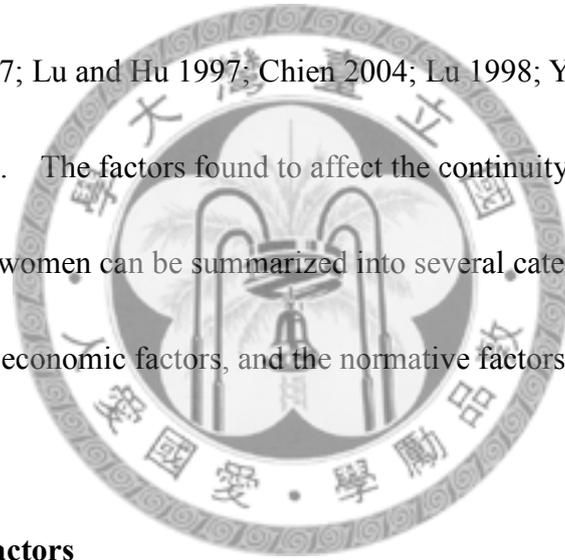
Previous studies have done much on the labor force participation of Taiwanese women, and most of them have focused on married women. Most of the prior research has examined the cross sectional phenomena of female labor force participation in Taiwan, but not much has examined the trends. In this section, I will first review studies on the cross sectional phenomena, and summarize the factors that may affect the continuity of labor force participation among married women in Taiwan. Next, I will examine the studies on the

trends in female labor force participation in general. While not many studies have examined the trends in Taiwan, I will review parallel studies done in other countries as well.

#### **1.4.1 Factors Affecting Female Labor Force Participation in Taiwan Using Cross**

##### **Sectional Data**

Many previous studies have sought to identify factors that affect the continuity of female labor force participation with cross sectional data (Chien and Hsueh, 1996; Yi and Chien, 2001; Chien, 1997; Lu and Hu 1997; Chien 2004; Lu 1998; Yu 2009; Chang, 1978; Liu, 1988; Chang, 1980). The factors found to affect the continuity of labor force participation of married women can be summarized into several categories: the family composition factors, the economic factors, and the normative factors.



##### **Family Composition Factors**

Factors related to family composition are the number and the ages of children, the number of additional adults in the household, and women's age. Married women who are during their marriage and childbearing ages are less likely to work than women who are not (Chien 2004). The more children a woman has and the younger her children are, the lower the probability she is to participate in the labor force (Chien and Hsueh, 1996; Lu, 1998; Lu and Hu, 1997; Chang, 1980). These findings are similar to those documented using

American data (Waite, 1980; Leibowitz and Klerman, 1995).

Additional adults in the household may serve as supplemental unpaid caregivers.

Previous studies have found that families using paid childcare have fewer additional teenagers and adults in the household than families that do not use paid care (Powell, 1997).

Tan and Yu's (1997) study on Taiwanese women also finds that additional teenagers and adults (i.e. household members aged 15 and above) in the household have a positive effect on a woman's hours of work. They interpret this result as reflecting a woman's likelihood to enlist the help from a supplemental unpaid caregiver.

However, additional adults in the household may also indicate whether or not a woman lives in a traditional household, which may be a source of pressure for the woman to stay home instead of participating in the labor force. In Taiwan, it is a traditional norm that a man does not move out of his family of origin to form an independent family until both his parents pass away; oftentimes brothers live together even after marriage. Although the norm is no longer strictly enforced, we may still expect a woman living with more additional adults to be living in a more traditional household than a woman living with fewer additional adults, and thus have a lower likelihood to participate in the labor force.

### **Economic Factors**

Educational attainment, work experiences, and earnings of both married women and

their husbands are often used as indicators of economic factors. Previous studies have found that the more a woman earns, the more likely she is to participate in the labor force (Chang, 1980). Earnings of a married woman's husband are often found to have a negative effect on married women's labor force participation (Chang, 1978). Economists call this the "income effect," which means that a woman with higher household income would be less willing to work than a woman with lower household income. The income effect counteracts with the "wage effect"—that is, a woman with higher wages would have a greater incentive to work and a higher opportunity cost if she does not than a woman with lower wages. As a woman's choice to work is more often a family decision than an individual decision, her husband's earnings, which can be treated as a woman's income, will be negatively related to her decision to work (Mincer, 1962). Educational attainment and work experience together are often used as the "reduced form" of earnings of married women and their husbands (Chien, 1997; Yi and Chien 2001; Chien and Hsueh, 1996; Chang, 1980). Occupation of the married woman and that of her husband are also sometimes used as proxies for their earnings potential (Chien, 1997; Lu and Hu 1997).

### **Normative Factors**

Normative factors are often indicated by the gender-role attitudes one holds. Previous studies have found that the more traditional a woman's gender-role attitude, the less likely

she would participate in the labor force (Yi and Chien, 2001; Lu 1998; Lu and Hu 1997). Sometimes without direct measure of gender role attitudes, educational attainment, controlling for earnings, can also be regarded as an indicator of such normative factors (Chang, 1978). The higher the educational attainment, the more modern gender role attitudes we would expect an individual (regardless of gender) to hold. Similarly, if a woman's husband holds a modern gender role attitude, we should expect her dual roles of being both an employee and a mother is more likely to be appreciated by her husband than one whose husband holds a traditional gender role attitude.

#### **1.4.2 Theories about Trends in the Female Labor Force Participation**

Prior literature on theories about trends in the female labor force participation focuses on the resources and constraints a woman faces when she makes her choices between family and work. One line of the literature focuses on the characteristics that a woman possesses, and argues that variation in these characteristics may lead to different probabilities of participating in the labor market. The other line focuses on the constraints a woman faces in the labor market including the industrial structures, atmosphere of the workplace, and earnings opportunities provided. It is worth to note that it is not either set of the factors alone that explains the trends in female labor force participation. Instead, it is the interaction between both sets of factors that help explain the secular trends in female labor

force participation (Oppenheimer, 1982).

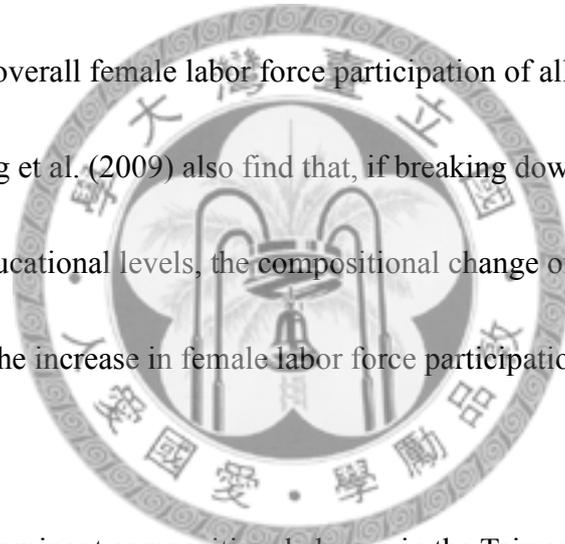
In the following section, I review both lines of the literature and construct theories to explain trends in the labor force participation among married women in Taiwan.

### **1.4.3 Compositional and Behavioral Changes among Married Women**

The characteristics of married women may help explain trends in female labor force participation through two dimensions: changes in population composition and changes in behavior (Chang, 1997; Huang et al., 2009; Shapiro and Shaw, 1983).

Shapiro and Shaw (1983) try to decompose the compositional and behavioral changes on female labor force participation by studying the trends in the United States. They document a large difference in labor market attachment between women aged 30-34 in 1967 and their counterparts in 1978. They argue that more than 50% of the increasing labor market attachment of these two cohorts can be explained by the compositional change of the population, such as educational expansion for women and changes in family structures, rather than by the behavior adjustment of women in the younger cohorts. Even though the behavior pattern of the subgroups of the population have not changed over time—which means the effects of the determinants of female labor force participation have not changed over time—the composition of the population has shifted to the direction where the proportion of working women is continuously increasing.

Examining changes in female labor force participation rates between 1980 and 2005 in Taiwan, Huang et al. (2009) also find that the compositional change of the population is one of the major factors explaining the recent trends in Taiwan. They decompose the compositional change by educational levels, marital status, and family structures of the population. They find that the direction of the changing composition of these factors have shifted in a way parallel to the changes in female labor force participation. For example, the proportion of married women with preschool children has decreased over time, which explains partly why the overall female labor force participation of all married women has been increasing. Huang et al. (2009) also find that, if breaking down the labor force participation rates by educational levels, the compositional change of each educational group explains most of the increase in female labor force participation rates in Taiwan during this period.



