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台灣女性初婚率的世代變遷與教育落差

Trends in Educational Differentials in Marriage Formation among Taiwanese Women

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張怡娟 撰

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台灣女性初婚率的世代變遷與教育落差

摘要

本論文區分「晚婚」與「不婚」的概念來分析台灣的經驗現象，試圖檢驗「隨著女性經濟獨立性提升，女性益發不願意走入婚姻」此一假設。第一部份之分析以教育作為女性經濟獨立性之指標，分析高教育程度女性是否較易「晚婚」和「不婚」；第二部份之分析再進一步檢驗「不同教育程度台灣女性在結婚行為上的落差，是否完全來自於其經濟潛力差異」此一假設。

本文以 Cox 等比例風險率模型（Cox proportional hazard model）分析高教育程度台灣女性是否較易「晚婚」，以 Kaplan-Meier 方法分析高教育程度台灣女性是否較易「不婚」，分析資料為行政院主計處於 1979 年到 2006 年間蒐集（共計 15 波）之婦女婚育與就業調查資料。並以非連續時間風險率模型（discrete-time hazard model）分析台灣女性結婚行為之教育落差，是否可完全由五種不同的經濟潛力變項解釋；其中這些經濟潛力變項之建構則結合主計處於 1976 年到 2005 年間蒐集（共計 30 波）之家庭收支調查資料與前述之 15 波婦女婚育與就業調查資料。

結果發現教育程度較高的台灣女性，不只更容易「晚婚」，也更容易「不婚」，此一結婚行為的教育落差不但在越晚近的出生世代越顯著，同時無法完全透過這五種經濟潛力的中介變項解釋。因此，本論文之結果指出教育除了透過既有理論所強調的經濟機制之外，仍透過其他非經濟的機制影響台灣女性的結婚行為，此一結果既不支持 Becker（1981）的理論，也不支持 Oppenheimer（1988）的理論。

關鍵詞：初婚率、教育落差、事件史分析、女性經濟獨立假設、職業生涯假設。

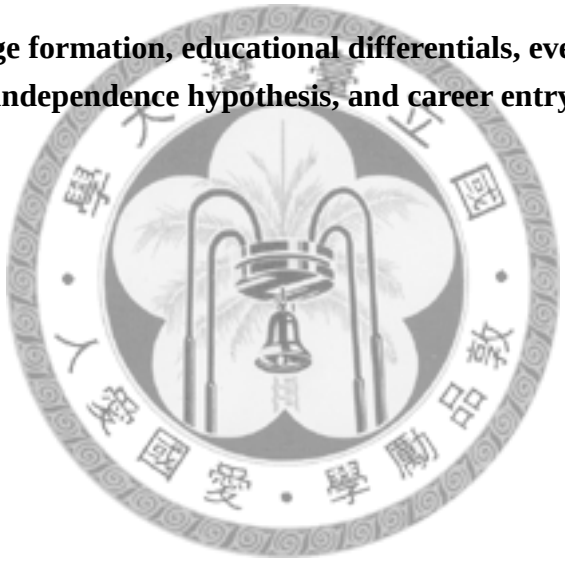
Trends in Educational Differentials in Marriage Formation among Taiwanese Women

ABSTRACT

In this thesis, I address the debate over whether or not women are retreating from marriage as their economic potential improves. The empirical analyses focus on distinguishing between marriage delayed and marriage forgone. I use data pooled from 15 waves of the Women's Marriage, Fertility, and Employment Surveys (WMFES) conducted between 1979 and 2006 to document cohort trends in marriage formation. I apply Cox proportional hazard regressions to analyze rates for marriage delayed and the Kaplan-Meier estimates of eventual probabilities for marriage forgone. I further examine the role of education as a proxy for women's earnings potential in driving the documented trends in marriage formation. Earnings potentials are calculated using data pooled from the 1976-2006 waves of the Survey of Family Income and Expenditure (SFIE), and included in discrete-time hazard models to analyze the WMFES data. The results show that more highly educated Taiwanese women marry later and fewer than less educated women. The observed

educational differentials in marriage formation among Taiwanese women cannot be fully attributed to the differences in human capital investment. These results suggest that there are non-economic mechanisms behind the educational differentials in Taiwanese women's marriage formation. Hence my findings support neither Becker's nor Oppenheimer's theory about marriage formation.

Key words: marriage formation, educational differentials, even history analysis, women's economic independence hypothesis, and career entry hypothesis.



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CHAPTER 1 INTRODUCTION

1.1 MOTIVATION

1.1.1 Marriage Formation in the Debate over Family Decline

In the past few decades, Western industrialized countries have experienced "the second demographic transition," (Van de Kaa 1987) which composes of three stages of changes. Changes in the first stage of the second demographic transition, roughly between 1955 and 1970, include increasing divorce rates, a decline in fertility, and the delay and even a retreat from marriage. During the second stage, roughly between 1970 and 1985, premarital cohabitation has spread over the Western countries and the proportion of nonmarital births among all births has increased. The third stage, occurred from the mid-1980s onward, has been characterized by a plateau in divorce rates. Lesthaeghe (1995) argues that the root of these changes is a series of transformations in values about personal relationships. These arguments suggest that the second demographic transition not only represents changes in people's behavior but also changes in people's beliefs. These phenomena have stimulated an intense debate over whether or not family as an institution is declining (Popenoe 1993; Stacey 1993; Waite 1995).

Some scholars involved in the debate believe that the decline in marriage rates is a manifestation of people's retreat from marriage. Hence, they maintain that we should be worried that marriage as a social institution is in decline (Popenoe 1993). Other scholars fundamentally reject the idea that family is an institution. Instead, they argue that the traditional nuclear family is an ideological, symbolic social construct with its unique history and politics. Thus the weakening of the traditional nuclear family ideology is conducive to a society of greater gender equalitarianism. Therefore, we should celebrate these trends as moving forwards a more diversifying form of marriage rather than frown upon them as a moral crisis (Stacey 1993). Still others hold that we are not necessarily forced into either of these polarized positions. They point out that the postponement of or the potential retreat from marriage is resulted from women's raising standard for an acceptable mate rather than a dramatic change in women's preferences toward marriage itself (Oppenheimer 1988). In this thesis, studying trends in marriage formation will help address the debate about whether or not marriage as an institution is declining. This is the overarching gal of my thesis.

1.1.2 Marriage Formation and Low Fertility in Taiwan

Taiwan has experienced changes in the past few decades that are similar to, at least the first stage of, the second demographic transition. In addition to the debate over family decline, the aforementioned changes in marriage formation are significant for other reasons as well in the Taiwanese context. Later and fewer marriages are closely related to low fertility and population aging in the Taiwanese context (Wang 2002).

Taiwan has experienced the first demographic transition from the late 19th century to the late 20th century.[1] The mortality rates in Taiwan have dropped since the 1920s and throughout the Japanese colonial period, and the fertility rates began to decline since the 1950s (Wang 2002). From the 1920s to 1950s, Taiwan has experienced a substantial population growth resulted from relatively low mortality rates and relatively high fertility rates. The population of Taiwan has continued to grow after 1950s because those born between the 1920s and the 1950s have gradually reached their childbearing ages so that the fertility rates are higher than before.

[1] According to Chang and Lee (2001), the first demographic transition in Taiwan has completed by 1983, since then the Net Reproduction Rates (NRR) has gone below the replacement level.

Despite the continued population growth after the 1950s, the age structure of Taiwanese population has transformed into a more constrictive population pyramid. Some studies suggest that the Taiwanese population will fall rapidly when the baby boomers become elderly (Wang 2002). The proportion of population older than 65 has exceeded 7 percent in 1993 (Hsueh 2002), and Taiwan has been considered as an aging society by the definition of the United Nations. Wang (2002) projects that the Taiwanese population will start to decline in 2020 and that the old-age dependence ratio in Taiwan will approach 50 percent in 2050.

Population aging is a common and continuing trend across all developed countries (Uhlenberg 1992). Population aging may lead to a shortage in the future labor supply, a heavy burden for the working population and state welfare policies, and a potential excess in educational resources (Wang 2002; Tsai 2007). These potential consequences of population aging make it an important social issue not only in Taiwan but also across all industrialized countries. Because low fertility is the primary cause of population aging in Taiwan (Uhlenberg 1992; Wang 2002), it is urgent to examine those factors that may potentially be responsible for the low fertility in Taiwan.

Prior research has examined a number of reasons that might explain the decreasing trend in fertility.[2] Some researchers have argued that the low fertility observed in developed countries is a temporary phenomenon representing the delay in childbearing (Bongaarts 2002; Goldstein et al. 2009). The postponement of childbearing reduces the number of children born in a given period but the completed cohort fertility may remain unchanged. Prior research studying low fertility in European countries have provided evidence for the recuperation of fertility rates (e.g., Bongaarts 2002; Myrskylä, Kohler, and Billari 2009). Others, however, have argued that the observed low fertility in some countries represents more than a postponement of childbearing and that low fertility will persist under certain socioeconomic and cultural circumstances (Lesthaeghe and Willems 1999; McDonald 2000 and 2006; Suzuki 2003).

Specifically, Lesthaeghe and Willems (1999) propose a three-phase theory about the trend in fertility among EU countries. During the first phase, there is a decline

[2] Notestein (1945) contends that the modernization leads to a new family institution, a new educational system, and increasing female labor force participation, thereby raising the cost of childrearing. Caldwell (1976, 1981) argues that the pattern of intergenerational wealth flows in nuclear families have changed from offspring-to-parents to parents-to-offspring, which reduces parents' incentive of childbearing. Easterlin (1978) discusses how increasing supply of children (via increasing survival rates of children) reduces the demand for children (as measured by fertility rates).

rather than postponement in fertility among EU counties. During the second phase, changes in women's educational opportunities, labor force participation, and gender role attitude have led to a postponement in EU countries' fertilities. During the third phase, despite the postponement has stopped, they argue that "the recuperation of fertility at older ages will be less than complete." (P. 227) They predict that several EU countries, such as Germany, Italy, and Spain, will remain in the second phase at least during the first decade in the 21st century. Other EU countries, although may reach the end of postponement earlier, may not experience a rapid increase in fertility.

McDonald (2000) argues that the low fertility may be explained by "the incoherence between levels of gender equality applying in different social institutions." (P.1) In countries where women are expected to have traditional gender role in the family but are allowed to pursue their career success in the labor market, the heightened level of conflicts between family and work for women may discourage women to bear children. Suzuki (2003) reports that, in such countries as Japan and Korea where the traditional family values are strong, the fertility rates have remained low even in the 1990s. In addition, cohabitation and nonmarital childbearing are uncommon in these countries so that one of the consequences of marriage decline is a decrease in fertility (Raymo 2003; Suzuki 2003). Similar to Japan and Korea,

Taiwan has a relatively traditional family system compared to Western countries and world's lowest total fertility rates. The decline in marriage is closely associated with low fertility and aging population in Taiwan. Hence, it is important to ask whether or not there is a trend toward marriage decline among Taiwanese women.

1.1.3 The Role of Education in Marriage Formation

Along with changes in the family, women's opportunities in education and labor force participation also have improved substantially in all industrialized countries in the past few decades. Many scholars attribute the transformations of the family to women's rising economic (Becker 1981; Blossfeld 1995; Sweeney 2002; Raymo 2003). They argue that the higher the women's earnings are, the less attractive marriage is for them—because they no longer need to trade money from men with their domestic labor. This hypothesis is known as "the economic independence hypothesis," which is relevant to the debate about whether or not marriage as an institution is declining. Many studies have used educational attainment to indicate "economic independence" for women (e.g., Blossfeld 1995; Raymo 2003). Education is considered as an important factor to predict earnings (Mincer 1974) and surveys routinely collect information about a respondent's educational attainment.

Based on analyses using panel data collected in Taiwan, Thornton et al. (1994) even argue that the association between education and marriage is causal.

In addition to the relationship between women's education and marriage rates, educational expansion has also been considered as an important factor in studies of assortative mating (Mare 1991; Tsai 1994; Yang et al. 2006; Stevens et al. 2008; Arum et al. 2008). According to these studies, educational attainment not only serves as a proxy for economic potential in the process of marriage formation, it also influences how people think about marriage and how people are treated by others in the process of spousal matching. It is thus imperative to consider all of these dimensions of education in analyzing the trends in marriage formation.

