

Hypergamy, Cross-boundary Marriages, and Family Behavior*

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Abstract

In this paper, we study cross-boundary marriages. We characterize the assignment profiles and utility shares in a simple two-marriage-market model with cross-boundary marriage costs. Because of gender asymmetry in evaluating individual attributes in the marriage market, more men from rich regions marry women from poor regions than the opposite match, displaying a geographic manifestation of hypergamy. With a decrease in cross-boundary marriage costs, the increase in gender-asymmetric cross-boundary marriages erodes the relative position of women in rich regions not only in the marriage market but also within the household. This theoretical prediction is supported by our empirical analysis based on the cross-boundary marriages between mainland China and Hong Kong (HK). Using the quasi-experiments brought about by the 1997 handover of HK to mainland China and the discrete quota changes of the one-way permit, we find that HK women's position in the marriage market has weakened, HK women work more, and more HK women than men migrate to North America.

JEL classification: F22, J11, J12

Key words: One-way permit, hypergamy, cross-boundary marriage, family behavior

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1 Introduction

In this paper, we theoretically and empirically analyze cross-national or cross-boundary marriages. Cross-boundary marriages have increasingly become an important socioeconomic phenomenon. For example, in 2009, the number of international migrants under the family reunion scheme accounted for approximately 35% of the total number of international migrants around the world (International Migration Organization, 2010). Cross-boundary marriages have constituted up to 35%-50% of newly registered marriages in Singapore and Hong Kong (HK) in recent years (Constable, 2005)

We first characterize the assignment profiles and utility shares in a simple two-marriage-market model with cross-boundary marriage costs. We assume that age is more important for women than for men in the marriage market where age is used as a proxy for beauty or fecundity. In contrast, income or wealth is assumed to be more important for men than for women because men usually carry the family financial responsibility in a traditional society. Under the assumption of gender asymmetry in evaluating individual attributes, women in poor regions are more attractive to men in rich regions than men in poor regions to women in rich regions.¹ This situation can result in more men from rich regions marrying women from poor regions than the opposite match, displaying a geographic manifestation of hypergamy.²

With a decrease in cross-boundary marriage costs, more gender-asymmetric cross-boundary marriages take place, which erodes the relative position of women in the rich region not only in the marriage market, but also within the household. As the well-being of these women deteriorates, they may migrate to other richer regions. We call this a repercussion effect because it is a chain effect of the decrease in cross-boundary marriage costs.

We empirically test these theoretical predictions by investigating cross-boundary marriages between mainland China and HK, which serves as a good setting for our study for several reasons: first, HK shares a similar social and cultural background with mainland China. The primary language used in HK is Cantonese, which is also the language used in Guangdong, the mainland province neighboring HK. However, HK had been colonized by the United Kingdom for ninety-nine years, which resulted in a huge economic gap between mainland China and HK. For example, when HK was handed over to mainland China in 1997, the gross domestic product (GDP) per capita was US\$27,055 in HK, in

¹Our assumption of gender asymmetry in evaluating individual attributes is consistent with the experimental evidence on gender differences in mating selection. For instance, Fisman et al.(2006) find that men respond more to women's physical attractiveness, whereas women prefer men who grew up in affluent neighborhoods in a speed dating experiment. See also Boulier and Rosenzweig (1984).

²The term hypergamy is used specifically in reference to a tendency in which females pursue males of higher status than themselves. It often manifests itself as females being attracted to men who are comparatively older and wealthier. The hypergamy analyzed in this paper is the tendency of women in poor regions to marry men in rich regions. We thus call it as a geographic manifestation of hypergamy.

contrast to the US\$770 in mainland China and US\$1,800 in Guangdong (NBS, 1998). Therefore, the similarity in social and cultural backgrounds and the huge economic gap provide great incentives for the mainland women to marry up with HK men and no incentive for HK women to marry down with mainland men.

Second, the increase in cross-boundary marriages between residents of HK and mainland China was triggered by clearly identifiable events: the handover of HK to mainland China in 1997 and the discrete increases in the one-way permit (OWP) quota. The handover greatly facilitated the interchange between the mainland and HK residents. Furthermore, the cross-boundary marriage behavior is strictly governed by the OWP scheme, which requires all mainland spouses or children of HK permanent residents to obtain an OWP document before moving to HK for family reunion.³ The daily OWP quota was 75 in 1982, which then increased to 105 in 1993 and to 150 in 1995. Prior to 1996, the mainland partners or children born in the mainland normally had to wait eight to ten years to obtain an OWP. The waiting period was reduced to three to five years after 1995. Therefore, the handover and the discrete increases in the OWP quotas serve as good quasi-experiments that exogenously reduced cross-boundary marriage costs.

Third, the number of cross-boundary marriages is significant enough to change the fundamentals of the HK marriage market. Cross-boundary marriages accounted for almost half of all marriages registered in HK in 2006 (Figure 1). Because of HK's superiority in public welfare, education, and medical systems, most mainland partners and children of HK residents migrated to HK under the OWP scheme (Bacon-Shone et al., 2008). There were a total of 855,116 new arrivals under the OWP scheme from the mainland in 1990-2008, accounting for 12.23% of the total population in 2008 and 69.85% of the population growth during the same period.

Fourth, cross-boundary marriages are notable for inducing gender asymmetry: HK men marrying mainland women outnumbered the opposite match seven times during the period 1986-2006 (Figure 2). Therefore, the new arrivals under the OWP scheme have been dominated by females, leading to increasingly female-biased sex ratios in HK (Figure 3). This issue has drawn serious attention from the mass media, academic researchers, and the HK government (Bacon-Shone et al., 2008; HK Task Force on Population Policy, 2003). The final appealing feature of the HK experience is that labor migration from mainland China is extremely restrictive. Labor migration was almost zero during the study period (Bacon-Shone et al., 2008).

Using the quasi-natural experiments brought about by the handover of HK to China and the discrete increases in the OWP quotas, the present study constructs a difference-in-differences estimator to test the theoretical predictions. We use Taiwan residents as a comparison group, which is suitable for several reasons: HK, Taiwan, and mainland China share the same Chinese cultural background. The immigration policy has been

³The OWP scheme is discussed in detail in the Background section.

stable in Taiwan during the study period. Both HK and Taiwan have traditionally sourced brides from the mainland since the 1980s. Furthermore, both regions experienced similar macroeconomic fluctuations, such as the East Asian financial crisis of the 1990s.⁴ We use the HK 1990 and Taiwan 1991 census years as the pre-treatment period and the HK 2001 and Taiwan 2000 census year as the post-treatment period.

Under this empirical strategy, we examine the reduced-form relations between the exogenous decrease in cross-boundary marriage costs and changes in residents' marital status, family structure, and intrahousehold bargaining power. Our empirical results show that the increases in the OWP quotas and the handover bolstered males' relative position in the marriage market and diminished that of females. Specifically, for women, the currently married and ever-married rates decreased, whereas the divorced rates increased. Furthermore, wives were less likely to be household heads. The results are opposite to those of men.

We further explore the richness of HK censuses and by-censuses (1991, 1996, 2001, and 2006) and check the gender differential changes in the marital status, family structure, intrahousehold bargaining, and labor market outcomes following the discrete changes in the WOP quota and the handover. By using the HK censuses, we are able to control for the time trend and use detailed measures of labor market outcomes. The estimation results on marital status, family structure, and intrahousehold bargaining are consistent with those when we use Taiwan residents as a comparison group. In addition, we find that the discrete changes in the OWP quota and the handover have exerted an incentive effect on HK women in the labor market relative to men. Women are more likely to participate in the labor force, be employed, and take a second job. Finally, we use the US 2000 census and the Canadian 2001 census to examine the repercussion effects. Immigrants from Taiwan, Singapore, and South Korea are used as a comparison group, and the immigration years before 1997 as the pre-treatment period. We find that the emigration from HK has been biased toward females since 1997.

We find stronger effect on labor force participation of women relative to men among HK residents with low education than among the highly educated. This result is consistent with our theoretical model in which the welfare of all HK women is negatively affected by the decrease in cross-boundary marriage costs, and women in the low tail of the distribution suffer the most. It contradicts an alternative hypothesis that the boom in female higher education has driven the rise in cross boundary marriages, which would imply that the labor market favors the highly educated women.

