Sons, Daughters, and Labor Supply in Early Twentieth-Century Hawaii.

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Immigration to Hawaii between 1868 and 1924 transformed its ethnic structure and population size. We investigate whether high Chinese, Japanese, and White sex ratios allowed females to negotiate better marriage terms and to allocate more household resources to daughters. Using IPUMS samples from the 1900, 1910, 1920, and 1930 Territorial Censuses of Hawaii, regression analysis suggests that both daughters and sons reduce mother labor force participation (LFP), but LFP effects are larger for a daughter than a son at some age intervals. Daughters have no effect on father LFP but for some age intervals a son has a positive effect on father LFP.

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Massive immigration to Hawaii between 1868 and 1924 transformed the ethnic structure and size of its population as well as the structure of the Hawaii economy. Most of the immigrants to Hawaii were Asian males, recruited to work on plantations in the rapidly expanding sugar and pineapple industries. Sex ratios of Chinese, Japanese, and Caucasian men and women of marriageable age were sometimes larger than two. High sex ratios imposed a constraint on the overall supply of female spouses that forced changes in the likelihood and timing of marriage in Hawaii. Increased competition among males for spouses may have tilted terms of the marriage contract towards features valued by females and changed *ex post* resource allocation within the household. Given its extremely high sex ratios at the turn of the twentieth century, Hawaii provides a good setting to investigate these propositions.

Our analysis uses pooled IPUMS samples from the 1900, 1910, 1920, and 1930 Territorial Census of Hawaii to document how critical demographic and labor market variables evolved over three decades and to consider how different constraints on marital choice and the presence of children affected male and female labor force participation in Hawaii. The description of demographic and labor market variables focuses on the evolution of ethnic sex ratios, marriage rates and composition, number of children and teenage and adult labor force participation across the four census samples. This sets the stage for us to consider how high sex ratios may have affected *ex post* changes in labor force participation due to increased female bargaining power. In particular, we investigate how the presence of children in a household affected the labor supply of married males and females and whether these effects vary with the gender composition of a married couple's children.

Our analysis of these questions is grounded in recent theoretical models of marriage that emphasize the central rule of sex ratios in generating endogenous sharing rules for allocation of consumption and time within the household (Chiappori, Fortin, and Lacroix, 2002; Iyigun and Walsh, 2007). Our econometric analysis draws from the framework utilized in Lundberg and Rose's (2002) study of the effect of child gender and parity on parent's labor market choices and outcomes. Results reveal substantial differences in parental labor force participation, some of which are tied to parents' ethnicities and their children's gender.

1. Immigration to Hawaii, 1872-1924

The 1850-1930 period in Hawaii provides an interesting case study of a small country (and after 1898 a small U.S. colony) that allowed foreign residents and firms to make enormous investments in large-scale plantations to grow and process sugar cane and pineapples. By 1900, the two industries would employ more than half of Hawaii's labor force, and almost all of their employees were immigrants from Asia, Europe, and the United States.

In 1872 Hawaii's population amounted to just 56,897 people, with about 8 percent of residents foreign born (Table 1). Most were Chinese agricultural workers; others were descendants of U.S. missionaries, white managers employed in firms associated with the sugar industry, and white property owners. In 1876, a reciprocity treaty between the Kingdom of Hawaii and the United States allowed sugar produced in Hawaii to enter the United States duty free. The treaty induced a massive expansion of the sugar industry in Hawaii and created demands by sugar plantations for tens of thousands of new workers to staff new and expanded plantations (La Croix and Grandy, 1997). Between 1868 and

1898, planters and the Hawaii government cooperated to facilitate immigration from China, Japan, and Portugal to work in sugar and pineapple fields and associated processing factories. This immigration transformed Hawaii's population between 1872 and 1900, with the overall population increasing by 270 percent and the percent foreign-born from 8.0 to 61.7 percent (Table 1).

Conflicts between sugar planters, white settlers, and Hawaii's government led to the overthrow of the Hawaiian monarchy in 1893. Substantial opposition in the U.S. Senate to consecutive treaties of annexation between the new Republic of Hawaii and the United States scuttled them but fighting in the Philippines during the Spanish-American War raised the strategic value of Hawaii, and it was annexed by a joint resolution of Congress in July 1898. Hawaii's population continued to soar after annexation, increasing by 240 percent from 1900 to 1930. First-generation immigrants comprised 61.7 percent of the population in 1900 and 41.8 percent in 1930. Most of the immigrants to Hawaii were young males, ages 18-25, recruited by sugar plantations from Japan and China to work in field and factory.[1] Migrants had also come from Portugal to work as plantation workers and foremen (*lunas*) and from the United States to work in white-collar positions. After annexation in 1900, sugar plantations attempted to diversify their workforce by recruiting workers from newly annexed Puerto Rico, Korea, Canada, England, Germany, and Spain, and then, in much larger numbers, from another newly annexed U.S. colony, the Philippines. The result was a sweeping transformation of both the size and ethnic composition of Hawaii's population during the first three decades of U.S. colonial rule (Table 2).

[1] See La Croix and Fishback (2000) for an in-depth discussion of the ethnic composition of the plantation workforce.

Because the overwhelming majority of the immigrants to Hawaii were young males, the sex ratios of its population of marriageable age (18-35) reached extremely high levels in our four census samples (Table 3). The Chinese sex ratio was the highest, standing at 9.0 in 1900 before declining to 4.0 in 1910, and 2.6 in 1920. One reason for its persistence at a relatively high level was the strict application of the Chinese Exclusion Act to Hawaii after annexation. The high Filipino sex ratios for 1920 (6.1) and 1930 (9.0) were primarily due to the late start of mass Filipino migration in 1915 relative to other immigrant groups and the U.S. ban on Filipino immigration set by the Immigration Act of 1924.[2] The decline in the Portuguese sex ratios from 2.0 in 1900 to 1.2 in 1910, 0.9 in 1920, and 1.0 in 1930 reflects the relatively early arrival of Portuguese immigrants relative to other immigrant groups and to the more balanced gender composition of Portuguese immigrants to Hawaii.

Sex ratios for native Hawaiians of marriageable age did not exhibit the extreme values of immigrant groups in 1900 and 1910, registering at levels close to 1.0 in both 1900 and 1910.[3] Native Hawaiian sex ratios subsequently fell to 0.75 in 1920 and 0.79 in 1930. The reasons for the decline are unclear, although emigration of Hawaiian men to the U.S. west coast played some part. The sharp increase in the white sex ratio—from 1.5 in 1900 to 2.23 in 1910, 2.25 in 1920, and 4.26 in 1930—was due to a surge in

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[2] 1924 Immigration Act. An act to limit the immigration of aliens into the United States, and for other purposes. H.R. 7995; Pub.L. 68-139; 43 Stat.

[3] Sex ratios of Koreans of marriageable age show the most dramatic change, falling from 13.53 in 1910 to 1.02 in 1920 to .49 in 1930. The fall between 1910 and 1920 is due to almost all males from the first wave of Korean immigrants (1903-1905) becoming older than the upper bound of the marriageable age interval [18-35] by 1920 and to immigration of Korean picture brides. The fall in the Korean sex ratio between 1920 and 1930 is due to immigration of Korean women rather than emigration of Korean men.

immigration of white males from the mainland United States after annexation. The increase was partly due to the establishment of the federal and territorial governments in Hawaii as well as construction on U.S. military bases, in particular Pearl Harbor and Schofield Barracks.

The Japanese sex ratio for ages 18-35 was relatively high in both 1900 (3.55) and 1910 (2.70) before declining to 0.82 in 1920 and 0.96 in 1930. The two main factors behind the decline were the Gentlemen's Agreement of 1907-1908, which ended the immigration of male Japanese workers to Hawaii, and the *Yobiyose Jidai* ("Summoned Era") immigration, in which close relatives and "picture brides" (*shashin hanayome*) joined the roughly 50,000 Japanese males working in Hawaii in 1907. Over the entire *yobiyose* period (1908-1924), 26,506 men, 30,633 women, and 5,138 children came to Hawaii.

The U.S. Immigration Service categorized 14,276 of the *yobiyose* women as picture brides.[4] Typically, the immigrant's family would use a go-between to assist in finding a suitable bride. "An exchange of photographs" and information about "family genealogy, wealth, education, and health" were normal parts of the traditional marriage screening process that carried over to selection of immigrant picture brides (Ichioka, 1988, p. 164). The Japanese Consulate required that the name of the picture bride be entered into the immigrant's family registry six months before she applied for a passport to the United States. Prior to 1915, laborers were ineligible to summon brides,

[4] Adams, 1924, p. 16. Some of the *yobiyose* women were wives who joined their husbands in Hawaii. Others were women who married immigrant men who had made the journey back to Japan to find a bride. Few workers could afford the journey to Japan, the return travel for the couple, and expenses associated with a Japanese wedding. Another barrier was that returnees were subject to the military draft if their stay exceeded 30 days (Ichioka 1988, p. 164).

businessmen needed an annual gross income of $1,200 and savings of $1,000, and farmers had to show gross annual profits of $400-$500 and savings of $1,000. From 1 July 1915, all Japanese males with savings of at least $800 were eligible to summon picture brides or their wives (Ichioka, 1988, p. 165). After 1915, the Japanese government required that the groom be no more than 13 years older than the bride; occasional waivers were granted. Japanese brides were often motivated to migrate and marry by the opportunity to remit earnings to their families.

