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Marriage, female labor supply, and Asian zodiacs

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Abstract

Marital status and labor supply decisions could be correlated on the unobservable. Using South Korean data, this paper exploits exogenous selection into marriage caused by an eccentric cultural phenomenon—preferences for wives' zodiacal signs—to estimate the causal effect of marital status on female labor force participation.

Keywords: Marriage; Female labor force participation; Zodiac; Instrumental variable

JEL classification: J12; J22

1. Marriage and female labor force participation

Marriage and career are no less than often incompatible for women because they bear a disproportionate burden of child care and housework. Marriage is a strong deterrent to market work among women, especially in developing countries. On the other hand, the economics literature on marriage has highlighted that female marital status is affected by labor market activities. This reverse causality implies that ignoring the endogeneity of marital status should lead to a misleading estimate for the effect of marriage on female labor supply.

There are two potentially offsetting issues of endogeneity. First, preferences for marriage and career are heterogeneous across individuals. Those who are concerned about career development would be less

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likely to get married. Any estimation that fails to control for the unobserved heterogeneity in career ambition should underestimate the negative effect of marriage on labor supply. Second, people bring their traits to the marriage market, and some of the traits might also affect their labor market activities. For example, more intelligent persons might be more likely to marry and, at the same time, more likely to work for pay. The omitted variables make the negative effect of marriage overestimated.

Becker (1973) argues that the gains from marriage depend on observable or unobservable characteristics, which also affect market productivity and labor force participation. The simultaneity would make it hard to estimate the causal effect of marital status on labor market activities. Korenman and Neumark (1992) examine whether women select into marriage on unobservable characteristics. They find that female marital status is neither endogenous nor significant in the standard wage equation. But they did not investigate the endogeneity of marital status in labor force participation. The studies on marriage and wages have paid little attention to this kind of sample selectivity, probably because they focus on the wage premium for married men (Korenman and Neumark, 1991, Nakosteen and Zimmer, 1987). Van der Klaauw (1996) finds that preferences for marriage and working are significantly correlated for women. His results implicitly suggest that any estimation ignoring the endogeneity of marriage should exaggerate the adverse effect of marriage. Nevertheless, most studies have examined female labor supply conditional on marital status by focusing on married women (Killingsworth and Heckman, 1986). To my knowledge this paper is the first attempt to estimate the effect of marital status on female labor force participation taking the endogeneity into account.

Using South Korean data, I estimate the causal effect of marriage on female labor force participation by exploiting exogenous selection into marriages due to unique cultural heritage-zodiacal astrology. From the ancient times people in many Asian countries have used the lunar calendar in which every year is assigned a zodiac according to the rotating cycle of twelve animal symbols; *Rat*, *Ox*, *Tiger*, *Rabbit*, *Dragon*, *Snake*, *Horse*, *Goat*, *Monkey*, *Rooster*, *Dog*, and *Pig*. People believe that a person is destined to have a specific personality according to the zodiacal sign of his or her birth year. In particular, South Koreans have traditionally thought that the sign *Horse* is inauspicious for women's destiny because it represents masculine values, such as energy, vigor, and strong will.[1] These values are not desirable as female spouse quality in a patriarchal society where a traditional family model of the breadwinner husband and homemaker wife is still dominant as social norms.[2] Even worse, girls born during the year of the *Horse* are believed to destroy their husbands in the future (Kim, 1997). As a result, women of the *Horse* are unpopular in the marriage market, and they are less likely to be married. Whether superstitious or not, this culturally-eccentric phenomenon provides exogenous variations in female marital status at a given age, and allows us to estimate the causal effect of marriage on female labor supply by the instrumental-variable estimation method.

2. Data source and sample

The data set is South Korean Economically Active Population Survey, which is a South Korean counterpart of the U.S. Current Population Survey. The survey covers about 33,000 households and their

[1] See a newspaper article "Horse Year Panic" in Korea Herald, January 1, 2002.