This paper contributes to two related research agendas in family economics: the connections between marriage pattern and preferences and the impact of the sex ratio on marriage outcomes and marital shares. There is little economic research that explicitly

⁴Cortes and Pan (2013) also use Taiwan residents as a comparison group for HK residents in their study of the labor market.

studies marriage pattern such as hypergamy except for Siow (1998) and Edlund (1999). Siow (1998) discusses the effect of gender difference in fecundity on the spousal age gap. Edlund (1999) studies hypergamy in a society with son preference. With strong son preference, girls are more likely to be born in families with lower status. This fact may generate a general pattern that girls marry boys with a higher status.⁵ The present study contributes to this strand of literature as it uses gender-asymmetric attribute functions in two interrelated marriage markets to explain the gender-asymmetric cross-boundary marriages, yielding a geographic manifestation of hypergamy.

Recently, a wave of new studies has examined the consequences of changes in marriage-market conditions such as the sex ratio (e.g., Angrist, 2002; Chiappori, Fortin and Lacroix, 2002; Edlund, Li, Yi, and Zhang, 2013; Grossbard and Amuedo-Dorantes, 2008; Porter, 2007a, 2007b; Wei and Zhang, 2011a, 2011b; Lafortune, 2013).⁶ From the theoretical perspective, the sex ratio directly affects the intrahousehold resource allocation and can thus be used to test collective household behavior such as intrahousehold resource allocation and labor supply (Becker, 1973, Grossbard-Shechtman, 1993; Chiappori et al., 2002). From the policy perspective, male-biased sex ratios, particularly in Asian societies, have drawn increasing attention from government policy makers because of the resulting gender preference and gender selection. The present study contributes to this strand of the literature by linking the decrease in cross-boundary marriage costs and the gender-asymmetric cross-boundary marriages to the sex ratio imbalance and family behavior. In this regard, we depart somewhat from the existing literature. For instance, the exogenous variation in sex ratios explored by Angrist (2002) originates from the interaction between endogamy within ethnic groups and the change in the number of migrations induced by the change in American immigration laws. The exogenous variation in the sex ratio in our study comes from the interaction between hypergamy (where more women from poor regions marry men in rich regions than the opposite match) and the decrease in cross-boundary marriage costs. Although the policy change is exogenous, the resulting change in the sex ratio is endogenous, as explained by our model. In the HK context, both the sex ratio at birth and the sex ratio of the residents born in HK have been stable and balanced over the past three decades. Because of the interaction between hypergamy and the decrease in cross-boundary marriage costs, however, the sex ratio of the potential population in which HK men and women search for spouses is severely biased toward

⁵The marriage pattern of hypergamy has also been studied by sociologists, who emphasize preferences. Economists, however, approach it by emphasizing endowments, competition, and market equilibrium.

⁶The recent literature on sex ratios has explored variations from various different sources. Grossbard and Amuedo-Dorantes (2008) and Porter (2007a, 2007b) utilize large cohort shifts in fertility or mortality rates that altered the sex ratios to study the effects of sex ratio imbalance. Chiappori et al., (2002) use the regional variations in the sex ratio. Wei and Zhang (2011a, 2001b) analyze the cross-region and cross-cohort variation in the sex ratio induced by the one-child policy in mainland China. Angrist (2002) uses the variation in the sex ratio induced by the immigration flow to the United States in the early part of the 20th century.

females. The increase in the OWP quota and the handover have decreased the cost of cross-boundary marriages between the residents of mainland China and HK, and thus have decreased the virtual sex ratio for HK residents.

The remainder of this paper is organized as follows. Section 2 describes the background and Section 3 formulates the theoretical model. Section 4 introduces the data sets, and Section 5 specifies our empirical strategy. Section 6 presents our main empirical results, and Section 7 reports the repercussion effects. Section 8 concludes.

2 Background

2.1 The One-way Permit, Cross-boundary Marriages, and Gender Imbalance in HK

Cross-boundary marriages have become an increasingly important element in marriages involving HK residents. Figure 1 shows the fraction of cross-boundary marriages of all marriages registered in HK from 1986 to 2006.⁷ The ratio shot up from 2% in 1986 to 43% in 2006.⁸ These marriages are also notable for the displayed gender asymmetry. The cases of HK men marrying mainland women outnumber that of the opposite match six to seven times. Figure 2 shows the number of cross-boundary marriages registered in HK by residence of spouses from 1986 to 2006. Figure A1 in the web appendix shows the proportion of marriages registered in HK by residence of spouses from 1991 to 2006. The combination of mainland brides and HK grooms has dominated the opposite match during the past two decades, although the combination of HK brides and mainland grooms has increased since 2000.

The sharp increase in cross-boundary marriages between residents of the mainland and HK was triggered by a clearly identifiable event: the handover of HK to mainland China in 1997. Furthermore, the cross-boundary marriage behavior in HK is strictly governed by the exit policies of the mainland government of which the OWP scheme is most important. Compared with the lenient immigration policies on family reunion worldwide, extremely restrictive migration policies govern the residency of the mainland Chinese in HK, even for the spouses and children of HK permanent residents.

The mainland authority implements the OWP scheme to allow families with spouses and children residing in the mainland to be reunited in HK while preventing a large volume of immigration to HK. The OWP is available to two groups of immigrants: children of permanent HK residents with Certificate of Entitlement, and spouses and other dependents. The OWP scheme stipulates that all mainland spouses or children of HK permanent residents must obtain an OWP document to migrate to HK to reunite with

⁷The total number of cross-boundary marriages registered in HK by gender during the period 1991 to 2006 is tabulated in Table A1 in the web appendix.

⁸Some cross-boundary marriages were registered in mainland China. However, no aggregate statistics are available on the number of such marriages.

their families. The daily OWP quota was 75 in 1982, went up to 105 in 1993, and then to 150 in 1995. Prior to 1993, the total number of new arrivals under the OWP scheme was less than 30,000 per year. In 1996, the number hit a record high of 61,179. Prior to 1993, a mainland partner or a child born in mainland China normally waited for eight to ten years to obtain an OWP; however, the waiting period has decreased to three to five years since 1995. The shorter waiting period has greatly reduced both the material and psychological costs which in turn increased the number of cross-boundary marriages.

The new arrivals under the OWP scheme have been a major driver of population growth in HK during the past two decades. Drawn by HK's superior public welfare, educational, and medical systems, most mainland partners and children finally immigrated to HK through the OWP scheme. Therefore, these new arrivals constitute a lion's share of the population growth in HK (Figure A2 in the web appendix). There were 855,116 new arrivals under the OWP scheme during the 1990-2008 period, accounting for 12.23% of the total population in 2008 and 69.85% of the population growth during the same period. We also find two discrete jumps in the number of these arrivals coinciding with the two years when the OWP quota was increased from 75 to 105 in 1993, and further to 150 in 1995. Figure A3 in the web appendix depicts the number of new arrivals under the OWP scheme by the type of relatives in HK. It shows that approximately half of the arrivals have spouses and the other half have parents in HK.

The new arrivals, induced by the gender-asymmetric cross-boundary marriages, have severely biased the sex ratio in HK. Although the sex ratio of new arrivals with parents in HK was almost balanced during the 1996-2006 period, the sex ratio of those new arrivals with spouses in HK was severely biased toward females (Figure A4 in the web appendix). Given the large scale of cross-boundary marriages and these new arrivals, the sex ratio of the HK population has become severely biased toward females. Figure 3 shows that the sex ratio has experienced a monotonic decrease in past decades. The sex ratio decreased more dramatically after the increase in the OWP quota in 1995 and the handover of HK in 1997.⁹ We thus conclude that the imbalance in the sex ratio in HK is attributable to the gender-asymmetric cross-boundary marriages between residents of mainland China and HK.

⁹We can further check the robustness of the relationship between gender-asymmetric cross-boundary marriages and the biased sex ratio in the HK population. Figure A5 in the web appendix shows that the sex ratio at birth has been stable and balanced in past decades. Furthermore, Figure A6 shows that the sex ratio of residents born in HK has also been stable and balanced, suggesting that the sex ratio imbalance is not due to the biased emigration of local HK residents. Section 7 shows that more females than males have emigrated to North America since 1997. However, the total number of emigrants is too small to change the sex ratio of the HK population.

2.2 Spousal Characteristics of Cross-Boundary Marriages

We have discussed the trend of cross-boundary marriages between residents of mainland China and HK, the OWP scheme, and the relationship between gender-asymmetric cross-boundary marriages and the sex ratio imbalance in the HK population. Questions remain as to who is involved in cross-boundary marriages and why. Resident of mainland China who engage in cross-boundary marriages cannot migrate to HK immediately after marriage. Hence, we cannot access their information at the micro level. However, we can check the aggregate statistics on the spousal characteristics of cross-boundary marriages by residence type as reported by the HK Marriage and Records Office (CSD, 2007).