In 1924, the U.S. Congress passed the Asian Exclusion Act, bringing an end to all foreign immigration to Hawaii including picture brides from Japan and Korea and plantation workers from the Philippines.[5] The immigration ban redirected Japanese, Korean, and Filipino workers to native-born brides from their own and other ethnic groups.[6] The Japanese, Koreans, and Filipinos were not the first groups to encounter such legal barriers. Since 1900 the U.S. Chinese Exclusion Act had barred immigration of Chinese women to marry Chinese workers in Hawaii.

2. Sex Ratios and Household Resource Allocation

Sex ratios have the potential to affect individual behavior relating to marriage and household resource allocation via multiple channels. Several recent models provide a channel by which the scarce gender takes actions to make themselves more attractive in the marriage market by increasing family savings or investment in human capital prior to marriage. Iyigun and Walsh (2007) and Chiappori, Iyigun and Weiss (2009) have

[5] Paterson (2000, p. 80) estimated that between 600 and 1,000 picture brides came to Hawaii from Korea from November 1910 to 1924.

[6] There were few native-born Filipinas of marriageable age due to the short time between the immigration of Filipino workers and the ban on immigration from the Philippines.

developed models in which pre-marital investment affects both spousal matching in the marriage market as well as endogenous sharing rules that determine how household resources are allocated among spouses during their marriage. In Iyigun and Walsh's model, a higher sex ratio reduces (increases) the consumption share of the male (female) during the marriage and tends to increase (decrease) male (female) pre-marital investment in human capital.[7] Two recent papers provide empirical support. Wei and Zhang (2012) finds that high savings rates in China during the 2000s decade can be partly explained by China's high sex ratio for persons ages 18-35, as families with a son save more to make him more attractive in the marriage market. Lafortune (2013) finds that shifts in sex ratios in the U.S. states during the 1900-1930 period affected pre-marital human capital investment decisions of second generation Americans.

Another strand of this literature takes premarital investments in human capital as exogenous and develops a model of collective labor supply by a married couple, with the distribution of marital surplus dependent on each spouse's bargaining power. Chiappori's (1992) collective model of household resource allocation is founded on the assumption that choices by both two spouses are Pareto-efficient and that changes in spousal bargaining power affect the total distribution of surplus within the marriage. Chiappori, Fortin, and Lacroix (2002) extend Chiappori's collective labor supply model to allow analysis of factors that affect spouses' bargaining positions but not their preferences or household resources. They specify a structural microeconomic model that

[7] Iyigun and Walsh (2007a) note that the "impact of an unbalanced sex ratio is stronger in the lower assortative ranks, and it dissipates as the rank of a couple rises" (p. 526). In addition, the wife's share of the marital surplus increases monotonically as the couple's marital rank increases "the couples' outside prospects—be it their utility as singles or in another potential marriage—play an independent role in whether household allocations are made efficiently" and how endogenous sharing rules form (p. 510).

shows that as the sex ratio rises, female labor supply decreases and male labor supply increases. Using U.S. data from the Panel Study of Income Dynamics (PSID), Chiappori *et al.* (2002) find strong evidence for the model's results vis-à-vis female-male labor supplies as well as evidence showing that a higher sex ratio is associated with a larger share of household income allocated to the wife (pp. 59-67).

A third, earlier strand of the literature on marriage and household allocation also takes the spouse's premarital endowments as exogenous but focuses more closely on how the presence of children affects household resource allocation. This strand identifies a number of different channels by which the presence of an additional child in a household could affect parents' labor supply. Pioneering analysis by Becker (1973, 1991) emphasized how a child raises the value of the mother's home production, thereby inducing both short-run and long-run declines in female labor force participation and hours. The sex ratio plays a central role in Becker's models, as a scarcity of women of marriageable age relative to men allows women to gain a larger share of the surplus generated by marriage. Undertaking empirical tests of Becker's framework, Grossbard-Schechtman (1993) and Grossbard-Schechtman and Neideffer (1997) found that higher sex ratios were associated with less female labor force participation.[8]

Lundberg and Rose (2002) argued that that an additional child increases the value of home production to both parents rather than just the mother. Because the value of the

[8] Angrist (2002) provided another test of Becker's marriage model by examining how changes in sex ratios affected the marriage prospects and labor force participation of second-generation Italians in the United States between 1910 and 1940. To account for left-out variables and reverse causality, Angrist instrumented for the sex ratios of Italians of marriageable age with sex ratio of Italian migrants of marriageable age. His econometric estimates suggest "that high sex ratios in the early twentieth century improved female marriage prospects, reduced female labor force participation, and tilted the balance of household bargaining power toward women more generally. Estimates for families with children also suggest that higher sex ratios led to increased marital stability and higher income in families with children" (p. 999).

mother's home production increases relative to the value of the father's home production, their model yields an unambiguous increase in mother's time devoted to home production with the addition of a child to the household. The impact of the child on the father's labor force participation is ambiguous, as the decline in the relative value of the father's home production vis-à-vis the mother could be more than offset by the decline in the father's value of work relative to home production.

The magnitude of a mother's increased specialization in home production due to the presence of an additional child is likely to be affected by both the child's parity and the mother's cohort (Lundberg and Rose, 2002, p. 252). Adjustments in specialization at higher parities should be smaller due to adjustments already undertaken at lower parities. Cohort effects could affect specialization due to peer attitudes regarding labor force participation by married women with young children and to innovations in home production technologies and new capital goods that, over time, have provided parents with access to an increasing variety of substitutes for parental time in household production.

Lundberg and Rose (2002) estimated the effect of an additional child on parents' wages and hours, with several regression specifications accounting for children's gender. They "find little evidence of an effect of child gender on the labor market outcomes of mothers" but statistically significant and substantial effects of gender on labor market outcomes of fathers (p. 251). Fathers increased their hours and wages for both daughters and sons, but the magnitudes of the increases were bigger for sons than daughters. Lundberg and Rose (pp. 261-264) suggested a number of factors to explain the differential labor supply responses, including higher returns to educating sons than

daughters, expectations of additional support from a daughter for elderly parents, or a preference by men for sons that raises their value of marriage when they have a son. We develop this preference-based explanation for sons in the context of the early twentieth-century Hawaii labor market and extend it to situations in which mothers may have preferences for daughters or weaker preferences for sons.

3. The Collective Household Model and Preferences for Sons and Daughters

Married couples in Korea, China, and, more weakly, Japan revealed a preference for a son rather than a daughter during the late nineteenth and early twentieth centuries. Historians and demographers have shown that in these countries, sons often received better nutrition early in life, more time inputs from parents, and a better, longer education than daughters (Cornell, 1996; Caldwell and Caldwell, 2005; Lee and Wang, 1999). Our analysis proceeds by assuming that young male immigrants from these countries brought this cultural preference for sons with them to Hawaii.[9] Until 1898, their preferences were relatively unimportant for Hawaii marriage and labor markets, as most immigrants were medium-term, temporary workers. Most did not intend to marry and settle in Hawaii but rather were focused on accumulating wealth to enhance prospects when they returned to their home countries.

The U.S. annexation of Hawaii in 1898 and the establishment of a territorial government in June 1900 changed the decision-making calculus for sugar plantation workers from East Asia. The change from a government controlled by corporate sugar interests and a small minority of white settlers to a U.S. territorial government secured

[9] Using data from the 2001 and 2006 Canadian censuses, Almond, Edlund, and Milligan (2013) analyze the sex ratios of children of Asian migrants to Canada and show that they reveal a strong preference for sons.

more rights for individual workers and access for their products to U.S. markets. The Organic Act—the federal legislation establishing the constitution of the new territorial government—also voided all existing and future indentured or penal labor contracts in Hawaii.[10] Liou (2013) shows that plantation wages in Hawaii immediately increased after the Organic Act's ban on penal labor contracts became effective.[11] For single male workers, the change in government and higher wages increased the benefits of settling permanently in Hawaii. Once this decision was made, the next step was to form a family.

High sex ratios for Chinese, Japanese, and Korean males implied a heightened level of competition for brides of the same ethnicity. To find a wife, immigrant workers would either have to offer sufficiently good terms to a woman in Hawaii or pay passage and marriage broker fees to bring a bride from their home country to Hawaii. One aspect of the multi-margin marriage contract that could be affected by high sex ratios is resource allocation within the household to sons and daughters. Competition for brides is more likely to affect this when there are differences in preferences between males and females regarding such allocation.