In sum, the most prominent compositional change in the Taiwanese society in the past few decades is educational expansion. In the past 30 to 40 years, the enrollment of teenagers and the number of higher-education institutions have increased dramatically. There were only a total of 7 colleges (including junior colleges, colleges and universities) in Taiwan in 1950, compared to a total of 164 colleges in 2008. In 1976, the enrollment rate of teenagers aged 12 to 17 was 65.7%, compared to 94.9% in 2008. For teenagers aged

18-21, the enrollment rates rose from 10.0% in 1976 to 59.8% in 2008.<sup>3</sup> In 2008, almost all teenagers between ages 12 and 17 were enrolled in junior or senior high school, and over half of the teenagers between ages 18 and 21 were enrolled in college.

In 1970, female enrollment rates of both age groups mentioned above were lower than those of their male counterparts. However, in 2008, female enrollment rates have surpassed male enrollment rate in both age groups. Apparently, women have benefited more from the educational expansion in Taiwan than men.

What are the implications of the expansion of female education? Holding constant the effect of educational attainment on female labor force participation, we expect that the higher a woman's educational attainment, the higher her probability to participate in the labor force. Educational attainment is often understood as having a positive effect on labor force activities for individuals through the accumulation of human capital.

In the human capital tradition, Rosenzweig (1995) argues that schooling improves individuals' productivity by enhancing their ability to learn and by expanding their access to information. In other words, through schooling, we improve our productivity and thus increase our human capital which may potentially provide us with greater chances to earn more in the labor market. Facing a choice between family and work, women who have accumulated more human capital would be more likely to stay in the labor force than women

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<sup>3</sup> Ministry of Education, Republic of China, 2008. *Educational Statistics of the Republic of China 2008*.

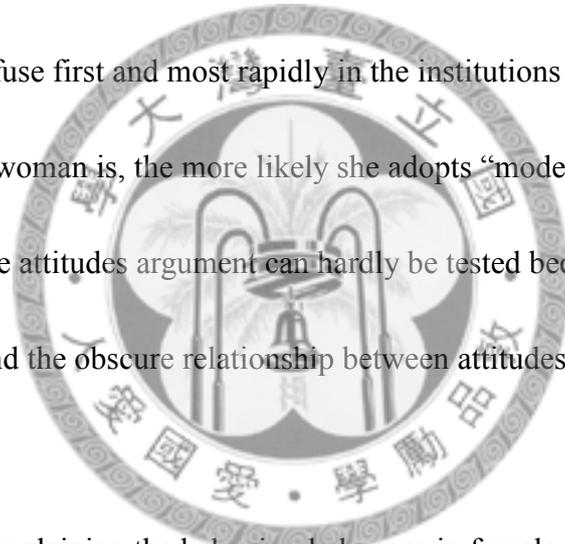
who have accumulated less human capital. If women are getting more education in general, female labor force participation rates should increase over time.

One of the aims of my thesis is to examine the influence of compositional change associated with educational expansion on the trends in female labor force participation in Taiwan. I argue that the effect of educational expansion represents the cohort effect in explaining trends in female labor force participation in Taiwan, since it is across cohort that the average level of educational attainment differs and individuals in the same birth cohort tend to go through educational transitions at approximately the same age.

However, the effect of the educational attainment may also increase (i.e. the behavioral change) and contribute to trends in the female labor force participation. Behavioral change means the alteration of response to environmental changes, including changes in economic structures or changes in social norms.

In Taiwan, we observe similar trends in behavioral changes associated with female labor force participation. The average labor force participation rates for women of all educational groups, except for women with six years of schooling or lower, have increased substantially from 1983 to 2006 (see Figure 5). The greatest and most constant increase among all educational groups is women with a junior or senior high school diploma, and the difference in labor force participation rates of these women between 1983 and 2006 is as high as 20%.

The observed behavioral change in female labor force participation may be explained by changes in gender-role attitudes. As prior research has suggested, the traditional values in Taiwanese and Western societies stipulate that the pivotal role of a married woman is being a good wife and a good mother (Sweet, 1982; Yi and Chien, 2001). However, the traditional values have changed in response to the pursuit of gender equality all over the world. More and more people recognize and support a multitude of roles for women holding the “modern” gender-role ideology (Spain and Bianchi, 1996). These changes in gender-role attitudes diffuse first and most rapidly in the institutions of education. The more highly educated a woman is, the more likely she adopts “modern” gender-role attitudes. However, the gender-role attitudes argument can hardly be tested because of the lack of appropriate indicators and the obscure relationship between attitudes and behaviors (Ajzen, 1988).



Another argument explaining the behavioral changes in female labor force participation is to consider the structural constraints faced by these women while making their decisions about labor work and child care. This leads us to consider the interactions between changes in behavior and the constraints of the local labor market.

#### **1.4.4 Preference of the Local Labor Market**

Brinton (1995) suggests that the increasing effects of educational attainment must be

considered in the context of local labor market. The context of the local labor market may include the atmosphere of the workplace, earnings opportunities, and the kind of occupations or positions provided by the local labor market (Oppenheimer, 1970; Yu, 2009; Huang et al., 2009). These conditions, taken together, construct a preference for the kinds of employees favored by the local labor market.

Previous studies conducted in the Western societies have documented evidence in support of the labor market explanations (Goldin, 1990; Oppenheimer, 1970). For example, Goldin (1990) suggests that, in the United States during the 1920s and 1930s, younger and less experienced (and unmarried) high-school girls are more likely to be hired and retained in the labor force than older and more experienced (and married) women. However, demographic changes such as the decline in fertility and the increase in education have led to the declining supply of young women in the 1950s. Companies need to adapt to the shortage in supply of young women in the 1950s by considerably altering their labor market preference. Those older and more experienced women—who have left the labor market earlier upon marriage, by now past their childrearing age—are suddenly welcomed in the labor market.

In sum, when the supply of laborers is inadequate, increasing demand for female labor may remove the marriage barriers and change preferences of the labor market. Employers may therefore make better offers to married women than they used to, thereby changing the

labor force behavior of these women (Brinton 1995; Yu, 2005).

In her comparative research of Japanese and Taiwanese female labor force participation, Yu (2009) finds that because of higher labor demand in Taiwan during the postwar period, employers of Taiwanese firms need to provide better incentives for female homemakers to leave their home and join the labor force. Female workers in this period, however, have still concentrated in the labor-intensive industries which demand mostly low-skilled laborers, and women with higher education may still remain relatively uninterested in the labor force.

By the 1980s, the Taiwanese economy has shifted from labor-intensive industries to skill- and capital-intensive industries, and the demand for more highly educated and skilled workers has expanded (Yu, 2009). Women with higher education are then both favored by the employers who are willing to provide jobs with a better pay and better career prospects for female employees, and these women, in turn, are also more willing to take these jobs.

In sum, the adjustment of labor force participation behavior of married women with higher education must be understood in terms of the changing preferences of the local labor market. If the marriage barriers remain, and the labor market prefers women with low skills, the impact of educational attainment would be relatively small. In contrast, if the labor market favors women with higher education, the impact of educational attainment would be relatively large.

Using a time series of cross-sectional data, Tan and Yu (1996) document a structural

change in the demand of the labor market in Taiwan over time. Distinguishing the labor market in Taiwan into a primary and a secondary labor market, they find that female and ethnic minorities often face noneconomic barriers when entering the primary labor market, which often offers better wages and better benefit packages than the secondary labor market. They find a gender difference in the probability of entering the primary labor market in 1978, but the gender difference has become smaller in 1992. They conclude that the demand structure of the labor market in Taiwan has changed over time. Women in 1992 face lower noneconomic barriers when entering the primary labor market than women in 1978.

In sum, I argue that the change in preferences of the local labor market may help explain trends in female labor force participation in Taiwan. In earlier times, the labor-intensive industrial structure in Taiwan did not favor women with higher education. Now that Taiwan has shifted to skill- and capital-intensive industries since the 1980s, and the preferences of the labor market have changed as well, more highly educated women have increasingly experienced better job prospects in the labor market.

The goals of my thesis are to examine both the changing behavior of better-educated women and the changing preferences of the local labor market. I use a two-step analysis. First, I examine changes in the effect of educational attainment on labor force participation over time, and see whether women with higher education are more likely to participate in the labor force in a later period than in an earlier period. Second, I construct the year-

area-, education-, and age-specific “potential earnings” for each individual woman. These potential earnings represent the preferences of local labor markets. I then examine whether the effect of educational attainment and the effect of preferences of local labor market both explain the overall trends in female labor force participation. If so, I argue that it is consistent with the hypothesis that the increasing preference of the local labor markets for more highly educated women plays a role in driving the increase in female labor force participation in Taiwan. It is important to note, however, that these two measures represent period effects when explaining the recent trends in the female labor force participation in Taiwan. All else being equal, women with the same level of educational attainment across birth cohorts should all be preferred more by the labor market in the later period than in the earlier period.