[2] Antecol (2003) find that cultural differences in male attitudes toward sex roles in market versus home work explain cross-country variation in female labor force participation.

Table 1
Descriptive statistics[a]

	Solar calendar (I)		Lunar calendar (II)		No Jan. & Feb. (III)	
	Horse	Others	Horse	Others	Horse	Others
Age	24.39 [4.59]	26.19 [3.95]	24.50 [4.72]	26.17 [3.94]	24.45 [4.64]	26.18 [3.95]
Married	0.30 [0.46]	0.47 [0.50]	0.31 [0.46]	0.47 [0.50]	0.30 [0.46]	0.47 [0.50]
LFP	0.56 [0.50]	0.53 [0.50]	0.55 [0.50]	0.53 [0.50]	0.55 [0.50]	0.53 [0.50]
Schooling	13.07 [1.65]	13.12 [1.83]	13.02 [1.76]	13.12 [1.82]	13.05 [1.77]	13.13 [1.82]
Urban areas	0.87 [0.33]	0.89 [0.31]	0.88 [0.33]	0.89 [0.31]	0.88 [0.33]	0.89 [0.11]
$N=$	50,332 (8.6%)	535,205	49,931 (8.5%)	535,606	41,009 (8.4%)	446,378

[a] Standard deviations are in brackets. The numbers in parenthesis of the last row represent the proportion of the *Horse* in the sample.

members aged 15 years old and over, and it is collected on a monthly basis. Individuals are directly surveyed by official interviewers. It contains basic information about individual characteristics and labor market activities. This study uses the pooled data of 60 monthly files between 1998 and 2002 (=5 years × 12 months).

I assigned individuals' zodiacal signs according to their birth year and date reported by resident registration number. The assigned zodiacal sign is, however, subject to error; we do not know whether the birth date is reported based on the solar or lunar calender, while the zodiacal cycle follows the lunar calender.[3] Thus I use two different assigning methods: one based on the assumption that all birth dates in the survey are reported on the solar calendar and the other under the assumption that all birth dates are reported on the lunar calender. In addition I experiment with a sub-sample excluding those born in January and February. For this sub-sample zodiacs can be assigned without error. Zodiacs could be wrongly assigned only for those born in January or February when a lunar year begins.

The sample is restricted to those between age 19 and 32 when a majority of women are first married. About 90% are married by 32 in the sample. The final sample consists of 585,537 single and married women. The average age is 26. The average schooling is 13 years, and 89% live in urban areas. If people are working or unemployed but searching for jobs in the last week, they are defined as participating in the labor force. In the sample, 53.4% participate in the labor force.

In Table 1 the descriptive statistics are tabulated by zodiacal signs and assignment methods. Those of the *Horse* account for 8.5% of total sample, which is consistent with the fact that a single zodiac must account for 8.33% in a randomly selected sample since there are twelve rotating signs (1/12=8.33%). It is also notable that the sample characteristics do not differ across assignment methods and samples. Lastly, those of the *Horse* and others are not different in schooling and residential location, but the two groups are different in age and marital status. Those of the *Horse* are younger. Note that the sample contains women between age 19 and 32 in any of 5 years, while a cycle of zodiacs completes in 12 years. Thus it is sampling the *Horse* cohort at a

[3] There is no required formal document from doctors or hospitals to register a newborn child. Parents can virtually choose their child's birth date. As a result, parents are actually free to choose their child's birth date at their will. Although the solar calendar is officially used, people use the lunar-calendar birth date if they want to.