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[10] The Organic Act. An Act to Provide a Government for the Territory of Hawaii. Act of April 30, 1900, C 339, 31 Stat 141. Section 10 voids labor contracts that hold persons in "service for a definite term":

> "That all contracts made since August twelfth, eighteen hundred and ninety-eight, by which persons are held for service for a definite term, are hereby declared null and void and terminated, and no law shall be passed to enforce said contracts in any way; and it shall be the duty of the United States marshal to at once notify such persons so held of the termination of their contracts."

[11] Naidu and Yuchtman (2013) specify a model of a labor market with penal sanctions for breach of contract and show that elimination of the penal sanction is associated with a higher wage. They study the 1875 repeal of Britain's Master and Servant law and their econometric estimates reveal positive and statistically significant effects of repeal on wages (pp. 135-141).

In the context of a collective model of household resource allocation, women whose ethnicities are characterized by high sex ratios could enter marriages on more favorable terms, which may have included allowing them to assert their preferences more strongly.[12] In both cases, more household resources would be allocated to girls. From the perspective of labor supply in the collective household, this means that mothers work less and spend more time with their daughters.[13] This article tests this proposition by examining how the gender composition of a couple's children affects labor force participation by both parents.

4. Sex Ratios in Hawaii and Marriage Rates, 1900-1920

How did Hawaii's high sex ratios affect the marriage rate and the characteristics of married couples? Sex ratios for ethnic populations ages 18-35 in Hawaii (Table 3) were inversely related to male marriage rates (Table 4) in each of the four census samples. For example, in 1910, the three ethnic groups with the highest sex ratios for persons ages 18-35—White, Japanese and Chinese—also had the three lowest male marriage rates: Japanese (34 percent), Chinese (33 percent) and White (26 percent). Not surprisingly, female marriage rates were much higher than male marriage rates and were positively correlated with sex ratios. For example, Japanese had the second highest sex

[12] An alternative to the case described above is a screening explanation: The tight Hawaii marriage market screens out males with strong son preferences, allowing only males with weak or neutral son preferences to marry.

[13] From a slightly different perspective, Grossbard-Schechtman (1984) argued that an increase in sex ratios increases the demand for wives' spousal labor, thereby increasing the shadow wage for home production and reducing work outside the home. Because this decision decreases household income, a general equilibrium solution could involve the husband working more hours or participating in the labor force when he otherwise would not.

ratio (ages 18-35) in 1910 and the highest female marriage rate, while Hawaiians had the lowest sex ratio (ages 18-35) and the second lowest female marriage rate.

One might conjecture that Hawaii's high ethnic sex ratios would result in high rates of exogamy due to the low odds faced by males of finding a spouse of the same ethnicity. Table 5 shows ethnic marriage matrices for the four census samples, with the number of endogamous marriages displayed on the diagonal. The vast majority of marriages observed in 1900—92 percent, in 1910—96 percent, and in 1920—93 percent, were endogamous, i.e., marriages to a person of the same ethnicity. One explanation for the high rates of endogamy in 1900 and 1910 is that with the exceptions of Native Hawaiians, sex ratios for all ethnic groups were relatively high, with relatively fewer brides to go around; brides from scarce ethnic groups were easily matched with men from the same ethnic group. Native Hawaiians who had the lowest sex ratio and the highest relative supply of women, also had the highest rates of exogamy among females. If a Caucasian, Portuguese, Japanese or Chinese male married a woman of another ethnicity, it was usually a Native Hawaiian woman.

Endogamous marriages declined sharply between 1910 and 1930, registering at just 82 percent of marriages in 1930.[14] Embedded in this decline are endogamy rates for Japanese men and women exceeding 99 percent. This is primarily due to the large number of Japanese picture brides matched with Japanese plantation workers between 1908 and 1924. If we remove marriages involving Japanese men and women from the 1930 sample, the endogamy rate for marriages involving any other ethnic group falls to

[14] The decline in endogamy is very similar if we combine Portuguese and White into a single ethnic group: 97 percent in 1900, 97 percent in 1910, 95 percent in 1920, and 84 percent in 1930.

67 percent. Portuguese, Chinese, and Hawaiian women and Chinese and White men had the highest rates of exogamy in 1930.

5. Gainful Employment in the Hawaii Territorial Censuses

Our paper uses samples drawn by the Integrated Public Use Microdata (IPUMS) project from the first four Territorial Censuses of Hawaii: 1900, 1910, 1920, and 1930 (Ruggles *et al.*, 2010). The samples vary in size due to increases in the Hawaii population over the four census samples and variations in the percent of observations drawn from each census: 20 percent in 1900, five percent in 1910, one percent in 1920, and five percent in 1930. We estimate all regressions using a subset of observations (i.e., married couples both with and without children) for each census sample and this further reduces the sample size. For some regressions, observations from each sample year are weighted by the percentage of households drawn by IPUMS from the census for a particular year. We report both weighted and unweighted regression results.

We use the binary (yes/no) response to the following territorial census question as the dependent variable for our labor force participation regressions: Do you have an occupation? After consulting with a somewhat detailed set of rules concerning the response, the census taker could accept the response and classify the person as a "gainful worker," ask clarifying questions to place the person's response into a more specific category, or not accept the worker's response as an occupation under census rules, e.g. homemaker and student were not accepted and nor was the occupation given by a long retired person.

It is, however, far from clear that the answer to the "occupation" question would be the same as the answer elicited from the three modern questions that determine

whether you are classified as in the labor force. The Current Population Survey asks a sample of the non-institutional population over the age of 16: Were you employed at all in the current survey week; if no, have you looked for work in the last 4 weeks; and are you currently available for work?[15]

Goldin (1986) argued that the gainful worker question systematically omitted women working in three sectors: family agriculture, manufacturing, and boardinghouse keepers. After accounting for these omissions, Goldin estimated that the labor force participation rate for married women in 1890 would increase from 4.6 percent to between 12.3 and 14 percent. Abel and Folbre (1990) examined manuscript census returns for two small Massachusetts towns and calculated that adjustments to the data to reflect Goldin's concerns would raise married women's labor force participation rates from 10.1 to 47.3 percent in one town and from 9.9 to 68.2 percent in the other.[16] Carter's (2006, pp. 14-15) survey of the literature on the correspondence of these two concepts concluded that scholars "have achieved widespread agreement on three points. First, the gainful worker and the labor force concepts would have yielded similar statistics for prime-age males had both questions been asked at the same time. Second, the gainful worker and labor force concepts produce different estimates for youthful and older males and for females of all ages. This is because when the census asked about occupations, it did not indicate the period of time for which the question of occupation pertained." Third, "instructions to enumerators … were generally consistent from one census to the next, except in the case

[15] See http://www.bls.gov/bls/empsitquickguide.htm for 2013 questions.

[16] Carter and Sutch (1996) examined the original enumerations of the 1880 Census and found that census takers frequently did not categorize women who had reported that they were housekeepers (defined as keeping house for pay) as gainfully employed.

of the 1910 Census. In that year, the census included special instructions to enumerators that substantially raised the gainful worker rates of children and women—especially black women—relative to reports for the previous and following censuses. … The special entreaties to enumerators also reduced the recorded labor force participation rates of older men."

How important are these considerations for the Hawaii territorial census samples? First, family farms are less important in Hawaii than on the U.S. mainland as most agricultural output was produced on plantations. There is, however, considerable evidence that a substantial percentage of Japanese field workers at sugar plantations were accompanied on most days by their unpaid wives who specialized in particular types of field tasks. If a wife worked more than 15 unpaid hours, the rationale for including her in the labor force is the same as for a family farm.[17]

Second, social historians have reported that married women often took boarders into their households and provided them and other single male plantation workers with a variety of household services, such as shirt making, meals, and hot baths. In part, this was due to the lack of opportunities for married women living on plantations located in isolated rural areas. Thus we expect that omission of this category will bias measures of married female labor force participation downwards in all three Hawaii censuses.

Third, were Hawaii enumerators also supplied with the special 1910 instructions regarding the gainful employment? Unfortunately, we do not know. We note, however,

[17] After the 1909 sugar strike, the sugar plantation owners reorganized production to provide greater incentives to individual workers. Many were assigned particular plots of land. Some tasks, e.g., planting, burning, and harvesting, were done by company teams, while others, e.g., weeding, were done by the worker and his family. Worker compensation was primarily based on the output of sugar on the assigned plot and the price realized from sale of the sugar to California and east coast refiners.

that the Hawaii data on gainful employment of married women exhibit the same spike in 1910 as the mainland data. The spike could, of course, be due to Hawaii-specific factors affecting labor force participation but is nonetheless suggestive.

