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ORIGINAL PAPER

Sex ratios and the red dragon: using the Chinese Communist Revolution to explore the effect of the sex ratio on women and children in Taiwan

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Abstract In 1949, Mao Zedong and the People's Liberation Army defeated the Chinese Nationalist Army. Hundreds of thousands of mainland Chinese fled to the island of Taiwan. In this paper, I use the demographic consequences of the Chinese Communist Revolution and subsequent Taiwanese military policy to identify the effect of the marriage market sex ratio on women and children in Taiwan. I find that as the sex ratio rises, the bride price relative to the dowry increases, the fraction of female children in a family increases, the total number of children in a family decreases, and human capital investments in children increase.

Keywords Sex ratios · Marriage market · Intrahousehold bargaining

JEL Classification D13 · J12 · J13

1 Introduction

In 1949, Mao Zedong and the People's Liberation Army defeated Chiang Kai-shek and the Chinese Nationalist Army. Hundreds of thousands of mainland Chinese, including nearly the entire nationalist government and military, fled to the island of Taiwan. Men outnumbered women by a factor of 4 to 1 in this group. The impact on the sex ratio of Taiwan was dramatic. Between 1947 and 1950, the overall sex ratio jumped from 101 to 119, and the sex ratio of 20–24 year olds jumped from 97 to 152. Exploiting the demographic consequences

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of the Chinese Communist Revolution and subsequent Taiwanese military policy, I empirically estimate the effect of the marriage market sex ratio on women and children in Taiwan in order to test economic theories of the marriage market, family, and intrahousehold bargaining power.

Economists have long been interested in the sex ratio. The theoretical literature relates the sex ratio to the allocation of marital output between spouses, dowries and bride prices, marriage rates, and labor force participation (Becker 1981; Edlund 1999; Grossbard-Shechtman 1984, 1993). Chiappori et al. (2002) argue that the sex ratio is a "distribution factor," which affects the husband and wife's bargaining position, but not their preferences or joint budget set. In this way, the sex ratio might also influence investments in children and other household decisions. Other studies generally model the household decision-making process (Browning et al. 1994; Browning and Chiappori 1998; Chiappori 1988, 1992; McElroy and Horney 1981).

Empirical studies estimate the impact of the sex ratio on the labor market in the US (Angrist 2002; Chiappori et al. 2002), crime rates in China (Edlund et al. 2007), the Women's Liberation Movement (Heer and Grossbard-Shechtman 1981), and dowries and bride prices in India (Caldwell et al. 1983; Rao 1993). Empirical studies also estimate the effect of other measures of intrahousehold bargaining power, e.g., the relative income and education of spouses, on the health and education of children (Duflo 2000, 2003; Thomas 1990, 1994) and the incidence of selective abortion, infanticide, and neglect (Olds 2006; Qian 2008). However, it is difficult to identify the causal effect of the sex ratio (and other measures of intrahousehold bargaining power) because changes in the sex ratio are typically not exogenous. The sex ratio is a function of parental sex preferences, in addition to economic, social, and cultural variables (Edlund 1999; Grossbard-Shechtman 1993). Therefore, good empirical studies are scarce, especially those that focus on developing countries.

Taiwan makes an interesting case study for several reasons. The demographic shock was large and unexpected. During the decades that followed, there was virtually no immigration to or emigration from the island. I argue that, unlike most other empirical studies, changes in the sex ratio were exogenous. Combining annual population data with a micro dataset on Taiwanese women, I examine the relationship between the sex ratio and the bride price relative to the dowry, fraction of female children, total number of children, and children's educational attainment. I define the marriage market sex ratio as the number of men aged 15–39, excluding mainlanders in the military, divided by the number of women aged 15–39. The sex ratio does not include mainlanders enlisted in the Taiwanese military because the government socially isolated mainlanders in the military, not permitting them to marry or retire until it was able to conscript native Taiwanese to replace them.

The results support economic theories of the marriage market and intrahousehold bargaining power. I find that the marriage market sex ratio is positively related to the bride price relative to the dowry. The findings affirm Becker (1981) and Grossbard-Shechtman's (1993) theories and are consistent with Rao's (1993) empirical analysis of dowry payments in India. Shedding

light on the debate between Edlund (2000) and Rao (2000), the findings imply that bride prices and dowries are related to variables that characterize the marriage market environment but operate independently of parental bequests. However, parental bequests may still play a role in affecting dowries, as several economists argue (Botticini and Siow 2003; Zhang and Chan 1999).

The marriage market sex ratio is positively related to the fraction of female children in a family, negatively related to the total number of children in a family, and positively related to human capital investments in children. The findings on the fraction of female children imply that the incidence of selective abortion, infanticide, and neglect is inversely related to women's intrahousehold bargaining power. Empowering women, wives and mothers, reduces the number of "missing women." The results are consistent with Qian's (2008) results in mainland China and Olds' (2006) results in early twentieth century Taiwan, although they are not necessarily incompatible with the potential effect of the hepatitis B virus (Oster 2005). The findings on human capital investments in children broadly affirm other empirical studies, which discover that when bargaining power within the household shifts from men to women, children's health and education increase (Duflo 2000, 2003; Thomas 1990, 1994; Qian 2008).

The remainder of the paper is organized as follows. Section 2 discusses the political, social, and demographic history of Taiwan with emphasis on the sex ratio. Section 3 describes the population data, the micro dataset on Taiwanese women, and the estimation framework. Section 4 presents and interprets the empirical results. Section 5 concludes.

2 Historical background

2.1 Political and social history

Chiang Kai-shek and the Kuomintang (KMT), i.e., the nationalist political party, ruled mainland China from 1928 until the late 1940s. During that time, the KMT faced two major challenges: a brutal Japanese occupation and a growing communist movement. As Mao Zedong, leader of the Red Army, rose in popularity, the communist movement turned into a civil war. In 1949, Mao Zedong and the People's Liberation Army defeated Chiang Kai-shek and the Chinese Nationalist Army. Chiang Kai-shek and the KMT were forced to flee to the island of Taiwan, which had just recently been transferred from Japanese to Chinese control at the conclusion of World War II.[1] Hundreds of thousands of mainland Chinese, including nearly the entire nationalist administration and military, fled to Taiwan. This group consisted of about 600,000 soldiers and half a million civilians. Men outnumbered women by a factor of 4 to 1.

[1] Taiwan is located about 161 km (100 mi) off the coast of mainland China.

In 1949, about seven million native Taiwanese were living on the island. Most were descendants of immigrants from mainland China during the seventeenth and eighteenth centuries. While the native Taiwanese belonged to distinct ethnic groups, they shared a common cultural heritage with many Chinese, especially with those residing in the nearby Fukien province.[2] Although the native Taiwanese outnumbered the mainlanders, Chiang Kai-shek and the KMT monopolized political power in Taiwan for several decades (Roy 2003). Despite ethnic differences, ethnic intermarriage was relatively common in the 1950s and 1960s. By far, most mainland Chinese men who got married wedded a native Taiwanese woman. As many as 15% to 20% of Taiwanese women married a mainland Chinese man in the 1950s and 1960s (Wang 1993a, b, 2001).

Several specific historical issues relate to the sex ratio. After the Communist Revolution, there was virtually no immigration to or emigration from the island. The number of people who migrated between Taiwan and mainland China was well under 5,000 in almost every year from the mid-1950s through the 1970s (Republic of China 1974a). This was, in part, due to the political and military tension between Taiwan and China during the period. Moreover, few men went to prison. The stock of men incarcerated for more than a year was under 10,000 in nearly every year since 1950 (Republic of China 1974a). Another factor that could potentially affect sex ratios is reproductive technology. The government began to promote family planning policies in the late 1960s. Use of abortion, ultrasound, and other reproductive technologies started to increase during the late 1960s and early 1970s (Chang 1986; Chen 1978; Khoo 1978; Sullivan et al. 1974). Since I examine the sex ratio of 15 to 39 year olds, the sample only includes cohorts who were born prior to the era of modern reproductive technology.