#### **1.4.5 Summary of Hypotheses**

Previous studies on trends in labor force participation among married women in Taiwan have not decomposed the explanatory factors into factors contributing to the period effects and factors contributing to the cohort effects. In this thesis, I seek to identify factors that may help explain the cohort and period effects of the trends in labor force participation for married women with preschool children from 1983 to 2006. I use linear trend indicators of calendar year and birth cohort to indicate, respectively, the period effect and the cohort

effect. The expected effects on labor force participation of married women and the trends for each potential explanatory variable are summarized in Table 1.

[Table 1 about here]

Following the logic of Leibowitz and Klerman (1995), I use the interaction of educational attainment with a trend indicator of calendar year to indicate the changing effect of educational attainment over time. If the coefficient of the interaction term significantly differs from zero, and helps explain the coefficient of the period trend indicator, I argue that this is evidence for changing behaviors in labor force participation for women of different level of education. Moreover, if the coefficient of potential earnings of married women, which indicates the preference of the local labor market, also helps explain the coefficient of the period trend indicator, I argue that it is the incentives that the local labor market provided for those better-educated women that promote the behavioral changes of their labor force participation during the quarter century in my study.

Educational attainment alone (i.e., without the interaction term) indicates the effect of educational expansion. Following the same logic, if the inclusion of educational attainment (without the interaction term), which is the indicator of educational expansion, explains the cohort coefficient, I argue that the educational expansion helps explain the cohort trend in female labor force participation. In addition, I include family composition factors and husband's characteristics in my analysis as explanatory variables.

## CHAPTER 2 DATA AND VARIABLES

### 2.1 Women's Marriage, Fertility, and Employment Surveys

I use data from eleven waves of the Women's Marriage, Fertility, and Employment Survey, a repeated cross-sectional survey of nationally representative samples of women aged 15 and above residing in Taiwan.<sup>4</sup> The eleven waves of survey were administered via face-to-face interview in 1983, 1984, 1985, 1986, 1987, 1988, 1990, 1993, 2000, 2003 and 2006. The survey includes a wealth of information on women's labor force participation, marriage, childbearing history, and family composition, and thus is suitable for the purpose of my study.

My main analysis is limited to married women with preschool children (i.e. six years of age or younger). After list-wise deletion of respondents with missing data on the dependent variable and explanatory variables, the size of the analytic sample is 45,609. A supplementary analysis is done on all women aged 15 to 64, regardless of their marital status. After excluding women aged 65 and above, the size of this analytic sample is 271,293.

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<sup>4</sup> Data analyzed in this thesis were collected by the Directorate General of Budget, Accounting and Statistics of Executive Yuan, R.O.C. (Taiwan). The Center for Survey Research of Academia Sinica is responsible for the data distribution. I appreciate the assistance in providing data by the institutes and individuals aforementioned. The views expressed herein are my own.

## 2.2 Family Income and Expenditure Surveys

I pool data from the Family Income and Expenditure Surveys (FIES) from 1981 to 2005 to estimate the age-, education-, and year-specific earnings potential in the local labor market. FIES is an annual repeated cross-sectional survey of nationally representative samples containing information on each respondent's age, education attainment and earnings and thus is suitable for my study.

## 2.3 Variables

### 2.3.1 Dependent Variable: Labor Force Participation

I follow the Ministry of Interior Affairs of Taiwan's official definition to construct a binary dependent variable to indicate the respondent's labor force participation. The respondent is considered in the labor force 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 out of the labor force.

### 2.3.2 Explanatory Variables

I construct three sets of variables to test the family composition explanation: (a) the number of children is a continuous variable, and based on the respondent's answer to the question of "How many children do you have now?" (b) I create five 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). Each of these dummy variables is coded 1 if the age of the respondent's youngest child falls into the specific age category, and coded 0 if not. (c) The number of additional adults in the household is included as three dummy variables: 0 adults (reference category), 1 to 2 adults, 3 to 4 adults, 5 or more adults. These series of dummy variables are based on the number of household members aged 15 or older other than the respondent and her husband.



To examine whether recent trends in women's labor force participation is a period phenomenon or a cohort phenomenon, I use a continuous variable to indicate period trend by calendar year, centered at 1983. In the analysis of married women with preschool children, I construct a continuous variable for the respondent's birth cohort, centered at 1960. In the analysis of all women aged 15 to 64, I use three dummy variables to indicate four birth cohorts, including women born between 1919-1938 (reference group), 1939-1958, 1959-1978, and 1979-1991.

I also construct a series of dummy variables to indicate the respondent's age. In the analysis of all women aged 15 to 64, age is divided into five categories: 15-24 (reference group), 25-34, 35-44, 45-54 and 55-64. In the analysis of married women with preschool children, due to the small number of women having preschool children older than the age

of 35, those age categories of 35-44, 45-54 and 55-64 are combined into the same category, using 25-34 as the reference category.

Educational attainment of the respondent is included as a continuous variable (measured as the years of schooling) or as a series of dummy variables in different models. In the dummy variable specification, I divide educational attainment into the following categories: 0-9 years of schooling (reference group), 12 years of schooling, 14 years of schooling, and 16 or more years of schooling.

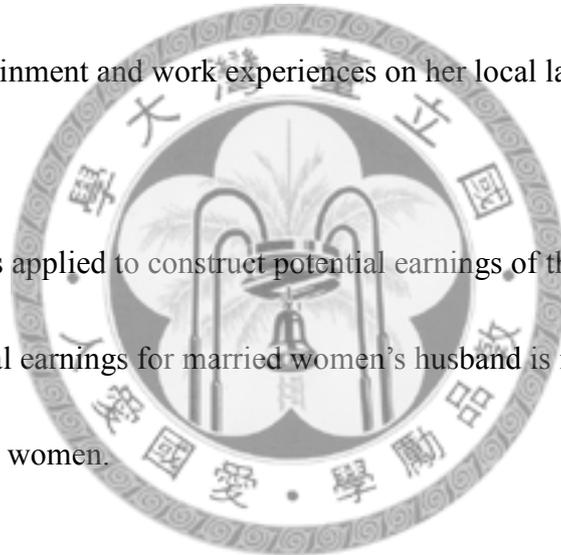
To indicate the changing effect of educational attainment over time, I add the interactions of educational attainment and calendar year. Age and educational attainment of the respondent's husband are included as continuous variables.

To examine the preference of the local labor market, I draw data from the Taiwan Family Income and Expenditure Surveys (FIES) from 1981 to 2005 to estimate the potential earnings opportunities in the local labor market of women. Following the logic of Mincer's (1962) earnings equations, I use education and the Mincer's experience to construct the potential earnings of women in specific year period and local market. First, I group the 25-year FIES data into five-year periods: 1981 to 1985, 1986 to 1990, 1991 to 1995, 1996 to 2000 and 2001 to 2005; Mincer's experience into 11 groups: 0 to 3, 4 to 7, 8 to 11, 12 to 15, 16 to 20, 21 to 25, 26 to 30, 31 to 35, 36 to 40, 41 to 50 and 51 to 60. Second, within each period, I compute mean logged earnings for each education-experience

group for each county-specific labor market. The logged earnings are adjusted for inflation by consumer price index (CPI) and expressed in 2006 dollars. I use this non-parametric procedure to capture potential non-linear variations in the Mincer's equation. These estimated earnings are linked to the Women's Marriage, Fertility, and Employment Survey for women of the same characteristics and in the same calendar-year period.<sup>5</sup>

One advantage of my approach is that the predicted logged earnings is independent of a particular woman's personal preferences for work and family, and captures the average effect of educational attainment and work experiences on her local labor market earnings opportunities.

The same method is applied to construct potential earnings of the married women's husbands. The potential earnings for married women's husband is included to indicate the income effect of married women.



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<sup>5</sup> Due to poor data qualities of the 2006 FIES survey, the potential earnings of women in the 2006 Women's Marriage, Fertility, and Employment Survey are computed by data from the FIES 2001 to 2005 surveys.

## CHAPTER 3 STATISTICAL MODELS

### 3.1 Logistic Regressions

I use two sets of logistic regression models in this thesis. The first set of models is to predict the labor force participation of these married women with preschool children, and examine if the direction of the predictions are consistent with what prior theory would lead us to expect. The second set of models includes APC models examining the trends in the labor force participation of these women.

Among the APC models, the first model includes age, calendar year and birth cohort to identify the period and cohort effects of the trends in labor force participation of married women with preschool children:

$$\log\left(\frac{p}{1-p}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} \quad (1)$$

I then add each set of the explanatory factors to the model respectively, and examine how the coefficients for the period effect ( $b_3$ ) and cohort effects ( $b_2$ ) of the trends in labor force participation change after the inclusion of these explanatory variables.