This study is possible because the first territorial censuses used a relatively detailed ethnicity variable that placed individuals into specific ethnic categories based on country of origin.[18] For our purposes, this is particularly important, because immigrants (or their descendants) from five countries—the Philippines, Korea, China, Japan, and Portugal—accounted for over 75 percent of the population in each of the three census years. We aggregate residents with Caucasian backgrounds into a "White" variable and aggregate full Hawaiian and part Hawaiian residents into a "Hawaiian" category.

Our counts of daughters and sons only account for a couple's children (ages 0-18) who are living in the household. If some reside elsewhere on a semi-permanent basis, either because the parents cannot take care of them or other families have adopted them, then the number of sons and daughters in residence is probably the desired variable for our regression analysis of labor force participation. On the other hand, if the child is living at another residence temporarily (e.g. with an Auntie in Honolulu who lives close to the child's private or public school), then the measure of daughters and sons in residence does not adequately reflect the ongoing influence on the household of the children living elsewhere on parental decisions.

Table 6 breaks down LFP in Hawaii by gender and age across the four census years. The opposing trends for male and female teenagers are notable. Male teenager

[18] Beginning with the 1940 census of population, the U.S. Census Bureau offered only an "Asian" box for immigrants from any Asian countries to select. Analysis of census samples beyond 1930 is difficult, as the IPUMS one percent U.S. census samples for 1940 and 1950 do not include data from Hawaii and Alaska.

(16-18) LFP has a negative trend, falling from 78 percent in 1900 to 73 percent in 1910, 60 percent in 1920, and 46 percent in 1930. At the same time female teenager LFP increased from 15 percent in 1900 to 23 percent in 1910, 47 percent in 1920, and 26 percent in 1930. The falling male teenage participation rates could be partly due to increases in school enrollment. Enrollment of 16-17 ages (male and female) increased from 35.9 percent in 1910 to 40.1 percent in 1920 and 51.4 percent in 1930, while enrollment of 18-19 ages (male and female) increased from 13.9 percent in 1910 to 16.4 percent in 1920 and 21.3 percent in 1930 (Schmitt, 1977, Table 9.8).

Younger male (19-34) LFP was very high in 1900 and 1910 (97 percent) and fell slightly in 1920 and 1930 to 95 percent. Younger female LFP did not change much over the four census years, increasing from 23 percent in 1900 to 24 percent in 1920 and 1930. (See earlier discussion in this section of the 1920 spikes in LFP.) Mirroring U.S. trends in female LFP for this period (Goldin, 2006), older female (35-60) LFP rose from 12 percent in 1900 to 17 percent in 1920 and 18 percent in 1930.[19]

6. Children and Picture Brides in the Hawaii Census Samples

Table 7 presents a breakdown of the average number of children ages 0-18 living with married women ages 18 to 40. For two groups—White and Portuguese, the average number of children declines between 1910 and 1930, while for Puerto Ricans, the

[19] In 1900, the majority of Hawaii's population was employed on large sugar and pineapple plantations in rural areas or on small privately owned farms producing traditional native products. Female labor force participation in 1900 largely reflected the opportunities available to rural women married to Hawaii plantation workers. While blue collar jobs in the sugar processing factories on Hawaii's plantations were largely closed to women, a change in the contracting system used by most Hawaii plantations after the 1909 sugar plantation strike provided more opportunities for wives to work alongside their husbands in the fields. Sugar plantations began to provide male household heads with a land allocation and instituted a compensation system that tied their wages to sugar output on their parcel and the wholesale price of sugar in San Francisco.

average number declines between 1910 and 1920, the only two years in which Puerto Ricans are identified in the census.[20] By contrast the average number of children living with Hawaiian mothers is relatively low over the 1900-1920 period (1.82-1.92 children) but jumps to 2.65 in the 1930 census. Even more striking is the growth in the number of children per married Japanese woman over the 1900-1930 period, from 0.60 children in 1900 to 3.08 in 1930. The number of children per married Chinese woman rises from 2.56 children in 1900 to 3.66 in 1910 and 4.12 in 1920, before falling back to 3.34 children in 1930. While there are some positive and some negative trends for individual ethnic groups, there is a strong positive trend for the full sample, with the number of children per married couple rising from 1.54 in 1900 to 2.76 in 1930.

We develop eight variables to count the number of sons and number of daughters in four discrete age intervals—0-1, 2-5, 6-10, and 11-18—who resided with both parents. This enables us to analyze how parental LFP decisions may be related to the presence of sons and daughters and to specific phases in their development.

Table 8 provides estimates of the percent of Japanese and Korean wives who were picture brides in the 1920 and 1930 census samples. Since the IPUMS census samples for Hawaii do not contain a direct measure identifying a woman as a picture bride, we develop three alternative algorithms to identify a picture bride, each of which is based on a combination of individual variables available in the IPUMs samples. The first defines a Japanese picture bride as a married Japanese women who migrated to Hawaii between 1908 and 1924 and was between 18 and 25 years of age at migration (Definition 1). The second (Definition 2) does not place any restrictions on age at migration, and the third

[20] For Puerto Ricans, this may be due to arrival in Hawaii within a limited time period (1901-1902) as well as grown-up children leaving the household prior to the 1910 and 1920 censuses.

(Definition 3) sets the age at migration between 18 and 35. The three algorithms used to identify Korean picture brides are identical except the immigration period is set from 1910 to 1924.

7. Sons, Daughters, Sex Ratios, and Parental Labor Force Participation

We use the linear probability model to estimate several specifications of labor force participation (LFP) regressions for married women and, separately, for married men. Census samples of married women are restricted to women below the age of 40 and census samples of married men are restricted to men below the age of 40. Both census samples include married men and women without children. We confine the census samples to married couples as our focus is on estimating the effects of sons and daughters on LFP in the context of a collective model of household resource allocation in which choices by two spouses are assumed to be Pareto-efficient. Households without two marriage partners did not face this coordination problem, and the unmarried household head's LFP decisions were likely driven by others variables not considered in our econometric model.

We estimate separate regressions for LFP of married men and married women for each of the four census samples and a pooled census sample. All regressions using a pooled census sample include a census year binary variable. They are run with and without two binary variables for the wife's ethnicity and the husband's ethnicity and two binary variables identifying a Japanese or Korean married woman as a picture bride.

From the perspective of the collective model of household resource allocation, how would being a picture bride have affected the LFP decisions of a Japanese or Korean woman? Starting from the central assumption of the collective model—that decisions

made within the household are Pareto optimal, we hypothesize that various aspects of the marriage contract would be tilted towards picture brides, with adjustments including less LFP. Considerations on both sides of the market support this hypothesis. The Japanese and Korean males in Hawaii who turned to the overseas market for brides had earlier been unable to match with potential brides in Hawaii, and their decision to participate in the overseas market provided a signal that they were unlikely to be ideal marriage matches. From the perspectives of the bride and her family, a decision to marry an unknown male working as a common laborer on a sugar plantation many thousands of miles from home was very risky. While picture brides were typically from poor agricultural families living in poor regions of Japan, they still could have demanded that marriage margins be tilted more to the bride to compensate them for the low expected quality of the marriage and for the risk.[21]

Table 9 reports results from OLS regressions on LFP of married women using each of the four census samples and a pooled census sample. Our first four specifications (Table 9, columns 1-4) are run using data from each of the four Hawaii census samples. The estimated coefficient on *Age* is positive in each of the census regressions but is statistically significant only in the 1910 and 1930 samples. All but one of the estimated coefficients on the *Number of Sons* variables are negative, eleven of the 16 estimated coefficients are statistically significant at the five percent level, and one is statistically significant at the ten percent level. Three of the four statistically insignificant

[21] The discussion in the text emphasizes *ex ante* competition in the marriage market. Once they had arrived in Hawaii, brides were vulnerable to *ex post* opportunistic behavior by their spouses. Most did not have the resources to return to Japan if they were unhappy with their husbands; they did not have close or distant relatives in Hawaii; and they were more isolated than other wives in Hawaii due to the concentration of Japanese workers in rural Hawaii sugar plantations at the turn of the century. See Mitsugnaga (1984) for a discussion of violence against Japanese brides during the 1895-1905 period.

estimated coefficients are for the 1920 sample, which is much smaller (N_{1920}=309) than the other three samples (N_{1900}=3651, N_{1910}=4390, N_{1930}=1689). Estimated coefficients for each of the *Number of Son* variables tend to be largest for the 0-1 age interval, reflecting a 4.71 to 12.76 percent decline in mother's LFP, to be smaller (except in 1930) for the 2-5 age interval (-5.27 to -7.47 percent), to decline further for the 6-10 age interval (-3.85 to 1.34 percent), and to increase (except in 1920) for the 11-18 age interval (-0.9 to -8.85 percent).