Military service policy substantially impacted the sex ratio. Chiang Kai-shek and the KMT believed that they were still at war and they were preparing to counter what they felt was an imminent communist invasion (Lin 2003; Wang 1993a; Yang 2000). For this reason, the government did not permit mainlanders in the military to marry or retire until it was able to conscript native Taiwanese to replace them (Lin 2003; Wang 1993a; Yang 2000). Indeed, mainlanders in the military were systematically isolated from the civilian population. When the government established compulsory military service in 1956, all Taiwanese men in their early twenties had to spend 2 years in the military (Bullard 1997; Hsu 2003). As the government conscripted native Taiwanese to serve in the military, it released mainlanders into the civilian population. Both the size and timing of the entry of mainlanders into the population were not related to the marriage market, but to military policy.

[2]The two major ethnic groups of native Taiwanese are the Minnan (or Hokkien) and the Hakka.

2.2 Demographic history

Precise data on the massive migration from mainland China to Taiwan in the wake of the Communist Revolution do not exist. I estimate the size and characteristics of the migration. Details about these estimates are found in the Population data appendix. I find that about 571,000 male soldiers fled to Taiwan by the end of 1950. Data on place of original household registration indicate that, in addition, about 315,000 male and 210,000 female civilians fled to Taiwan by the end of 1950 (Republic of China 1974a). Altogether, I estimate that approximately 1.1 million mainland Chinese went to Taiwan. The sex ratio of this group was highly skewed. Men outnumbered women by a factor of 4 to 1. Moreover, the migrants were primarily young adults. Sixty percent of the male soldiers were in their twenties; 84% of the male soldiers were between the ages of 15 and 35.[3] As there were about seven million native Taiwanese, migrants from the mainland represented about 14% of the total population in 1950. These estimates compare well with other studies. Bullard (1997) cites evidence that 600,000 soldiers and 600,000 civilians went to Taiwan. Roy (2003) puts the number of soldiers at about 600,000 and the total number of migrants between 1.5 and 2 million. Wang (1993b) says that the number of migrants was about one million and emphasizes that the sex ratio, about three men for every woman, was quite high. Lin (2002) also points out that the sex ratio of mainlanders who went to Taiwan was high.

Table 1 displays sex ratios by age from 1940 to 1950. The sex ratio is the number of men divided by the number of women multiplied by 100. As the table shows, Taiwanese sex ratios between 1940 and 1947 were relatively balanced. The demographic impact of the Communist Revolution is clear. Between 1947 and 1950, the overall sex ratio jumped from 101 to 119 and the sex ratio of 20–24 year olds jumped from 97 to 152. Migrants from mainland China were ages 15 to 54 in 1950. They were especially concentrated in ages 20 to 34. Figure 1 depicts the overall sex ratio from 1940 to 1989. The sex ratio includes everyone living on the island. The figure illustrates the dramatic effect that the migrants had on the sex ratio of Taiwan.

The sex ratio most closely related to the marriage market is the sex ratio of 15 to 39 year olds, excluding mainlanders in the military. In Taiwan, nearly all marriages occur between the ages of 15 and 39. Also, as I have discussed, the government did not allow mainlanders in the military to marry, isolating them from the civilian population until it was able to conscript native Taiwanese to replace them. I estimate that the number of mainlanders in the military is relatively constant in the early 1950s. Starting in 1956, when the government established the compulsory military service system, the number drops rapidly in several waves, as soldiers enter the population. By 1963, the number drops

[3]The historical evidence suggests that the vast majority of male soldiers either were single or abandoned their wives in mainland China. Most of the soldiers were effectively unmarried when they came to Taiwan.

Table 1 Sex ratios by age, 1940–1950

		Age														
Year	All	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70+
1940	103.2															
1943	103.5															
1946	101.0	104.4	104.1	103.4	102.3	97.5	99.9	105.8	99.8	105.1	104.7	102.9	95.5	84.5	73.5	54.3
1947	101.5	104.4	103.7	103.4	102.7	97.1	101.1	106.2	103.1	105.3	105.2	102.8	97.0	87.7	75.1	56.6
1950	119.4	104.4	106.7	105.8	119.0	152.5	153.9	145.6	138.9	122.3	115.7	107.7	98.8	88.2	77.1	56.0

The Chinese Communist Revolution occurred between 1947 and 1950. The sex ratio is the number of men divided by the number of women, multiplied by 100.
Data source: Taiwan Demographic Fact Book and Statistical Yearbook

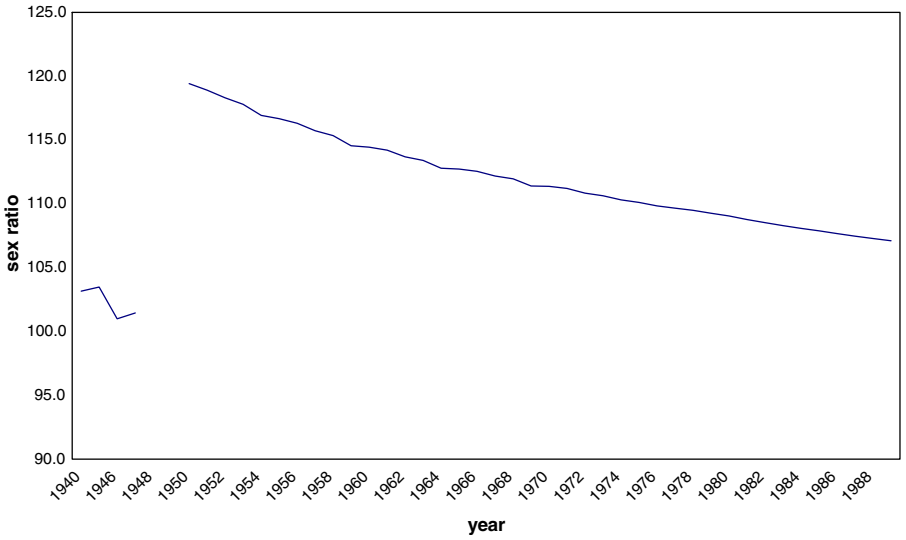

Fig. 1 Overall sex ratio of Taiwan, 1940–1989

to one half of its original level; by 1969, to one fourth; and by 1975, to one tenth. Figure 2 depicts the sex ratio of 15 to 39 year olds, excluding mainlanders enlisted in the military. The sex ratio rises as mainlanders enter the civilian population and falls when they leave the age range.