Model 2 includes age, period, cohort, and the family composition factors. Model 3 includes age, period, cohort, and variables of the husband's characteristics. Model 4 and Model 5 include age, period, cohort, and educational attainment. Model 6 and Model 7

include age, period, cohort, educational attainment and the interaction term of educational attainment and calendar year. Educational attainment is included as a continuous variable in Model 4 and Model 6, and as dummy variables in Model 5 and Model 7. Model 8 includes age, period, cohort and potential earnings. Model 9 includes age, period, cohort and all the explanatory variables (see Equation 2 to 9).

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{FamComp}} \quad (2)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{Husband's}} \quad (3)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{Years of Schooling (YoS)}} \quad (4)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{Edu Dummies}} \quad (5)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{YoS}} + b_5 \cdot X_{\text{YoS}} \cdot \text{Year} \quad (6)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{EduDummies}} + b_5 \cdot X_{\text{EduDummies}} \cdot \text{Year} \quad (7)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{Earnings}} \quad (8)$$

$$\log\left(\frac{\rho}{1-\rho}\right) = b_0 + b_1 \cdot \text{Age Dummies} + b_2 \cdot \text{Cohort} + b_3 \cdot \text{Year} + b_4 \cdot X_{\text{All}} \quad (9)$$

If, by adding any set of the explanatory variables, the coefficient for calendar year or birth cohort approaches zero, I interpret the results as in support of the claim that this set of explanatory variables helps explain the period effect or the cohort effect behind trends in the labor force participation of married women with preschool children.

## CHAPTER 4 RESULTS

### 4.1 Descriptive Statistics

Table 2 presents descriptive statistics of the sample of all women aged 15 to 64 and the sample of married women with preschool children. I report descriptive statistics of all eleven waves (from 1983 to 2006), as well as descriptive statistics of the first (1983) and the last (2006) cross sections. The latter part provides a crude, but informative, comparison of the trend in these variables of interest.

[Table 2 about here]

The first three columns are for all women aged 15 to 64. The labor force participation rates for these women are 44% in 1983, and 57% in 2006. In 1983, the percentage of women aged 15 to 64 who were never married is 31% and it has slightly increased to 35% in 2006. On the contrary, the percentage of being married has decreased from 63% in 1983 to 57% in 2006. These figures show that more women are participating in the labor force and more women are never married over these 23 years.

The fourth, fifth, and sixth columns present descriptive statistics of married women with preschool children. In 1983, only one third (34%) of married women with preschool children are in the labor force, and the percentage has almost doubled (to 62%) in 2006. Married women have an average of 2.4 children in 1983, but only 1.8 children in 2006.

Because the demand for rearing a child and the demand for work often compete for the limited time and energy a woman has, women with fewer children are expected to be more likely to participate in the labor force. Similarly, the average age of married women has increased from 28.0 to 31.7 years old, and the average age of these women's husbands has risen from 31.9 to 35.0 years old between 1983 and 2006. Married couples with preschool children in 2006 are, on average, older than their counterparts in 1983—which might reflect the delay of marriage and the delay of childbearing. Delay of marriage and childbearing for women in 2006 may be accompanied with more work experiences, and higher earnings than their counterparts in 1983. More work experiences and higher earnings provide greater incentives for these women to participate in the labor force. Similarly, the earnings of their husbands might also be higher in 2006 than in 1983. However, greater earnings of the husband might decrease the labor force participation of married women with preschool children by reducing the necessity for them to contribute to household income. Married couples are living with fewer adults (other than themselves) in the same household in 2006 than their counterparts in 1983, but it is unclear how this trend would affect trends in the labor force participation of these women.

Educational attainment and potential earnings of married women with preschool children and those of their husbands have risen dramatically between 1983 and 2006. In 2006, married women with preschool children are more likely to be high school graduates,

and to have higher potential earnings than their counterparts in 1983. These trends might lead to an upward trend in female labor force participation.

In contrast, growth in their husband's educational attainment may have led to growth in family income. Family income, in turn, would have a negative effect on these women's labor force participation. The effect of husband's education on women's labor force participation is ambiguous due to two countervailing mechanisms: highly educated men may embrace a modern gender-role ideology that encourages their wife to work. Compared with lower educated men, they also tend to earn more so that their wife may have lower incentives to participate in the labor force.



## **4.2 Regression Results**

### **4.2.1 Factors Predicting Labor Force Participation**

In Table 3, I examine whether each set of explanatory variables help predict the labor force participation of married women with preschool children as previous studies would lead us to expect. Two sets of coefficient estimates are presented: those obtained by bivariate regressions considering only the variable itself (unadjusted) and those obtained from a model including all the variables (adjusted). Age estimates in these models may be confounded with period or cohort effects, thus is only included as a control to examine the effects of other explanatory variables.

[Table 3 about here]

The bivariate analysis shows that the more children a woman has, the lower the probability she participates in the labor force. However, after controlling for other factors, the negative effect no longer remains.

The direction of the age of a woman's youngest child is as expected: the younger the age of a woman's youngest child, the lower the probability she participates in the labor force—presumably because women having younger children have greater demands for childcare, and thus are less likely to participate in the labor force than women with older children.

Compared with women with no additional adults in the household, women with one or two additional adults in the household are more likely to be in the labor force. Women having three or more additional adults in the household, however, are less likely to be in the labor force than women having no additional adults in the household. I interpret these results to suggest that one or two additional adults in the household may provide help in childcare to these married women, but households with many adults may be relatively traditional and impose pressures for the women to stay home.

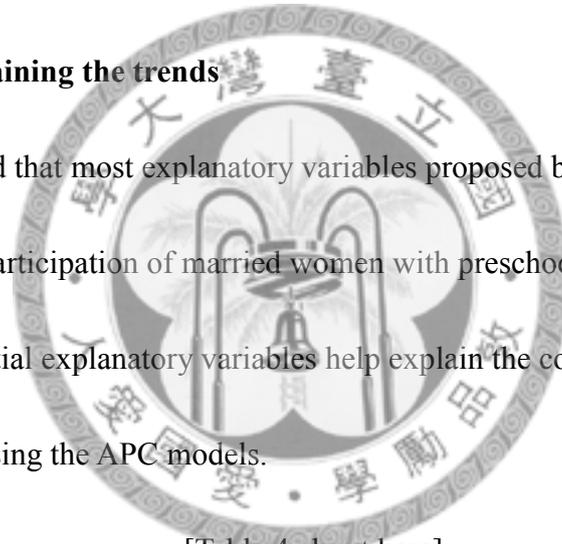
The effects of husband's characteristics on these women's labor force participation are confounded with other variables. For example, husband's potential earnings is the proxy for the income effect on women's labor force participation, but the estimates could only be

interpreted causally after controlling for women's earnings, which serves as the wage effect. After controlling for all other variables, women having more highly educated husbands, younger husbands, and husbands with lower potential earnings are more likely to participate in the labor force than women having husbands who are otherwise.

Finally, women of higher education and higher potential earnings are more likely to participate in the labor force than women of lower education and lower potential earnings.

#### 4.2.2 Factors Explaining the trends

From Table 3, I find that most explanatory variables proposed by the past literature help predict the labor force participation of married women with preschool children. In Table 4, I examine if these potential explanatory variables help explain the cohort effect or the period effect of the trends by using the APC models.



[Table 4 about here]

In Model 1, I decompose trends in the labor force participation of married women with preschool children into age, period and cohort effects. I am not particularly interested in the age effects, but discretize the age variable to purchase identification of the three otherwise perfectly collinear time trends. Nonetheless, the patterns of age effects are consistent with what one would expect. Women between ages 25 to 34 years old have the highest probability to participate in the labor force than women of younger or older ages.

Many women aged 15 to 24 are still in school, and thus are not part of the labor force. The oldest group of women consists of married women with at least one preschool child from age 35 and up, and has the lowest labor force participation rate.

The period effect indicated by the coefficient of calendar year shows that the labor force participation rates for married women with preschool children have increased from 1983 to 2006 with an odds ratio of 1.08 ( $= \exp[.0803]$ ) per year. The cohort effect is, somewhat unexpectedly, in the opposite direction to the period effect: married women with preschool children in more recent birth cohorts have lower chances to participate in the labor force than their counterparts in the earlier birth cohorts.<sup>6</sup>

In Models 2 to 6, I include different sets of explanatory variables separately, and see how they affect estimates of the time trends. All but one of these variables indicate theoretical mechanisms presumably associated with the period trends. Hence, their inclusion changes relatively little of the estimated age effects and cohort effects across all models.<sup>7</sup>

In Model 2, I add family composition factors including the number of children, the age

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<sup>6</sup> The monotonic developments of educational expansion and industrial structures in Taiwan lead us to expect monotonic trends for both period and cohort effects. Different specifications of recoding period and cohort effects into sets of dummy variables are also done by the author. The results also show monotonic estimates of both period and cohort effects.