In sum, education is associated with marriage formation in multiple ways and studying women's educational differentials in marriage rates is a way to engage and contribute to the theoretical debate over family decline. Because Taiwan has experienced a much more rapid educational expansion than Western industrialized countries (Tsai 2004), it may serve as a unique and interesting case for analyzing the association between educational expansion and marriage formation. The goal of this thesis is to provide additional evidence by examining the relationship between educational attainment and Taiwanese women's first marriage rates.

1.2 THEORETICAL BACKGROUND

There is a debate about the relationship between women's improving opportunities in education and labor force participation among scholars from two camps. Each of these two camps has posited a hypothesis concerning the association between women's education and their marriage formation process. Each has held a distinct opinion about whether or not people are retreating from marriage. I discuss these hypotheses as follows.

1.2.1 The Economic Independence Hypothesis

In his book *A Treatise on the Family*, Becker (1981) proposes "the specialization and trading model," which is also called "the economic independence hypothesis." He claims that marriage is a trading behavior between single men and women. This trade is possible only when the gains for both men and women to be married are higher than the gains for them to remain single. The premise of this argument is that the gains from marriage come from the labor specialization between husband and wife. The division of labor that maximizes the gains from marriage is for men to invest more in human capital on market work and for women to invest more in the human capital on domestic work. By exchanging each other's specialized human capital,

marriage becomes an interdependent relationship between husband and wife. In Becker's view, with women's economic independence increasing, this gendered specialization will be inefficient. If women invest more in market work, they will become more similar to men and will no longer need to exchange with men for their market work. Hence, Becker (1981) predicts that when women become economically more independent, their gains from marriage will decrease, and their incentives to marry will also decrease. In this sense, if women become economically more and more independent, they will increasingly retreat from marriage because marriage will be less attractive to them.

1.2.2 The Career-Entry Hypothesis

Becker's theory posits a static hypothesis that only compares two marital statuses—single (which may be never married, separated/divorced, or widowed) and married; therefore he does not discuss the issue of marriage timing. Instead of focusing on the static statuses between single and married, Oppenheimer (1988) emphasizes the timing of marriage formation. She applies the job-search theory to the analysis of the marriage process, and proposes "the career-entry hypothesis." The job-search theory assumes that both workers and employers lack the knowledge

necessary to achieve a perfect and instantaneous matching of workers to jobs. Therefore, workers need to set up a "reservation wage," which is a function of the expected returns and the costs of searching. When the wage reaches the worker's reservation wage, he/she will accept the job—even if this job is not the best one this worker can find—because the costs to keep searching are higher than the potential return from a potential better job.

Oppenheimer argues that a similar theory can also be applied to explain how the spouse-search process works. She suggests that we can imagine a similar concept of "reservation wage" for a spouse. Based on this theory, she further argues that changes in marriage timing are the result of how easy the search process is. The transition to adult work role may affect the timing of marriage because it influences the costs and returns of spousal search. Therefore, changes in both men's and women's economic standings will affect the matching process and alter the timing of marriage.

Although Oppenheimer places greater emphasis on men's economic role than women's economic role in affecting the timing of marriage, she maintains that when women's labor market opportunities improve, the uncertainties of spouse search will also increase. Therefore, they may lead to marriage delayed, but not necessarily

marriage forgone. In Oppenheimer's opinion, increasing female economic independence will not necessarily lead to a retreat from marriage as Becker's theory (at least, implicitly) predicts.

1.2.3 Marriage Delayed or Marriage Forgone?

The major difference between Becker's and Oppenheimer's theory is that Becker argues that women's incentives to marry will decline as their economic opportunities improve. On the contrary, Oppenheimer contends that the gains from marriage for women have not been in declining. She argues that what we have observed is really a delay in marriage—which reflects the increasing uncertainties of the spouse-search process—not a retreat from marriage. The gist of this debate is whether or not women are getting less likely to marry as their economic potentials improve. To adjudicate between these two hypotheses, we need to find out whether trends in marriage formation reflect marriage delayed or marriage forgone (Oppenheimer and Lew 1995; Oppenheimer 1997).

To discern marriage delayed from marriage forgone in this thesis, I try to distinguish the difference between the "quantum" and "tempo"[3] in marriage

[3] Bongaarts and Feeney (1998) use "quantum" and "tempo" to indicate two components of the total fertility rate (TFR). The "quantum" concept defined in their study is different from mine. They

formation. First, I use cohort estimates rather than period estimates. If the tempo of marriage is slowing down for later cohorts, period measures may overestimate the never married population and confound the tempo with the quantum of marriage formation for a given cohort. To avoid this distortion, I estimate marriage rates by birth cohorts. This allows me to distinguish women at near the end of their marital life cycle—by which age the instantaneous marriage rates tend to be very low and close to zero—from younger women who are still at relatively higher risks of being married.

Second, I carefully distinguish two measures of marriage formation—marriage rates and the eventual probabilities of marriage. Marriage rates are the instantaneous probabilities of getting married at a given age for people who have never been married before that age. Empirically, marriage rates vary by age and usually have a unimodal distribution (Wu 1987). By contrast, the eventual probability of marriage is the proportion of women ever married prior to a relatively old age. The eventual probability of first marriage must be a monotonically increasing function because the transition into first marriage is an irreversible event. In other words, the older the

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define the "quantum" concept as a component of TFR, which is a period measurement. In this thesis, the concept of "quantum" is defined as the eventual probability of marriage, which is a cohort measurement.

age of a birth cohort, the higher the proportion of people in that birth cohort have ever been married. It is difficult to define "eventual" because a never married, surviving person is always at risk of being married. Hence, I arbitrarily pick some fairly old age, e.g., 30, 40 or 50, and look at what proportion of the population remains never married by that age. I examine the eventual probability of marriage for marriage forgone, and marriage rates for marriage delayed.

[Figure 1, 2, and 3 about here]

To fix ideas and illustrate the merits of distinguishing between marriage rates and the eventual probabilities of marriage, there are at least three possible relationships between women's economic independence and marriage formation. I provide three stylized examples using hypothetical survival curves of never-married women (shown in Figure 1, 2, and 3) as follows. Figure 1 presents a scenario that involves differences in the timing of marriage formation but no difference in the eventual probabilities of marriage between economically more independent and economically less independent women. In Figure 1, economically more independent women marry later than economically less independent women, but they subsequently catch up. Figure 2 also presents a catch-up scenario for economically more independent women, but in contrast with Figure1, their probability of marriage exceeds that of

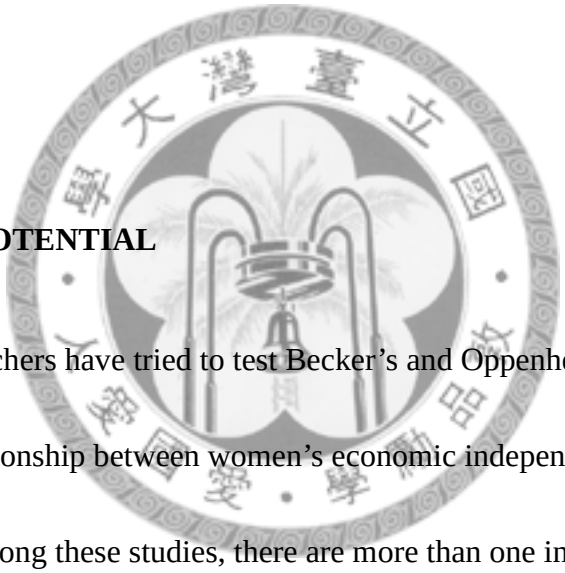
economically less independent women at a later age. In Figure 3, compared with economically less independent women, economically more independent women not only marry later, but also have a lower eventual probability of marriage.

The above examples help shed light on how to adjudicate between Becker's and Oppenheimer's theories regarding women's economic independence (using education as a proxy) and marriage formation: marriage forgone should translate into differences in the eventual probability of marriage. If women with more years of schooling are less likely to eventually marry than women with fewer years of schooling (as shown in Figure 3), it provides evidence for Becker's theory. If it is marriage delayed and not necessary marriage forgone, which means the peak age of marriage rates occurs later for women with a higher level of education than women with a lower level of education (as shown in Figure 1 and 2), it lends support to Oppenheimer's theory. The goal of my thesis is to discern between marriage delayed and marriage forgone using data from successive cohorts of women born in Taiwan between 1910 and 1991.

1.2.4 Factors Responsible for Trends in Marriage Rates

Despite the aforementioned differences, these two hypotheses have something in common. Although the two theories posit opposite directions of the association,

they agree on the importance of the association between economic factors and marriage formation. I argue that economic potentials are not the only factor responsible for trends in marriage formation, and it is possible to empirically test this hypothesis. I test the hypothesis that education influences marriage rates through earnings potential by adding other indicators of economic potentials in my models in the second part of my thesis. In the following sections, I go into details of the concept of economic potential and develop the hypotheses.



1.3 ECONOMIC POTENTIAL

Previous researchers have tried to test Becker's and Oppenheimer's hypotheses by studying the relationship between women's economic independence and their marriage rates. Among these studies, there are more than one indicator of women's economic independence, including women's educational attainment and enrollment status (Preston and Richards 1975; Cherlin 1980; Mare and Winship 1991; Lichter et al. 1991; Lichter et al. 1992; Blossfeld 1995; Oppenheimer and Lew 1995; Sweeney 2002), employment status (Cherlin 1980; Goldscheider and Waite 1986; Lichter et al. 1991; Lichter et al. 1992; Oppenheimer and Lew 1995; Raymo 2003), public

assistance (Lichter et al. 1992; Fossett and Kiecolt 1993), socioeconomic status (Fossett and Kiecolt 1993), current earnings (Preston and Richards 1975; Teachman et al. 1987; Mare and Winship 1991; Lichter et al. 1991; Lichter et al. 1992; Oppenheimer and Lew 1995; Sweeney 2002), and earnings potential (Xie et al. 2003). Behind the choices among these indicators, there are some noteworthy theoretical differences. I discuss two most frequently used indicators of economic potential as follows.

1.3.1 Education

The most often used and well-discussed proxy for the long-term economic potential is people's investments in education. There are two components of the association between marriage formation and education—enrollment status and educational attainment. The distinction between these two components is closely related to my goal to adjudicate between the economic independence hypothesis and the career-entry hypothesis. If the negative relationship between women's educational investments and marriage formation is confined to the period before leaving school—which means the relationship between enrollment and marriage rates is negative and the relationship between educational attainment and marriage rates is

positive or neutral—it is consistent with the prediction of the career-entry hypothesis (Blossfeld 1995; Raymo 2003). If the relationships between women's marriage rates and both components of the educational effect are negative, the economic independence hypothesis is supported.

It is worth mentioning, however, that education means more than just an indicator of human capital, and there is something more about the association between education and marriage rates. In the field of social stratification, researchers of educational assortative mating have argued that education may contribute to educational homogamy in multiple ways. First, colleges may provide marriage markets for people to establish connections and networks (Arum et al. 2008).

Second, college degree may also serve as a signal of specific characteristics, and this signal may affect how other people treat him/her, thereby affecting the mating process (Mare 1991; Stevens et al. 2008). Third, the experiences in college may incubate one's tastes, dispositions, and ways of living (Stevens et al. 2008); these preferences and values may affect how one chooses his/her spouse and how others choose him/her. The last two ways in which education may contribute to homogamy are pertinent to the present study because they raise an important alternative to the human capital conceptualization of education and its relationship to marriage

formation. This dimension of education has been ignored by previous researchers in the studies of entry into first marriage. In this thesis, I seek to address this ignorance by examining to what extent earnings potential explains the association between education and marriage rates.

1.3.2 Income

In Becker's (1981) theory, the benefits of gender specialization in a marriage come from the comparative advantage between husband's and wife's returns from their investments in human capital. A direct indicator of the comparative advantage is the current wage rates between husband and wife (Søensen 1995). Besides the relative wage rates between spouses, many scholars have used current income as an indicator of people's current economic ability or a proxy for the future economic potentials in prior research (Preston and Richards 1975; Teachman et al. 1987; Mare and Winship 1991; Lichter et al. 1991; Lichter et al. 1992; Sweeney 2002).

However, some of these scholars have not thought through to what extent such conceptualizations are appropriate. While education and income presumably indicate the same theoretical construct, many previous studies have included both variables in the same model without much justification. One of the goals of my

thesis is to document the associations between economic potential and women's marriage rates more clearly than previous research.