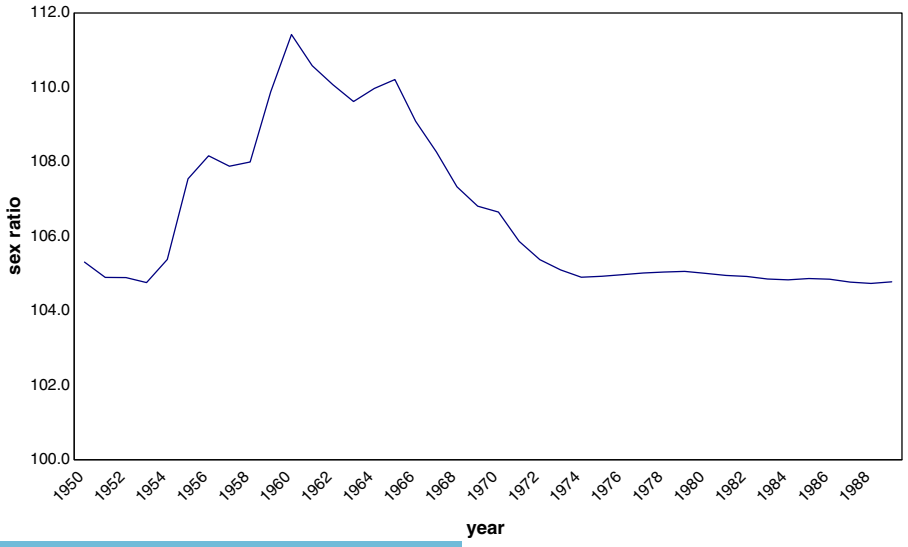

Fig. 2 Sex ratio of Taiwan ages 15–39, excluding mainlanders in the military, 1950–1989

3 Data and empirical strategy

3.1 Population data and sex ratio

I use annual population statistics derived from data collected through the household registration system to construct the sex ratio. Annual Taiwan-level statistics on population and death rates by gender and age for 1950–1989 come from the Statistical Abstract (Republic of China 1974a) and Statistical Yearbook (Republic of China 1975a, 1999, 2004). Annual county-level statistics on population by gender and age for 1961–1989 come from the Demographic Fact Book (Republic of China 1961, 1963–1968, 1971–1973, 1974b, 1975b, 1976–1989); 1961 is the earliest year for which county-level data are available. Since the Taiwan-level population data exclude all men enlisted in the military prior to 1969 and the county-level population data exclude mainlanders enlisted in the military prior to 1969, I estimate the annual number of mainlanders and native Taiwanese in the military in order to calculate marriage market sex ratios. Please refer to the Population data appendix.

The historical evidence presented in the previous section indicates that the Chinese Communist Revolution and subsequent Taiwanese military policy underlie variation in the sex ratio, the principal explanatory variable in the empirical analysis. Using population estimates, I construct the sex ratio as the number of men aged 15–39, excluding mainlanders in the military, divided by the number of women aged 15–39, then multiplied by 100. It does not include mainlanders enlisted in the Taiwanese military because the government socially isolated mainlanders in the military, not permitting them to marry or retire until the government was able to conscript native Taiwanese to replace them. It includes native Taiwanese enlisted in the military because they typically only served for 2 years and maintained close social connections with the civilian population. I construct the sex ratio at the regional level based on five standard geographic regions (north, central, south, east, and islands).[4,5] I specify the sex ratio variable in two ways related to the marriage market. First, I use the regional sex ratio during the year in which the respondent was actually married. Second, I use the regional sex ratio during the year in which the respondent was 20 years old. Age 20 is just before the median female age at marriage in the sample.

[4]Intercounty migration rates for males and females in the late 1960s and early 1970s were similar. Female-biased marriage migration is only an issue at the intracounty level (Tsai 1978).

[5]Region 1 includes Hsinchu City, Hsinchu County, Ilan County, Keelung City, Taipei City, Taipei County, and Taoyuan County. Region 2 includes Changhwa County, Miaoli County, Nantou County, Taichung City, and Taichung County. Region 3 includes Chiayi City, Chiayi County, Kaohsiung City, Kaohsiung County, Pingtung County, Tainan City, Tainan County, and Yunlin County. Region 4 includes Taitung County and Hualien County. Region 5 includes Penghu County. Nearly all of the population lived in regions 1, 2, and 3.

3.2 Micro dataset on women

The micro dataset that I use is the 1989 Taiwan Women and Family Survey (TWFS), which was designed by William Parish and Robert Willis and collected by the University of Chicago/NORC and National Taiwan University (Parish and Willis 1993). The TWFS is an island-wide survey of women aged 25–59 and is fully representative of all adult working-age women in Taiwan. The full sample contains 3,803 observations. It includes variables on the respondent's background, employment, marriage, husband, children, parents, and parents-in-law. I limit the sample to respondents who were married exactly once because the dataset only contains information on the respondent's most recent marriage.[6] I construct several dependent variables: two measures of the bride price relative to the dowry, the fraction of female children, total number of children, and children's educational attainment. It may be challenging to use a cross-sectional survey to measure what happened in people's lives several decades ago. Issues of memory and recall bias are a concern. However, the analysis involves major life events, e.g., year of marriage, number and gender of children, and recall bias is likely to be small.

With the TWFS, I construct a number of control variables. I create a set of dummies to control for ethnicity, since marriage market and fertility preferences may vary by ethnic group. The TWFS lacks a direct measure of ethnic group. The ethnicity dummies are derived from the language or languages used in the survey interview.[7] I create a set of respondent education variables because the sex ratio may impact education, and education is, in turn, related to marriage and fertility. The education dummies encompass three categories: primary school or less; more than primary school but less than college/career school; and any college/career school or more. To control for omitted time-invariant region-specific effects, I include a set of region fixed effects.[8] Furthermore, all regressions include a set of region-specific time trend variables, which are intended to control for cohort/year effects. When I use the sex ratio during year of marriage, the region-specific time trend is based on year of marriage, and when I use the sex ratio at age 20, the region-specific time trend is based on year of birth. Also, changes in the number of men aged 15–39 may not only affect the sex ratio but the outcome variables and other closely related variables as well. To account for this potentially omitted variable, Angrist (2002) introduces the level of immigrant flows into the regressions.

[6]Since only 1.7% of respondents (who were ever married) were married two or more times, this is a minor issue. Only 2% of women in the sample were ever divorced.

[7]Specifically, the ethnicity dummies are based on six categories: mostly or totally Mandarin; half Minnan (Fukienese), half Mandarin; half Hakka, half Mandarin; mostly or totally Minnan; mostly or totally Hakka; and other.

[8]The TWFS only reports the respondent's county of current residence (as of 1989). The region fixed effects and regional sex ratio variables utilize this information.

In this spirit, all regressions control for the logarithm of the number of men aged 15–39 (cohort size) at the regional level in either year of marriage or year age 20.

3.3 Differences between mainland Chinese and native Taiwanese men

Differences in ethnicity, human capital, and other characteristics between mainland Chinese and native Taiwanese men may potentially frustrate the identification of the effect of the marriage market sex ratio. That is, a potential omitted variable is the average "quality" of men in the marriage pool. The sample provides empirical evidence that some differences may exist, e.g., mainland Chinese husbands are more likely to have a college education than native Taiwanese husbands. For this reason, it is critical that the regressions account for differences between mainland Chinese and native Taiwanese men. To this end, every regression controls for husband's education. Furthermore, all regressions are run with and without an indicator for whether the respondent's husband is mainland Chinese or native Taiwanese. About 16% of respondents report that their husband's origin was mainland China.

3.4 Estimation framework

The estimation framework is straightforward. The estimating equation for individual i of cohort year t living in region j is:

$$y_{ijt} = \alpha S_{jt} + \beta X_i + \delta_j + \gamma_{jt} + \lambda N_{jt} + \varepsilon_{ijt}$$

where S_{jt} is the sex ratio of region j in cohort year t, X_i is a vector of covariates, δ_j is a regional fixed effect, γ_{jt} is the region-specific time trend, and N_{jt} is the logarithm of the number of men aged 15–39 in region j during cohort year t. Cohort year t is either the year in which the respondent was married or the year in which the respondent was 20 years old. I report robust standard errors adjusted for region–cohort clustering.

4 Empirical results and discussion

In this section, I present the empirical results, which are organized into two sections: marriage market and children. To preview some of the findings, refer to Fig. 3. The figure plots the ratio of bride price to dowry by year. The bride price relative to the dowry takes roughly the same path as the marriage market sex ratio in Fig. 2, thus providing prima facie evidence that the two variables are positively related. I test this hypothesis and others in the empirical analysis that follows. Table 2 presents the summary statistics for the dependent and independent variables.