<sup>7</sup> Educational expansion indicates a cohort mechanism, but its inclusion has little impact on the estimated cohort effect either.

of the youngest child, and the number of additional adults in the household. The directions of these family-composition effects are consistent with my expectation but the inclusion of these family composition factors has explained little of the period effect. The coefficient for calendar year changes from .0803 in Model 1 to .0762 in Model 2. Hence, these factors are unlikely to account for trends in the labor force participation of these women.

Model 3 includes husband's characteristics including husband's educational attainment, husband's potential earnings, and husband's age. None of these husbands' characteristics help explain the period effect on the labor force participation of these women, either, with the coefficient of calendar year remaining almost unchanged.

Model 4 includes women's educational attainment, measured by years of schooling, as a proxy for the compositional effect of educational expansion. The results show that educational attainment has a positive effect on labor force participation for married women with preschool children, but it has not explained the coefficient for the cohort indicator as prior theory has expected. Neither does its inclusion change much of the coefficient for calendar year.

Educational attainment, as a linear term of years of schooling, and the interaction of educational attainment and calendar year are included in Model 6. In this specification, the coefficient for calendar year decreases and flips sign (from .0803 in Model 1 to -.0154 in Model 6), and the coefficient for the interaction term is significantly greater than zero.

This suggests that the increase in the impact of educational attainment on labor force participation helps explain the period trends in the labor force participation of married women with preschool children between 1983 and 2006.

To examine if the effect of educational attainment on labor force participation is linear, I use a series of dummy variables to replace years of schooling (see Model 5 and Model 7). In Model 5, the results are similar to Model 4. Model 7 adds the interaction terms of each educational category with calendar year. The results show that, the difference in the probability of labor force participation for women with 0-9 years of schooling and women with 12 years of schooling are getting larger over time. The difference between women with 0-9 years of schooling and women with 14 or more years of schooling is also increasing over time, but this latter difference is not statistically significant. In sum, the findings are consistent with behavioral changes in labor force participation across educational groups as an explanation for trends in labor force participation among these women, but the change is the greatest among married women with a (senior) high school diploma.

In Model 8, after adding women's potential earnings, the coefficient for calendar year reduces from .0803 in Model 1 to .0320 in Model 8. Model 8 shows that woman's potential earnings, the indicator of preference of the local labor market, also has a positive effect on women's labor force participation; and this helps explain the period trends in labor force

participation among married women with preschool children.

All five sets of explanatory variables are included in Model 9. The pattern of each variable remains as what previous models have shown, except that husband's age is no longer significantly different from zero.

In sum, both the interaction between educational attainment and calendar year, and women's potential earnings help explain the period trends (with the coefficient for calendar year changing from .0803 in Model 1 to -.0246 in Model 9). The inclusion of these explanatory variables, however, does not help explain much of the cohort trends (with the coefficient for birth cohort changing only modestly from -.0466 in Model 1 to -.0373 in Model 9).



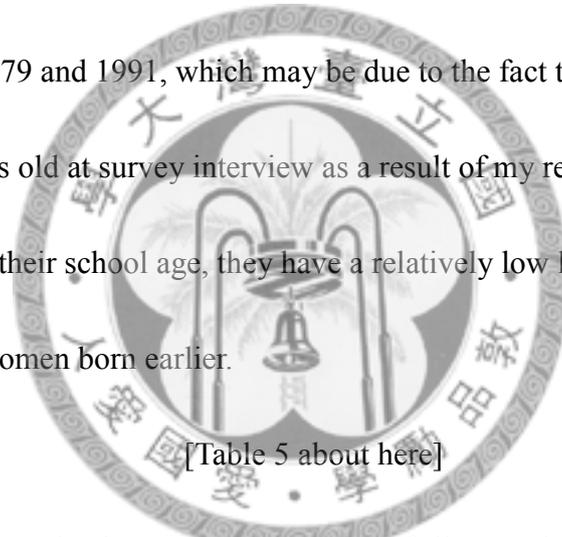
#### **4.3 Looking into the Downward Cohort Trend**

In Model 1 to Model 9, I observe an unexpected negative cohort effect on labor force participation among married women with preschool children, net of age and period effects. I speculate that this anomalous cohort-effect finding may be due to sample selection bias. So far, the analytical sample focuses on married women with preschool children, but some women with high work commitment may not have children or may not even get married, and thus are not part of the sample. This leaves my sample selected on women with lower average work commitment than the general population. Because women in more recent

cohorts tend to have higher work commitment than women in earlier cohorts, this sample selection problem is more serious in more recent cohorts than in earlier cohorts, and may produce a negative estimate of the cohort effect.

To test my speculation, I replicate the analysis of a similar age-period-cohort model on an analytic sample of all women (of all marital statuses) aged between 15 and 64 inclusively.

Results in Table 5 show that women born in more recent cohorts are more likely to participate in the labor force than women born in earlier cohorts. The only exception is for women born between 1979 and 1991, which may be due to the fact that women in this cohort are under 27 years old at survey interview as a result of my research design. As most of them are still in their school age, they have a relatively low likelihood to participate in the labor force than women born earlier.



[Table 5 about here]

In sum, I find an upward cohort trend for women of all marital statuses between ages 15 and 64, but a downward cohort trend for only married women with preschool children. This is consistent with my speculation that by limiting my analytic sample to married women with preschool children, I leave out women with higher work commitment than an average woman drawn from the general population. This sample selection may be responsible for the unexpected negative cohort trends in my analysis.

## CHAPTER 5 DISCUSSION

This study attempts to address two research questions. First, what factors predict the labor force participation of married women with preschool children? Second, what are the cohort and period effects behind trends in labor force participation among married women with preschool children during the period from 1983 to 2006 using a mechanism-based approach that is similar to the approach described in Winship and Harding (2008)?

### 5.1 Factors Predicting Labor Force Participation of Married Women with Preschool

#### Children

This study shows that except for the number of children, all explanatory variables predict labor force participation of married women with preschool children.

As expected, childcare and work compete for mother's time and energy. Thus, the younger a woman's youngest child, the more likely a woman is to be out of the labor force.

Previous research has suggested that additional adults in the household may serve as supplemental unpaid caregivers. If so, these additional adults help accommodate married women's need for childcare (Tan and Yu, 1997). My results show that, in contrast to the linear specification in previous research, the effect of additional adults on women's labor



force participation is nonlinear: one or two additional adults in the family may serve as help in childcare, but too many additional adults in the household may represent a traditional family which is a source of pressure for women to stay at home rather than work.

Husband's earnings are conceptualized as the income effect on labor force participation of married women with preschool children as in prior research (Lu and Hu 1997). My results show that being married to a higher-earning husband discourages women to participate in the labor force. The effect of husband's educational attainment, net of his earnings, is conceptualized to indicate the gender-role attitudes of the husband. The higher the educational attainment, the more modern gender-role attitudes we expect one to hold. My results are consistent with the argument that husbands with a more modern gender-role attitude are more likely to appreciate a multitude of roles than husbands with a more traditional gender-role attitude, thereby encouraging women to participate in the labor force.

The above factors are predictive of labor force participation of married women with preschool children, but they explain neither the cohort effect nor the period effect of trends in the labor force participation of these women.

## **5.2 Factors Explaining the Trends in Labor Force Participation**

Using a variant of the APC model first proposed by Mason et al. (1973), I find an upward period trend and a downward cohort trend, net of each other and the age effects.

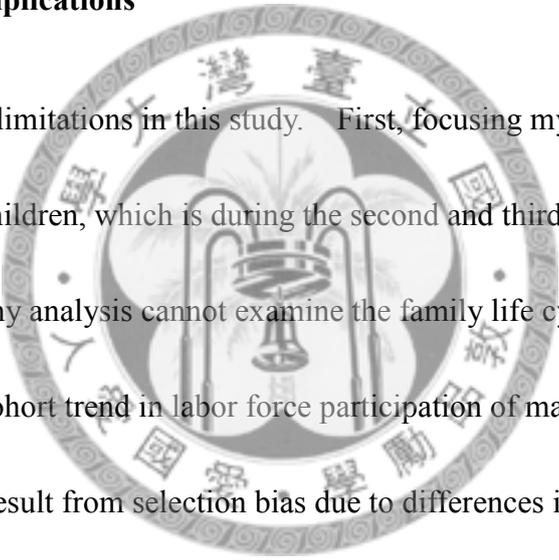
Controlling for women's age, birth cohort, and other characteristics, women in the later period are more likely to participate in the labor force than women in the earlier period. I argue that it is the change in the preferences for the local labor market that helps explain this period trend. In the earlier period, the labor-intensive industrial structure in Taiwan does not favor women with higher education. As the Taiwanese economy shifts to skill- and capital-intensive industries, the labor-market preference for women with higher education has monotonically increased over time. It is this increasing preference for women with higher education in the labor market that helps explain the upward period trend. Thus I find that the behavioral change across educational groups and preferences for the local labor markets both help explain the period effect. It is worth to note that among all educational groups, high school graduates are those who have made the biggest behavioral adjustments in their labor force participation among married women with preschool children.