In fact, it is more reasonable if people consider the long-term rather than current economic ability in making their marital decisions because marriage is a long-term contract between spouses. In reality, people do not have perfect information about their potential mates' economic potential throughout the spouse-search processes, and they are not even sure about their own economic potential. Moreover, Oppenheimer (1988) argues that, in the United States, these uncertainties are increasing for both men and women as people spend more time in school. Therefore, some researchers are interested in the concept of "the perceived post-marriage long-term economic potential," which is believed to be a better proxy than current earnings or wage rates to capture the concept of subjective evaluation in the spouse-search process (Xie et al. 2003: 353-4).

In his seminal work in labor economics, Mincer (1974) expands the schooling model by including the post-school investments to better explain the distribution of earnings. Mincer's earnings equation is a function of both educational investments and post-school investments, which is an inferred work experience equal to current age minus age at completion of schooling (Mincer 1974):

$$\ln E_t = \ln E_0 + rs + \beta_1 t - \beta_2 t^2$$

where *t* is years of work experience, *s* is years of schooling, and $t = (A - s - b)$, where *A* is current age and *b* is age at the beginning of schooling.

Based on Mincer's earnings function, Xie et al. (2003) develop five measurements of earnings potential (i.e., predicted current earnings, predicted earnings over the next five years, predicted past earnings, predicted future earnings, and predicted lifetime earnings) to analyze union formation in the United States.

These measurements are time-varying variables and designed to capture earnings potentials in five segments of the life course. While current earnings potential and earnings potential over the next five years are both proxies for relatively short-term economic potentials than the other earnings potentials, there are some differences between these two measurements. Current earnings potential is a proxy for the perceived economic potential at present. Earnings potential over the next five years is a proxy for the perceived economic potential in the near future. The latter is less vulnerable to the fluctuations of individual income than the former because the latter is the sum of one's earnings potentials over five years. The past total earnings potential is a proxy for the perceived economic potential in the past, which is more likely to be perceived by the potential mates thus may have more influences on

women's marriage rates then the other measurements. The future earnings potential and the lifetime earnings potential are proxies for the perceived long-term economic potentials, which may have more measurement errors because it tries to capture one's economic potential for a longer time.

In this thesis, I adopt the method used by Xie et al. (2003) to examine the relationships between women's economic potentials and marriage formation in Taiwan. I hypothesize that if the coefficient of educational attainment diminishes and disappears when I control for women's earnings potential, then the association between women's education and marriage formation can be explained fully by the human capital theory. Otherwise, it suggests that education is not just an indicator of people's investments in human capital. This is the hypothesis that I seek to test in the second analysis of my thesis.

1.4 EMPIRICAL FINDINGS IN PRIOR RESEARCH

Many prior studies have engaged in the theoretical debate between Becker and Oppenheimer. Some studies have focused on the association between women's economic independence and marriage rates, and others have focused on discerning between marriage delayed and marriage forgone. These findings vary in the data,

the level of analysis, and proxies for economic independence.

1.4.1 Marriage Delayed vs. Marriage Forgone

Before Oppenheimer and Lew (1995) first propose the theoretical importance of discerning between marriage delayed and marriage forgone, most researchers have taken the relationship between women's economic independence and marriage rates as the key to adjudicate between these two hypotheses. If marriage rates at a relatively old age (e.g., 50 years old) are lower for economically more independent women than for economically less independent women, they argue that this is consistent with Becker's theory. Otherwise, if marriage rates at an old age are higher for economically more independent women than for economically less independent women, it is consistent with Oppenheimer's theory. However, according to the discussion in section 1.2.3, these studies may confound tempo with quantum of marriage formation.

Findings about the relationship between women's economic independence and marriage rates are mixed. In those aggregate-level analyses, the unit of analysis is area rather than individual. The independent variables are proxies for women's economic independence such as earnings (Preston and Richards 1975; Lichter et al.

1991), public assistance (Fossett and Kiecolt 1993), socioeconomic status (Fossett and Kiecolt 1993), employment status (Lichter et al. 1991; Mare and Winship 1991), and education (Preston and Richards 1975; Lichter et al. 1991; Mare and Winship 1991). In these aggregate-level analyses, the relationship between women's economic independence and the prevalence of marriage is negative (Preston and Richards 1975; Lichter et al. 1991; Fossett and Kiecolt 1993; McLanahan and Casper 1995)—except Mare and Winship (1991). Mare and Winship (1991) find that, although the relationship between white women's expected employment status and marriage formation is negative, women's educational attainment and current earnings are positively related to marriage formation. However, these studies have been criticized on two grounds. First, the economic independence hypothesis refers to individual-level behavior, and thus testing it with aggregate-level data may potentially commit the ecological fallacy (Oppenheimer 1997). For example, the mean educational attainment of women in an area may also serve as a proxy for other factors—such as the educational attainment of men in that area—which may be negatively associated with marriage formation (Oppenheimer and Lew 1995). Second, data used by these aggregate-level analyses are cross-sectional data, and it is hard to determine the temporal order or the spatial connections that are essential to

establishing causal connections in observational studies (Oppenheimer 1997).

In the individual-level analyses, the unit of analysis is individual and the indicators of economic independence are similar to independent variables in the aggregate-level studies. By contrast, if respondents' enrollment status are controlled, the relationship between women's economic independence and marriage rates in most individual-level analyses is either positive (Goldscheider and Waite 1986; Lichter et al. 1992; Oppenheimer, Blossfeld, and Wackerow 1995; Oppenheimer and Lew 1995; Ono 2003) or neutral (Cherlin 1980; Blossfeld and Huinink 1991; Blossfeld and Jaenichen 1992; Blossfeld and Rohwer 1995; Hoem 1995; Robert and Blossfeld 1995; Xie et al. 2003).

Although the individual-level analyses do not suffer the drawback of ecological fallacy and some of them have used panel data, which provide better leverage for establishing causality, they have other limitations too. Because usually panel data are restricted to the life course behavior of a narrow age range, these analyses do not provide data for discerning between marriage delayed and marriage forgone. For example, in the panel data used by Oppenheimer and Lew (1995), the oldest respondents were only 32 years old at the time of the last survey.

There are some exceptions to the positive relationship between economic

independence and marriage rates in these individual-level studies. The relationship between economic independence and marriage rates is negative in Italy (Pinnelli and De Rose 1995), Spain (Ignacio Martínez Pastor 2008), and Japan (Raymo 2003; Ono 2003). Raymo (2003) argues that the family system in Italy and Japan is more traditional than other Western countries. Therefore, sharply differentiated gender roles in Italy and Japan make it difficult for women to combine work and family. The family system in Taiwan is considered more traditional than Western countries as well. I discuss the trend in marriage formation in Taiwan at the end of this chapter. Here, I am going to discuss studies that adjudicate between marriage delayed and marriage forgone.

A common challenge for all prior research is right-censoring, which makes it difficult for researchers to ascertain the eventual probabilities of marriage for women. There are two ways to deal with this challenge in prior research. The first is to use statistical models to forecast the eventual probabilities of marriage for women. Goldstein and Kenney (2001) use the Coale-McNeil model and the Hernes model to forecast women's eventual probabilities of marriage after 1970 for successive cohorts in the United States. Their results indicate that although college graduates are less likely to marry than non-college graduates at younger ages, their eventual

probabilities of marriage will catch up and even exceed non-college graduates at older ages. Thus it is consistent with the marriage-delayed hypothesis rather than the marriage-forgone hypothesis. However, forecasting has a major drawback. Forecasting models predict people's marriage behavior under sometimes relatively strong assumptions and are based on the observed information in the past. If the assumption of certain forecasting model is inconsistent with the reality or there is an abrupt historical change, then the forecast may deviate substantially from truth (Cherlin 1990). This may be the reason why results provided by prior studies applying these forecasting models are inconsistent for more recent birth cohorts (Martin 2004).

The second way to deal with the challenge of right-censoring is extending the observation period. Because the analysis is based on observed data, it can avoid the aforementioned drawback of forecasting. Sweeney (2002) compares the marital history of two birth cohorts to study the historical trends in marriage formation. With relatively complete event history data of these two cohorts of American women, she reports a positive relationship between women's economic independence and marriage rates. Although Sweeney (2002) estimates, rather than forecasts, the trend, she does not differentiate between marriage delayed and marriage forgone. The

same problem can also be found in Wong's (2003) study of women's marriage formation in Hong Kong. Wong (2003) finds that both women's educational attainment and job position are positively related to marriage rates in Hong Kong. In both Sweeney (2002) and Wong (2003), the discussions are limited to marriage delayed rather than marriage forgone. In my thesis, I analyze both marriage rates and the eventual probabilities of marriage for successive birth cohorts of Taiwanese women, and provide additional evidence on the debate over marriage delayed and marriage forgone.

1.4.2 Education as Proxy for Economic Potential

Educational attainment is most commonly used as a proxy for economic potential in prior research. Meanwhile, there are other proxies for economic potential such as current earnings, earnings potential, and employment status. Many studies have included more than one proxy for economic potential in their models, and I think it is necessary to go into details of the results of these studies. Most studies have not compared the coefficients of educational attainment before and after controlling for other proxies for economic potential. It is often the case that after controlling for current earnings or employment status, the coefficient of educational

attainment is positive and statistically significant (Mare and Winship 1991; Lichter et al. 1992; Sweeney 2002; Ono 2003). An exception is the paper by Xie et al. (2003) which finds that, controlling for estimated earnings, the coefficient of educational attainment for American women is positive but no longer statistically significant.

Blossfeld and Huinink (1991) compare the coefficients of educational attainment before and after controlling for on-the-job training experience, which is another proxy for economic potential. Their results indicate that both coefficients of educational attainment are insignificant and the coefficient of on-the-job training experience is also insignificant. Since women's timing of marriage is independent of their educational attainment in Germany, it is not necessary for them to test the hypothesis that education influences women's marriage rates through earnings potential. However, if the correlation between women's educational attainment and marriage formation is not zero, it is necessary to discuss how the improvement of women's education is associated with the process of marriage formation. I compare the coefficients of educational attainment before and after controlling for earnings potential in the second analysis of my thesis. With a more detailed discussion about how women's education is associated with marriage formation, I provide additional evidence for the debate between Becker's and Oppenheimer's theory.

1.4.3 Marriage Formation in Taiwan: A Historical Overview

Taiwan has experienced tremendous social, economic, and demographic changes during the past half-century. These changes include a decrease in mortality and fertility, the educational expansion, and the transformation from an agricultural society to an industrialized and urbanized society (Hermalin et al. 1994). According to Thornton et al. (1994), these changes have shifted many fundamental individual activities from familial settings to other social institutions. Thus they have substantial influences on the family institution, including marriage formation behaviors, in Taiwan.

Before World War II: Changes in Sex Composition

The characteristics of marriage among Taiwanese women before 1905 are early and universal marriage (Lin et al. 1994; Lee 1994). In contrast with women, men in Taiwan marry later than women across all birth cohorts. The nearly universal and early marriage is common in other Asian countries as well, e.g., Japan, South Korea, and Singapore (Jones 2007) but in sharp contrast with Western countries. The difference in age at first marriage between men and women partially represents the age norm of marriage. It also represents the imbalanced sex composition of the

population.

Historically, Taiwan was a migrant society with immigrants mainly from mainland China. One population characteristic of a migrant society is an imbalanced ratio between men and women (Wang 1993). The population, however, was almost closed to immigration since 1895, the beginning of the Japanese colonization. The imbalanced ratio between men and women has been gradually decreasing as well (Wang 1993). Table 1 presents the ratio of men to women by year and age from 1905 to 2010.

[Table 1 about here]

In 1905, ten years into the Japanese colonization, most of the ratios are above 110 except for men and women aged 45 years old and above. There are more women than men in this age group because women have longer life expectancies than men. The imbalanced sex ratio has been gradually decreasing during the Japanese colonization period. For example, the sex ratio for men and women aged between 15 and 19 decreased from 116 in 1915 to 104 in 1935. But the sex ratio for men and women aged 40 to 44, who were born before 1895, was still high (i.e., 114) in 1935.