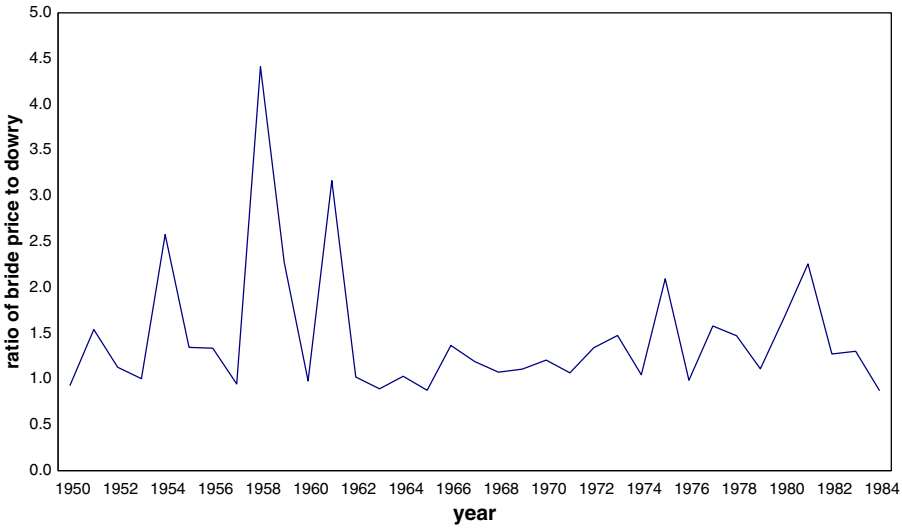

Fig. 3 Average annual ratio of bride price to dowry, 1950–1984

4.1 Marriage market

Nearly all women in Taiwan marry; 99.5% of women aged 50 and above, 99% between age 40 and 60, and 97% between age 30 and 40 in the sample were married. Thus, consistent with Becker (1981), the marriage rate for women in Taiwan was high, as the number of men had greatly exceeded the number of women throughout the period. The median age at marriage was about 22. In Taiwan, the interfamilial exchange of dowry and bride price was a widespread cultural practice.[9] Most marriages involved a dowry or bride price, and many marriages involved both. In the sample, 71% of marriages involved a dowry, bride price, or both. I examine the effect of the sex ratio on two measures of the bride price relative to the dowry. The first measure is the ratio of bride price to dowry. The second is a dummy variable which equals 1 when the value of the bride price is greater than the value of the dowry and equals 0 otherwise. The second measure is intended to moderate the potential influence of extreme values.

Table 3 presents evidence that the marriage market sex ratio is positively associated with the bride price relative to the dowry. The coefficient on the sex ratio during the year in which the respondent was married is positive and significant when the dependent variable is either the ratio of bride price to dowry or the bride price dummy. The coefficient on the sex ratio during the year in which the respondent was 20 is positive, but not significant. A

[9] A transfer to the groom is a dowry; a transfer to the bride (or her parents) is a bride price. A dowry may consist of clothing, furniture, radios, and cash; a bride price may consist of cakes, jewelry, and cash (Wolf 1972).

Table 2 Summary statistics

	Number	Mean	SD	Min	Max
Sex ratio in year married	2,954	106.01	4.37	99.32	119.50
Sex ratio in year age 20	3,002	106.17	4.29	99.32	119.50
Ratio of bride price to dowry	1,111	1.48	3.14	0	50
Bride price dummy (=1 if bride price>dummy)	1,091	0.28	0.45	0	1
Fraction of female children	3,529	0.47	0.31	0	1
Total number of children	3,740	2.90	1.50	0	10
Average education of male children	3,101	7.52	4.55	0	18
Average education of female children	2,855	7.36	4.45	0	18
Wife secondary education	3,739	0.34	0.47	0	1
Wife college education	3,739	0.09	0.29	0	1
Some Minnan	3,740	0.19	0.39	0	1
Some Hakka	3,740	0.01	0.11	0	1
Mostly Minnan	3,740	0.34	0.47	0	1
Mostly Hakka	3,740	0.01	0.12	0	1
Other language	3,740	0.00	0.04	0	1
Husband secondary education	3,508	0.37	0.48	0	1
Husband college education	3,508	0.20	0.40	0	1
Region 2	3,740	0.23	0.42	0	1
Region 3	3,740	0.35	0.48	0	1
Region 4	3,740	0.03	0.17	0	1
Region 5	3,740	0.01	0.07	0	1
Cohort size	2,954	13.82	0.55	9.82	14.48
Mainlander husband	3,740	0.16	0.37	0	1

Data source: TWFS, Taiwan Demographic Fact Book, and Statistical Yearbook

ten-point increase in the sex ratio (year married) leads to approximately a one standard deviation increase in the first measure, and a ten-point increase in the sex ratio leads to an increase in the second measure of about 0.19, which is large in magnitude since the sample mean is 0.28. It is unlikely that differences between mainland Chinese and native Taiwanese men explain the effect of the sex ratio on the bride price relative to the dowry. All regressions control for husband education and the estimated coefficients are essentially unchanged when an indicator of whether the respondent's husband was from mainland China is included in the regressions. Moreover, the analysis reveals that husband education tends to lower, not raise, the bride price relate to the dowry, suggesting that potential unobserved differences in wealth and human capital between mainland Chinese and native Taiwanese are unlikely to account for why the coefficient on the sex ratio is positive.

Therefore, when the sex ratio rises, competition among men for scarce women bids up the bride price relative to the dowry. Women rise in value relative to men. This result confirms Becker (1981) and Grossbard-Shechtman's (1993) theories of the marriage market. It is also consistent with the findings of Rao (1993) and Caldwell et al. (1983) in India that a decrease in the marriage market sex ratio caused dowry payments to increase, thus shedding light on the debate between Edlund (2000) and Rao (2000). Since changes in the sex ratio in Taiwan were uncorrelated with the determinants of parental bequests, the findings imply that bride prices and dowries are related to variables that

Table 3 Bride price and dowry

	Ratio of bride price to dowry				Bride price dummy			
Sex ratio (year married)	0.336 (0.152)**	0.336 (0.152)**			0.019 (0.008)**	0.019 (0.008)**		
Sex ratio (year age 20)			0.136 (0.110)	0.139 (0.109)			0.003 (0.011)	0.004 (0.011)
Wife secondary education	−0.023 (0.186)	−0.022 (0.185)	−0.091 (0.203)	−0.085 (0.201)	−0.035 (0.036)	−0.034 (0.036)	−0.040 (0.044)	−0.037 (0.043)
Wife college education	−0.057 (0.452)	−0.054 (0.453)	−0.164 (0.429)	−0.153 (0.426)	−0.134 (0.054)**	−0.130 (0.054)**	−0.129 (0.076)*	−0.122 (0.077)
Some Minnan	−0.323 (0.213)	−0.320 (0.218)	−0.303 (0.265)	−0.296 (0.266)	−0.021 (0.045)	−0.019 (0.045)	−0.021 (0.046)	−0.018 (0.045)
Some Hakka	3.647 (2.891)	3.655 (2.896)	0.932 (1.114)	0.958 (1.113)	0.201 (0.108)*	0.209 (0.109)*	0.192 (0.120)	0.203 (0.120)*
Mostly Minnan	−0.494 (0.292)*	−0.487 (0.302)	−0.363 (0.341)	−0.347 (0.345)	−0.033 (0.051)	−0.028 (0.051)	−0.026 (0.056)	−0.020 (0.056)
Mostly Hakka	0.217 (0.895)	0.211 (0.874)	0.612 (1.245)	0.575 (1.183)	0.197 (0.207)	0.190 (0.201)	0.238 (0.258)	0.217 (0.247)
Husband secondary education	−0.599 (0.227) **	−0.600 (0.226)**	−0.513 (0.224)**	−0.519 (0.222)**	−0.091 (0.034)**	−0.093 (0.033)**	−0.076 (0.038)**	−0.079 (0.038)**
Husband college education	−0.927 (0.316) **	−0.935 (0.307)**	−0.802 (0.353)**	−0.828 (0.341)**	−0.137 (0.049)**	−0.145 (0.049)**	−0.112 (0.056)**	−0.123 (0.054)**