The signs, magnitudes, and statistical significance of estimated coefficients on the *Number of Daughters* variables are very similar to those on the *Number of Sons* variables. All but one of the estimated coefficients on the *Number of Daughters* variables are negative, eleven of the 16 estimated coefficients are statistically significant at the five percent level, and one is statistically significant at the ten percent level. Magnitudes of the estimated coefficients again tend to decline from the 1900 to the 1930 census, to be largest for the 0-1 age interval, reflecting a 7.85 to 11.55 percent decline in mother's LFP, to be smaller for the 2-5 age interval (-5.08 to -7.40 percent), to decline further for the 6-10 age interval (-3.55 to 3.01 percent), and to increase (except in 1930) for the 11-18 age interval (-0.99 to -8.85 percent). *F*-tests cannot reject at the ten percent level of statistical significance the null hypothesis that the estimated coefficients on corresponding sons and daughters variables within each census are equal. We note, however, that the hypothesis that the estimated coefficients on the Number of Sons (-4.71) and Number of Daughters (-7.85) variables for the 0-1 age interval in 1930 are equal has a *p*-value of 0.1179.

The next four specifications (Table 9, columns 5-8) are estimated with the pooled sample. The first specification (column 5) is the same used in earlier regressions for single census years. The estimated coefficient on *Age* is positive and statistically significant at the one percent level. All estimated coefficients on *Number of Daughters* and *Number of Sons* variables are negative and statistically significant at the one percent level. The same patterns found in results for individual census years also appear in results from the pooled sample: Declines in the magnitude of estimated coefficients from the 0-1 age interval to the 6-10 age interval and an increase in magnitude for the 11-18 age interval. The pattern of estimated coefficients on *Numbers of Daughters* and *Number of Sons* persists in the next three specifications (columns 6-8) when we add variables to control for the married woman's ethnicity, her husband's ethnicity (columns 6-8), and picture bride status (columns 7-8).[22] *F*-tests cannot reject at the ten percent level of statistical significance the null hypothesis that the estimated coefficients on the corresponding sons and daughters variables within each census are equal.

To identify the effect of ethnicity on married women LFP, we included binary variables for wife ethnicity and husband ethnicity in all pooled regressions. Estimated coefficients for wife ethnicity and husband ethnicity vary little across the three pooled specifications, so we focus primarily on the specification reported in column 7 which uses "Definition 1" versions of *Korean Picture Bride* and *Japanese Picture Bride* variables. Consider an endogamous Portuguese marriage: The estimated coefficient for *Portuguese Wife* is negative (-4.03) and statistically significant, a result consistent with

[22] All estimated coefficients on *Number of Sons* and *Number of Daughters* variables are negative, with 10 of 12 estimated coefficients on *Number of Sons* statistically significant at the five percent level and 12 of 12 estimated coefficients on *Number of Daughters* statistically significant at the five percent level.

the Portuguese being a low sex-ratio group. The estimated coefficient on *Portuguese Husband* is positive (2.76), and the net effect on LFP of an endogamous marriage is a -1.27 percent change in wife's LFP. An exogamous marriage of a Portuguese women with a White male, would yield a bigger net effect, as White is the base group in the regression and the net effect on LFP would be -4.03 percent.

Consider now married women from another low sex-ratio group, native Hawaiians. The estimated coefficient on *Hawaiian Wife* is negative (-6.07) and statistically significant, a result consistent with Hawaiians being a low sex ratio group. Regardless of whether her marriage was with a *Hawaiian Husband* (0.96) or a *Portuguese Husband* (2.76) or a *White* Husband, the net effect on a married Hawaiian woman's LFP was negative, ranging from -6.07 to -3.31 percent.

Consider now married women from a group with high sex ratios in 1900 and 1910, the Japanese.[23] The estimated coefficients on *Japanese Wife* (columns 6-8) stand out from the other ethnicity coefficients for their positive sign and size, ranging from 19.79 to 21.07. The size of these effects is much larger than those for other ethnic groups and they are not offset by negative coefficients on *Japanese Husband*, which is also statistically insignificant in all three specifications. The higher LFP of Japanese wives is likely to be due to cultural traditions in rural Southern Japan in which Japanese wives work with their husbands in the fields. However, Japanese wives who are also picture brides participate in the labor force much less than native-born wives or wives who immigrated to Hawaii before the picture bride era (1908-1924). The estimated coefficient on Japanese Picture Bride (Definition 1) is -12.80 and statistically significant at the one percent level (column 7) while the estimated coefficient on Japanese Picture

[23] A similar analysis holds for endogamous Korean couples and Korean picture brides.

Bride (Definition 2) is -15.17 and statistically significant at the one percent level (column 8). The net effect on LFP for Japanese picture brides is 7.88 for Definition 1 and 5.90 for Definition 2. These results are consistent with our earlier analysis of picture brides' LFP which suggests that the *ex ante* terms of their marriages would need to be adjusted for them to marry unknown men working on sugar plantations in a distant land (p. 21).

Table 10 reports results from weighted regressions for the same specifications reported in Table 9, columns 6-8. The weight on observation *i* from census *j* is equal to the inverse probability of sampling observation *i* from census *j*. The broad pattern of results for the *Number of Sons* and *Number of Daughters* variables is similar to the pattern reported for the unweighted regressions: All of the estimated coefficients are negative, the largest estimated coefficients are for the 0-1 and 2-5 age intervals, and 15 of 24 estimated coefficients are statistically significant at the five percent level. One difference from the unweighted results is that none of the estimated coefficients for the 11-18 age interval variables are statistically significant. F-tests cannot reject the hypothesis that estimated coefficients on sons and daughters variables within the 0-1 age interval and the 2-5 age interval are equal.[24] However, F-tests reject the hypothesis that the estimated coefficients on the son and daughter variables for the 6-10 age interval are equal.[25] For the 6-10 age interval, the LFP response by married women to a daughter is larger than their response to a son.

Estimated coefficients for wife and husband ethnicity are very similar to those in the pooled unweighted regressions (Table 9, columns 6-8) but for three exceptions: The

[24] For the three specifications, *p*-values for the 0-1 age interval range from 0.24 to 0.25 and for the 2-5 age interval from 0.86 to 0.90

[25] For the three specifications, *p*-values for the 6-10 age interval range from 0.06 to 0.07.

estimated coefficients on *Portuguese Wife* are statistically significant in just one of three specifications (Table 10, column 3); the estimated coefficients on *Japanese Picture Bride* (Table 10, columns 2 and 3) are only about one-third as large as their counterparts in the unweighted pooled regressions; and the estimated coefficient on *Japanese Picture Bride* loses statistical significance in the specification (column 2) using the "Definition 1" variable.

Table 11 reports results from OLS regressions on LFP of married men using each of the four census samples (columns 1-4), a pooled census sample (columns 5-6), and a weighted pooled census sample (columns 7-8). The estimated coefficient on *Age* is negative and statistically significant in the 1900 sample, but varies in sign and is not statistically significant in the 1910, 1920, and 1930 samples (columns 2-4). It is negative in the pooled regressions (columns 5-8) and becomes statistically significant at the five percent level when ethnicity variables are added to the pooled unweighted (column 6) and pooled weighted specifications (column 8).

Examining results for all eight regression specifications, none of the 32 estimated coefficients on *Number of Daughters* is statistically significant. For the four regressions on individual census years, three of the 16 estimated coefficients on *Number of Sons* are positive and statistically significant at the ten percent level. *F*-tests cannot reject at the ten percent level of statistical significance the null hypothesis that the estimated coefficients on sons and daughters variables are equal with the sole exception of the 0-1 age interval for 1900.[26] Moreover, estimated coefficients for sons and daughters

[26] For the 0-1 age interval for 1900, we note that the estimated coefficients on *Number of Sons* and *Number of Daughters* were both statistically insignificant at the ten percent level.

variables in a regression using a pooled census sample (column 5) are all statistically insignificant.

Regression results change somewhat when wife ethnicity and husband ethnicity are added to weighted and unweighted pooled regressions (columns 6 and 8). In the unweighted specification (column 6), the estimated coefficient on *Number of Sons* for the 11-18 age interval is positive (0.97) and statistically significant at the one percent level. However, an *F*-test cannot reject at the ten percent level of statistical significance the null hypothesis that the estimated coefficients on sons and daughters variables for the 11-18 age interval are equal. In the weighted specification (column 8), estimated coefficients on *Number of Sons* for the 2-5 age interval (0.71), for the 6-10 age interval (0.57), and 11-18 age interval (1.01) are positive (0.97) and statistically significant at least at the ten percent level. An *F*-test rejects at the ten percent level of statistical significance the null hypothesis that the estimated coefficients on sons and daughters variables for the 2-5 age interval are equal.