Unexpectedly, I find a downward cohort trend in labor force participation among married women with preschool children. Educational expansion, presumably a cohort mechanism, cannot explain the cohort effect. I propose a sample selection explanation and test it indirectly in this thesis. The empirical evidence seems to support this sample selection argument. However, a better solution addressing the selection problem is to use the Heckman Two-Stage Model to correct the selectivity bias directly. By controlling for the effect of work commitment on the probability of women being married and have a

preschool child (the criteria of being included in my sample), the bias that leads to this unexpected cohort effect may be ameliorated.

Because there is no direct measure of work commitment in the Women's Marriage, Fertility and Employment Survey, future studies with other data sources that include direct measures of work commitment will help test this sample selection argument.

### **5.3 Limitations and Implications**



There are two main limitations in this study. First, focusing my sample on married women with preschool children, which is during the second and third stages of the family life cycle (Glick 1947), my analysis cannot examine the family life cycle hypothesis. Second, the downward cohort trend in labor force participation of married women with preschool children may result from selection bias due to differences in work commitment across cohorts. Further studies may address this problem by using different sources of data with direct measurement of work commitment.

Despite the above limitations, this thesis suggests that while examining the trends in female labor force participation, we should decompose the effect into period effects and cohort effects while trying to explain the trends in female labor force participation.

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# TABLES AND FIGURES

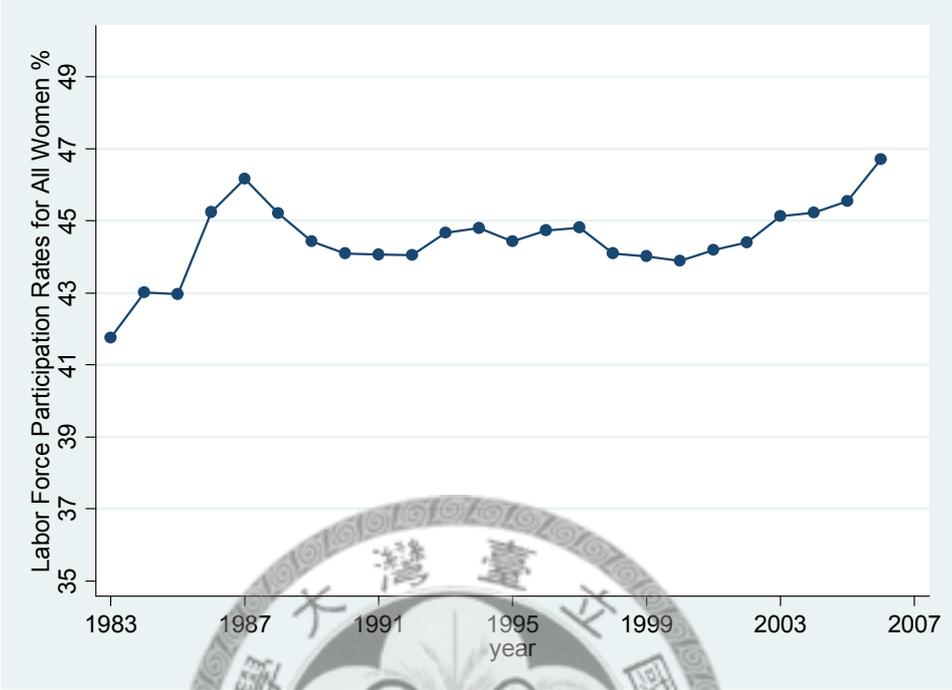


Figure 1. Female Labor Force Participation Rates for All Women, 1983 to 2006.  
 Source: Labor Force Survey in Taiwan Area, R.O.C 1983 to 2006.

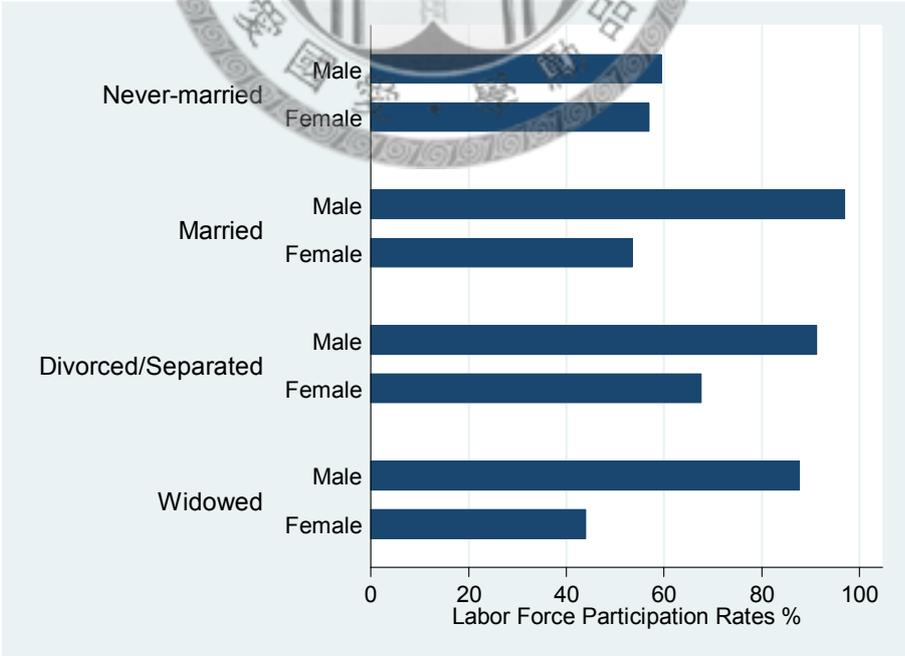


Figure 2. Labor Force Participation Rates of Men and Women Aged 15 to 64, 2006.  
 Source: Labor Force Survey in Taiwan Area, R.O.C 2006.

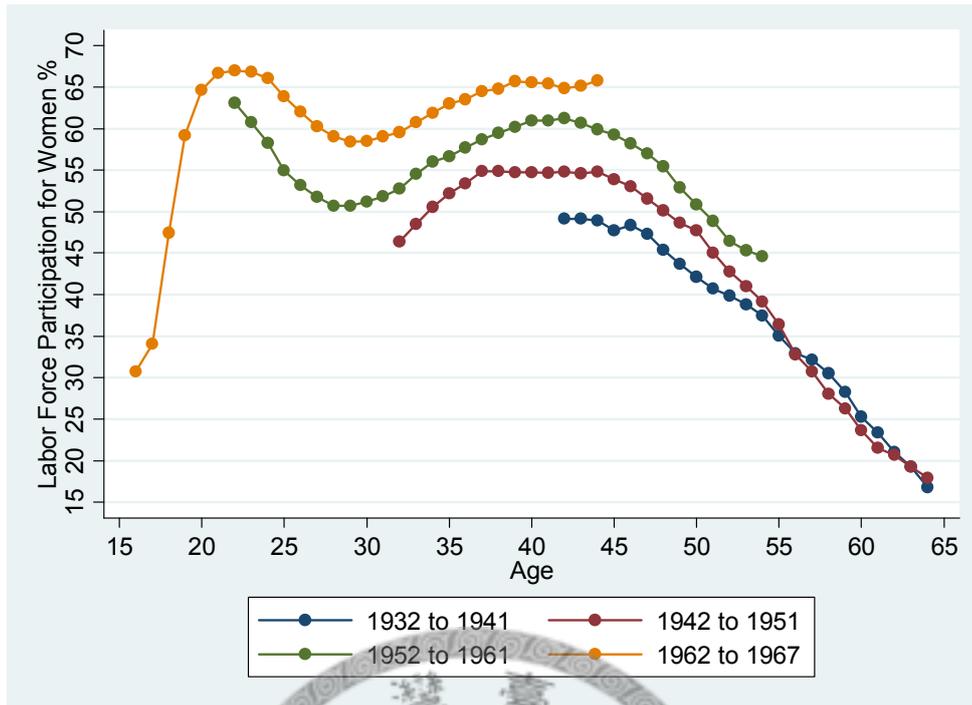


Figure 3. Labor Force Participation Rates of Women Aged 15 to 64, by Birth Cohort. Source: Labor Force Survey in Taiwan Area, R.O.C 1983 to 2006.