Table 3 (continued)

	Ratio of bride price to dowry				Bride price dummy			
Region 2	−0.700	−0.706	0.088	0.088	−0.061	−0.067	−0.149	−0.151
	(2.725)	(2.723)	(2.449)	(2.445)	(0.224)	(0.224)	(0.298)	(0.296)
Region 3	1.935	1.919	0.090	0.060	0.290	0.274	−0.045	−0.064
	(3.680)	(3.679)	(3.965)	(3.966)	(0.356)	(0.356)	(0.535)	(0.536)
Region 4	−3.270	−3.209	5.300	5.634	−0.905	−0.846	−0.291	−0.131
	(6.396)	(6.405)	(6.385)	(6.368)	(0.901)	(0.905)	(1.272)	(1.278)
Region 5	2.478	2.514	12.858	12.991	−0.720	−0.676	−0.202	−0.105
	(13.224)	(13.211)	(13.620)	(13.635)	(1.594)	(1.607)	(2.458)	(2.472)
Cohort size	−0.565	−0.534	3.631	3.803	−0.618	−0.587	−0.108	−0.022
	(4.524)	(4.522)	(4.851)	(4.848)	(0.510)	(0.508)	(0.783)	(0.784)
Mainlander		0.101		0.286		0.089		0.120
husband		(0.297)		(0.265)		(0.064)		(0.076)
Number	950	950	928	928	931	931	908	908

Numbers in parentheses are robust standard errors adjusted for region–cohort clustering. All regressions include controls for cohort/year effects. The bride price dummy equals 1 if the bride price is greater than the dowry and equals 0 otherwise. The sex ratio, calculated at the regional level, is the number of men aged 15–39, excluding mainlanders in the military, divided by the number of women aged 15–39 and multiplied by 100

$^{*}p = 0.1$; $^{**}p = 0.05$

characterize the marriage market environment but operate independently of parental bequests. Nevertheless, parental bequests may still play a role in affecting dowries, as economists argue (Botticini and Siow 2003; Zhang and Chan 1999). More generally, the effect of the marriage market sex ratio on the bride price and dowry is an example of how economic and social variables shape cultural traditions.

4.2 Children

Economists contend that the sex ratio is a factor that affects the husband and wife's intrahousehold bargaining position, but not their preferences or joint budget set (Browning et al. 1994; Browning and Chiappori 1998; Chiappori 1988, 1992; Chiappori et al. 2002). That is, an increase in the sex ratio raises women's bargaining power within the household. Since husbands and wives may differ in terms of preferences and household production technology, changes in the distribution of intrahousehold bargaining power may affect many household decisions, such as the number, gender, and human capital of children. It is through this mechanism that the sex ratio may affect children.

Prior to estimating the effect of the sex ratio on the fraction of female children in a family, it is important to discuss the practice of selective abortion, infanticide, and neglect in Taiwan. The evidence indicates that not only does son preference exist throughout the sample period, but also that abortion, infanticide, and/or neglect partially account for elevated sex ratios at birth. Following Ben-Porath and Welch (1976), I calculate parity progression ratios, the fraction of families who have another child, conditional on the number of boys and girls. Table 4 shows that, when the first two children are boys, 63% of families have another child; when the first two children are girls, 80% of families have another child. When the first three children are boys, 48% of families have another child; when the first three children are girls, 77% of families have another child. However, as Leung (1991) stresses, parity

Table 4 Parental sex preferences

Number of children	Number of boys	Number of families	Fraction who have another child
1	1	1,828	0.91
	0	1,764	0.91
2	2	866	0.63
	1	1,616	0.69
	0	789	0.80
3	3	269	0.48
	2	837	0.35
	1	881	0.56
	0	296	0.77
4	4	68	0.41
	3	208	0.36
	2	389	0.32
	1	373	0.48
	0	109	0.67

The number of children (n) refers to the first n children in families who have at least n children. The fraction of families who have another child is also known as the parity progression ratio. Data source: TWFS

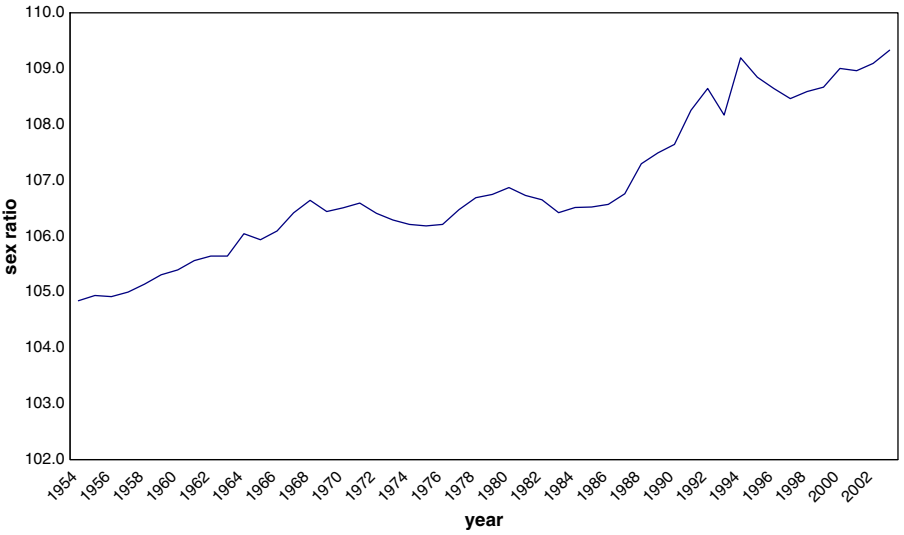

Fig. 4 Sex ratio of Taiwan ages 0–4, 1954–2003

progression ratios do not establish the existence of son preference, only the existence of parental sex preference generally. While manipulating the total number of children cannot, by itself, affect the sex ratio at birth, practicing abortion, infanticide, and neglect can. Figure 4 displays the sex ratio of children aged 0–4 in Taiwan. The sex ratio of children increases until about 1987, when it rises more rapidly, presumably because abortion and ultrasound technology became more widely available. Taken together, the table and the figure provide evidence that the parental sex preference in Taiwan is son preference. Furthermore, son preference underlies the practice of selective abortion, infanticide, and neglect, which tends to push the sex ratio of children upward. "Missing women" are a reality in Taiwan.

To identify the effect of women's bargaining power on the incidence of selective abortion, infanticide, and neglect, I regress the fraction of female children on the sex ratio. Table 5 presents evidence that the sex ratio is positively related to the fraction of female children in a family. The coefficient on the sex ratio (in both year married and year age 20) is positive and significant with and without controls for husband origin. Interpreting the coefficient on the sex ratio in the year the respondent was married, a ten-point increase in the marriage market sex ratio leads to a 0.06 increase in the fraction of female children in a family. This implies that the incidence of selective abortion, infanticide, and neglect is inversely related to women's intrahousehold bargaining power.[10] Empowering women, wives and mothers,

[10]This effect is not incompatible with the potential effect of the hepatitis B virus, which may likewise operate on sex ratios at birth (Oster 2005).