In the weighted pooled specification (column 8), wife and husband ethnicity variables are generally statistically insignificant, with exceptions noted for *Japanese Wife* (-26.14), *Japanese Husband* (27.16), and *Hawaiian Wife* (-5.04). The *Hawaiian Wife* estimate is inconsistent with the collective household model, as it predicts that the husband of a wife from a low sex-ratio group—Hawaiians—would work more.[27] For an endogamous Japanese marriage, the sum of the two Japanese ethnicity variables (1.02) is

[27] Adult Hawaiian males generally did not work on sugar plantations but rather had urban occupations or worked on family farms in traditional agriculture.

more consistent with the collective household model, as it predicts that males from a high sex-ratio group would work more to attract a bride from the same ethnic group.[28]

7. Conclusion

Our econometric analysis was conducted on a measure of labor force participation that is somewhat crude, particularly for married women. This is, however, necessarily the case for studies of labor force participation in the 1900-1930 period that analyze U.S. or Hawaii census data, as it is the best measure of LFP for this period. Despite the noisy dependent variable, our regression results on LFP of married men and women in Hawaii during the 1900-1930 are broadly in accord with the predictions of the collective model of household resource allocation. Our analysis of the 1900-1930 Hawaii territorial censuses showed that married women's LFP declined as the household added both sons and daughters and that her LFP response was, in some cases, larger for daughters than sons. Regression results for both weighted and unweighted pooled census samples revealed that women from two low sex-ratio ethnic groups—Portuguese and Hawaiian—tended, as predicted by the collective household model, to participate less in the labor force. In addition, we found some evidence supporting the proposition that Japanese and Korean picture brides had lower LFP rates than other Japanese and Korean wives.

Most of our econometric results are consistent with the proposition that women from low-sex ratio groups in Hawaii were able to enter marriages in which the terms of the marriage contract were tilted towards particular features favored by the women. We have posited that additional resource allocation to daughters may have been one of those features, and our regression results provide evidence that the declines in married

[28] Japanese sex-ratios are very high in 1900 and 1910 but are much closer to one in 1920 and 1930 (Table 3).

women's LFP were larger in the presence of a daughter than a son for some age intervals. One result, the positive and large estimated coefficients on *Japanese Wife* in married women's LFP regressions, is inconsistent with the collective household model, as Japanese women are from a high sex-ratio group. We posit, however, that a feature of culture in Southern Japan—a tradition of Japanese women working with the husband in the field—is likely to be responsible for the higher LFP of Japanese women.

Our results differ somewhat from those obtained by Lundberg and Rose (2002) who compare the labor supply responses of two cohorts of U.S. men and women (born before or in 1950 and born after 1950) to additional male and female children. They found that "men work more and/or harder after having sons relative to daughter" and "no evidence that children's gender affects women's hourly wages and no evidence of an effect on labor supply" (p. 261). By contrast, we found differential responses of male labor supply in response to sons and female labor supply in response to daughters. Comparability of the studies is, however, by their very nature very limited, as our study looks at the *extensive* margin of labor force participation whereas Lundberg and Rose's econometric analysis is focused on *intensive* margins of wages and hours.

In this article, we have emphasized how variations in sex ratios could lead to adjustment of various features of *ex ante* marriage contracts, thereby allowing female preferences for additional resource allocation to daughters to be realized. Lundberg rightly emphasized the difficulty of separating the effects of son-daughter preferences from other possible explanations for behavioral adjustments that stem from high sex ratios, e.g., fathers may have a "technological" comparative advantage in raising boys; fathers may provide better role models for boys; boys are harder to raise than girls,

prompting fathers to behave altruistically; and there may be differential time costs associated with raising boys.[29] In the context of plantation Hawaii in the early twentieth century, there may well be other explanations lurking behind our regression results. We leave such investigations for future research.

[29] See Lundberg (2005) for a survey of the effects of sons and daughters on parental behavior in the United States and Moretti and Dahl (2008) for an analysis of the demand for sons.

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Table 1: Hawaii's Population Count in Kingdom and Territorial Censuses

Census Date	Hawaii Population	Percent Foreign Born	Percent Children of 1-2 Foreign-Born Parents
1872 Dec. 27	56,897	8.0	7.9
1896 Sept. 27	109,020	52.2	na
1900 June 1	154,001	61.7	16.3
1910 April 15	191,874	54.9	26.5
1920 Jan. 1	255,881	46.7	35.0
1930 April 1	368,300	41.8	37.5

Sources: Hawaii Population from Schmitt (1977), Table 1.2; Percent Foreign Born from Schmitt (1977), Table 3.1; Percent Children of Foreign-Born Parents from Schmitt (1977), Tables 1.2, 3.1, and 3.2.

Table 2: Ethnic Composition (Percent) of Hawaii's Population: 1872-1930

Ethnicity	1872	1900	1910	1920	1930
Hawaiian	86.2	19.3	13.6	9.3	6.1
Part-Hawaiian	4.4	6.4	6.5	7.0	7.7
Japanese	0.0	39.7	41.5	42.7	37.9
Chinese	3.6	16.7	11.3	9.2	7.4
Caucasian	4.4	5.5	7.7	7.7	12.2
Portuguese	0.7	11.9	11.6	10.6	7.5
Korean	0.0	0.0	2.4	1.9	1.8
Filipino	0.0	0.0	1.2	8.2	17.1
Puerto-Rican	0.0	0.0	2.5	2.2	1.8
Spanish	0.0	0.0	1.0	0.9	0.3
Other	0.7	0.4	0.6	0.3	0.2
Total Population	56,897	154,001	191,909	255,912	368,336

Source: Schmitt (1977), Table 1.12.

Table 3: Sex Ratios in the IPUMS Samples of Hawaii Population by Ethnicity and Year, 1900, 1910, and 1920

All ages	1900	1910	1920	1930
White	1.33	1.70	1.86	2.23
Portuguese	1.56	1.13	1.04	1.00
Puerto Rican	-	1.50	1.44	-
Chinese	6.14	3.76	3.00	1.38
Japanese	3.35	2.33	1.27	1.13
Filipino	-	-	3.55	4.56
Korean	-	-	1.86	1.63
Hawaiian	1.13	1.13	1.27	0.92

Over 18	1900	1910	1920	1930
White	1.24	2.13	2.03	2.85
Portuguese	2.33	1.22	1.00	1.08
Puerto Rican	-	2.03	1.00	-
Chinese	11.50	8.10	5.25	1.86
Japanese	4.00	3.17	1.50	1.33
Filipino	-	-	6.14	9.00
Korean	-	-	2.85	2.45
Hawaiian	1.17	1.13	1.13	0.89

Between 18 & 35	1900	1910	1920	1930
White	1.50	2.13	2.23	4.26
Portuguese	2.03	1.22	0.85	0.96
Puerto Rican	-	2.23	0.49	-
Chinese	9.00	4.00	2.57	1.22
Japanese	3.55	2.70	0.82	0.96
Filipino	-	-	6.14	9.00
Korean	-	-	0.33	0.56
Hawaiian	1.00	1.04	0.75	0.79

Source: IPUMS samples for 1900, 1910, 1920 and 1930 Territorial Censuses of Hawaii. In 1930, the U.S. Census coded Puerto Ricans as "White" rather than a separate ethnic category.

Table 4: Marriage Rates by Ethnicity and Age

Ages [16-18)	1900		1910		1920		1930	
	Males	Females	Males	Females	Males	Females	Males	Females
White	0.00	0.21	0.00	0.12	0.00	0.00	0.00	0.14
Portuguese	0.00	0.22	0.00	0.14	0.00	0.33	0.02	0.08
Puerto Rican	-	-	0.00	0.75	0.00	-	-	-
Chinese	0.01	0.20	0.00	0.20	0.00	0.00	0.00	0.00
Japanese	0.01	0.47	0.01	0.20	0.00	0.13	0.00	0.02
Filipino	-	-	-	-	0.00	1.00	0.00	0.67
Korean	-	-	-	-	0.00	0.00	0.00	0.00
Hawaiian	0.05	0.24	0.01	0.15	0.00	0.25	0.05	0.15

Ages [18-35]	1900		1910		1920		1930	
	Males	Females	Males	Females	Males	Females	Males	Females
White	0.30	0.74	0.26	0.63	0.27	0.54	0.16	0.71
Portuguese	0.64	0.86	0.54	0.82	0.32	0.72	0.47	0.68
Puerto Rican	-	-	0.46	0.89	0.50	1.00	-	-
Chinese	0.20	0.95	0.33	0.84	0.29	0.75	0.35	0.57
Japanese	0.30	0.97	0.34	0.96	0.59	0.85	0.41	0.71
Filipino	-	-	-	-	0.28	1.00	0.32	0.93
Korean	-	-	-	-	1.00	1.00	0.56	0.93
Hawaiian	0.51	0.74	0.50	0.78	0.63	0.88	0.56	0.73

Ages (35-65]	1900		1910		1920		1930	
	Males	Females	Males	Females	Males	Females	Males	Females
White	0.65	0.81	0.65	0.60	0.85	0.96	0.67	0.65
Portuguese	0.89	0.89	0.86	0.84	0.78	0.77	0.78	0.80
Puerto Rican	-	-	0.56	0.71	0.88	0.75	-	-
Chinese	0.36	0.83	0.43	0.88	0.49	0.92	0.56	0.82
Japanese	0.56	0.92	0.63	0.95	0.71	0.96	0.76	0.87
Filipino	-	-	-	-	0.33	1.00	0.53	0.91
Korean	-	-	-	-	0.42	1.00	0.41	0.72
Hawaiian	0.63	0.72	0.67	0.72	0.66	0.91	0.67	0.74

Source: IPUMS samples for 1900, 1910, 1920 and 1930 Territorial Censuses of Hawaii.