Along with the decreasing ratios of men to women, trends in marriage formation have changed between 1905 and World War II. Furthermore, the

directions of changes are different for men and women. While there is an overall trend toward a lower prevalence of marriage for women, marriage has increased for men (Lin et al. 1994; Lee 1994). Lin et al. (1994) and Lee (1994) argue that these trends are resulted from the decreasing sex ratio of men to women, which means that the marriage squeeze produced by a surplus of men is ameliorating. Thus the average age at marriage have increased for women but decreased for men.

After World War II: Changes in Sex Composition and Behavior

The sex ratio of men to women has changed dramatically after World War II. The influx of a large number of single men from mainland China to Taiwan following World War II has resulted in an even greater surplus of men than in 1905 (Lin et al. 1994; Lee 1994). In the approximately 910,000 immigrants from mainland China, men accounts for three quarters and women only accounts for one quarter (Wang 1993). As shown in Table 1, the ratio of men to women over 35 sharply has increased between 1935 and 1966. Most of these men were born before 1930, and followed the Nationalist government to Taiwan around or after 1949. The imbalanced sex composition among this birth cohort is also represented in the sex ratios for age group 45 to 49 from 1970 to 1979 and for age group 50 and above from 1978 to 1994.

The increasing surplus of men has not increase women's prevalence of marriage, but rather associated with a sharp decline in women's prevalence of marriage. The age at marriage increased for both men and women during this period. The decreasing prevalence of marriage reported in Lin et al. (1994) and Lee (1994) represents delayed marriage rather than non-marriage because the decrease is confined to early ages and the prevalence of marriage at older ages remains high in Taiwan at that time. With the calculation of the percentage never marrying of a hypothetical cohort, Lin et al. (1994) predict that significant numbers of Taiwanese women and men will never marry throughout their lifetime.

Other research has also reported delayed or both delayed and forgone marriage in Taiwan during this period (Wei and Reischl 1983; Thornton et al. 1994; Yang et al. 2006; Chen 2007; Jones 2007; Chen 2009; Jones and Gubhaju 2009; Jones 2010) and some of them have tried to provide explanations for the trends in marriage formation. The delayed and forgone marriage for both men and women are inconsistent with the hypothesis that sex ratio is the only mechanism influencing marriage formation. This suggests that there is other mechanism going on during this period.

Taiwan has experienced educational expansion and the transformation from an agricultural society to an industrialized and urbanized society during this period.

The modern Western education in Taiwan is first instituted during the Japanese colonization. The Japanese colonial government has carried out a six-year compulsory education for Taiwanese people since 1898. At the end of Japan's occupation of Taiwan, the enrollment rates for men and women were about 81% and 61%[4] (Tsai 2004).

After World War II, the Nationalist government came to Taiwan and extended the educational system. The total number of colleges and universities has increased from 4 to 27 by 1960 and the compulsory education in Taiwan has extended into nine years since 1968 (Tsai 2004). The educational expansion after World War II is closely related to economic development. The economic policy in Taiwan between 1961 and 1973 emphasize labor intensive and export-oriented manufacturing industry (Hermalin 1994). To provide sufficient labor for the labor intensive industry, the government has regulated the ratio of academic high school students to vocational high school students to remain 3 to 7 between 1960s and 1980s (Tsai 2004). The educational policies during this period have focused on the vocational education to

[4] In addition to the six-year compulsory education, the colonial government has also instituted secondary education and tertiary education during their occupation in Taiwan. But the secondary and tertiary education have primary enrolled Japanese in Taiwan and the highest educational attainment for most Taiwanese students is six-year compulsory education (Tsai 2004).

produce enough labor force for the economic expansion. The establishment of schools of tertiary education has been under strict regulation by the government until 1985 (Tsai 2004). After the deregulation of tertiary education, the number of colleges and universities has jumped from 105 in 1986 to 150 in 2000—a tremendous expansion in higher education.

These changes in educational system and economy in Taiwan during the past few decades have substantial influences on the pattern of marriage formation. Many prior studies have provided evidence to support these arguments. Wei and Reischl (1983) analyze data collected from families in northern Taiwan in 1978 and compare marriage formation in urban and rural areas. Their findings indicate that age at marriage for men and women in rural areas are lower than in urban areas. They also find that higher education increases age at marriage for men and women in both urban and rural areas, especially among urban male.

Chen (2007) fits Hernes's (1972) non-homogenous diffusion model to more recent data. Her results show that Taiwanese women with higher education and in more recent birth cohorts are more likely to marry at a later age and have a lower cumulative prevalence of first marriage. Her results also suggest a trend toward greater variation in age at first marriage, which reflects a more flexible pattern of

marriage formation. A limitation is that the Hernes's model is a parametric model. Although she has compared her estimations with the observed data, it is unclear whether they fit the trend of the incomplete birth cohorts as well.

In addition, several other studies have examined the pattern of marriage formation for both men and women in Taiwan and have found an asymmetrical pattern between men and women. Chen (2009) applies the life table method and the survivorship function to analyze the marriage formation among Taiwanese men and women. She finds an extremely high mean age at first marriage for less educated men born in more recent cohorts—which may reflect their relative lack of attraction to potential mates. In contrast, more highly educated women born in more recent cohorts have the highest mean age at first marriage—which may reflect their lower preferences for marriage.

Yang, Li, and Chen (2006) also report opposite directions of relationships between education and age at marriage for men and women. They find a negative association between education and age at marriage before age 30 for both men and women. The association becomes positive for men while negative for women after age 30. They argue that the relatively late age at marriage for less educated men and more highly educated women reflect their disadvantaged position in the marriage

market. They conclude that the combination of the traditional norm of "female hypergamy" and women's increasing educational opportunities are responsible for the "marriage squeezes" for less educated men and more highly educated women. In sum, the delayed marriage for less educated men is attributable to their disadvantaged economic status (Oppenheimer 1988). The delayed marriage for more highly educated women is attributable to changes in attitude toward marriage (Becker 1981) or to a shortage of potential mates (Raymo 2005; Wilson 1987). With continued expansion of higher education and increase in age at first marriage, the marriage formation patterns for less educated men and more highly educated women, in particular, have received tremendous attention in research on Taiwan.

Mechanisms behind Educational Differentials in Marriage Formation

Distinguishing between delayed marriage and forgone marriage is at the core of adjudicating between the hypotheses of Becker and Oppenheimer. It is necessary to clarify the tempo and quantum behind the educational differentials in marriage formation. Then the next step is to explain the mechanisms behind the trends in educational differentials in marriage formation in Taiwan.

Thornton et al. (1994) argue that the most important factor in trends in marriage formation in Taiwan is education. Other factors, such as family background, affect

women's marriage rates through education. They report a negative relationship between women's education and marriage rates, and find that educational attainment alone can fully account for the historical changes in marriage rates. Nonetheless, the oldest respondents in their data were only 30 years old at the survey, which means that many respondents who had not been married might marry after the survey interview. Also the same design constraint makes it difficult to distinguish the difference between the effect of enrollment and the effect of educational attainment. On the contrary, based on data from Japan and South Korea (but not Taiwan), Jones and Gubhaju (2009) claim that changes in educational composition play a relatively minor role in explaining the trends in the retreat from marriage in East Asia (presumably including Taiwan).

The role of education in Taiwanese women's marriage formation has received mixed empirical support in the studies reviewed above. Therefore, the goal of my thesis is to clarify the relationship between women's education and marriage rates in Taiwan using data for successive cohorts of women born in Taiwan between 1910 and 1991. These data also provide a more complete event history than in Thornton et al.'s (1994) study.

CHAPTER 2 DATA AND VARIABLES

2.1 WOMEN'S MARRIAGE, FERTILITY, AND EMPLOYMENT SURVEYS[5]

I use data pooled from the 1979 to 2006 waves of Women's Marriage, Fertility, and Employment Surveys (WMFES), a series of repeated cross-sectional surveys conducted in Taiwan that are similar to the June Supplement of the U.S. Current Population Survey.[6] Each WMFES includes a nationally representative sample of women aged 15 or higher residing in Taiwan, and was conducted by the Directorate General of Budget, Accounting and Statistics of Executive Yuan (DGBAS) in Taiwan. These surveys include information on age at first marriage (measured in years), calendar year in which a respondent was born, and the highest degree a respondent completed, and thus are suitable for the purpose of my analysis. A total of 405,526 respondents were successfully interviewed in these 15 waves of WMFES surveys.

[5] 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.

[6] These include a total of 15 waves of WMFES, conducted annually from 1979 to 1988, and at varying intervals thereafter in1990, 1993, 2000, 2003, and 2006.

After deleting those respondents whose self-reported gender is male, who were over 65 years old at survey year,[7] and a handful of respondents whose age at first marriage is younger than 12 years old, the analytic sample in the first analysis has a total of 366,003 cases.

In the second analysis, I use data only from respondents born after 1963[8] and apply a series of discrete-time hazard models. After deleting those respondents whose self-reported gender is male, who were over 65 years old at survey year, a handful of respondents whose age at first marriage is younger than 12 years old, and those who were born before 1963, the analytic sample has a total of 112,053 cases. Data in the second analysis are organized into person-year records, with one record for each annual interval in which a respondent was at risk of first marriage. The total number of person-year records is 957,104. For both analyses, I assume that the respondents started to become at risk of first marriage at age 13.

[7] I drop respondents who were over 65 years old (approximately 8.6 % of the total sample) for the reason that these respondents may be a selected group of individuals with better socioeconomic status, better health, and so forth, which may in turn be associated with their marriage behavior.

[8] Those respondents born in or before 1962 are deleted from the sample for the reason that the earnings potential files I use in this thesis only provide information from 1976 to 2006. Therefore, there are missing values of earnings potential for those respondents who were born before 1963 and were older than 13 years old before 1976.

2.2 SURVEYS OF FAMILY INCOME AND EXPENDITURE[9]

In the second analysis, I also use data pooled from the 1976 to 2005 waves of the Survey of Family Income and Expenditure (SFIE)—a series of annually repeated cross-sectional surveys conducted in Taiwan that are similar to the U.S. Consumer Expenditure Survey—to construct gender-, age-, education-, county-, and year-specific earnings profiles. These earnings profiles are used to estimate the earnings potential of the respondents in the WMFES. These surveys include information on calendar year in which a respondent was born, the respondent's earnings in the last year, the highest degree a respondent completed, and thus are suitable for the purpose of my analysis.

2.3 VARIABLES

2.3.1 The First Analysis

I construct dummy variables to indicate the respondent's birth cohort in the

[9] 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.

following 20-year categories: 1910-29, 1930-49, 1950-69, and 1970-91, with the oldest cohort being the reference category. The respondent's educational attainment is coded into four dummy variables: fewer than 12 years of schooling, 12 years of schooling (indicating high school diploma, for Taiwan does not have a GED program; and this is the reference category), 13-15 years of schooling (a set of schools conferring a degree that is comparable to the associate degree in the United States), and 16 or more years of schooling (a bachelor's degree or higher).

First marriage is the event of interest. For the dependent variable of marriage rates, I construct a binary indicator for the event of a first marriage, and a continuous variable for the waiting time. For those respondents who reported having experienced the event of a first marriage (event = 1), I use their age at first marriage (in years) as the waiting time. For those respondents who reported never having been married at the time of the survey interview, they are "censored" (event = 0) and the waiting time is their age at survey interview.

[Table 2 about here]

Table 2 presents the descriptive statistics of the analytic sample. Over 68 percent of women had ever been married at the survey time, and their average age at first marriage is about 21.8 years. Most of the respondents were born between 1930

and 1969 and relatively fewer respondents are in the earliest and latest birth cohorts. As the majority of respondents were born before 1969, the proportion of women with less than 12 years of schooling in the entire sample is over 60%. Respondents with more than 13 years of schooling only consist of 12% (i.e., 6% for 13 to 15 years and 6% for more than 16 years) of the total sample.

2.3.2 The Second Analysis

In the discrete-time hazard model, I construct dummy variables to indicate different intercepts (indicating baseline hazards) for each age group in the following categories: 13 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 43 years old, with the age group of 25 to 29 being the reference category. Because data of the second analysis is from respondents born after 1963, I construct a series of new dummy variables to indicate respondent's birth cohort in the following categories: 1963-1971, 1972-1981, and 1982-1991, with the oldest cohort being the reference category. The coding of respondents' educational attainment is the same as in the first analysis with one exception: in the second analysis, educational attainment is a time-varying variable. Because there is no information about the actual enrollment status of respondents in the WMFES, I infer their enrollment status using the normative ages of graduation

according to their highest degree completed. The respondent was enrolled (enrollment = 1) if her current age was above the normative age at which the respondent's highest level of education was attained and vice versa (enrollment = 0).