Table 5 Fraction of female children and total number of children

	Fraction of female children				Total number of children			
Sex ratio (year married)	0.006 (0.003)*	0.006 (0.003)*			−0.020 (0.011)*	−0.017 (0.011)		
Sex ratio (year age 20)			0.011 (0.004)**	0.011 (0.004)**			−0.026 (0.011)**	−0.025 (0.011)**
Wife secondary education	0.015 (0.017)	0.014 (0.017)	0.013 (0.020)	0.012 (0.019)	−0.182 (0.044)**	−0.196 (0.045)**	−0.376 (0.052)**	−0.391 (0.052)**
Wife college education	0.018 (0.029)	0.017 (0.029)	0.026 (0.036)	0.026 (0.036)	−0.335 (0.064)**	−0.350 (0.062)**	−0.705 (0.069)**	−0.720 (0.070)**
Some Minnan	−0.009 (0.021)	−0.010 (0.021)	−0.009 (0.020)	−0.011 (0.020)	0.096 (0.041)**	0.050 (0.040)	0.120 (0.044)**	0.082 (0.046)*
Some Hakka	0.067 (0.044)	0.066 (0.044)	0.060 (0.046)	0.058 (0.047)	0.318 (0.207)	0.271 (0.202)	0.364 (0.221)	0.326 (0.222)
Mostly Minnan	0.014 (0.019)	0.012 (0.018)	0.015 (0.019)	0.012 (0.019)	0.301 (0.059)**	0.232 (0.058)**	0.360 (0.053)**	0.307 (0.052)**
Mostly Hakka	0.071 (0.058)	0.070 (0.059)	0.005 (0.076)	0.005 (0.076)	0.260 (0.159)	0.239 (0.171)	0.616 (0.326)*	0.602 (0.329)*
Other language	−0.084 (0.256)	−0.087 (0.255)	−0.440 (0.023)**	−0.443 (0.023)**	0.237 (0.080)**	0.145 (0.093)	0.281 (0.064)**	0.218 (0.064)**
Husband secondary education	−0.014 (0.013)	−0.013 (0.013)	−0.010 (0.015)	−0.009 (0.015)	−0.137 (0.046)**	−0.117 (0.047)**	−0.198 (0.046)**	−0.183 (0.046)**

Table 5 (continued)

	Fraction of female children				Total number of children			
Husband college education	0.008	0.009	0.009	0.012	−0.337	−0.279	−0.405	−0.360
	(0.022)	(0.022)	(0.025)	(0.025)	(0.058)**	(0.059)**	(0.059)**	(0.059)**
Region 2	0.111	0.112	0.155	0.155	−1.186	−1.159	−1.117	−1.130
	(0.088)	(0.088)	(0.109)	(0.110)	(0.379)**	(0.380)**	(0.303)**	(0.301)**
Region 3	0.189	0.191	0.447	0.448	−4.338	−4.229	−3.072	−3.059
	(0.164)	(0.164)	(0.203)**	(0.203)**	(0.446)**	(0.447)**	(0.576)**	(0.583)**
Region 4	−0.183	−0.189	−0.888	−0.894	8.266	8.045	4.519	4.417
	(0.400)	(0.400)	(0.508)*	(0.508)*	(1.303)**	(1.301)**	(1.391)**	(1.398)**
Region 5	−0.326	−0.335	−0.324	−0.314	17.884	17.555	11.851	12.008
	(0.837)	(0.839)	(1.056)	(1.054)	(3.311)**	(3.297)**	(3.580)**	(3.554)**
Cohort size	−0.210	−0.213	−0.568	−0.570	5.475	5.354	3.146	3.119
	(0.252)	(0.253)	(0.306)*	(0.306)*	(0.784)**	(0.791)**	(0.872)**	(0.883)**
Mainlander husband		−0.010		−0.015		−0.366		−0.308
		(0.022)		(0.021)		(0.049)**		(0.050)**
Number	2,835	2,835	2,733	2,733	2,895	2,895	2,793	2,793

Numbers in parentheses are robust standard errors adjusted for region–cohort clustering. All regressions include controls for cohort/year effects. The sex ratio, calculated at the regional level, is the number of men aged 15–39, excluding mainlanders in the military, divided by the number of women aged 15–39 and multiplied by 100

*$p = 0.1$; **$p = 0.05$

Table 6 Human capital investments in children

	Education of boys				Education of girls			
Sex ratio (year married)	0.463 (0.091)**	0.468 (0.092)**			0.267 (0.178)	0.275 (0.176)		
Sex ratio (year age 20)			0.634 (0.365)*	0.628 (0.358)*			0.660 (0.432)	0.644 (0.429)
Wife secondary education	0.386 (0.283)	0.358 (0.278)	−0.656 (0.413)	−0.605 (0.417)	0.197 (0.278)	0.160 (0.284)	−0.687 (0.297)**	−0.602 (0.317)*
Wife college education	−0.765 (0.461)	−0.825 (0.461)*	−3.231 (0.600)**	−3.131 (0.658)**	0.022 (0.503)	−0.062 (0.508)	−1.725 (0.615)**	−1.558 (0.648)**
Some Minnan	−0.142 (0.236)	−0.175 (0.234)	−0.348 (0.290)	−0.295 (0.300)	−0.206 (0.270)	−0.250 (0.269)	−0.357 (0.293)	−0.268 (0.281)
Some Hakka	−0.890 (0.950)	−0.922 (0.947)	−1.909 (0.790)**	−1.868 (0.799)**	−0.693 (0.807)	−0.734 (0.797)	−1.044 (0.886)	−0.977 (0.911)
Mostly Minnan	−0.556 (0.233)**	−0.606 (0.244)**	−0.517 (0.216)**	−0.439 (0.199)**	−0.603 (0.235)**	−0.671 (0.230)**	−0.582 (0.288)*	−0.459 (0.293)
Mostly Hakka	−0.396 (0.488)	−0.429 (0.476)	−2.087 (0.741)**	−2.032 (0.752)**	−0.949 (0.570)	−0.995 (0.564)*	−2.824 (0.989)**	−2.728 (0.990)**
Other language	−1.276 (0.280)**	−1.335 (0.309)**	0.000 (0.000)	0.000 (0.000)	−2.079 (0.445)**	−2.161 (0.425)**	0.000 (0.000)	0.000 (0.000)
Husband secondary education	0.833 (0.189)**	0.849 (0.183)**	0.782 (0.240)**	0.760 (0.245)**	0.934 (0.177)**	0.950 (0.180)**	0.914 (0.212)**	0.889 (0.212)**
Husband college education	1.866 (0.289)**	1.918 (0.312)**	2.147 (0.453)**	2.066 (0.507)**	1.604 (0.319)**	1.677 (0.333)**	1.477 (0.485)**	1.346 (0.534)**

Table 6 (continued)

	Education of boys				Education of girls			
Region 2	11.27	11.33	21.00	21.00	5.415	5.503	20.10	19.48
	(2.38)**	(2.40)**	(15.68)	(15.39)	(4.420)	(4.424)	(20.41)	(20.32)
Region 3	19.86	20.18	23.58	23.37	11.45	11.88	22.81	22.37
	(4.37)**	(4.45)**	(12.21)*	(11.99)*	(6.48)*	(6.39)*	(13.41)*	(13.43)
Region 4	−40.70	−41.40	11.34	12.58	−30.92	−31.70	2.56	1.54
	(11.82)**	(11.93)**	(48.14)	(47.87)	(17.00)*	(16.86)*	(61.93)	(61.15)
Region 5	−54.20	−55.61	8.49	9.23	−40.99	−42.51	1.41	−2.28
	(20.58)**	(20.81)**	(89.07)	(88.08)	(29.56)	(29.32)	(116.38)	(114.78)
Cohort size	−20.28	−20.66	7.06	7.72	−13.48	−13.88	3.06	2.67
	(6.67)**	(6.73)**	(24.63)	(24.54)	(9.77)	(9.71)	(31.45)	(31.08)
Mainlander husband		−0.169		0.266		−0.221		0.394
		(0.278)		(0.350)		(0.257)		(0.284)
Number	748	748	655	655	691	691	608	608