We check two types of spousal characteristics, age and education. Table 1a summarizes the median age at marriage by sex and residence of spouse for all marriages registered in HK in 2006. Traditionally, Chinese husbands are, on average, two to three years older than their wives. This traditional protocol is confirmed by columns (1) and (4) with respect to the two marriage types of HK bride - HK groom and mainland bride - mainland groom. With regard to mainland bride - HK groom marriages, the husbands are, on average, nine years older than their wives (column (2)). In contrast, the husbands are, on average, younger than their wives in HK bride - mainland groom marriages (column (3)).¹⁰ Table 1b tabulates the distribution of the educational attainments of the grooms and brides who married in HK by residence of spouses in 2006. Cross-boundary marriages mainly involve individuals with low level of education and most of them have not attained tertiary education.¹¹

The aggregate statistics on spousal characteristics in Tables 1a-b clearly display a geographic manifestation of hypergamy. Although the motivation for cross-boundary marriage is multidimensional, the aggregate statistics show that age is an important factor. Given the huge population pool in mainland China, HK males who are involved in cross-boundary marriages may want and are able to find younger women. This fact leads to the marriage of young women in the poor region with old men in the rich region. These observations will be incorporated into our theoretical analysis.

¹⁰Figure A7 in the web appendix shows the proportion of marriages registered in HK by residence of spouse and difference in age. Among the four marriage types, mainland bride - HK groom has the largest proportion of marriages with the brides younger than the grooms by at least five years. In contrast, HK bride - mainland groom has the largest proportion of marriages with the brides older than the grooms by at least five years.

¹¹Figure A8 shows the proportion of marriages registered in HK by residence of spouses and difference in educational attainment. Among the four marriage types, Mainland bride - HK groom has the largest proportion of marriages with better-educated grooms. On the contrary, HK bride - mainland groom has the largest proportion of marriages with better-educated brides.

3 The Model

The purpose of the model is to explain the main forces that generate cross-boundary marriages and to identify the agents most likely to engage in such marriages. We use a simple framework of transferable utility and a continuum of agents that allows us to map from given distributions of male and female traits to the matching patterns that would arise before and after the reduction in the costs of cross-boundary marriages between the two regions. The basic ingredients of the model are in Browning, Chiappori and Weiss (2013).

3.1 Marital attributes and traits

We define in each region a male attribute m_i for man i and a female attribute f_j for woman j . These attributes are derived from some basic traits such as age and income. Specifically, we assume

$$m_i = \alpha_M age_i + \beta_M Y_i + \varepsilon_i, \quad (1)$$

$$f_j = \alpha_F age_j + \beta_F Y_j + \varepsilon_j, \quad (2)$$

where Y measures income (or wealth) and ε is a random variable that researchers do not observe but is observed by the agents, such as beauty or intelligence. The basic traits such as age and income can differ across countries and have different weights for men and women, implying different distributions of attributes. However, these simple formula impose a common ordering so that in each region agents can unambiguously rank their potential spouses based on their attributes. This formulation is flexible enough to allow asymmetry by gender. Importantly, α may have opposite signs for men and women, as wealth may be a more important attribute for men than for women. This gender-asymmetry in the attribute function does not reflect the gender difference in preferences. Instead, it reflects the gender differences in wealth and age in the production of total marital outputs. Because men usually take the family financial responsibility, wealth is more important for men in producing marital outputs. In contrast, because women give birth to children and the reproductive window is shorter for women, age is a more important attribute for them.¹² Allowing gender-asymmetric attribute functions is consistent with the observed pattern of the spousal characteristics of cross-boundary marriages discussed in the previous section. Table 1a shows that age is an important factor for HK men to find mainland women. Among the four marriage types, Figure A7 in the web appendix shows that Mainland bride - HK groom has the largest proportion of marriages with younger brides. In terms of education, Figure A8 shows that mainland bride - HK groom combination has the largest proportion of marriages with better-educated grooms.

Individuals from different regions may have different marital endowments, m_i and f_j .

¹²The economic implications of the gender difference in fecundity are explored in Siow (1998).

Men from poor regions, say, the mainland, will be at the bottom of the male distribution (pooling both HK and mainland men), because they have low Y . This is not necessarily true for mainland women because wealth is less important for women than men. If the cost of cross-boundary marriages is not too high, there exists a demand for mainland brides in HK, in particular, for the young brides. In contrast, the demand for mainland grooms is lower than that for the brides. Therefore, the observed hypergamy in cross-boundary marriages can originate from the gender-asymmetric attribute functions and the very different distribution of the attributes between the two regions.

3.2 The Autarky Marriage Market

We first consider a situation without cross-boundary marriages, such that each region is an autarkic marriage market. When a man with attribute m and a female with attribute f marry their basic traits are combined to generate a single marital good according to the household production function

$$h(m, f) = mf + m + f. \quad (3)$$

The produced marital good can be divided between partners so that the utility is *transferable* between them.¹³ We further assume that the utility of a single individual equals his or her marital trait m or f . The marital surplus is then given by mf , which is always positive, and therefore, everyone wants to marry if he or she finds a match and receives a positive share of the surplus.¹⁴

The assumed household production function is supermodular, indicating the complementarity of the male and female traits. This important feature can be rationalized by the use of public goods or increasing returns in the household production function (Lam, 1988; Weiss, 1997)¹⁵. Becker (1973) first notes that complementarity within the household induces a positive assortative match in the marriage market at large,¹⁶ implying that

$$1 - F(m) = r(1 - G(f)), \quad (4)$$

where $F(\cdot)$ and $G(\cdot)$ are the cumulative distribution functions of the traits for males and females, respectively, and r is the ratio of women to men. For simplicity, we assume

¹³This assumption allows us to have a meaningful concept of aggregate welfare in terms of a common cardinal presentation of preferences.

¹⁴For various reasons, some individuals may prefer to remain single even if a spouse is available. However, given our focus on potential cross-boundary marriages, our problem is substantially simplified if we assume that everyone wants to marry.

¹⁵Boulier and Rosenzweig (1984) and Behrman, Rosenzweig, and Taubman (1994) provide supportive empirical evidence.

¹⁶Boulier and Rosenzweig (1984) and Behrman, Rosenzweig, and Taubman (1994) provide supportive empirical evidence.

uniform distributions for the male and female traits in each region.

$$\begin{aligned} m &\sim [a, a + \delta], \\ f &\sim [b, b + \delta]. \end{aligned}$$

We assume that under autarky, there are more men than women in both regions, ($r < 1$), implying that all women are married and some men are single.¹⁷ We denote the lowest married man by

$$m_0 = a + \delta(1 - r).$$

Given the uniform distributions that we assume, the assignment profiles are linear and given by

$$m = rf + a + \delta - r(b + \delta) \equiv \phi(f) \text{ for } f \geq b, \quad (5)$$

$$f = \frac{m}{r} - \frac{a + \delta}{r} + (b + \delta) \equiv \psi(m) \text{ for } m \geq m_0 = a + \delta(1 - r). \quad (6)$$

When man m is married to woman f , we denote the shares of the man and woman as $u(m)$ and $v(f)$, respectively. Given that $h(m, f) = u(m) + v(f)$, the shares satisfy¹⁸

$$\begin{aligned} u(m) &= k^m + \int_{m_0}^m h_m(\phi(t), t) dt, \\ v(f) &= k^w + \int_b^f h_f(s, \psi(s)) ds, \end{aligned}$$

where

$$\begin{aligned} h_m &= f + 1, \\ h_f &= m + 1, \end{aligned}$$

are the *marginal* contributions of man m and female f to the marriage. That is, the equilibrium shares that agents receive reflect the fact that each man has a very close substitute for each woman he may choose and the same holds for each woman. Using Equations (5) and (6), we then have

$$u(m) = k^m + \int_{m_0}^m \left(1 + \frac{s}{r} - \frac{a + \delta}{r} + (b + \delta)\right) ds, \quad (7)$$

$$v(f) = k^w + \int_b^f (1 + rt + a + \delta - r(b + \delta)) dt. \quad (8)$$

¹⁷Although the sex ratio at birth is balanced, a shortage in women always occurs in the marriage market. See the discussions in Siow (1998) and Edlund (1999). One major reason is that women have a shorter reproductive window than men.

¹⁸For the derivation of the results, see Section 8.2.1 in Browning, Chiappori, and Weiss (2013).