Since my theoretical interest is in the "perceived long-term economic potential," I follow Xie et al. (2003) to construct five predicted earnings potential variables.[10] I use the SFIE data to estimate Mincer's (1974) earnings equation for women, with calendar year, birth cohort, and county added to the original version of the equation:

$$\ln E_t = \ln E_0 + \beta_1 education + \beta_2 experience - \beta_3 experience^2 + \beta_4 cyear + \beta_5 cohort + \beta_6 county$$

where education, cohort, and county are dummy variables and working experience and calendar year are continuous variables. Education, cohort, and county are coded into the same categories as in the WMFES. Work experience used in the earnings equation of this analysis is also an inferred work experience which equals the respondent's current age subtracts her years of schooling and the age at the beginning of schooling (i.e., 6 years of age in Taiwan). For those respondents whose

[10] There are two steps in their analysis for constructing these earnings-potential variables. The first step is using the 1990 U.S. Census data to estimate sex- and education-specific earnings equations as functions of potential work experience, and using these earnings equations to predict respondents' earnings potential in another dataset. The second step is modifying the earnings equations in step 1 by adding other observable characteristics (such as AFQT scores) in the equations. There is no comparable information about these characteristic in the WMFES. Therefore, I only use the first step to construct the earnings potential variables in my analysis.

educational level was under 6 years of schooling, their work experience equals their current age subtracts 12. The dependent variable is the natural logarithm of the total yearly earnings in the last year before the survey year, which is transformed into 2005 dollars by the Consumer Price Index. Then I use the earnings equation to compute the predicted current earnings potential of each person-year record of the WMFES data. The predicted earnings over the next five years are calculated as the sum of the predicted current earnings over the following four year:

$$E_{5_{jk}} = \sum_{x=k}^{k+4} E_{jx}$$

where j is the educational level and k is the inferred work experience. The calculation of predicted future earnings is based on the assumption that permanent exit from the labor force occurs at age 60 for people of all levels of educational attainment. The predicted future earnings are calculated as:

$$E_{F_{jk}} = \sum_{x=k}^{60-\theta_j} E_{jx}$$

where θ_j denotes the normative ages of school completion. The predicted total past earnings are calculated as the sum of cumulative earnings at all levels of educational attainment:

$$E_{P_{j\bar{k}}} = \sum_{j=1}^{4} \sum_{x=0}^{k_j} E_{jx}$$

where k_j is the years of work experience at educational level j, and $\bar{k}$ is respondents'

inferred work history. The predicted lifetime earnings are calculated as subtracting the current earnings from the sum of the past earnings and future earnings:

$$E_{L_{j\bar{k}}} = E_{P_{j\bar{k}}} + E_{F_{jk}} - E_{jk} \cdot$$

The event of interest is also first marriage. Table 3 presents the descriptive statistics of the person-year data. For those person-year records which the event has occurred, the average age at first marriage is 22.56.

[Table 3 about here]

The mean current earnings potential is NT$167,711 (= exp[12.03]). The mean earnings potentials are NT$984,609 (= exp[13.80]) over the next five years, and NT$634,124 (= exp[13.36]) cumulated in the past. The means for future earnings potential and lifetime earnings potential are, respectively, NT$16,852,339 (= exp[16.64]) and 17,716,377 (= exp[16.69]).

CHAPTER 3 STATISTICAL MODELS

3.1 KAPLAN-MEIER ESTIMATES

I use the Kaplan-Meier estimator for the proportions of women who had never been married by age *t* (Kaplan and Meier 1958; Cox and Oakes 1984:48-50):

$$\hat{S(t)} = \prod^{(t)} \left(1 - \frac{d_j}{r_j}\right)$$

where r_j is the number of respondents who had never experienced a first marriage by age *t*; d_j is the number of respondents who had experienced a first marriage at age *t*.

3.2 COX PROPORTIONAL HAZARD MODELS

I then estimate the Cox proportional hazard models to verify the Kaplan-Meier results. The Cox proportional hazard models assume that the differentials in marriage rates *h(t)* are multiplicative across respondents in different birth cohorts and with different levels of educational attainment:

$$h(t) = h_0(t)\exp(\beta_1 \cdot cohort + \beta_2 \cdot education).$$

With the Cox model specification, I also test whether or not educational differentials in marriage rates have changed across successive birth cohorts of women in Taiwan:

$$h(t) = h_0(t)\exp(\beta_1 \cdot cohort + \beta_2 \cdot education + \beta_3 \cdot cohort \times education) .$$

If β_3 is not zero, it means the educational differentials in marriage rates are varying across birth cohorts.

3.3 DISCRETE-TIME HAZARD MODELS

I estimate a series of discrete-time hazard models to compare the effects of different proxies for economic potential on the entry into first marriage. In the discrete-time model, it is assumed that the hazard rate will change with time, the dependent variable is the log odds of first marriage (Allison 1984), and the covariates are birth cohort, educational attainment, and enrollment status:

$$\log[P(t)/(1-P(t)] = a(t) + \beta_1 \cdot cohort + \beta_2 \cdot education(t) + \beta_3 \cdot enrollment(t)$$

where *a(t)* denotes different intercepts for each age group *t*, and *education(t)* and *enrollment(t)* denote time-varying covariates. With the discrete-time specification, I also compare the coefficients of five different earnings potential variables and examine how their inclusions affect the coefficients of education:

$$\log[P(t)/(1-P(t)) = a(t) + \beta_1 \cdot cohort + \beta_2 \cdot education(t) + \beta_3 \cdot enrollment(t) + \beta_4 \cdot earnings(t).$$

If β_2 has diminished after including earnings potentials, it suggests that education affecting Taiwanese women's marriage rates fully through the intervening of economic potentials. If β_2 has increased or reduced but diminished after including earnings potentials, it suggests that education affects Taiwanese women's marriage rates through mechanism other than economic potentials.

CHAPTER 4 RESULTS

4.1 MARRIAGE DELAYED OR MARRIAGE FORGONE?

To get a general picture of trends in Taiwanese women's marriage behavior, I estimate the proportions of women who had ever been married for each birth cohort. Results presented in Figure 4 suggest that, similar to other industrialized countries, Taiwanese women born in more recent cohorts marry later and fewer than women born in earlier cohorts. The marriage pattern is universal marriage for Taiwanese women born before 1949. Almost every Taiwanese woman born before 1949 were married by age 35, this is consistent with Thornton and Lin's (1994) findings.

[Figure 4 about here]

I also estimate the proportions of never-married women at specific ages by education and birth cohort (shown in Table 4). More than 95 percent of Taiwanese women born between 1910 and 1929 had ever been married by age 40, and there are nearly no educational differentials among Taiwanese women in these birth cohorts. But the educational differentials in the eventual probabilities of marriage have increased for women born after 1930. The proportions of never-married women are

monotonically increasing across birth cohorts and years of schooling. The sharpest contrast is among women in more recent birth cohort. For example, among Taiwanese women born between 1960 and 1969, although only 5 percent of women with fewer than 12 years of schooling had never been married by age 40, as much as 25 percent of women with 16 or more years of schooling had never been married by age 40.

[Table 4 about here]

Do these results imply a ceiling effect so that there is no room for educational differentials in the eventual probabilities of marriage among Taiwanese women born before 1949? The answer indeed depends on how low the proportion of more highly educated women in earlier birth cohorts is because more highly educated women consist of only a small proportion of the population in earlier birth cohorts. Accordingly, I break down the Kaplan-Meier estimates by years of schooling to compare the educational differentials in the eventual probabilities of marriage.

[Figure 5 about here]

Figure 5 presents Kaplan-Meier estimates of the proportions of Taiwanese women who had ever been married by different levels of educational attainment. There is no crossing between the four groups of women in their estimated age-specific

proportions of ever having been married. These results suggest that less educated women not only marry earlier but also have greater chances to have ever been married at all ages (and thus ever eventually been married) than their more highly educated counterparts.

I then break down these Kaplan-Meier estimates by birth cohorts (see Figure 6). The patterns are similar to those presented in Figure 4 and Figure 5: there is no crossing in the age patterns of proportions of ever having been married for Taiwanese women in all birth cohorts. These results are in contrast with those reported in Goldstein and Kenney (2001) and in Sweeney (2002), which show that more highly educated American women marry at a lower rate at younger ages than their less educated counterparts and subsequently at a higher rate at older ages.

Note also that the educational differentials in the proportions of Taiwanese women having ever been married are smaller in earlier birth cohorts than in later birth cohorts. To my knowledge, except for Raymo's (2003) study about Japanese women's transition to first marriage, no other study has documented similar trends in the educational differentials in proportions of women having ever been married. Raymo (2003) finds that the cohort decline in marriage rates is greater among more highly educated women than less educated women in Japan. He argues that the

increasing educational differentials in cohort decline suggests that the "increasing economic opportunities for women in the absence of gender-role convergence may be contributing to a reduction in the gains to marriage and/or an extended period of employment before marriage" (Raymo 2003: 97).

Another possible explanation is that relatively few Taiwanese women born in earlier birth cohorts had attended higher education and almost everyone of them had ever been married, so the educational differentials in marriage rates are smaller in earlier birth cohorts. My analyses only provide preliminary and descriptive findings about the interaction between education and birth cohort on women's marriage rates. Hence whether the increasing educational differentials in cohort decline in marriage rates reflect increasing economic opportunities for women over birth cohorts, or reflect changes in the composition of women's educational attainment need further research.

[Figure 6 about here]

The lack of crossings in the Kaplan-Meier survival curves presented in Figure 5 and Figure 6 also add to my confidence that it is unlikely for there to be any substantial violation of the proportional hazards assumption. Hence, I proceed to estimate Cox regression models to verify the nonparametric explorations of marriage

formation behaviors among Taiwanese women. These results are presented in Table 5. The coefficient β denotes the additive contrast in logged-hazard rates of a specific group from the reference group. Exponentiating the coefficients, *exp(β)*, gives the multiplicative relative risks of a specific group compared with the reference group. I report the percentage change in hazard rates (i.e., $[exp(\beta)-1]\times 100$) associated with a specific group relative to the reference group (see, e.g., Bumpass, Sweet, and Martin 1990).

[Table 5 about here]

As shown in Model 1 of Table 5, Taiwanese women born in more recent cohorts have lower rates of first marriage than those born in earlier cohorts. The relative risks are roughly 13%, 30%, and 55% lower for birth cohorts from 1930 to 1949, 1950 to 1969, and 1970 to 1991 than for birth cohort from 1910 to 1929. Model 1 also indicates that more highly educated Taiwanese women have lower rates of first marriage than less educated women. Compared with women with 12 years of schooling, the rates of first marriage are roughly 108% higher for women with fewer than 12 years of schooling, and are 33% and 51% lower for women with 13 to 15 and 16 or more years of schooling. The differentials are monotonic across years of schooling. The trend of declining rates in first marriage across successive birth

cohorts in Taiwan is similar to those patterns documented in other industrial countries. The negative relationship between women's education and first marriage rate, however, is inconsistent with the relationship in most industrial countries, save for Italy, Spain, and Japan (Blossfeld 1995; Raymo 2003, 2005; Ignacio Martínez Pastor 2008).

Adding interactions between years of schooling and birth cohorts, as in Model 2, significantly improves the goodness of fit. Compared to Model 1, which constrains the interaction effects to zero, Model 2 increases the log likelihood by 640.7 ($p<.001$). Model 2 also has a lower BIC than Model 1, which indicates a better model fit (Raftery 1995). The significant improvement in Model 2 suggests that the relationship between educational attainment and the risk of marriage is not time invariant. Cohort declines in marriage rates are smaller among women with 13-15 years of schooling than among women with 16 or more years of schooling. Hence, these regression results on marriage rates corroborate with the nonparametric Kaplan-Meier estimates of the probabilities of having ever been married. The educational differentials in marriage rates are larger among more recent birth cohorts than among earlier birth cohorts.

In brief, Taiwanese women born in more recent cohorts marry later and fewer

than their counterparts born in earlier cohorts. Taiwanese women with higher educational attainment marry later and fewer than their counterparts with lower educational attainment. Moreover, the educational differentials have become even larger for more recent birth cohorts of women.