Numbers in parentheses are robust standard errors adjusted for region–cohort clustering. All regressions include controls for cohort/year effects. Human capital investments are measured as the average number of years of schooling of male and female children in the respondent's family. The analysis is limited to respondents who are over age 40. The sex ratio, calculated at the regional level, is the number of men aged 15–39, excluding mainlanders in the military, divided by the number of women aged 15–39 and multiplied by 100

*$p = 0.1$; **$p = 0.05$

reduces the number of missing women. While society may prefer male to female children, several studies suggest that women may prefer male children relatively less than men do (Duflo 2000, 2003; Thomas 1990, 1994). My findings are consistent with Qian's (2008) results in mainland China that a rise in relative female income raised the survival rate of girls, whereas a rise in relative male income lowered the survival rate of girls. They are also consistent with Olds' (2006) results in early twentieth century Taiwan that an increase in adult female productivity under Japanese rule lowered rates of female infanticide and improved the welfare of daughters.

In addition, I regress the total number of children on the sex ratio. Table 5 presents evidence that the sex ratio is negatively associated with the total number of children in a family. The coefficient on the sex ratio is negative and significant in three of the four regressions. Interpreting the coefficient on the sex ratio in the year the respondent was married, when the sex ratio increases by ten points, the total number of children in the family falls by about 0.2. As the sex ratio increases, enhancing women's intrahousehold bargaining power, families choose to have fewer children. This is likely because men and women have different preferences regarding ideal family size. In many countries, women prefer to have fewer children than men, perhaps because they bear more of the costs of raising children (Campbell and Campbell 1997; Mason and Taj 1987; Mahmood and Ringheim 1997).

Table 6 presents evidence that the sex ratio is positively associated with human capital investments in children. I measure human capital investments as the average number of years of schooling by gender. Since some respondents in the overall sample have children who are still in school, I limit the analysis to those respondents who are over age 40. The coefficient on the sex ratio is positive and significant for boys, whereas it is positive and insignificant for girls. As the sex ratio goes up, boosting women's intrahousehold bargaining power, human capital investments in children rise, especially in boys. This is broadly congruent with other empirical studies that find that, when bargaining power within the household shifts from men to women, children's health, nutrition, survival, and education increase (Duflo 2000, 2003; Thomas 1990, 1994; Qian 2008).

5 Conclusion

In this paper, I have used the demographic consequences of the Chinese Communist Revolution and subsequent Taiwanese military policy to estimate the effect of the marriage market sex ratio on women and children in Taiwan. I find that when the marriage market sex ratio increases and competition among men for scarce women intensifies, the bride price relative to the dowry increases. This finding validates the economic theory of the marriage market and sheds light on the debate about the determinants of dowries and bride prices. I also find that as the sex ratio rises, thereby increasing women's intrahousehold bargaining power, the fraction of female children in a family

increases, the total number of children in a family decreases, and human capital investments in children increase. These findings confirm the notion that when bargaining power within the household shifts from men to women, children's welfare rises. Moreover, the results suggest that the incidence of selective abortion, infanticide, and neglect is inversely related to women's intrahousehold bargaining power.

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Population data appendix

In this data appendix, I describe the procedure that I follow to estimate the marriage market sex ratio and other population statistics. I use population data collected through the household registration system. In Taiwan, every birth, death, marriage, and intercounty change of residence must be registered with the government within a couple of weeks. The household registration system is comprehensive. Statistics based on the household registration system compare well with Taiwanese census figures (Republic of China 1961). Annual Taiwan-level statistics on population and death rates by gender and age for 1950–1989 come from the Statistical Abstract (Republic of China 1974a) and Statistical Yearbook (Republic of China 1975a, 1999, 2004). Annual county-level statistics on population by gender and age for 1961–1989 come from the Demographic Fact Book (Republic of China 1961, 1963–1968, 1971–1973, 1974b, 1975b, 1976–1989); 1961 is the earliest year for which the county-level data are available.

For the years 1950–1968, the raw Taiwan-level data exclude all men enlisted in the military. For the years 1961–1968, the raw county-level data exclude mainlanders enlisted in the military. All soldiers are counted starting in 1969. Prior to 1969, soldiers are counted only when they retire. Lin (2002) speculates that the Taiwanese government does not report the number of soldiers during this period to keep its military capabilities secret from China. I calculate marriage market sex ratios that exclude mainlanders in the military. For this reason, I must distinguish between civilians and soldiers, as well as between mainlanders and native Taiwanese in the military. Specifically, I add to the raw Taiwanese population data the estimated number of native Taiwanese in the military prior to 1969; subtract from the raw Taiwanese population data the estimated number of mainlanders in the military after 1969; and subtract from the raw county population data the estimated number of mainlanders in the military after 1969. My estimates compare well with other studies (Bullard 1997; Lin 2002; Roy 2003; Wang 1993b). See the discussion in Section 2.

The estimation procedure consists in four steps. First, I estimate the total civilian and military population of Taiwan by gender and age for 1950–1968. Going backwards in time, I use gender-specific and age-specific death rates and post-1969 population statistics, which include the military, to estimate

the total number of men and women living in Taiwan by age in each year prior to 1969. I assume that there is no immigration to or emigration from the island and that civilian and military death rates are identical. As I have discussed previously, there is virtually no immigration or emigration during the period. Overall death rates are quite low for young and middle-aged adults. Moreover, the military is not involved in any significant combat. Hence, the population estimates are not sensitive to the assumptions about immigration and death rates. I then subtract the raw Taiwan-level population statistics from my estimates of the total population to obtain estimates of the military population by gender and age.

Second, I distinguish between mainlanders and native Taiwanese in the military for 1950–1968. Native Taiwanese males aged 20–24 began to enlist in the military in 1956 when the government established the compulsory military service system (Bullard 1997; Hsu 2003). By this time, mainlanders in the military were older than 20–24 years old. I follow the cohorts of native Taiwanese and mainlanders enlisted in the military over time. New recruits are native Taiwanese, and older soldiers are mainlanders. With these estimates, I add to the raw Taiwanese population data the number of native Taiwanese in the military prior to 1969.

Third, I estimate the number of mainlanders in the military post-1969. I calculate the age-specific rate of retirement for mainlanders in the military prior to 1969. Using these rates of retirement and estimates of the number of mainlanders in the military prior to 1969, I estimate the number of mainlanders in the military post-1969. The number of mainlanders in the military after 1969 is small, so these estimates are not sensitive to the assumptions. I subtract from the raw Taiwanese population data the number of mainlanders in the military after 1969.

Fourth, I estimate the number of mainlanders in the military post-1969 by county. For each county–age cell, I calculate how many men one would have to add to the 1968 population to make the 1968 county–age sex ratio equal to the corresponding 1969 sex ratio, which already includes the military. With this, I calculate the age-specific distribution of mainlanders in the military across countries in 1968. Assuming this distribution is fixed across time, I multiply the total number of mainlanders in the military by each county's proportion for each age and year. I subtract from the raw county population data the number of mainlanders in the military after 1969. These estimates are not sensitive to the assumptions because the total number of mainlanders in the military post-1969 is small.