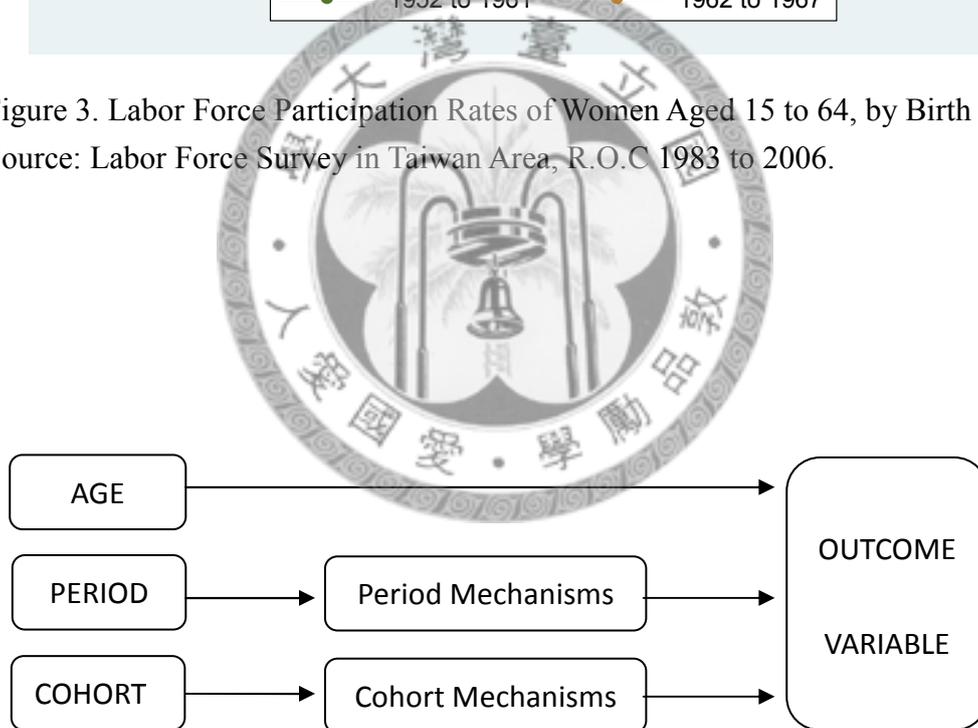


Figure 4. Theoretical Framework of APC Models.

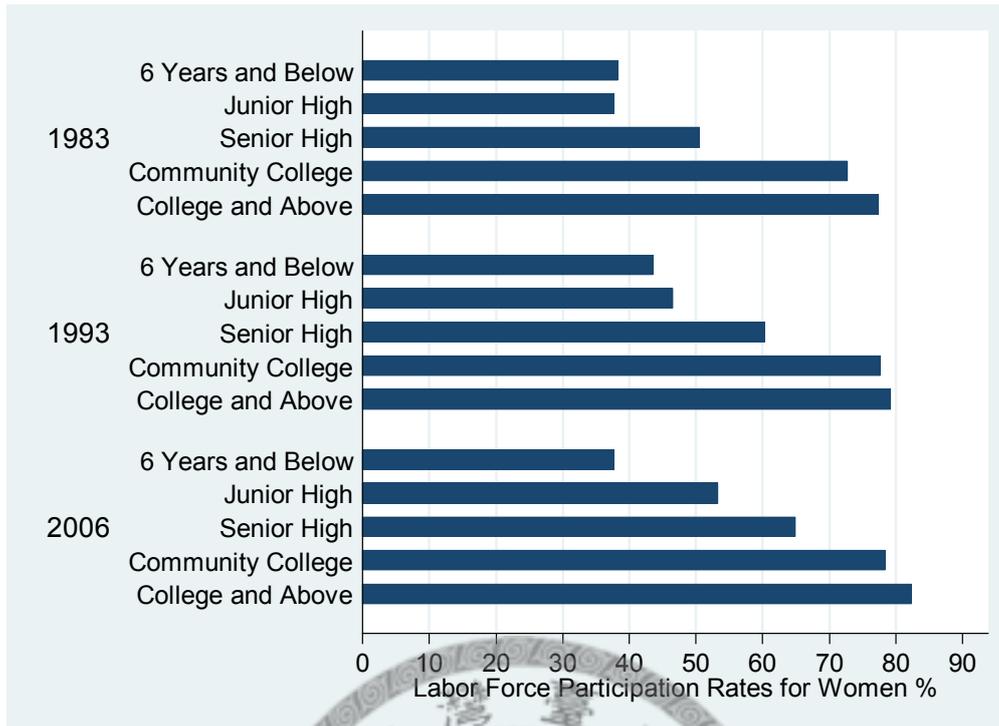


Figure 5. Labor Force Participation Rates of Women Aged 25 to 64, by Educational Attainment.

Source: Labor Force Survey in Taiwan Area, R.O.C 1983 to 2006.



Table 1. Summary of Hypotheses: Prediction of Explanatory Variables on Labor Force Participation among Married Women with Preschool Children.

| Variables  | Expected Effects on<br>Labor Force Participation | Expected Effects<br>on the Trends |
|--|--|-----------------------------------|
| <b>Family Composition Factors</b>                    |  |                                   |
| Number of Children                                   | (-)  |                                   |
| Age of Youngest Child                                | (+)  |                                   |
| Number of Additional Adults in the Household         | (+/-)  |                                   |
| <b>Husband's Characteristics</b>                     |  |                                   |
| Husband's Age  | (x)  |                                   |
| Husband's Years of Schooling                         | (+)  |                                   |
| Husband's Potential Earnings                         | (-)  |                                   |
| <b>Educational Expansion</b>                         |  |                                   |
| Years of Schooling                                   | (+)  | Explaining the cohort trends      |
| <b>The Changing Effect of Educational Attainment</b> |  |                                   |
| Years of Schooling × Calendar Year                   |  | Explaining the period trends      |
| <b>Preference of Local Labor Market</b>              |  |                                   |
| Potential Earnings                                   | (+)  | Explaining the period trends      |



Table 2. Descriptive Statistics (Means and Standard Deviations)

|   | <u>All Women, Aged 15 to 64</u> |         |         | <u>Women With Preschool Children.</u> |         |         |
|---|---------------------------------|---------|---------|---------------------------------------|---------|---------|
|   | 1983 to 2006                    | 1983    | 2006    | 1983 to 2006                          | 1983    | 2006    |
| Labor Force Participation                           | .50                             | .44     | .57     | .44                                   | .34     | .62     |
| Never Married                                       | .32                             | .31     | .35     | --                                    | --      | --      |
| Married   | .62                             | .63     | .57     | 1.00                                  | 1.00    | 1.00    |
| Divorced/Separated                                  | .02                             | .01     | .04     | --                                    | --      | --      |
| Widowed   | .04                             | .04     | .05     | --                                    | --      | --      |
| Age   | 34.92                           | 33.40   | 38.07   | 29.09                                 | 28.01   | 31.73   |
|   | (13.60)                         | (13.58) | (13.54) | (4.74)                                | (4.54)  | (4.88)  |
| Husband's Age                                       | --                              | --      | --      | 32.58                                 | 31.89   | 34.95   |
|   |                                 |         |         | (5.79)                                | (6.25)  | (5.53)  |
| Number of Children                                  | --                              | --      | --      | 2.20                                  | 2.40    | 1.84    |
|   |                                 |         |         | (1.06)                                | (1.23)  | (.81)   |
| Age of Youngest Child<br>(months)                   | --                              | --      | --      | 34.57                                 | 33.20   | 37.03   |
|   |                                 |         |         | (19.07)                               | (18.40) | (19.96) |
| No. of Additional Adults                            | --                              | --      | --      | 1.69                                  | 1.93    | 1.51    |
|   |                                 |         |         | (2.11)                                | (2.37)  | (1.70)  |
| Years of Schooling                                  | --                              | --      | --      | 9.75                                  | 8.25    | 12.67   |
|   |                                 |         |         | (3.23)                                | (3.46)  | (2.31)  |
| Husband's Years of Schooling                        | --                              | --      | --      | 10.54                                 | 9.44    | 12.79   |
|   |                                 |         |         | (3.30)                                | (3.55)  | (2.39)  |
| Potential Earnings<br>(thousands dollars)           | --                              | --      | --      | 245.5                                 | 154.4   | 431.8   |
|   |                                 |         |         | (126.8)                               | (54.7)  | (151.9) |
| Husband's Potential Earnings<br>(thousands dollars) | --                              | --      | --      | 432.3                                 | 300.1   | 648.4   |
|   |                                 |         |         | (178.6)                               | (84.5)  | (217.5) |
| Number of cases                                     | 271,293                         | 24,201  | 23,903  | 45,609                                | 5,010   | 2,166   |

Note: Standard deviations are in parentheses.