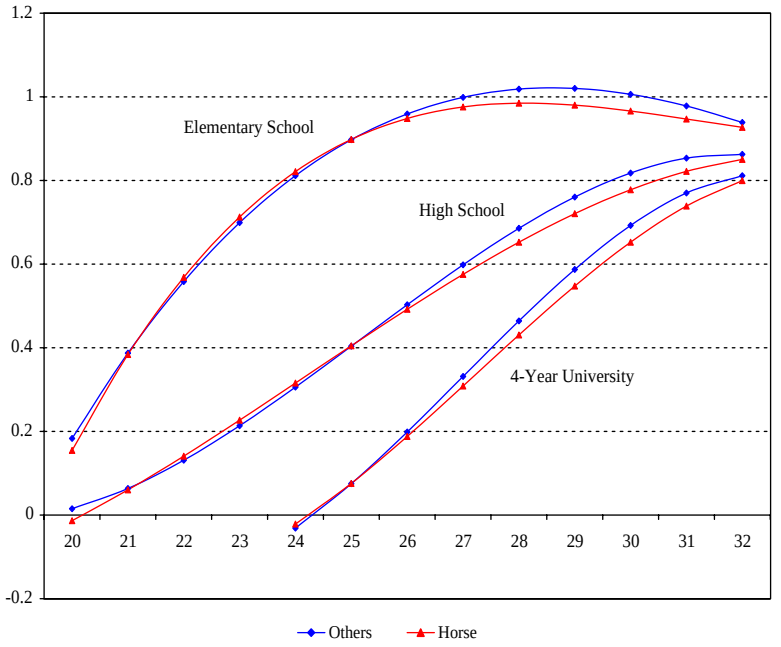

Fig. 1. Age profile of marriage probability by education level: the solar calendar.

different age range than the other cohorts. That they are younger partially explains why they are less likely to be married.

3. Instrumental-variable estimation

I first estimate the linear probability model of marital status (the first stage regression), controlling for age, years of schooling, residential location, and dummies for survey years and months. Age profile is approximated by a cubic curve, which is suggested by unconditional sample averages of marriage probability over age. The interactions between the *Horse* and age variables allow different age profiles of marriage probability for treatment and control groups.

Fig. 1 shows the model's predicted probability profile, evaluated at three different levels of schooling.[4] Obviously more schooling generally decreases the likelihood of getting married earlier. Regardless of education levels, those of the *Horse* are likely to be married later than others. The gap is statistically significant after age 26. It amounts to about 4% at age 29. The stigma of the *Horse* in the marriage market should get stronger when they are older. The estimates for the *Horse* and its interactions with age variables are jointly significant.[5]

[4] The profile is calculated based on the estimates in the first column in Table 2. The other sets of estimates do not change the results qualitatively.

[5] I also compare the age profile of marriage of each and every other zodiac with that of the *Horse*. I re-estimate the first-stage equation after adding the age-profile variables for a zodiac other than the *Horse*. Compared one by one with the other eleven zodiacs, those of the *Horse* are less likely to be married at all ages, in particular at the age range of the late 20s.

The last four columns in Table 2 present the causal effect of marriage on female labor force participation. The first shows the simple ordinary least squares (OLS) estimates ignoring the endogeneity of marital status. As expected, getting married significantly decreases the likelihood of female participation in the labor force by about 41%. On the other hand, the instrumental-variable (IV) estimation results indicate that the OLS estimate is biased upward. The IV estimates are negative and substantially larger in size. It seems unusually large in part because the sample focuses on young women (average age 26) and in part because it is for South Korea where sexual division of labor within a marriage is dichotomized. Marriage is really a strong deterrent to market work for these young women.

My results show that for women, marital status is endogenous and jointly determined with labor supply decisions. Contrary to the results of Van der Klaauw (1996), the findings here suggest that there

Table 2
Marriage and labor force participation: instrumental variable estimation[a]