4.2 DISCRETE-TIME HAZARD MODELS

To test the hypothesis that education influences Taiwanese women's marriage rates through earnings potential, I apply a series of discrete-time hazard models including educational attainment and earnings potential. The results of these discrete-time hazard models are presented in terms of the percentage change in the marriage rates associated with a category of a predictor variable relative to the omitted category (see Table 6).

[Table 6 about here]

Model 1 of Table 6 shows that the age dependence of first marriage rates has an inverted U-shape with the highest rates between ages 25 and 29. This age dependence is consistent with that reported in previous research (Blossfeld 1995). Taiwanese women born in more recent cohorts have lower rates of first marriage than those born in earlier birth cohorts. The rates of first marriage for the 1971-1980 and

1981-1990 birth cohorts are roughly 16% and 44% lower than the 1963-1970 birth cohort. These results are consistent with the nonparametric findings in Figure 4 and the semiparametric findings of Cox models in Table 5. This cohort decline in rates of first marriage in Taiwan is similar to those documented in other industrial countries (Raymo 2003).

There are at least two parts of the educational effect on the rates of entry into first marriage: enrollment status and educational attainment. On the one hand, the coefficients presented in Model 1 of Table 6 suggest that school enrollment reduces the rates of first marriage by 95%. The negative coefficients of enrollment status presented in Model 1 may reflect the role conflict between being a student and being married, which is consistent with results of all previous studies (Mare and Winship 1991; Blossfeld 1995; Sweeney 2002; Raymo 2003; Xie et al. 2003; Ono 2003).

On the other hand, the negative relationship between women's educational attainment and marriage rates is inconsistent with the relationship in most industrial countries, with the exception of Italy, Japan, and Spain (Blossfeld 1995; Raymo 2003, 2005; Ignacio Martínez Pastor 2008). Compared to women with 12 years of schooling, the rates of first marriage are roughly 61% higher for women with less than 12 years of schooling, but are 37% and 51% lower for women with 13-15 and 16 or

more years of schooling, net of enrollment status. This finding appears to be in line with Becker's (1981) economic independence hypothesis, but not with Oppenheimer's (1988) theory.

To further adjudicate between these two theories, my next step is to answer the question of whether this negative relationship between educational attainment and marriage rates reflects the fact that women who expect to have higher long-term economic potentials may marry later than their counterpart with lower economic potentials. To answer this question, I include five proxies for earnings potentials in Model 2 to Model 6 of Table 6. The inverted U-shaped age dependence of rates of first marriage, the cohort decline of marriage rates, and the negative relationship between enrollment status and the risks of first marriage in these models are essentially the same as in Model 1.

Consistent with my expectations, the coefficients of educational attainment change after the inclusion of earnings potential, and the direction of change is the opposite of the prediction of human capital theory except for Model 5 and Model 6—which I will discuss later. Women with higher education are less likely to marry than their counterparts with lower education even if earnings potential is included in the model. This result indicates that there is something else about education behind

its association with the risks of first marriage, and the direction of this association is negative. A possible explanation may be that higher education is a signal of some characteristics that are unattractive in the marriage market, and thus decrease the marriage rates for more highly educated women. Another possible explanation may be that the experiences of higher education cultivate specific tastes and dispositions of women which reduce women's preference for marriage. More highly educated women may have egalitarian gender role attitudes or stronger work commitment and thus are less willing to marry than less educated women. I cannot distinguish between these two possible explanations in the present analysis. The hypothesis of decreasing attractiveness in the marriage market and the hypothesis of decreasing willingness to marry among highly educated Taiwanese women may both be true.

Unexpectedly, however, the coefficients of these five earnings potentials suggest an explanation consistent with neither Becker's nor Oppenheimer's theory. The relationships between earnings potentials and the risks of entry into first marriage are positive for the predicted current earnings, earnings over the next five years, and total past earnings, but are negative for the predicted future earnings and lifetime earnings. As shown in Model 2, if a woman's current earnings potential, earnings potential over the next five years, and total past earnings potential increase by 1%, the risk of entry

into first marriage will be, respectively, 2.11%, 3.28%, and 1.91% higher. In contrast, if a woman's total future earnings potential and lifetime earnings potential increase by 1%, the risks of entry into first marriage will, respectively, decrease by .65% and .63%. These results are inconsistent with Xie et al. (2003), which suggest that all of these five earnings potentials have an insignificant but positive effect on entry into marriage for American women.

Potential earnings in the past and in the near future are positively associated with Taiwanese women's marriage rates. But potential earnings in the future and for her lifetime are negatively associated with Taiwanese women's marriage rates. I can speculate two possible explanations: the first explanation is about the problem of endogeneity. The earnings profile estimated by the SFIE data does not consider respondents' marital status, which was not asked in the survey. Over 17 percent of married and employed Taiwanese women left the labor market and never came back after they got married in the past twenty years[11], and previous research has found that many of these women who have returned to the labor market are employed in the informal sectors (Yu 1999). Therefore, respondents who were currently employed and with earnings information in the SFIE data are over-representative of women who

[11] This information is calculated from the WMFES data, and for the accurate number, please see Appendix 1.

did not leave the labor market and who have changed their sector of employment upon their return. Those in my SFIE sample are a selected group of women who did not get married, who did not give up their career for marriage, or who might have changed to a job with reduced earnings after marriage. This over representation may result in a correlation between respondents' earnings potential and marital status and thus lead to biased estimation of earnings potentials.

The second explanation is that the expected future earnings may be a signal of women's long-term commitment to their career. Occupations differ in their starting wages and their rates of appreciation, and women who earn significantly more in predominantly male occupations than in female occupations—i.e., women have higher starting wages and higher subsequent earnings in male occupations (England 1984). If a rational woman attempts to pursue her career and maximize her lifetime earnings, she should seek employment in a male dominated occupation than in a female dominated occupation. In the meantime, high earnings in male dominated occupations may also increase the costs of marriage for these women. In contrast, a woman with lower commitment to career will be more willing to change jobs or leave the labor market after marriage. This kind of work trajectory is more "traditional" and these women may be more attractive to Taiwanese men because, despite their

higher past earnings, they are willing to sacrifice their career and long-term earnings for their family after marriage.

In sum, there may be an omitted variable which indicates the strength of women's long-term career commitment, which is also associated with the predicted future earnings. Women with higher long-term commitment to career may be less likely to marry in Taiwan. The relationship between economic potential and the probabilities of entry into marriage in Taiwan is more complicated than the theories proposed by Becker and Oppenheimer. Women with the same educational level have heterogeneous commitment to their career. Thus, economic potential is not the only factor associated with women's marriage rates.

The latter explanation is consistent with findings of the net effects of educational attainment. Except for Model 5 and Model 6, the coefficients of educational attainment change in the reverse direction than the human capital theory will predict after the inclusion of earnings potential in the models. While more highly educated women in general tend to have higher earnings potential in the past and in the near future, only those with stronger long-term career commitments have higher future and lifetime earnings potentials. Women with stronger long-term career commitments may not only have higher future and lifetime earnings potentials but they may have

lower preference for marriage as well. Hence, the coefficients of educational attainment are reduced in Model 5 and Model 6 but not in Model 2 to Model 4.

Apart from human capital investment, educational attainment also serves as a signal function and higher education institutions may incubate specific cultural capital. Moreover, the relationship between earnings potential and the risks of first marriage is not linear and is more complicated than in our current understanding. Earnings potential is also an indicator of long-term career commitment. Women who earn more in the past and in the near future but who earn less in the long run are most likely to get married in Taiwan.

CHAPTER 5 CONCLUSIONS AND DISCUSSIONS

5.1 CONCLUSIONS

In this thesis, I address the debate over marriage decline by distinguishing between marriage delayed and marriage forgone in the Taiwanese context. Specifically, I document trends in marriage formation, and then examine the role of education as a proxy for women's earnings potential in explaining the documented trends. The results show that more highly educated Taiwanese women marry later and fewer than less educated women. This finding is consistent with the prediction of Becker's (1981) economic independence hypothesis and inconsistent with the prediction of Oppenheimer's (1988) career-entry hypothesis. The results also show that educational attainment influences Taiwanese women's risks of first marriage through mechanisms other than human capital investment. Hence, educational attainment should not be treated merely as an indicator of human capital investment while studying marriage formation. This finding is neither consistent with Becker's nor with Oppenheimer's theory, and suggests that we should be cautious about how to explain educational differentials in marriage formation.

In the first analysis in this thesis, I estimate both marriage rates and the eventual

probabilities of marriage among successive cohorts of Taiwanese women. The results suggest a trend toward later and fewer marriages across birth cohorts. That is, marriage formation among Taiwanese women has shifted from early and universal marriages into later and fewer marriages. Educational attainment is positively associated with marriage timing and negatively associated with risk of being married among Taiwanese women. Educational differentials in risk of being married have increased over birth cohorts.

These results seem to be consistent with Becker's (1981) theory about marriage formation. If women are more educated (and with greater economic independence), their gains from marriage will decline and they will be less likely to get married eventually. Prior studies have reported similar findings in Italy, Japan, and Spain (Blossfeld 1995; Raymo 2003, 2005; Ignacio Martínez Pastor 2008), and these findings are interpreted as evidence for a "liberating" hypothesis (Blossfeld 1995). The liberating hypothesis posits that, in societies where women's roles in family and the labor market are more incoherent, more highly educated women will face stronger difficulties in combining family and work and thus will be less likely to marry (Blossfeld 1995; Raymo 2003, 2005).

In the second analysis in the thesis, I include both years of schooling and

earnings potentials in my models to test the hypothesis that education influences women's marriage rates through earnings potential. Consistent with my expectations, enrollment is negatively associated with the risks of being married, and I interpret it as reflecting the role conflict between student and wife. In addition, I find that more highly educated Taiwanese women are less likely to be married than less educated women even after I hold constant earnings potential. This finding suggests that there are mechanisms other than human capital investment in explaining how education influences Taiwanese women's marriage formation behaviors. Taiwanese women's marriage rates may be negatively associated with these unobserved factors. Educational attainment may serve as a signal to potential mates, indicate one's tastes and lifestyle, or shape the marriage market for the spouse-search process. To clarify what these unobserved factors, we need more studies in the future. Neither Becker's (1981) nor Oppenheimer's (1988) theory has considered these other unobserved factors. Researchers should be more cautious in explaining the effect of educational attainment on marriage formation.

To my surprise, the relationship between Taiwanese women's earnings potentials and marriage rates is more complicated than suggested in prior research. Potential earnings in the past and in the near future are positively associated with Taiwanese

women's marriage rates. But potential earnings in the future and for the lifetime are negatively associated with Taiwanese women's marriage rates. There may be an omitted variable indicating the strength of women's long-term career commitment that is associated with their economic potentials. These results seem to imply that the relationship between women's economic potential and marriage formation is more complicated then the theories proposed by Becker and Oppenheimer.

5.2 LIMITATIONS

Several limitations of this study should be recognized. The first limitation concerns the use of cross-sectional data to analyze marriage formation. Several time-varying variables in this study are based on the assumption that respondents with the same educational level have shared the same time trajectory of education. This assumption is strong and may influence the estimation of the relationship between education and marriage timing. The second limitation is also about data constraints. The oldest respondents in the most recent birth cohort in my analysis were only 35 years of age. To provide more definitive conclusions about educational differentials in marriage formation among more recent birth cohorts, we need more time to observe the completed marriage history for them.

The third limitation is the lack of information about respondents' family background in the data. Although Thornton et al. (1994) argue that family background influences women's marriage rates through education, other studies have reported a significant association between family background and marriage formation (e. g., Wu and Tsay 2006; Yu and Su 2008). For example, Yu and Su (2008) find that parents' education is negatively associated with Taiwanese men's marriage rates. They also find that the association between sibship structure and marriage rates differs for men and for women. The data I use in this thesis have a very limited set of variables, and thus I cannot include other family background factors than education in my models.

This present study may suffer from my not being able to consider the sex composition in the local marriage market. Including conditions of potential mates is important for differentiating between an active retreat from marriage and an involuntary non-marriage resulted from lack of available mates. This differentiation is important since the gist of the debate between Becker and Oppenheimer is whether women are less willing to marry if they become economically more independent. Without considering sex composition in the local marriage market, these results cannot be taken as evidence for an increasing trend in voluntary retreatment from

marriage among highly educated Taiwanese women. The same results may be a consequence of a shortage in available potential mates. Since I cannot differentiate between these two mechanisms in this study, it should be emphasized that my analyses are descriptive in nature and not an attempt to make causal inferences.