Table 5: Marriage Matrices: 1900, 1910, 1920, and 1930

1900

Wife\Husband	White	Portuguese	Chinese	Japanese	Hawaiian
White	464	207	4	2	6
Portuguese	1	235	0	0	0
Chinese	0	0	267	1	0
Japanese	0	0	1	1964	2
Hawaiian	48	6	38	8	862

1910

Wife\Husband	White	Portuguese	P-R	Chinese	Japanese	Hawaiian
White	424	4	2	0	0	1
Portuguese	38	735	4	3	3	2
Puerto Rican	4	0	155	3	1	0
Chinese	1	0	0	294	0	0
Japanese	3	1	0	2	2572	1
Hawaiian	41	12	1	75	10	735

1920

Wife\Husband	White	Portuguese	P- R	Chinese	Japanese	Filipino	Korean	Hawaiian
White	33	0	0	0	0	0	0	0
Portuguese	7	35	1	1	0	2	0	1
Puerto Rican	0	0	8	1	0	1	0	0
Chinese	0	0	0	17	0	0	0	0
Japanese	2	0	0	0	208	0	0	0
Filipino	0	0	0	0	0	19	0	0
Korean	0	0	0	0	0	0	7	0
Hawaiian	2	1	0	7	0	0	1	45

1930

Wife\Husband	White	Portuguese	Chinese	Japanese	Filipino	Korean	Hawaiian
White	273	8	3	1	0	0	1
Portuguese	30	263	5	6	11	1	1
Chinese	4	12	112	1	2	0	2
Japanese	2	1	2	1069	0	0	3
Filipino	2	0	0	0	217	0	0
Korean	0	0	0	0	0	39	0
Hawaiian	15	6	11	0	10	3	119

Source: IPUMS samples for 1900, 1910, 1920 and 1930 Territorial Censuses of Hawaii.

Table 6: Labor Force Participation by Gender, Age, and Year

Age	1900		1910		1920		1930	
	Males	Females	Males	Females	Males	Females	Males	Females
16-18	0.78	0.15	0.73	0.23	0.60	0.47	0.46	0.26
19-34	0.97	0.23	0.97	0.31	0.95	0.24	0.95	0.24
35-60	0.94	0.12	0.97	0.23	0.96	0.17	0.95	0.18
61+	0.76	0.08	0.73	0.07	0.84	0.11	0.60	0.07

Source: IPUMS samples of Territorial Census of Hawaii, 1900, 1910, 1920 and 1930.

Table 7: Average Number of Children by Mother's Ethnicity: 1900, 1910, 1920, and 1930

Mother's Ethnicity	1900	1910	1920	1930
White	2.59	1.67	1.45	1.27
Portuguese	3.07	3.07	3.17	3.01
Puerto Rican	-	2.17	1.00	-
Chinese	2.56	3.66	4.12	3.34
Japanese	0.60	1.47	2.20	3.08
Filipino	-	-	3.00	2.22
Korean	-	-	3.00	3.51
Hawaiian	1.82	2.02	1.92	2.65
Full Sample	1.54	1.99	2.24	2.76

Source: Derived from IPUMS Census Samples for 1900, 1910, 1920 and 1930. The table covers children ages 0-18.

Table 8: Summary Statistics for Three Definitions of Picture Brides

	Percentage of Japanese Wives Who Were Picture Brides	Percentage of Korean Wives Who Were Picture Brides
	1920	
Definition 1	29.38%	28.57%
Definition 2	54.03%	28.57%
Definition 3	42.18%	28.57%
	1930	
Definition 1	31.57%	17.95%
Definition 2	52.74%	38.46%
Definition 3	39.37%	19.95%

Table 9: Unweighted Married Female Labor Force Participation Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	0.0002	0.0052***	0.0007	0.0057***	0.0034***	0.0010	0.0011	0.0011
	(0.0011)	(0.0011)	(0.0042)	(0.0016)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Number of Sons								
0-1	-0.1018***	-0.1276***	-0.0662*	-0.0471***	-0.1027***	-0.0854***	-0.0853***	-0.0827***
	(0.0143)	(0.0142)	(0.0384)	(0.0170)	(0.0087)	(0.0086)	(0.0085)	(0.0085)
2-5	-0.0747***	-0.0560***	-0.0533	-0.0527***	-0.0619***	-0.0524***	-0.0517***	-0.0502***
	(0.0093)	(0.0106)	(0.0324)	(0.0114)	(0.0061)	(0.0059)	(0.0060)	(0.0060)
6-10	-0.0385***	-0.0244**	0.0134	-0.0122	-0.0225***	-0.0117**	-0.0091*	-0.0086
	(0.0083)	(0.0110)	(0.0330)	(0.0123)	(0.0064)	(0.0063)	(0.0062)	(0.0062)
11-18	-0.0443***	-0.0885***	-0.0090	-0.0325***	-0.0588***	-0.0197***	-0.0196***	-0.0196***
	(0.0084)	(0.0099)	(0.0400)	(0.0111)	(0.0060)	(0.0058)	(0.0057)	(0.0057)
Number of Daughters								
0-1	-0.1100***	-0.1155***	-0.0747*	-0.0785***	-0.1077***	-0.0993***	-0.0984***	-0.0978***
	(0.0142)	(0.0146)	(0.0426)	(0.0172)	(0.0088)	(0.0086)	(0.0086)	(0.0086)
2-5	-0.0740***	-0.0567***	-0.0655***	-0.0508***	-0.0623***	-0.0513***	-0.0490***	-0.0486***
	(0.0095)	(0.0104)	(0.0298)	(0.0120)	(0.0061)	(0.0061)	(0.0061)	(0.0061)
6-10	-0.0355***	-0.0253**	0.0301	-0.0308	-0.0302***	-0.0151**	-0.0136**	-0.0118**
	(0.0087)	(0.0110)	(0.0266)	(0.0110)	(0.0062)	(0.0061)	(0.0061)	(0.0061)
11-18	-0.0557***	-0.0858***	-0.0324	-0.0099	-0.0536***	-0.0151***	-0.0135**	-0.0122**
	(0.0094)	(0.0094)	(0.0386)	(0.0116)	(0.0059)	(0.0057)	(0.0056)	(0.0056)
Wife Ethnicity								
Other	-	-	-	-	-	-0.0007	-0.0039	-0.0061
						(0.0179)	(0.0178)	(0.0177)
Portuguese	-	-	-	-	-	-0.0364**	-0.0403**	-0.0438***
						(0.0160)	(0.0157)	(0.0156)
Chinese	-	-	-	-	-	0.0185	0.0153	0.0138
						(0.0322)	(0.0319)	(0.0317)
Japanese	-	-	-	-	-	0.1979***	0.2068***	0.2107***
						(0.0523)	(0.0518)	(0.0515)
Hawaiian	-	-	-	-	-	-0.0625***	-0.0607***	-0.0592***
						(0.0178)	(0.0177)	(0.0176)
Korean	-	-	-	-	-	-0.0143	0.0330	0.0308
						(0.0674)	(0.0834)	(0.0913)

Husband Ethnicity								
Other	-	-	-	-	-	0.0320*	0.0285*	0.0253
						(0.0170)	(0.0169)	(0.0168)
Portuguese	-	-	-	-	-	0.0253*	0.0276*	0.0300**
						(0.0153)	(0.0151)	(0.0150)
Chinese	-	-	-	-	-	0.0162	0.0194	0.0208
						(0.0290)	(0.0287)	(0.0285)
Japanese	-	-	-	-	-	0.0615	0.0640	0.0684
						(0.0516)	(0.0510)	(0.0507)
Hawaiian	-	-	-	-	-	0.0076	0.0096	0.0108
						(0.0173)	(0.0172)	(0.0171)
Korean	-	-	-	-	-	0.1498***	0.1251***	0.1045***
						(0.0322)	(0.0326)	(0.0338)
Japanese Picture Bride – Def 1	-	-	-	-	-	-	-0.1280***	-
							(0.0225)	
Korean Picture Bride – Def 1	-	-	-	-	-	-	-0.1731**	-
							(0.0813)	
Japanese Picture Bride – Def 2	-	-	-	-	-	-	-	-0.1517***
								(0.0200)
Korean Picture Bride – Def 2	-	-	-	-	-	-	-	-0.0758
								(0.1169)
p-value on difference in Number of Sons – Number of Daughters estimated coefficients								
0-1	0.6353	0.4815	0.8663	0.1179	0.6298	0.1846	0.1779	0.1462
2-5	0.9617	0.9544	0.7577	0.9029	0.9523	0.8942	0.7392	0.8367
6-10	0.7972	0.9560	0.2145	0.2300	0.3712	0.6950	0.6097	0.7074
Years	1900	1910	1920	1930	All	All	All	All
R^2	0.0807	0.0799	0.0454	0.0590	0.0826	0.1805	0.1831	0.1849
N	3651	4390	309	1698	10048	10048	10048	10048

Note: The table reports OLS regression coefficients. The dependent variable is a dummy variable indicating that the husband is in the labor force. Each observation is a family. We only employ households in which the husband is 40 years or younger. The omitted race category is "White". Census year dummies are included in all pooled estimates. Robust standard errors are reported in parentheses.