The constants k^m and k^w are determined by the condition that, if men outnumber women, the "last" married man should have no rent and, similarly, if women outnumber men the last married woman has no rent. Having assumed that $r < 1$ and that singles consume their own "income," we set

$$k^m = m_0. \quad (9)$$

Hence, the woman who marries m_0 reaps all the marital surplus of m_0b , and

$$k^w = m_0b + b. \quad (10)$$

When more women are available and r increases marginally, fewer men are single and m_0 declines. Then an increase in r reduces the utility of all women and increases the utility of all married men.¹⁹ However, we shall also discuss changes resulting from substantial cross boundary movement that would raise the total number of women (local and imported) in HK to the point that some women in HK become single.

3.3 Cross-boundary Marriages

We now consider HK and mainland China as two marriage markets with possible migration between them. We assume that imported women from mainland China must stay with their husbands and therefore cannot compete directly with local women when in HK. So competition with local women is indirect and limited to the case in which HK men can refrain from marrying local women and marry an imported mainland Chinese woman instead.²⁰

To motivate the asymmetric cross boundary movement from mainland China to HK we assume different distributions of traits in the two regions. To simplify, we assume the same scale parameter δ but different lower bounds in the two regions, so that all four distributions for males and females are *linear shifts of each other*. Specifically we set

$$a_h + \delta > a_c + \delta \geq a_h,$$

$$b_h + \delta > b_c + \delta \geq b_h,$$

where the subscript h stands for HK and the subscript c stands for mainland China. We thus assume that the top men (women) in Hong Kong are better than the top men (women) in mainland China who are, however, better than the HK men (women) at the bottom of the distribution. Furthermore, to explain the gender asymmetry in cross-boundary marriages, we assume that the gap in the lower bound between HK men and mainland China men is larger than the gap in the lower bound between HK women and

¹⁹See Becker (1991) and Browning et al. (2013).

²⁰This qualification distinguishes our analysis from the free entry of women from China to HK, which could be analyzed as an exogenous rise of the female male ratio in HK.

mainland China women.

$$a_h - a_c > b_h - b_c.$$

To simplify further, we assume the same sex ratio in the two countries in the autarky state

$$r_h = r_c = r < 1.$$

Thus in both regions all women are married and some men are single. We recognize that mainland China has much larger population than Hong Kong and thus normalize the population of men in HK to 1 and of HK women to r and set the corresponding populations of men and women in mainland China to σ and $r\sigma$, where $\sigma \gg 1$.

To limit cross-boundary marriages, we assume that there are costs of waiting associated with the OWP scheme. During proportion ω of time, the newly married partners live separately applying for the OWP. After obtaining the OWP, the partners live together during the remaining proportion $1 - \omega$ of the time. We then have the marital output of a HK couple

$$m_h + f_h + m_h f_h, \tag{11}$$

the marital output of a couple in mainland China

$$m_c + f_c + m_c f_c, \tag{12}$$

and the marital output of a cross-boundary marriage,

$$w(m_h + f_c) + (1 - w)(m_h + f_c + m_h f_c). \tag{13}$$

A necessary and sufficient condition for a cross-boundary mixed marriage between a married woman in mainland China and a married man in HK is that the newly formed mixed marriage covers at least the sum of the utilities received by the two partners in their previous marriage:

$$w(m_h + f_c) + (1 - w)(m_h + f_c + m_h f_c) \geq u(m_h) + v(f_c). \tag{14}$$

This condition is necessary because otherwise at least one partner will be worse off. It is also sufficient because if it holds then both partners can be made better off and thus will want to take advantage of this opportunity. A similar condition applies to cross-boundary marriages between HK women and men from mainland China. However, based on the observed data, we shall focus on cross-boundary marriages of HK men to women from mainland China, assuming that only such cross-boundary marriages take place. (We will examine the validity of this assumption later).

In our analysis we assume that, because of large differences in size, migration does not affect the marital share of women from mainland China, $v(f_c)$, but that the marital shares of HK men, $u(m_h)$, and of HK women, $v(f_h)$, can change. If the entry of women from mainland China to HK is sufficiently large to cause some HK women to become single, then the marital share of HK men will rise and they will become less willing to import women from abroad.

3.3.1 The equilibrium level of cross-boundary marriages

We now describe the pattern of cross-boundary marriage that forms in equilibrium. Obviously, the particular solution depends on the particular parameters used. We provide here an illustration of the basic forces at work, using a chosen set of parameters.

Starting with autarky in both mainland China and Hong Kong, the marital share of married men in Hong Kong is given by

$$u(m_h) = m_{h,0} + \int_{m_{h,0}}^{m_h} \left(1 + \frac{x}{r} - \frac{a_h + \delta}{r} + b_h + \delta\right) dx, \quad (15)$$

where $m_{h,0} = a_h + \delta(1 - r)$, while the marital share of married women in mainland China is

$$v(f_c) = b_c(m_{c,0} + 1) + \int_{b_c}^{f_c} (1 + rt + a_c + \delta - r(b_c + \delta)) dt, \quad (16)$$

where $m_{c,0} = a_c + \delta(1 - r)$.

Because men in HK can compete for imported mainland women, there is assortative matching between HK men and mainland Chinese women, starting from the top of the female distribution in mainland China and the top of the male distribution in Hong Kong, implying that

$$r\sigma\left(\frac{b_c + \delta - f_c}{\delta}\right) = \frac{a_h + \delta - m_h}{\delta}. \quad (17)$$

Hence, the prospective mainland wife of man m_h in Hong Kong is

$$f_c(m_h) = \delta + b_c + \frac{m_h - \delta - a_h}{r\sigma}. \quad (18)$$

We can, therefore, evaluate for each man m_h in HK who considers a cross-boundary marriage, the share that his prospective imported woman would have in mainland China,

$$v_c(m_h) = b_c(m_{c,0} + 1) + \int_{b_c}^{f_c(m_h)} (1 + rt + a_c + \delta - r(b_c + \delta)) dt. \quad (19)$$

We can then write the marital output of a cross-boundary marriage between HK man m_h and his matched wife $f_c(m_h)$ as

$$l(m_h) = w(m_h + f_c(m_h)) + (1 - w)(m_h + f_c(m_h) + m * f_c(m_h)), \quad (20)$$

and the sum of the values of the two potential partners as

$$s(m_h) = u(m_h) + v_c(m_h). \quad (21)$$

If $m_h < m_{h,0}$ so that m_h is single, we replace $u(m_h)$ by the value of singlehood, m_h .

$$q(m_h) = m_h + v_c(m_h). \quad (22)$$

Using these definitions we can now examine the regions in which the necessary and sufficient condition is satisfied for a given set of parameters. Table 2 presents the chosen set of parameters that we consider to be plausible given the assumptions of the model and the available data.²¹ Based on these chosen parameters, Figure 4 presents sum of the marital shares of the two parties, $s(m_h)$, by the dashed line, while the marital output of prospective cross-boundary marriages, $l(m_h)$, is represented by the solid line. The indifference condition

$$s(m_h) = l(m_h),$$

has the solution $m_2 = 182.33$. Figure 5 shows the corresponding graph for single HK men. We see that these men would also marry a mainland woman, as the sum of the alternative costs, $q(m_h)$, is lower than the marital output $l(m_h)$ that such cross-boundary marriages generate.

We see that top HK men above m_2 are unwilling to import women from mainland China because they already have a good match in HK, reflecting the assumption that top HK women are better than top mainland women. All HK men below m_2 would like to import a woman from mainland China and form a cross-boundary marriage. However we need to take into account the impact of such replacement on the marital shares in local marriages. If a sufficient number of HK men actually replace their wives, then there will be more HK women than men who want to marry.²² This will raise the share of men in each local marriage and mitigate their willingness to import women from mainland China.²³

Specifically, the marital share of HK men who marry HK women would rise from

$$u(m_h) = m_{h,0} + \int_{m_{h,0}}^{m_h} \left(1 + \frac{x}{r} - \frac{a_h + \delta}{r} + b_h + \delta\right) dx, \quad (23)$$

to

²¹We discuss these parameters in the web appendix.

²²In practice, replacement of a local HK woman by a mainland woman can occur either by divorce from a local HK man or by avoiding the local marriage in the first place. The latter case will be more common if costs of divorce are substantial.