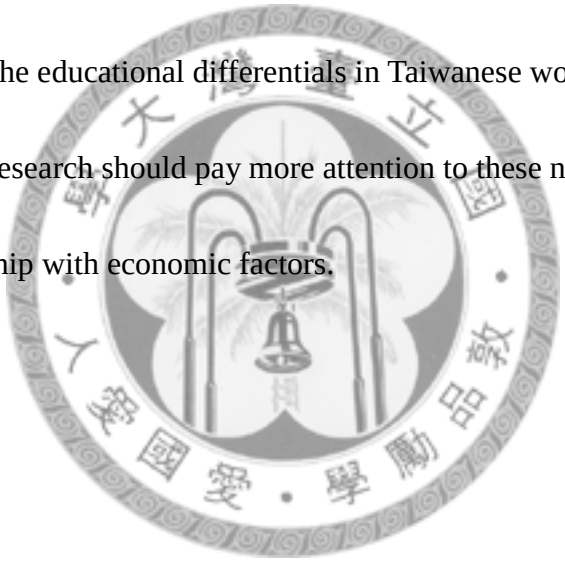
Yet another limitation of my study is that my analyses ignore men. Marriage formation is a process involving both men and women. The lack of information of age at first marriage for men in my data makes it impossible to analyze marriage formation among Taiwanese men. Future research can get a clearer picture of the process of marriage formation in Taiwan if it considers both sides of the story for men and women.

5.3 SUMMARY AND IMPLICATIONS FOR FUTURE RESEARCH

Despite these limitations, the results suggest that it is both the case of marriage delayed and marriage forgone for more highly educated Taiwanese women. This is in sharp contrast with most Western countries, but consistent with countries with a relatively traditional family system. Although later marriages may potentially reduce barriers to intermarriage across educational groups and thus increase social mobility (Mare 1991),with relatively few alternatives to marriage, later and fewer

marriages for more highly educated Taiwanese women may lead to lower fertility and deteriorate population aging.

Testing the hypothesis that education influences women's marriage rates through earnings potential, I argue that there may be unobserved factors other than economic potential that are negatively associated with marriage rates. Hence, the results reported in this thesis seem to support neither Becker's nor Oppenheimer's theory about marriage formation. These results suggest that there are non-economic mechanisms behind the educational differentials in Taiwanese women's marriage formation. Future research should pay more attention to these non-economic factors and to their relationship with economic factors.



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TABLES AND FIGURES

Table 1. Ratio of men to women in Taiwan: 1905-2010

	Year	1905	1915	1920	1925	1930	1935	1966	1970	1975	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Age	15-19	126	116	112	109	106	104	106	106	104	105	105	105	105	105	105	105	105	105	105	105	105	106	105
	20-24	123	122	116	112	108	106	101	104	102	105	105	105	105	105	105	105	105	105	105	105	105	105	105
	25-29	122	124	120	114	111	108	104	102	99	106	105	105	105	105	105	105	105	104	104	104	104	105	105
	30-34	119	120	121	118	114	110	112	100	99	105	106	106	106	106	106	106	105	105	105	104	104	104	104
	35-39	116	114	115	118	116	112	143	114	100	104	104	104	104	105	105	106	106	106	105	105	105	105	105
	40-44	112	108	108	110	114	114	149	145	114	124	117	111	108	105	104	104	104	104	104	105	105	105	104
	45-49	100	100	99	101	105	109	142	145	146	152	149	144	138	131	123	116	110	106	104	103	102	102	103
	50+	73	73	73	75	77	81	108	114	120	122	123	125	126	127	128	128	128	127	126	125	123	121	120

	Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Age	15-19	105	105	105	105	105	105	106	106	106	106	106	106	106	106	106	107	107	108	109	109	109	109	109
	20-24	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	106	106	106	107
	25-29	105	105	105	105	105	105	105	105	105	104	104	104	104	103	103	104	104	103	103	103	102	102	102
	30-34	104	104	105	104	105	105	104	104	104	104	104	104	104	103	103	103	102	102	101	101	101	100	100
	35-39	104	104	104	104	104	104	103	104	104	104	104	104	103	103	103	103	103	102	102	101	100	99	99
	40-44	104	104	105	104	104	104	103	103	103	103	103	103	103	102	103	103	103	102	102	102	101	101	101
	45-49	103	103	103	103	104	103	103	103	103	103	102	102	102	102	101	101	101	101	101	101	101	100	100
	50+	118	116	115	114	112	111	110	109	108	107	106	104	103	102	101	100	100	99	98	97	96	96	95

Source: Data for 1905 through 1975 are from Lin et al. (1994); for 1976 onwards are from the Dept. of Household Registration Affairs, MOI.

Table 2. Descriptive Statistics (Sample Means with Standard Deviations in Parentheses)

Variable	Mean
Event (First marriage)	.68
Age at first marriage	21.79
(for ever-married women)	(3.41)
Birth cohort	
1910-1929	.08
1930-1949	.27
1950-1969	.52
1970-1991	.13
Years of schooling	
Fewer than 12 years	.61
12 years	.27
13-15 years	.06
16 or more years	.06
Number of cases	366,003

Source: Women's Marriage, Fertility and Employment Surveys: 1979 – 2006.

Table 3. Descriptive Statistics for Person-Year Data (Sample Means with Standard Deviations in Parentheses)

Variable	Mean	
Event	.03	
Age at first marriage (for ever-married women)	22.56	(3.82)
Age Group		
13 to 19	.71	
20 to 24	.21	
25 to 29	.06	
30 to 34	.02	
35 to 43	.01	
Birth cohort		
1963 to 1971	.67	
1972 to 1981	.26	
1982 to 1991	.07	
Educational attainment (time varying)		
Less than 12 years	.70	
12 years	.21	
13 to 15 years	.05	
16 or more years	.04	
Enrollment status	.61	
Logged earnings potential (in 2005 dollars)		
Current earnings	12.03	(.38)
Earnings over the next five years	13.80	(.40)
Past earnings	13.36	(.95)
Future earnings	16.64	(.31)
Lifetime earnings	16.69	(.30)
Number of person-year records	957,104	

Source: Women's Marriage, Fertility and Employment Surveys: 1979 – 2006.

Table 4. Survivor Functions at Specific Ages by Birth Cohort and Years of Schooling (N=366,003)

Age	Education	Birth Cohort						
		1910-19	1920-29	1930-39	1940-49	1950-59	1960-69	1970-79
30	Fewer than 12	.03	.02	.02	.02	.04	.08	.17
	12 years	.04	.05	.05	.10	.14	.18	.26
	13-15 years	.07	.05	.04	.14	.20	.27	.43
	16 or more years	.04	.10	.09	.13	.25	.38	.56
40	Fewer than 12	.01	.01	.01	.01	.02	.05	---
	12 years	.03	.02	.02	.06	.08	.11	---
	13-15 years	.00	.01	.02	.08	.13	.17	---
	16 or more years	.04	.02	.06	.10	.16	.25	---
50	Fewer than 12	.01	.01	.01	.01	.02	---	---
	12 years	.03	.01	.02	.06	.08	---	---
	13-15 years	.00	.01	.02	.08	.12	---	---
	16 or more years	.04	.01	.05	.09	.15	---	---
60	Fewer than 12	.01	.01	.01	.01	---	---	---
	12 years	.03	.01	.02	.05	---	---	---
	13-15 years	.00	.01	.02	.08	---	---	---
	16 or more years	.04	.01	.05	.09	---	---	---

Source: Women's Marriage, Fertility and Employment Surveys: 1979 – 2006.

Table 5. Percentage Change in Women's Rates of First Marriage, Cox Models (N=366,003)

Variable	Model 1		Model 2	
Birth cohort				
1910-1929	0		0	
1930-1949	-13.28 (.01)	***	-27.04 (.02)	***
1950-1969	-30.45 (.01)	***	-45.07 (.02)	***
1970-1991	-55.39 (.01)	***	-56.90 (.01)	***
Years of schooling				
Fewer than 12 years	108.37 (.01)	***	68.23 (.05)	**
12 years	0		0	
13 – 15 years	-33.29 (.01)	***	-14.68 (.05)	***
16 or more years	-51.46 (.01)	***	-30.29 (.04)	***
Interaction term				
Fewer than 12 years x 1910-1929			0	
Fewer than 12 years x 1930-1949			18.96 (.04)	***
Fewer than 12 years x 1950-1969			30.54 (.04)	***
Fewer than 12 years x 1970-1991			19.52 (.05)	***
13 – 15 years x 1910-1929			0	
13 – 15 years x 1930-1949			-1.85 (.06)	
13 – 15 years x 1950-1969			-20.25 (.05)	***
13 – 15 years x 1970-1991			-43.66 (.04)	***
16 or more years x 1910-1929			0	
16 or more years x 1930-1949			.82 (.06)	
16 or more years x 1950-1969			-23.77 (.05)	***
16 or more years x 1970-1991			-65.07 (.02)	***
Log likelihood	-2,935,609.10		-2,934,968.40	
BIC	5,871,295		5,870,129	

* p < .05 ** p < .01 *** p< .001

Source: Women's Marriage, Fertility and Employment Surveys: 1979 – 2006

Table 6. Percentage Change in Women's Rates of First Marriage, Discrete-time Hazard Models, (N= 957,104)

Variable	Model (1)		Model (2)		Model (3)		Model (4)		Model (5)		Model (6)	
Age												
13 to 19	-69	(.02) ***	-56	(.03) ***	-54	(.03) ***	-29	(.03) ***	-67	(.02) ***	-70	(.02) ***
20 to 24	0		0		0		0		0		0	
25 to 29	93	(.02) ***	31	(.02) ***	27	(.02) ***	0	(.02)	77	(.02) ***	95	(.02) ***
30 to 34	25	(.04) ***	-38	(.05) ***	-41	(.05) ***	-64	(.05) ***	-2	(.04)	27	(.04) ***
35 to 39	-67	(.12) ***	-86	(.12) ***	-86	(.12) ***	-94	(.13) ***	-79	(.13) ***	-66	(.12) ***
40 to 43	-80	(.52) **	-91	(.52) ***	-91	(.52) ***	-97	(.52) ***	-91	(.53) ***	-80	(.52) **
Birth cohort												
1963 to 1970	0		0		0		0		0		0	
1971 to 1980	-16	(.02) ***	-25	(.02) ***	-27	(.02) ***	-25	(.02) ***	-6	(.02) ***	-6	(.02) ***
1981 to 1991	-44	(.05) ***	-54	(.05) ***	-56	(.05) ***	-53	(.05) ***	-30	(.06) ***	-31	(.06) ***
Educational attainment (time-varying)												
Less than 12 years	61	(.02) ***	76	(.02) ***	91	(.02) ***	75	(.02) ***	13	(.03) ***	20	(.03) ***
12 years	0		0		0		0		0		0	
13 to 15 years	-37	(.02) ***	-47	(.03) ***	-51	(.03) ***	-42	(.02) ***	-16	(.03) ***	-20	(.03) ***
16 or more years	-51	(.03) ***	-65	(.03) ***	-70	(.03) ***	-58	(.03) ***	-13	(.04) ***	-21	(.04) ***

Table 6. (*continued*)

Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Enrollment status	-95 (.04) ***	-94 (.04) ***	-94 (.04) ***	-92 (.04) ***	-93 (.04) ***	-93 (.04) ***
Earnings potential (in 2005 dollars)						
Current earnings		211 (.05) ***				
Earnings over the next five years			328 (.05) ***			
Past earnings				191 (.02) ***		
Future earnings					-65 (.06) ***	
Lifetime earnings						-63 (.06) ***
Loglikelihood	-32216558	-32106021	-32051737	-31848661	-32160457	-32171428
BIC	64400000	64200000	64100000	63700000	64300000	64300000