* Significance at the 10% level

** Significance at the 5% level

*** Significance at the 1% level

Table 10: Weighted Married Female Labor Force Participation Regressions

	(1)	(2)	(3)
Age	0.0020	0.0019	0.0020
	(0.0013)	(0.0013)	(0.0013)
Number of Sons			
0-1	-0.0715***	-0.0716***	-0.0701***
	(0.0140)	(0.0141)	(0.0141)
2-5	-0.0598***	-0.0585***	-0.0575***
	(0.0102)	(0.0102)	(0.0101)
6-10	-0.0102	-0.0091	-0.0096
	(0.0116)	(0.0116)	(0.0115)
11-18	-0.0150	-0.0157	-0.0162
	(0.0142)	(0.0142)	(0.0143)
Number of Daughters			
0-1	-0.0922***	-0.0927***	-0.0911***
	(0.0148)	(0.0148)	(0.0148)
2-5	-0.0620***	-0.0603***	-0.0596***
	(0.0104)	(0.0104)	(0.0105)
6-10	-0.0338***	-0.0334***	-0.0337***
	(0.0089)	(0.0089)	(0.0089)
11-18	-0.0141	-0.0143	-0.0141
	(0.0118)	(0.0118)	(0.0118)
Wife Ethnicity			
Other	-0.0217	-0.0241	-0.0258
	(0.0299)	(0.0297)	(0.0296)
Portuguese	-0.0447	-0.0475	-0.0504*
	(0.0274)	(0.0273)	(0.0273)
Chinese	0.0211	0.0194	0.0188
	(0.0511)	(0.0510)	(0.0509)
Japanese	0.2255**	0.2350**	0.2394**
	(0.1180)	(0.1157)	(0.1145)
Hawaiian	-0.0688**	-0.0689**	-0.0687**
	(0.0335)	(0.0333)	(0.0332)
Korean	-0.0204	0.0221	0.0084
	(0.0691)	(0.0800)	(0.0809)
Husband Ethnicity			
Other	0.0138	0.0140	0.0132
	(0.0265)	(0.0262)	(0.0261)
Portuguese	0.0281	0.0302	0.0327
	(0.0255)	(0.0253)	(0.0251)
Chinese	0.0192	0.0208	0.0216
	(0.0436)	(0.0435)	(0.0434)
Japanese	-0.0421	-0.0407	-0.0337
	(0.1181)	(0.1153)	(0.1138)
Hawaiian	0.0161	0.0181	0.0196
	(0.0346)	(0.0344)	(0.0343)
Korean	0.0710	0.0662	0.0610
	(0.0513)	(0.0515)	(0.0525)
Japanese Picture Bride – Def 1	-	-0.0457	-
		(0.0351)	
Korean Picture Bride – Def 1	-	-0.1428**	-
		(0.0638)	
Japanese Picture Bride – Def 2	-	-	-0.0597*
			(0.0310)

Korean Picture Bride – Def 2	-	-	-0.0633 (0.0861)
p-value on difference in Number of Sons – Number of Daughters estimated coefficients			
0-1	0.2463	0.2376	0.2403
2-5	0.8639	0.8961	0.8718
6-10	0.0695	0.0632	0.0656
Years	All	All	All
R^2	0.1389	0.1403	0.1410
N	10048	10048	10048

Note: The table reports OLS regression coefficients.
* Significance at the 10% level
** Significance at the 5% level
*** Significance at the 1% level

Table 11: Male Labor Force Participation Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.0015**	0.0003	-0.0023	0.0001	-0.0005	-0.0010***	-0.0008	-0.0011**
	(0.0007)	(0.0004)	(0.0023)	(0.0008)	(0.0003)	(0.0003)	(0.0007)	(0.0005)
Number of Sons								
0-1	0.0086	0.0044	-0.0068	0.0022	0.0041	0.0052	0.0015	0.0019
	(0.0079)	(0.0033)	(0.0207)	(0.0071)	(0.0032)	(0.0032)	(0.0062)	(0.0059)
2-5	-0.0048	0.0013	0.0191*	0.0085*	0.0011	0.0024	0.0070**	0.0071**
	(0.0062)	(0.0026)	(0.0108)	(0.0046)	(0.0025)	(0.0026)	(0.0032)	(0.0031)
6-10	-0.0062	-0.0008	0.0208*	0.0035	-0.0002	0.0017	0.0058*	0.0057*
	(0.0094)	(0.0031)	(0.0116)	(0.0031)	(0.0307)	(0.0031)	(0.0031)	(0.0029)
11-18	0.0111	-0.0008	0.0211	0.0056	0.0038	0.0097***	0.0074**	0.0101***
	(0.0083)	(0.0031)	(0.0131)	(0.0034)	(0.0028)	(0.0029)	(0.0030)	(0.0030)
Number of Daughters								
0-1	-0.0048	0.0010	0.02422	0.0061	-0.0033	-0.0033	0.0061	0.0053
	(0.0102)	(0.0047)	(0.0128)	(0.0063)	(0.0042)	(0.0041)	(0.0043)	(0.0041)
2-5	0.0018	-0.0005	-0.0022	-0.0010	-0.0007	-0.0002	-0.0022	-0.0026
	(0.0071)	(0.0031)	(0.0123)	(0.0062)	(0.0028)	(0.0028)	(0.0043)	(0.0039)
6-10	0.0021	-0.0011	-0.0067	-0.0001	0.0002	0.0022	-0.0009	-0.0007
	(0.0082)	(0.0036)	(0.0193)	(0.0046)	(0.0031)	(0.0305)	(0.0052)	(0.0053)
11-18	-0.0236	-0.0011	-0.0059	0.0040	-0.0130	-0.0069	-0.0063	-0.0025
	(0.0122)	(0.0036)	(0.0186)	(0.0053)	(0.0055)	(0.0056)	(0.0061)	(0.0066)
Wife Ethnicity								
Other	-	-	-	-	-	-0.0039	-	-0.0328
						(0.0120)		(0.0280)
Portuguese	-	-	-	-	-	-0.0073	-	-0.0490
						(0.0133)		(0.0430)
Chinese	-	-	-	-	-	0.0024	-	-0.0270
						(0.0186)		(0.0354)
Japanese	-	-	-	-	-	-0.0798*	-	-0.2614*
						(0.0422)		(0.1562)
Hawaiian	-	-	-	-	-	-0.0286**	-	-0.0504*
						(0.0144)		(0.0280)
Korean	-	-	-	-	-	0.0127**	-	0.0125
						(0.0062)		(0.0077)

Husband Ethnicity								
Other	-	-	-	-	-	-0.0116	-	0.0190
						(0.0126)		(0.0317)
Portuguese	-	-	-	-	-	-0.0023	-	0.0413
						(0.0131)		(0.0412)
Chinese	-	-	-	-	-	0.0053	-	0.0302
						(0.0184)		(0.0378)
Japanese	-	-	-	-	-	0.0911**	-	0.2716*
						(0.0423)		(0.1580)
Hawaiian	-	-	-	-	-	-0.0071	-	0.0264
						(0.0151)		(0.0322)
Korean	-	-	-	-	-	-	-	
p-value on difference in Number of Sons – Number of Daughters estimated coefficients								
0-1	0.0439	0.5120	0.1990	0.5636	0.1182	0.0689	0.5079	0.6222
2-5	0.5054	0.5754	0.2190	0.2369	0.6260	0.4904	0.1096	0.0835
6-10	0.5229	0.9534	0.2831	0.5059	0.9213	0.9216	0.2721	0.3014
Years	1900	1910	1920	1930	All	All	All	All
Weights	No	No	No	No	No	No	Yes	Yes
R^2	0.0076	0.0050	0.0268	0.0052	0.0074	0.0237		
N	3107	4390	216	1199	7989	7989	7989	7989

Note: The table reports OLS regression coefficients in columns 1-6 and WLS coefficients in columns 7-8. The dependent variable is a dummy variable indicating that the husband is in the labor force. Each observation is a family. We only employ households in which the husband is 40 years or younger. The omitted race category is "White." Census year dummies are included in all pooled estimates. Robust standard errors are reported in parentheses.

* Significance at the 10% level

** Significance at the 5% level

*** Significance at the 1% level