²³Note that when women are imported from mainland China, the numbers of HK men and HK women do not change.

$$z(m_h) = a_h + a_h b_h + \int_{a_h}^{m_h} \left(1 + \frac{x}{r} - \frac{a_h + \delta}{r} + b_h + \delta\right) dx, \quad (24)$$

We note that HK men above m_2 who are unwilling to import women under an autarky will be even more unwilling to do so when their marital share in HK rises. Therefore, they will not compete with HK men below m_2 over mainland women. This implies that for the group below m_2 , the assignment of mainland Chinese women to HK men is

$$F_c(m_h) = b_c + \delta + \frac{m_h - m_2}{r\sigma}, \quad (25)$$

and we are only interested in the marital share of these Chinese women, which is given by

$$V(F_c) = b_c(m_{c,0} + 1) + \int_{b_c}^{F_c(m)} (1 + rt + a_c + \delta - r(b_c + \delta)) dt. \quad (26)$$

Thus, HK men who ex-ante would like to import Chinese women are subject to two opposing effects ex-post: lower competition from the men at the top of the male distribution and an increase in the male share in local marriages. The first effect encourages import of women and the latter discourages it. However, the second effect is likely to be larger, as local shares change discontinuously when the market shifts to a majority of women and men at the bottom obtain all the rent (see Browning et al. chapter 8). Also, given the larger size of mainland China, HK men below m_2 who compete for top mainland women are not affected much by the withdrawal of top men above m_2 from the competition.²⁴ In general, any repercussions in mainland China resulting from cross-boundary marriages are negligible, given the size of China, and we therefore focus on the repercussions in HK.

Following the entry of mainland women and their replacement of local women, the sum of the shares $s(m_h)$ becomes

$$S(m_h) = V(F_c) + z(m_h)$$

and the output of cross boundary marriages now becomes

$$L(m_h) = w(m_h + F_c(m_h)) + (1 - w)(m_h + F_c(m_h) + m * F_c(m_h)). \quad (27)$$

Following these changes, the indifference condition $S(m_h) = L(m_h)$ has no solution in the relevant range. Figure 6 shows that the sum of the shares (the dashed line) always exceeds the total expected marital gain from cross-border marriages. Together, these results suggest that the actual replacement will be such that married HK men in the middle part of the distribution will replace their wives and release local women only up

²⁴Indeed in the simulation, $F_c(m)$ and $f_c(m)$ are almost indistinguishable.

to the point at which the number of married HK women equals the number of HK men.

To further establish the validity of the model, we conduct the analysis also for women and find that, given the assumed parameters and starting from Autarky, HK married women do not want to replace their current husbands by imported men from mainland China. Surprisingly, even HK women who became single as a result of the entry of mainland women would prefer not to import mainland men, as illustrated in figures A9 and A10. These sharp results reflect the relatively low potential contribution of mainland men to the joint marital output and are consistent with the gender asymmetry in cross-boundary marriages that we observe in the data.

Given the model, we can examine further how the model responds to changes in parameters. We are particularly interested in the decrease in the cost of waiting time ω , because it is directly affected by the OWP scheme. The increase in OWP quotas decreases the waiting time, and then the value of ω . The simulated comparative static results show that there is no cross-boundary marriages if ω is sufficiently high. A decrease in the cost of waiting ω leads to higher import of women from abroad and sharper decrease in the welfare of HK women.²⁵

To conclude, the reduction in the cross-boundary marriage cost can have a large effect on the assignment patterns and gains from marriage in HK. Because the difference in the marital attribute distribution between HK and mainland China is larger for men than for women, HK men are more likely than HK women to import their spouses from mainland China. However, HK men in the upper part of the male distribution maintain their marriage and their wives are only affected by the change in the female marital shares of HK women below them in the assignment scale.²⁶ Women from the bottom and middle of the HK female distribution are pushed down the assignment scale and some of them are likely to become single. Consequently, the marital share of all men rises while the marital share of all women declines. From a welfare perspective, aggregate welfare in HK rises following the entry of women from mainland China because the optimal assignment profile in the autarky marriage case is still feasible. However, the welfare of all women in HK declines. This happens even for high quality women who maintain their marriages, because their marital share declines when that of the women below them declines. By a similar logic the marital share and welfare of all HK men increase.

²⁵The results are shown in the web appendix.

²⁶Recall that for each HK woman, there is another HK woman slightly below her in the assignment profile who is an almost perfect substitute. Thus the marital share that each HK woman receives depends on the shares of HK women below her in the assignment profile. See equations (7) and (8).

3.4 Testable Implications

The theoretical model suggests several testable hypotheses that enable us to examine empirically the demographic and economic consequences of the changes in the OWP quota and the handover.²⁷ As we will show, these hypotheses differentiate our theory from an alternative theory in accounting for the increase in gender-asymmetric cross-boundary marriages. The major alternative factor that explains the rapid growth of cross-boundary marriages is the boom of female higher education. Women’s educational attainments have experienced rapid growth in both developed and developing countries (Chiappori, Iyigun, and Weiss, 2009; Pitt, Rosenzweig, and Hassan, 2012; Becker, Hubbard, and Murphy, 2012). If the labor market becomes more favorable to women, especially those with higher education, then more women will pursue higher education. Thus, women should have more intrahousehold bargaining power because they have more outside options. If the change in social norms that affect the intrahousehold resource allocation lags behind the boom, higher educated women may prefer being single to being married. Thus, men in rich regions may shift to poor regions to search for brides. These men still prefer marriage because the traditional intrahousehold bargaining continues to tilt toward them. Kawaguchi and Lee (2012) posit this theory and use it to explain the increase in the gender-asymmetric cross-boundary marriages in Japan, South Korea, Taiwan, and Singapore since the early 1990s. Indeed the rapid increase in female higher education has been one of the major socioeconomic changes in these regions during the past two decades. The special events that occurred in HK offer us a good opportunity to test different hypotheses.

Our empirical analysis below mainly involves comparisons of the HK marriage market between two census years 1991 and 2001. There were almost no cross-boundary marriages in 1991 (Figures 1-2). Thus, the main testable implications derived from the model involves comparisons between the case of a closed marriage market under autarky and the case of an open marriage market with cross-boundary marriages.

Hypothesis 1: *The decrease in cross-boundary marriage costs, induced by the increase in the OWP quota and the handover, increases males’ relative position in the marriage market and correspondingly decreases that of females. Specifically, relative to men, it decreases women’s currently married and ever-married rates, and increases women’s divorced and not remarried rate. Furthermore, the change in the marital status should be focused on the group with a low socioeconomic status (SES).*

In contrast to Hypothesis 1, the education boom hypothesis would suggest that the change

²⁷Due to data limitations, we are not able to structurally estimate the model. We use the HK census data to conduct our empirical analysis. However, because the mainland spouses of HK residents in the new marriages are unable to migrate to HK immediately, they are not enumerated in the census at the time of the new marriage.

in marital status should mainly occur within the group with a high SES.

Hypothesis 2: *The intrahousehold bargaining power tilts toward men with the decrease in cross-boundary marriage costs.*

In contrast, the boom hypothesis predicts increases in the bargaining power on the women's side because they have more outside options with the increase in female educational attainment.

Hypotheses 1 and 2 are explicitly derived from the model. Implicitly, however, our model suggests additional testable predictions that further differentiate our theory from the boom hypothesis. Although our model does not directly address HK residents' labor supply and household work, one may conjecture that the changes in relative position in the marriage market and relative bargaining power within the household between men and women also influence their labor market outcomes.²⁸ In this regard, we have our third hypothesis:

Hypothesis 3: *The decrease in cross-boundary marriage costs changes men and women's incentives in the labor market, causing the female labor force participation rate to increase relative to that of men. Furthermore, these incentive effects are larger for women with a low SES than for women with a high SES.*

The boom hypothesis also predicts an increase in the female labor force participation rate, which is a cause but not a consequence of cross-boundary marriages under the hypothesis. However, Hypothesis 4 differs from the boom hypothesis in at least two aspects. First, the increase in the female labor force participation rate in the boom hypothesis is due to the improvement in the labor market in favor of women, especially those with higher education. Hypothesis 4 states that the female labor force participation rate increases even in the absence of an improvement in the labor market. Second, Hypothesis 4 concludes that the labor force participation rate increases more for women with a low SES because they are the ones who are mainly affected by the entry of mainland women.

So far, we have focused on the two interacting marriage markets. However, we may consider HK as a more open marriage market in the sense that HK residents can also marry partners living in more developed regions. In this case, we expect an additional repercussion effect of cross-boundary marriages. If the well-being of local female residents deteriorates after the increase in cross-boundary marriages, women will be more likely to leave HK for other developed regions such as Canada and the US. Therefore, we may observe a chain of geographic manifestations of hypergamy.