References

Angrist J (2002) How do sex ratios affect marriage and labor markets? Evidence from America's second generation. Q J Econ 117(3):997–1038

Becker GS (1981) A treatise on the family. Harvard University Press, Cambridge

Ben-Porath Y, Welch F (1976) Do sex preferences really matter? Q J Econ 90(2):285–307

Botticini M, Siow A (2003) Why dowries? Am Econ Rev 93(4):1385–1398
Browning M, Chiappori PA (1998) Efficient intra-household allocations: a general characterization and empirical tests. Econometrica 66(6):1241–1278
Browning M, Bourguignon F, Chiappori PA, Lechene V (1994) Income and outcomes: a structural model of intrahousehold allocation. J Polit Econ 102(6):1067–1096
Bullard MR (1997) The soldier and the citizen: the role of the military in Taiwan's development. M.E. Sharpe, Armonk
Caldwell JC, Reddy PH, Caldwell P (1983) The causes of marriage change in South India. Popul Stud 37:343–361
Campbell EK, Campbell PG (1997) Family size and sex preferences and eventual fertility in Botswana. J Biosoc Sci 29:191–204
Chang MC (1986) Analysis of Taiwan KAP data in a socio-economic synthesis framework: a cross-sectional and time series study. In: Proceedings of conference on population change in Taiwan during the 20th century, population association of China, Taichung, pp 173–217
Chen SM (1978) An analysis of the content and strategy of family planning radio programs in Taiwan, 1969–1973. Journal of Population Studies (National Taiwan University) 2:106–150
Chiappori PA (1988) Rational household labor supply. Econometrica 56(1):63–90
Chiappori PA (1992) Collective labor supply and welfare. J Polit Econ 100(3):437–467
Chiappori PA, Fortin B, Lacroix G (2002) Marriage market, divorce legislation, and household labor supply. J Polit Econ 110(1):37–72
Duflo E (2000) Child health and household resources in South Africa: evidence from the old age pension program. Am Econ Rev 90(2):393–398
Duflo E (2003) Grandmothers and granddaughters: old-age pensions and intrahousehold allocation in South Africa. World Bank Econ Rev 17(1):1–25
Edlund L (1999) Son preference, sex ratios, and marriage patterns. J Polit Econ 107(6):1275–1304
Edlund L (2000) The marriage squeeze interpretation of dowry inflation: a comment. J Polit Econ 108(6):1327–1333
Edlund L, Li H, Yi J, Zhang J (2007) Sex ratios and crime: evidence from China's one-child policy. IZA Discussion Paper No. 3214
Grossbard-Shechtman SA (1984) A theory of allocation of time in markets for labor and marriage. Econ J 94(4):863–882
Grossbard-Shechtman SA (1993) On the economics of marriage. Westview, Boulder
Heer DM, Grossbard-Shechtman SA (1981) The impact of the female marriage squeeze and the contraceptive revolution on sex roles and the women's liberation movement in the United States, 1960 to 1975. J Marriage Fam 43(1):49–65
Hsu B (2003) Military recruiting to begin March 1. Taipei Times, 24 February, p 4. Available at http://www.taipeitimes.com/News/taiwan/archives/2003/02/24/195742
Khoo SE (1978) Effects of program contraception on fertility: a comparison of three Asian countries. East–West Center, Honolulu
Leung SF (1991) A stochastic dynamic analysis of parental sex preferences and fertility. Q J Econ 106(4):1063–1088
Lin SW (2002) The transition of demographic sexual structure in Taiwan: 1905–2000. National Chengchi University Journal of Sociology 33:91–133
Lin SW (2003) From soldier to veteran: institution-building of state and the formation of demographic categories in Taiwan (1949–1970). Taiwan: A Radical Quarterly in Social Studies 52:187–254
Mahmood N, Ringheim K (1997) Knowledge, approval and communication about family planning as correlates of desired fertility among spouses in Pakistan. Int Fam Plann Perspect 23: 122–129
Mason KO, Taj AM (1987) Differences between women's and men's reproductive goals in developing countries. Popul Dev Rev 13(4):611–638
McElroy MB, Horney MJ (1981) Nash-bargaining household decisions: toward a generalization of the theory of demand. Int Econ Rev 22(2):333–349
Olds K (2006) Female productivity and mortality in early-20th-century Taiwan. Econ Hum Biol 4:206–221
Oster E (2005) Hepatitis B and the case of the missing women. J Polit Econ 113(6):1163–1216
Parish WL, Willis RJ (1993) Daughters, education, and family budgets: Taiwan experiences. J Hum Resour 28:863–898

Qian N (2008) Missing women and the price of tea in China: the effect of sex-specific earnings on sex imbalance. Q J Econ 123(3):1251–1285
Rao V (1993) The rising price of husbands: a hedonic analysis of dowry increases in rural India. J Polit Econ 101(4):666–677
Rao V (2000) The marriage squeeze interpretation of dowry inflation: response. J Polit Econ 108(6):1334–1335
Republic of China (1961) Taiwan demographic fact book. Ministry of Interior, Taipei
Republic of China (1963–1968) Taiwan demographic fact book. Ministry of Interior, Taipei
Republic of China (1971–1973) Taiwan demographic fact book. Ministry of Interior, Taipei
Republic of China (1974a) Statistical abstract of the Republic of China. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taipei
Republic of China (1974b) Taiwan–Fukien demographic fact book. Ministry of Interior, Taipei
Republic of China (1975a) Statistical yearbook of the Republic of China. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taipei
Republic of China (1975b) Taiwan–Fukien demographic fact book. Ministry of Interior, Taipei
Republic of China (1976–1989) Taiwan–Fukien demographic fact book. Ministry of Interior, Taipei
Republic of China (1999) Statistical yearbook of the Republic of China. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taipei
Republic of China (2004) Statistical yearbook of the Republic of China. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taipei
Roy D (2003) Taiwan: a political history. Cornell University Press, Ithaca
Sullivan JM, Su KH, Liu TH (1974) The fertility effect of induced abortion in Taiwan. Population Studies Center, University of Michigan, Ann Arbor
Thomas D (1994) Like father, like son; like mother, like daughter: parental resources and child height. J Hum Resour 29(4):950–988
Thomas D (1990) Intra-household resource allocation: an inferential approach. J Hum Resour 25(4):635–664
Tsai HC (1978) Development policy and internal migration in Taiwan. Journal of Population Studies (National Taiwan University) 2:27–58
Wang FC (1993a) Causes and patterns of ethnic intermarriage among the Hokkien, Hakka, and Mainlanders in postwar Taiwan: a preliminary examination. Bulletin of the Institute of Ethnology, Academia Sinica 76:43–96
Wang FC (1993b) The consequences of ethnic intermarriages: the impacts of intermarriages on ethnic assimilation in Taiwan. Journal of Social Sciences and Philosophy 82(12):231–267
Wang FC (2001) Taiwan's ethnic intermarriages and ethnic relations revisited. In: Lau SK, Wan PS, Lee MK, Wong SL (eds) Social transformation and cultural change in Chinese societies. Hong Kong Institute of Asian-Pacific Studies, The Chinese University of Hong Kong, Hong Kong, pp 393–430
Wolf M (1972) Women and the family in rural Taiwan. Stanford University Press, Stanford
Yang Bo (2000) 228 exhibit provocative, praiseworthy. Taipei Times, 22 January, p 9. Available at http://www.taipeitimes.com/News/archives/2000/01/22/0000021015
Zhang J, Chan W (1999) Dowry and wife's welfare: a theoretical and empirical analysis. J Polit Econ 107(4):786–808