* p < .05 ** p < .01 *** p< .001

Source: Women's Marriage, Fertility and Employment Surveys: 1979 – 20

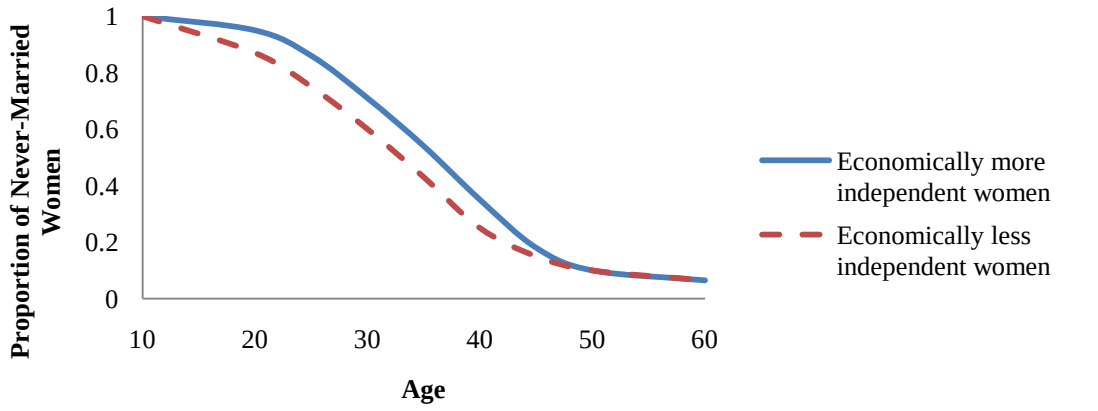

Figure 1. Simulated Survival Curves: Only Later Marriages

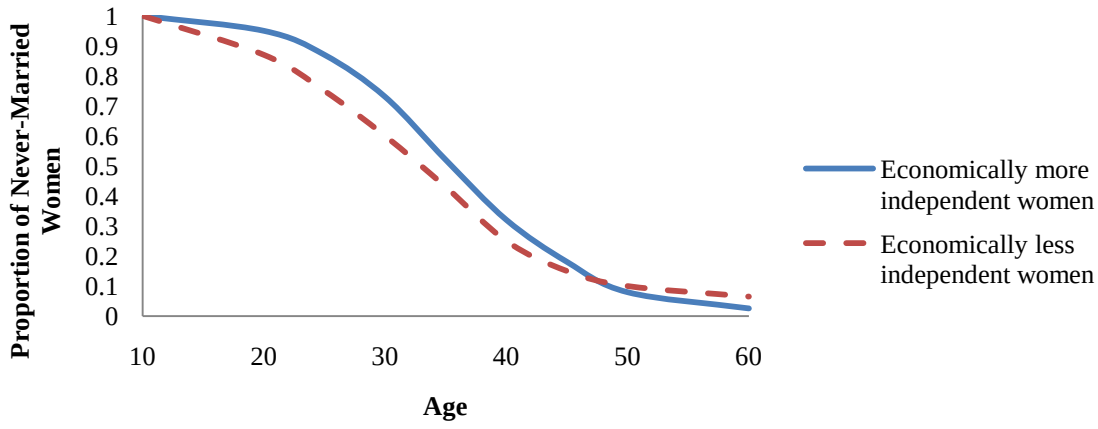

Figure 2. Simulated Survival Curves: Later but More Marriages

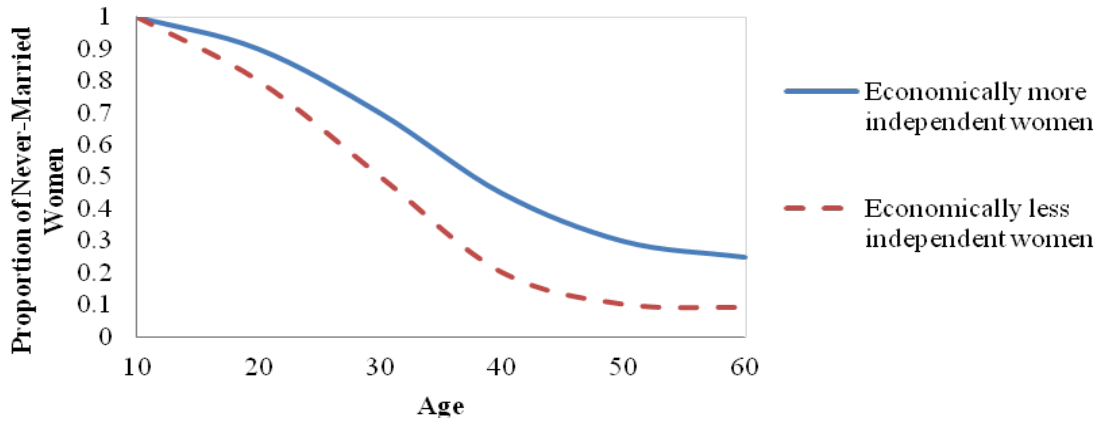

Figure 3. Simulated Survival Curves: Later and Fewer Marriages

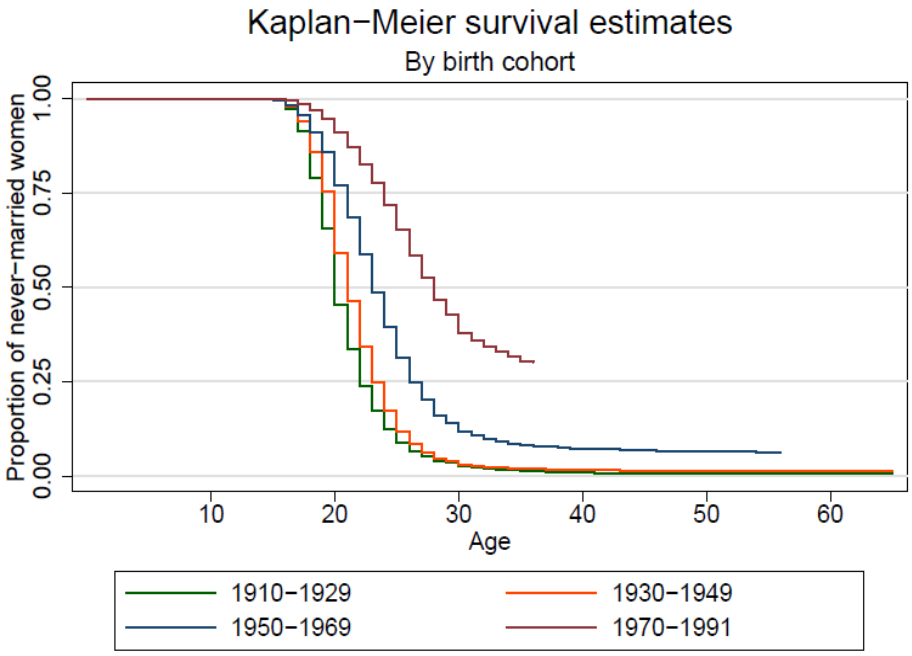

Figure 4. Kaplan-Meier Estimates of Survivorships of First Marriages for Taiwanese Women, by Birth Cohort (N=366,003)

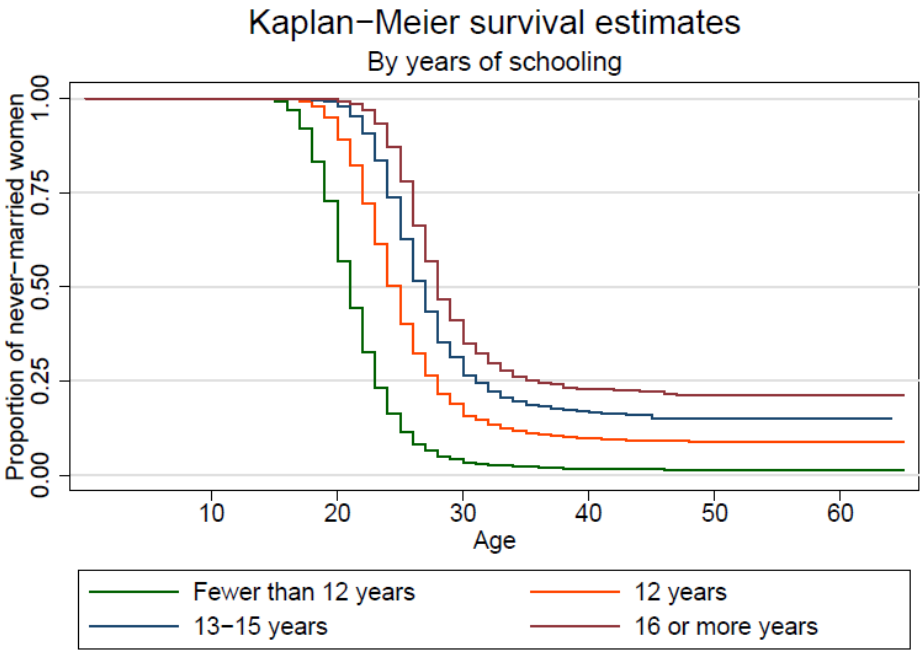

Figure 5. Kaplan-Meier Estimates of Survivorships of First Marriages for Taiwanese Women, by Years of Schooling (N=366,003)

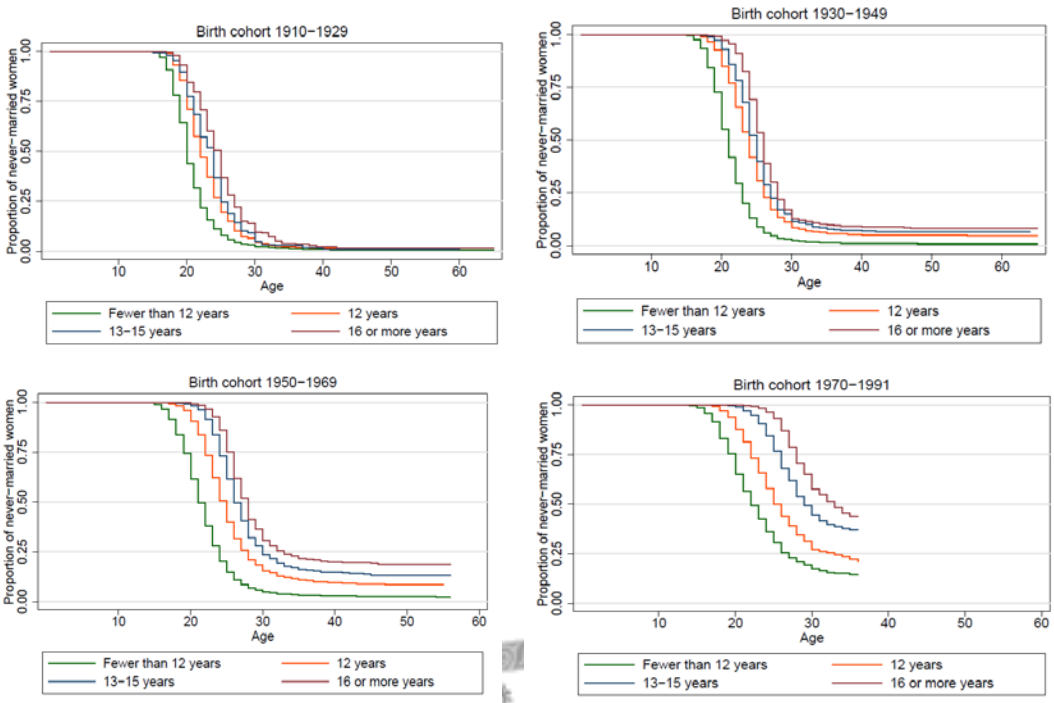

Figure 6. Kaplan-Meier Estimates of Survivorships of First Marriages for Taiwanese Women, by Birth Cohorts and Years of Schooling (N=366,003)

APPENDIX

Appendix 1. Percentages of Whether Leaving and Reentering Labor Market After Getting Married for Married and Employed Women in Taiwan

Year	Whether quitted because of marriage or not		
	Ever: whether had a job again or not		Never
	Ever had a job again	Never had a job again	
1983	3.90	19.24	76.85
1984	4.97	18.58	76.45
1985	4.67	17.59	77.74
1986	4.94	17.18	77.87
1987	4.59	16.35	79.06
1988	4.72	16.44	78.84
1990	4.45	17.46	78.09
1993	6.16	19.46	74.39
2000	9.10	20.42	70.48
2003	11.17	17.56	71.27
2006	11.84	17.11	71.05

Source: Reorganized from the table on the web site of DGBAS of Taiwan.

(http://www.dgbas.gov.tw/public/data/dgbas04/bc4/wtable6.xls)