	First stage			OLS	Second stage		
	(I)	(II)	(III)		IV (I)	IV (II)	IV (III)
Married				−.4087	−.6771	−.9363	−.9007
				(.0017)	(.1380)	(.1320)	(.1529)
Horse	−6.565	−7.159	−7.359				
	(.8928)	(.8452)	(.9981)				
Horse × age	.7741	.8483	.8730				
	(.1089)	(.1032)	(.1218)				
Horse × age^2	−.0300	−.0330	−.0340				
	(.0044)	(.0041)	(.0049)				
Horse × age^3	.0004	.0004	.0004				
	(.0001)	(.0001)	(.0001)				
Age	4.0307	3.9949	3.8825	−3.105	−2.018	−.9609	−1.515
	(.1425)	(.1426)	(.1566)	(.1827)	(.5936)	(.5736)	(.6431)
Age^2	−.1346	−.1332	−.1289	.0936	.0573	.0220	.0424
	(.0055)	(.0055)	(.0060)	(.0070)	(.0202)	(.0195)	(.0218)
Age^3	.0015	.0014	.0014	−.0009	−.0005	−.0001	−.0004
	(.0001)	(.0001)	(.0001)	(.00009)	(.0002)	(.0002)	(.0002)
Schooling	4.0246	4.0056	3.9211	−4.019	−2.943	−1.898	−2.323
	(.0932)	(.0931)	(.1022)	(.1196)	(.5699)	(.5476)	(.6197)
Schooling × age	−.4489	−.4467	−.4366	.3994	.2749	.1629	.2113
	(.0109)	(.0108)	(.0119)	(.0139)	(.0637)	(.0612)	(.0692)
Schooling × age^2	.0160	.0159	.0151	−.0130	−.0087	−.0046	−.0064
	(.0004)	(.0004)	(.0005)	(.0005)	(.0023)	(.0022)	(.0025)
Schooling × age^3	−.0002	−.0002	−.0002	.0001	.0001	.0004	.00006
	(.00001)	(.00001)	(.00001)	(.00001)	(.00003)	(.00003)	(.00003)
Urban areas	.0430	.0430	.0438	.0278	.0393	.0505	.0529
	(.0015)	(.0015)	(.0016)	(.0019)	(.0063)	(.0061)	(.0071)
Constant	−38.15	−37.84	−36.90	33.818	23.536	13.534	18.415
	(1.222)	(1.223)	(1.343)	(1.567)	(5.565)	(5.368)	(6.040)
R^2=	.4850	.4850	.4845	.1520	.1150	.0089	.0259

[a] Robust standard errors are in parenthesis. Five yearly dummies (1998–2002) are included to account for time trend over years. Monthly dummies from January to December are also included to account for seasonality. The dependent variable in the first stage indicates whether the individual is married or not. The dependent variable in the last four columns indicates whether the individual participates in the labor force or not.

exist unobservable characteristics appreciated in both the marriage and labor markets, like beauty, intelligence, diligence, or conformity, to name a few. Whether this is also true for men is a remaining question.

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References

Antecol, Heather, 2003. Why is there Cross-Country Variation in Female Labor Force Participation Rates? The Role of Male Attitudes Toward Family and Sex Roles. mimeo, Department of Economics, Claremont McKenna College.

Becker, Gary S., 1973. A theory of marriage: part I. Journal of Political Economy 81, 813–846.

Killingsworth, Mark R., Heckman, James J., 1986. Female labor supply: a survey. In: Ashenfelter, Orley, Layard, Richard (Eds.), Handbook of Labor Economics, vol. 1. North-Holland, Amsterdam, pp. 103–204.

Kim, Tai-Hun, 1997. The effects of sex-selective abortion on fertility level in Korea. Korea Journal of Population and Development 26 (1), 43–60.

Korenman, Sanders, Neumark, David, 1991. Does marriage really make men more productive? Journal of Human Resources 26 (2), 282–307.

Korenman, Sanders, Neumark, David, 1992. Marriage, motherhood, and wages. Journal of Human Resources 27 (2), 233–255.

Nakosteen, Robert, Zimmer, Michael, 1987. Marital status and earnings of young men. Journal of Human Resources 22 (2), 248–268.

Van der Klaauw, Wilbert, 1996. Female labour supply and marital status decisions: a life-cycle model. Review of Economic Studies 63, 199–235.