²⁸See Grossbard (1993, ch.6).

Hypothesis 4: *The decrease in the cost of and the increase in gender-asymmetric cross-boundary marriages have a repercussion effect on the HK marriage market. The increase in cross-boundary marriages could bias emigration from HK to the US and Canada toward females. The repercussion effect should be larger for women with a lower SES than those with a higher SES.*

The repercussion effect can also be derived from the boom hypothesis. However, in contrast to Hypothesis 4, the boom hypothesis expects a larger effect on women with a higher SES.

The four hypotheses are empirically tested in the following sections and we discuss their policy implications in the final section of the paper.

4 Data

To examine empirically the consequences of the decrease in cross-boundary marriage costs in the marriage market, within the household, and in the labor market in HK (Hypotheses 1-3),²⁹ we draw on comprehensive census data sets from HK and Taiwan. This section describes these census data sets and presents a simple graphic analysis.

4.1 HK Censuses: 1991, 1996, 2001, and 2006

We first derive our data from the 1991 and 2001 HK population censuses and the 1996 and 2006 by-censuses. HK conducts a population census once every ten years and a one-tenth by-census in the middle of the intercensal period. We draw on 5% samples from the 1991 and 2001 censuses and 50% samples from the 1996 and 2006 by-censuses. Thus, each of the four samples contains 5% of the HK population in the census or inter-census year. In forming these four samples, actions have been taken such that all residential quarters have an equal probability of selection by the HK Census and Statistics Department. The censuses contain rich information, such as demographic characteristics, family structure, and labor-market behavior.

We restrict our sample to HK residents who were born in HK. Most of the immigrants to HK during the past two decades have arrived through cross-boundary marriages between residents of mainland China and HK. Cross-boundary marriages are endogenous outcomes; hence, including immigrants that arrived through cross-boundary marriages may generate a selected sample. Furthermore, the sample that includes these immigrants is truncated because some mainland partners of HK residents have not migrated to HK at the census survey time.

Table 3 reports the descriptive statistics for the main variables. To test Hypothesis 1, we use three variables to measure marital status: currently married, ever-married, and currently divorced. To test Hypothesis 2, we use a dummy variable of being a household head as a proxy for intrahousehold bargaining power. It is an appropriate proxy variable.

²⁹The data sets used to test the repercussion effect (Hypothesis 4) are introduced in Section 7 .

As defined by the census manual, "the head of a household is the person acknowledged by members of the household to make major decisions affecting the household." We include only married couples who were born in HK in the analysis of the intrahousehold bargaining power. Because the by-census 2006 codes the household head differently from others, we drop this by-census in our analysis with respect to intrahousehold bargaining.³⁰ To examine the incentive effects of the decrease in cross-boundary marriage costs on the labor market (Hypothesis 3), we construct four labor market outcomes: labor force participation, employment status, wages, and whether the individual holds a second job.

4.2 Taiwan Censuses: 1990 and 2000

In our empirical analysis, we use Taiwan residents as a comparison group. Therefore, we supplement the HK censuses with Taiwan censuses. Similar to HK, Taiwan conducts a population census once every ten years. The two recent censuses were conducted in 1990 and 2000. However, Taiwan does not conduct a by-census in the middle of the intercensal period. Therefore, we only use the 1990 and 2000 Taiwan census data. Two points should be noted are about the use of the Taiwan censuses. First, to ensure comparability between the treatment and the comparison group, we choose only one city in Taiwan, Taipei. Second, we restrict our sample to local Taipei residents.

Table 3 also reports the summary statistics based on the 1990 and 2000 Taiwan census data. Similar to the HK censuses, the Taiwan censuses contain the same three variables that measure marital status and the household head as a proxy variable for intrahousehold bargaining power. However, the Taiwan censuses do not contain information on individual's labor market outcomes as in the HK censuses.

4.3 Graphic Analysis

This section presents the descriptive time series of the marital status of HK residents by gender. Figures 7a-c show the proportion of persons aged 15-65 who are currently married, ever-married, and currently divorced by gender. Two clear patterns are observed from these figures. First, the currently married, ever-married, and divorced and not remarried trends in HK have exhibited a gender-divergent pattern in the past two decades. For example, for males, the currently married rate experienced a substantial increase across the four census years. On the contrary, for females, the currently married rate decreased. It is important to note that the currently married rate for males surpassed that for females in the 2006 by-census (Figure 7a), although historically, the currently married rate for the females has been higher than that for males across almost all societies (Becker, 1991). Given that both the sex ratio at birth (Figure A1 in the web appendix) and the sex ratio of the residents born in HK (Figure A2) have been stable and balanced in the past decades, these gender-divergent trends in the marriage status across HK residents can

³⁰Only one head is reported in each household in censuses 1991 and 2001 and by-census 1996, whereas multiple heads in a household can be reported in by-census 2006.

be well explained by cross-boundary marriages. Second, these gender-divergent patterns have been increasingly evident since the 1996 census, coinciding with the increases in the OWP quota and the handover.

5 Empirical Framework

Although the graphic analysis is suggestive, we further conduct a formal econometric analysis to examine the predictions of the model. The formal econometric analysis involves cross-region, cross-time, cross-gender, and cross-educational variations in the differential treatments of the increase in the OWP quota and the handover. With all of the necessary controls, estimating the effects of the policy changes and the handover suggests a causal relationship between the decrease in cross-boundary marriage costs and demographic and economic outcomes in HK. The increase in the OWP quota directly reduces the cost, and the handover that may also considerably facilitate cross-boundary activities.

Specifically, our basic regression equation is a difference-in-differences (DD) estimator

$$Y_i = \alpha_0 + \alpha_1 HK_i + \alpha_2 T_i + \alpha_3 HK_i * T_i + X_i \alpha_4 + \varepsilon_i, \quad (28)$$

where the dependent variable Y measures individual i 's marital status and intrahousehold bargaining power. We use HK 1991 and 2001 censuses and Taiwan 1990 and 2000 censuses in estimating Equation (28). Taiwan residents serve as a comparison group. Therefore, the independent variable HK is equal to one if the individual is an HK resident, whereas it is equal to zero if the individual is from Taiwan. We use T to indicate the post-treatment period, which is equal to one if the individual is included in the HK 2000 census or the Taiwan 2001 census. If the individual is included in the 1991 HK census or the 1990 Taiwan census, T is equal to zero. X is a vector of variables that measure the individual's characteristics such as age, age squared, and schooling years. ε is an error term. We estimate Equation (28) for the male and female subsamples separately.

The interaction term $HK * T$ is used as a proxy variable for the decrease in cross-boundary marriages (ω in the theoretical model), induced by the discrete increase in the OWP quota and the handover. The coefficient of primary interest is α_3 . The estimated α_1 and α_2 pick up the regional and time period differences in the outcomes. Therefore, α_3 measures the cross-regional and cross-time changes in the outcomes driven by changes in gender-asymmetric cross-boundary marriages.

If we assume that, without the discrete changes in the OWP quota and the handover, HK and Taiwan local residents share the same time trend of marriage and intrahousehold behavior, α_3 has a causal interpretation. Furthermore, the estimate of α_3 provides us with direct tests of Hypotheses 1 and 2. For example, to test Hypothesis 1, we use the indicator of being currently married as the dependent variable. Hypothesis 1 then

predicts that α_3 is positive for males and negative for females.

We believe that the identification assumption is plausible in our study context. Taiwan residents serve as a good comparison group for HK residents for several reasons. First, Taiwan, HK, and the mainland share the same Chinese cultural background. Second, the Taiwan government did not change its marriage immigration policies during the 1990s. Although it strengthened its immigration policies to discourage marriage immigration in 2004 (Kawaguchi and Lee, 2012), this does not affect our empirical analysis because we only use Taiwan census 2000 as the post-treatment period. Third, Taiwan and HK experienced similar macroeconomic fluctuation during the 1990s, such as the 1997 East Asian financial crisis. Finally, mainland China has been the dominant region for both Taiwan and HK residents to source brides. Cortes and Pan (2013) use the same identification strategy as ours when they study the Hong Kong labor market.

The endogeneity in the implementation of policies in quasi-experimental studies (Meyer, 1995) may be less of a concern in our study. As discussed in the Background section, the OWP scheme is controlled and implemented by the mainland government. Therefore, the policy changes in the OWP should be plausibly exogenous to the social and economic factors in HK. The 1997 handover of HK to mainland China was stipulated in the Convention for the Extension of HK Territory in 1898 and was scheduled in the Sino-British Joint Declaration of 1984. Therefore, it is unlikely that there is an endogenous choice in the discrete changes in the OWP quota and the handover.