Table 3. Logistic Regressions Predicting Labor Force Participation of Married Women with Preschool Children

|                                    | Unadjusted Effects | Net Effects |
|------------------------------------|--------------------|-------------|
| Age15-24                           | -0.5333 ***        | -0.3024 *** |
| Age25-34                           |                    |             |
| Age36-64                           | 0.2483 ***         | 0.0132      |
| Number of Children                 | -0.0723 ***        | 0.0016      |
| Age of Youngest Child              |                    |             |
| mth00-12                           | -0.5720 ***        | -0.6336 *** |
| mth13-24                           | -0.5531 ***        | -0.5911 *** |
| mth25-36                           | -0.4579 ***        | -0.5009 *** |
| mth37-48                           | -0.2579 ***        | -0.3118 *** |
| mth49-60                           | -0.1640 ***        | -0.1945 *** |
| mth61-72                           |                    |             |
| Additional Adults in Household     |                    |             |
| 0                                  |                    |             |
| 1 – 2                              | 0.0182             | 0.0761 ***  |
| 3 – 4                              | -0.2033 ***        | -0.0480 *   |
| 5 up                               | -0.3644 ***        | -0.1180 *** |
| Husband's Years of Schooling       | 0.0958 ***         | 0.0445 ***  |
| Husband's Potential Earnings (log) | 0.8056 ***         | -0.5209 *** |
| Husband's Age                      | 0.0218 ***         | 0.0045 *    |
| Years of Schooling                 | 0.1186 ***         | 0.0615 ***  |
| Potential Earnings (log)           | 0.8369 ***         | 0.6140 ***  |
| N                                  | 45,609             | 45,609      |

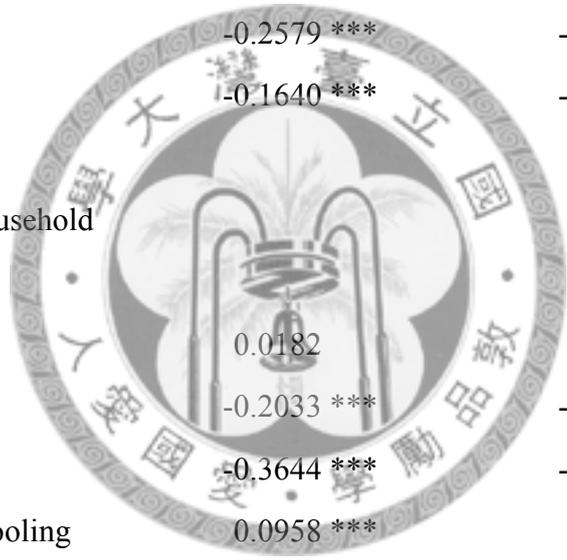


Table 4. Logistic Regressions Predicting Labor Force Participation of Married Women with Preschool Children—APC Models

|                                    | <u>Model 1</u> | <u>Model 2</u> | <u>Model 3</u> | <u>Model 4</u> |
|------------------------------------|----------------|----------------|----------------|----------------|
| Age15-24                           | -.1599 ***     | -.1534 ***     | -.1381 ***     | -.1115 ***     |
| Age25-34                           | ---            | ---            | ---            | ---            |
| Age36-64                           | -.2468 ***     | -.2362 ***     | -.2317 ***     | -.2117 ***     |
| Calendar Year (centered)           | .0803 ***      | .0762 ***      | .0847 ***      | .0635 ***      |
| Cohort (Centered)                  | -.0466 ***     | -.0477 ***     | -.0562 ***     | -.0494 ***     |
| Number of Children                 |                | -.1673 ***     |                |                |
| Age of Youngest Child              |                |                |                |                |
| mth00-12                           |                | -.4168 ***     |                |                |
| mth13-24                           |                | -.3967 ***     |                |                |
| mth25-36                           |                | -.3486 ***     |                |                |
| mth37-48                           |                | -.2115 ***     |                |                |
| mth49-60                           |                | -.1449 ***     |                |                |
| mth61-72                           |                | ---            |                |                |
| Additional Adults in Household     |                |                |                |                |
| 0                                  |                | ---            |                |                |
| 1 – 2                              |                | .0429 *        |                |                |
| 3 – 4                              |                | -.0655 **      |                |                |
| 5 up                               |                | -.1383 ***     |                |                |
| Husband's Years of Schooling       |                |                | .0838 ***      |                |
| Husband's Potential Earnings (log) |                |                | -.1942 ***     |                |
| Husband's Age                      |                |                | -.0060 **      |                |
| Potential Earnings (log)           |                |                |                |                |
| Years of Schooling                 |                |                |                | .1017 ***      |
| Years of Schooling * Year          |                |                |                |                |
| Constant                           | -.0703 ***     | -.0213         | 1.0804 ***     | -1.5989 ***    |
| N                                  | 45,609         | 45,609         | 45,609         | 45,609         |

Continue in next page

Table 4. Logistic Regressions Predicting Labor Force Participation of Married Women with Preschool Children—APC Models (Continued).

|                                    | <u>Model 5</u> | <u>Model 6</u> | <u>Model 7</u> | <u>Model 8</u> | <u>Model 9</u> |
|------------------------------------|----------------|----------------|----------------|----------------|----------------|
| Age15-24                           | -.1149 ***     | -.1117 ***     | -.1152 ***     | -.1517 ***     | -.1343 ***     |
| Age25-34                           | ---            | ---            | ---            | ---            | ---            |
| Age35-64                           | -.1746 ***     | -.2074 ***     | -.1729 ***     | -.2220 ***     | -.1907 ***     |
| Calendar Year (centered)           | .0506 ***      | -.0154 **      | .0424 ***      | .0320 ***      | -.0246 ***     |
| Cohort (Centered)                  | -.0344 ***     | -.0480 ***     | -.0343 ***     | -.0310 ***     | -.0373 ***     |
| Number of Children                 |                |                |                |                | -.0229 **      |
| Age of Youngest Child              |                |                |                |                |                |
| mth00-12                           |                |                |                |                | -.6068 ***     |
| mth13-24                           |                |                |                |                | -.5597 ***     |
| mth25-36                           |                |                |                |                | -.4754 ***     |
| mth37-48                           |                |                |                |                | -.2958 ***     |
| mth49-60                           |                |                |                |                | -.1859 ***     |
| mth61-72                           |                |                |                |                | ---            |
| Additional Adults in Household     |                |                |                |                |                |
| 0                                  |                |                |                |                | ---            |
| 1 – 2                              |                |                |                |                | .0671 ***      |
| 3 – 4                              |                |                |                |                | -.0603 **      |
| 5 up                               |                |                |                |                | -.1242 ***     |
| Husband's Years of Schooling       |                |                |                |                | .0428 ***      |
| Husband's Potential Earnings (log) |                |                |                |                | -.5165 ***     |
| Husband's Age                      |                |                |                |                | -.0033         |
| Potential Earnings (log)           |                |                |                | .7255 ***      | .3198 ***      |
| Years of Schooling                 |                | .0691 ***      |                |                | .0407 ***      |
| 0 – 9 years of schooling           | ---            |                | ---            |                |                |
| 12 years of schooling              | .3583 ***      |                | .2649 ***      |                |                |
| 14 years of schooling              | 1.0780 ***     |                | 1.0681 ***     |                |                |
| More than 16 years of schooling    | 1.5225 ***     |                | 1.5242 ***     |                |                |
| Years of Schooling * Year          |                | .0067 ***      |                |                | .0068 ***      |
| 0 – 9 years * Year                 |                |                | ---            |                |                |
| 12 years * Year                    |                |                | .0147 ***      |                |                |
| 14 years * Year                    |                |                | .0056          |                |                |
| More than 16 years * Year          |                |                | .0045          |                |                |
| Constant                           | -.8089 ***     | -1.2512 ***    | -.7716 ***     | -9.3196 ***    | 1.9035 ***     |
| N                                  | 45609          | 45609          | 45609          | 45609          | 45609          |



Table 5. Logistic Regression Predicting Labor Force Participation of All Women Aged 15 to 64—APC Models.

|                                  | <b><u>Model 1</u></b> |
|----------------------------------|-----------------------|
| Calendar Year (centered at 1983) | .0192 ***             |
| Birth Cohort                     |                       |
| 1919 to 1938                     | ---                   |
| 1939 to 1958                     | .0575 ***             |
| 1959 to 1978                     | .3683 ***             |
| 1979 to 1991                     | -.4277 ***            |
| Age                              |                       |
| 15 to 24 years old               | ---                   |
| 25 to 34 years old               | .5259 ***             |
| 35 to 44 years old               | .5686 ***             |
| 45 to 54 years old               | .2066 ***             |
| 55 to 64 years old               | -.6878 ***            |
| Constant                         | -.5129 ***            |
| N                                | 271,293               |