Despite these factors that favor our identification strategy, we further explore the richness of the four waves of HK census and by-censuses (1991, 1996, 2001, and 2006), and estimate the following alternative regression equation:

$$Y_i = \beta_0 + \beta_1 female_i + \beta_2 T_i + \beta_3 female_i * T_i + X_i \beta_4 + trend + \nu_i. \quad (29)$$

The dependent variable Y measures the marital, intrahousehold, or labor market outcome of individual i . The independent variable $female$ measures the individual's gender. It is equal to one if the individual is female otherwise it equals zero. The variable T indicates the post post treatment period. T equals if the census year is 2001 or 2006 and to zero if the census year is 1991 or 1996. As discussed earlier, the increase in the OWP quota and the handover of HK to China in 1997 serve as quasi-natural experiments in reducing the cost of cross-boundary marriages. We classify the census year 1996 as the pre-treatment period. The OWP quotas increased to 150 in 1995. But the mainland individuals who migrated to Hong Kong in 1995 were actually married to local residents several years before because of the waiting time. Furthermore, the local marriage market in 1996 was not affected by the 1995 policy relaxation as it would take some time to generate any visible effects. HK residents would need some time to find mainland Chinese spouses.

Thus, the effect of cross-boundary marriages may be lagged by one or two years.³¹ X is a vector containing the control variables. ν is the error term.

We are interested in the estimated coefficient β_3 in Equation (29). The estimated β_1 and β_2 pick up the gender and time period differences in individual outcomes. The estimated β_3 thus measures the changes in the gender differences in outcomes across the change in the OWP quota and the handover. The basic idea behind the estimation of Equation (29) is to examine whether cross-gender and cross-cohort changes in the marriage and labor market behavior are related to the cross-cohort changes in the gender-asymmetric cross-boundary marriages, induced by the discrete increases in the OWP quotas and the handover. The estimate of β_3 thus provides us tests for Hypotheses 1-3. For example, we can use the dependent variable of being employed to test Hypothesis 3. We expect the estimated β_3 to be positive.

Compared with Equation (28), the gains from estimating Equation (29) are four-fold. First, this specification avoids the use of Taiwan as the comparison group and provides a robust check for the results from Equation (28). Second, we can control time trend because we have two periods before the treatment. Controlling for time trend is valuable in the quasi-experimental studies using the DD estimator (Meyer, 1995). Third, we can estimate Equation (29) using the highly and poorly educated subsamples, respectively.³² By so doing, as discussed in the theoretical section, we can empirically distinguish our theory from the boom hypothesis in explaining the major behavioral motivation for the increase in cross-boundary marriages. Fourth, in contrast to the Taiwan censuses, the HK censuses contain rich information on individual's labor market outcomes. We estimate Equation (29) using several labor market outcomes as dependent variables to test Hypothesis 3. Therefore, we can examine the precondition for the alternative boom hypothesis that the labor market favored females during the 1990s. At the same time, as discussed in the previous section, we can check the incentive effects of the gender-asymmetric cross-boundary marriages on the labor market behavior of the HK residents. The disadvantage of estimating Equation (29) is that we cannot estimate the treatment effects on HK males and females separately. We can only estimate the differential treatment effects across gender.

In summary, guided by the theoretical model, the objective of our empirical analysis is to systematically examine the general pattern of changes in the marriage market, intrahousehold, and labor market behavior between the male and female HK residents, and to relate the changes in the pattern to the decrease in cross-boundary marriage costs. The latter was induced by the increase in the OWP quota and the handover. Although strong identification assumptions are involved in estimating Equations (28) and (29), our empirical analysis provides us with an opportunity to test the hypotheses derived

³¹Our empirical results remain almost the same after dropping the 1996 census from the estimation sample.

³²HK has adopted the British education system, which is substantially different from that in Taiwan. Therefore, we do not make this distinction in estimating Equation (28).

from our general theoretical model and to distinguish our model from the alternative hypothesis in accounting for the increase in cross-boundary marriages.

6 Empirical Results

This section reports our main empirical results. Table 4 presents the DD estimates of Equation (28) using Taiwan residents as a comparison group. These estimates capture the regional changes in outcomes after the discrete increases in the OWP quota and the handover. The top panel shows that, compared with Taiwanese women, HK women's currently married and ever-married rates decreased by 2.2 and 1.8 percentage points, respectively, whereas their currently divorced rate increased by 0.7 percentage points following the increases in the OWP quota and the handover. All estimates are statistically significant the 5% level (column (2)). The results for the men are opposite to those for the women (column (3)). These results are consistent with Hypothesis 1, suggesting that the decrease in cross-boundary marriage costs enhances the marriage rate for men but reduces for women. We conclude that the increase in the OWP quota and the handover have decreased women's relative position in the marriage market. The results presented in Table 4 imply that more mainland women than men marry HK residents because 97% of HK residents are married to either local residents or those from mainland China. Therefore, hypergamy occurs with the increase in the OWP quota and the handover.

HK women's intrahousehold bargaining power decreased compared with Taiwan women during the same period. The lower panel of Table 4 reports that the probability of being a household head decreased by 6.3 percentage points for the HK women after the discrete increases in the OWP quota and the handover, suggesting a decrease in their intrahousehold bargaining power. The estimate is statistically significant at a high level of 1%. The estimation results for men are opposite to those of women. Together, these results are consistent with Hypothesis 2 and contradict the boom hypothesis.

Although the Taiwan residents serve as a good comparison group for HK residents, it is possible that the time trend is different between the two regions even without the increases in the OWP quota and the handover. This may be due to potential unobservable factors. Thus, we focus on the gender differential change in the outcomes of the HK residents by estimating Equation (29) that does not use Taiwan as the comparison group. The results are reported in Table 5.

The top panel presents the results on marital status. Column (2) shows that the change in gender difference in marital status is consistent with those reported in the top panel of Table 4 when we use Taiwan residents as a comparison group, confirming Hypothesis 1. Relative to men, the currently married and ever-married rates for women decreased by 7.7 and 6.0 percentage points respectively, whereas the currently divorced rate increased by 1.5 percentage points. The three estimates are statistically significant at the 1% level. When the whole sample is divided into two subsamples by education

levels, we find that women with an educational attainment lower than the tertiary level are more likely to be affected by cross-boundary marriages. The magnitudes (in terms of absolute values) of the three estimates for the highly educated group are only one-third to one-half of those for the less educated group. Furthermore, the estimates of the currently married and ever-married rates are statistically significant. These results are again consistent with Hypothesis 1.

The middle panel reports the results for family structure. As predicted by Hypothesis 2, HK women's relative bargaining power within the household, as indicated by being a household head, has decreased with cross-boundary marriages. This result is consistent with that reported in Table 4. When we split the sample by education levels, we find an interesting result. Relative to men, the decrease in the intrahousehold bargaining power is significantly larger for highly educated women than that for the poorly educated ones.

This apparent puzzle can be rationalized by our theoretical model. Both poorly and highly educated HK women lose intrahousehold bargaining power with the decrease in cross-boundary marriage costs, because they are no longer at the short side of the marriage market. However, the poorly educated women lose less than the highly educated group. On the one hand, women with low education are "married down" with the increase in cross-boundary marriages. Thus, their SES relative to the husbands rises, which can partly offset the overall decrease in their intrahousehold bargaining power. On the other hand, the highly educated women are married to the same husbands after the increase in cross-boundary marriages. The loss of intrahousehold bargaining power is, therefore, larger for them. These results are strongly consistent with Hypothesis 2, whereas they contradict the boom hypothesis discussed in the theoretical analysis.

Combining the results reported in both the top and middle panels, we conclude that the HK women with a high SES are worse off only at the "intensive" margin because of the loss in the intrahousehold bargaining power.³³ However, the HK women with low SES are affected not only at the "extensive" margin but also at the "intensive" margin. The former is due to the decrease in the probability of being married and the increase in the probability of being divorced, and the latter is due to the loss of the intrahousehold bargaining power. The previous discussion indicates that the welfare loss at the intensive margin is larger for women with a high SES than that for women with a low SES. However, the decrease in welfare is larger for the latter group, as a whole, because being involuntarily unmarried or divorced causes a large loss in an individual's welfare, as specified in our theoretical model.

We next examine the labor market outcomes. The estimates are reported in the lower panel of Table 5. Relative to men, HK women were more likely to participate in the

³³ Although the rate of being currently divorced increased for highly educated women, Table 5 reports insignificant effects of the decrease in cross-boundary marriage costs on the rates of being currently married and ever married.

labor market, to be employed, and to take a second job after the discrete increase in the OWP quota and the handover, and their monthly wage income was also higher (column (2)). All four estimates are statistically significant at the 1% level. We conclude that the results show a negative effect on HK women's labor market opportunities, as predicted by Hypothesis 3. Although the female labor force participation rate increased by 8.1 percentage points, the employment rate increased by only 1.3 percentage points relative to the men.³⁴ This result implies that 6.8 percentage points of HK women who participated in the labor market were unemployed. Thus, the labor market actually becomes worse toward women. Second, the increase in the female's income is mainly because they worked harder. The estimates show that, although the wage income increased by 0.5%, an increase of 0.6 percentage points occurs in the number of the HK women who took a second job. If we assume that the wage income of the second job is 80% of that of the first job, then a 0.6 percentage points increase in taking a second job translates into a 0.48% increase in the income. Thus, the gender difference in wage income shows little change after the increase in cross-boundary marriages. These results are consistent with our theoretical model in which the welfare of all HK women is negatively affected by the decrease in cross-boundary marriage costs, and women in the low tail in the distribution suffer the most.

The very low labor force participation of mainland women indicates that the gain for mainland brides from cross-boundary marriages is not mainly from the labor market, see (Bacon-Shone et al., 2008). If the mainland brides whose quality is relatively low would actively participate in the labor market, the competition in the labor market would become fiercer for HK women with low education, and correspondingly, their wage income would decrease. However, the wage income of HK women with low education rises (marginally) relative to men, whereas among the highly educated, there is no significant difference between HK women and HK men. These results clearly contradict the boom hypothesis, which assumes that the labor market favors the highly educated women.

To sum up, the empirical results on the marital status, family structure, intrahousehold bargaining, and labor market outcomes are highly consistent with our theoretical analysis. The discrete increases in the OWP quota and the handover have decreased the cost of cross-boundary marriage, and reduced HK women's relative position both in the marriage market and within the household.

The decrease in cross-boundary marriage costs has induced more gender-asymmetric cross-boundary marriages, which is similar to a decrease in the virtual sex ratio. Thus, the effect of the increase in the OWP quota and the handover is similar to that of an increase in the ratio of females in the total population in the autarky marriage market case. This correspondence directly links our results to the literature that examines the demographic and socioeconomic consequences of sex ratio imbalance, such as Angrist

³⁴The employment rate here is based on the total population.

(2002). However, our results differ from those of Angrist (2002) in some aspects. For example, he finds that an increase in the sex ratio enhances the currently married rates for both males and females. He further finds that the effects on the females are consistently larger than those on males in both demographic and economic outcomes. Our results, as reported in Table 4, show contrasting effects on men and women. Furthermore, the magnitude of the effects (in terms of absolute values) on men and women appears to be very similar. These differences mainly originate from the fact that, whereas Angrist (2002) analyzes the change in the group-specific sex ratio by keeping the aggregate sex ratio constant, we focus on the economy-wide variations in the sex ratio.

7 Repercussion Effects

This section tests the repercussion effect of cross-boundary marriages as stated in Hypothesis 4. We use the 2001 Canada Census Integrated Public Use Microdata Series (IPUMS) file (2.5% sample) and the 2000 US Census IPUMS file (5% sample), and focus on the immigrants in these countries. Given that approximately 80% of HK emigrants moved to North America, the HK immigrants in the two censuses constitute the main sample of the HK emigrant population.³⁵ We draw on two subsamples from the two censuses. The first subsample includes all those who have immigrated to the US or Canada since 1991. To ensure the comparability of the treatment and the comparison groups in our estimation of the repercussion effect, we further restrict the first subsample to one that includes only immigrants who came from HK, Taiwan, Singapore, and South Korea, which gives us the second subsample. Given that these four economies are known as the “Asia’s Four Little Tigers” in terms of their economic performance, we consider that the immigrants from Taiwan, Singapore, and South Korea constitute a sound comparison group for those from HK.

Based on the two subsamples, we focus on the estimation of the following equation:

$$Gender_i = \gamma_0 + \gamma_1 T_i + \gamma_2 HK_i + \gamma_3 T_i * HK_i + X_i \gamma_4 + US_i + \varepsilon_i. \quad (30)$$

This equation is similar to Equation (28). We use a dummy variable *Gender* as the dependent variable. It equals one if the immigrant is a female and zero otherwise. With regard to the independent variable *T* that measures the treatment period, we consider 1991-1996 as the pre-treatment period and 1997 onward as the post-treatment period. We further consider immigrants from HK as the treatment group ($HK = 1$) and immigrants from other places as the comparison group ($HK = 0$). *X* is a vector of variables that measure individual characteristics. Finally, given that we pool two census data sets, we include a dummy variable *US* that indicates the US census. ε is the error term.

³⁵The total number of HK female immigrants who moved to North America is about 2% of the total number of mainland women who married HK men in the 1990’s

Hypothesis 4 predicts that γ_3 is positive, and the magnitude of γ_3 should be larger (in terms of absolute value) in the sample of low education group. The results are reported in Table 6. Using all other immigrants in North America as a comparison group, column (1) of Panel A reports the change in the gender difference in immigrants from HK. HK women were more likely to migrate than men to North America after the increase in the OWP quotas and the handover. The estimate of γ_3 is both statistically and economically significant. Relative to the immigrants from other regions, the number of females from HK has increased by 6.8 per 100 immigrants since 1997.

In column (4) of Panel B, we restrict the comparison group to immigrants from Taiwan, Singapore, and South Korea to North America. The results are very similar to those reported in column (1). Finally, the increase in the female immigrants from HK since 1997 is concentrated on the lowly educated group. Therefore, we conclude that the results reported in Table 6 show that cross-boundary marriages induced by the increase in the OWP quota and the handover have caused a greater number of poorly educated women to migrate to North America compared with other groups. These results are strongly consistent with Hypothesis 4, and again contradict the boom hypothesis.

8 Discussion and Conclusion

We theoretically and empirically investigate cross-boundary marriages and their demographic and economic consequences. Because the distributions of marital attributes in HK and mainland China differ more for women than for men, more women from mainland China marry to men in HK than the opposite match. We thus observe a geographic manifestation of hypergamy. When cross-boundary marriage costs decrease, more gender-asymmetric cross-boundary marriages take place. The relative position of women in HK deteriorates both in the marriage market and within the household. The disadvantaged position of HK women in the marriage market and within marriage, further exert an incentive effect on their labor market behavior, as more of HK women became unemployed. In addition, the repercussion effects of the increase in cross-boundary marriages caused more HK women than HK men to migrate to richer regions.

Our finding that the deterioration in marriage market outcomes was more pronounced for HK women with low education shows that, in the HK context, the main force affecting cross boundary marriages was the change in the OWP scheme and not the rise in female education. However, our theory may also account for the increase in cross-boundary marriages in other regions such as Taiwan, South Korea, and Singapore. Along with the revolution in communication technologies in the past decades, cross-boundary marriage costs may have decreased in these countries as well, which has in turn increased the demand for cross-boundary marriages and further stimulates the service market for such marriages. The flourishing of cross-boundary marriage brokers and the Internet dating systems further reduce the cost. As these effects reinforce each other, a drastic increase

in the gender-asymmetric cross-boundary marriages takes place. For females in the low tail of the distribution in these East Asian regions, the fiercer competition for grooms could lead to the boom in higher female education. Under this hypothesized logic, the boom in higher female education can be a consequence rather than the cause of the increase in cross-boundary marriages.³⁶ The decrease in cross-boundary marriage costs, however, is usually entangled with the change in other socioeconomic factors, posing an identification problem in empirical testing. The value of the HK experience is that cross-boundary marriages are strictly regulated by the exit policy in the mainland side. The increases in the OWP quotas and the handover serve as quasi-experiments that exogenously reduce the cost compared with neighboring regions such as Taiwan.

Finally, the present study raises important normative issues. As demonstrated by our theoretical model and verified by the empirical results, there are gainers and losers from the liberalization of cross-boundary marriages. Although aggregate marital output rises upon allowing such immigration there is no simple way to enforce transfers from the gainers to the losers and implement an overall Pareto improvement. This issue seems more problematic than in the labor or good markets, where taxation can be used.

³⁶We analyze this hypothesis in another study.

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