

Cross-border Marriage Costs and Marriage Behavior: Theory and Evidence*

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Abstract

This paper analyzes cross-border marriages between mainland China and Hong Kong (HK). We examine the effects of the reduction in cross-border marriage costs that occurred following the increase in marriage migration quotas and the handover of HK to China. We find that mainly men from the low and middle of the HK attribute distribution were involved in cross-border marriages. We also find that HK women's position in the marriage market and within households deteriorated following the reduction in cross-border marriage costs. Finally, we find that HK women's disadvantaged position in the marriage market exerts an incentive effect on their labor market behavior. These outcomes are consistent with our matching model.

JEL classification: F22, J11, J12

Key words: Hypergamy, cross-border marriage, family behavior

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1 Introduction

Amid the rapid globalization in recent decades, marriages that cross the borders of nations or states have become increasingly common, although they have received relatively little academic attention. In 2010, cross-border marriages constituted more than 40% of newly registered marriages in some small economies such as Hong Kong (HK), Singapore, Switzerland, and Cyprus. In large economies such as Spain, France, and Germany, the share of cross-border marriages out of all newly registered marriages is around 20%.¹ Marriages are becoming the cause rather than the consequences of international migration. For example, marriage migration to the United States almost tripled between 1960 and 1997, increasing from 9% to 25% of all immigration (Constable, 2005). In 2009, the number of international migrants under the family reunion scheme accounted for 35% of the total number of international migrants around the world (International Migration Organization, 2010). Despite the little research which has been done, cross-border marriages have raised serious concerns of policy-makers globally (Bacon-Shone, et al., 2008; Constable, 2012).²

The surging cross-border marriages exhibit a clear gender-asymmetric pattern. The international marriage migrants are dominated by women, and most of these women move from the poor "south" to the rich "north", from parts of Asia, Latin America, East Europe, and the former Soviet Union, to Western Europe, North America, Australia, and wealthier regions of East Asia. For example, 85% of legal migrants to the US who married US permanent residents were women in 1997. The Philippines is a popular place of origin of marriage migrants. Of all Filipinos married to foreigners in the 1990s, 91% involved Filipino women. In the late 1990s, for instance, more than 99% of the over 50,000 newly married Filipino-Japanese couples involved Filipino women and Japanese men. This general tendency of poor women to marry rich men abroad has been termed "global hypergamy" (Constable, 2005).

What are the causes of gender-asymmetric cross-border marriages? What are the consequences of gender-asymmetric cross-border marriages on destination countries? As a first attempt to answer these two questions, we conduct both a theoretical and empirical analysis. We first model cross-border marriages between two countries. One is poor and the other is rich.³ By examining cross-border marriages between HK and mainland China,

¹In 2010, 5% of marriages in Japan and the US included a foreign spouse. Before 1980, the share was less than 1% in both countries.

²Under the Immigration and Nationality Act of 1952, A K-1 visa is issued to the fiancé or fiancée of a United States citizen to enter the US. In 2003, the International Marriage Broker Regulation Act was introduced as an anti-trafficking campaign in the US.

³The cross-border marriages also involve both migration from one source country to multiple destination countries and migration from multiple source countries to one destination countries. But our paper focuses on cross-border marriages from one source country to one destination country.

we then empirically test the effects of the decrease in cross-border marriage costs on the destination marriage market.

In the theoretical analysis, we first characterize the assignment profiles and utility shares profiles that would exist under autarky, allowing different distributions of marital attributes in both a poor and a rich countries. We assume that in both countries age is a more important attribute in the marriage market for women than for men as a proxy for beauty or fecundity, while income or wealth is a more important attribute for men than for women, because men usually carry the family financial responsibility in a traditional society.⁴ Under this assumption of gender asymmetry, women in the poor country are more attractive to men in the rich country than men in the poor country are attractive to women in the rich country. This situation can result in more men from rich countries marrying women from poor countries than the opposite match, displaying a geographic manifestation of hypergamy or a spatial hypergamy.⁵

We then introduce cross-border marriage costs in the form of waiting for the marriage to materialize. With a decrease in cross-border marriage costs, more gender-asymmetric cross-border marriages take place, which erodes the relative position of women in the rich country not only in the marriage market, but also within the household. As the well-being of these women deteriorates, they may more likely to participate into the labor market and work more. We call this an incentive effect.

We empirically test these theoretical predictions by investigating cross-border marriages between mainland China and HK, which serves as a great setting for studying the importance of the immigration cost in explaining cross-border marriages and its consequences in the destination marriage market. First of all, the increase in cross-border 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-border 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. 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

⁴Our 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).

⁵The 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 countries to marry men in rich countries. We thus call it spatial hypergamy.

normally had to wait 8-10 years to obtain an OWP. The waiting period was reduced to 3-5 years after 1995. Therefore, the handover and the discrete increases in the OWP quotas serve as good quasi-experiments that exogenously reduced cross-border marriage costs. In addition, marriage migration is usually twisted together with labor migration. The cross-border marriages between HK and mainland China provide a unique setting to focus on marriage migration. Labor migration from mainland China to HK is extremely restrictive, which was almost zero during our study period (Bacon-Shone et al., 2008).⁶ Finally, the observed cross-border marriages are notable for inducing gender asymmetry: HK men marrying mainland women outnumbered the opposite match seven times during the period 1986-2006.

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 first constructs a difference-in-differences estimator to test the theoretical predictions. Specifically, we use the 1991 and 2001 HK population censuses and the 1996 and 2006 by-censuses. We classify the 1991 and 1996 (by-) census years as the pre-treatment period and the 2001 and 2006 (by-) census years as the post-treatment period. With two waves of (by-)censuses, we control for the time trend in our difference-in-differences estimator. We then check the changes in gender differences in marital status and the relative power of women within the household between pre- and post-treatment period. Our empirical results show that the increases in the OWP quotas and the handover diminished females' relative positions both in the marriage market and within the household. Specifically, relative to men, HK women's currently married and ever-married rates decreased by 8.8 and 6.8 percentage points, respectively, whereas their currently divorced rate increased by 1.8 percentage points following the increases in the OWP quota and the handover. Their probability of being a household head decreased by 8.5 percentage points. Finally, we find an incentive effect in the labor market. Comparing with men, HK women were more likely to participate in the labor market and take a second job after the discrete increase in the OWP quota and the handover.

We then construct a triple-difference estimator as a robust check. Specifically, we use Taipei as a comparison group. To establish Taipei as a good control group, we carefully check the common trend hypothesis. We find that Taipei and HK share a common trend in the gender difference in marital outcomes during the pre-treatment period. The triple-

⁶ Although labor migration from HK to mainland China is also scarce, there had been some economic interactions between HK and mainland China during our study period. Some HK residents regularly go north to mainland China for work such as cross-border drivers. But the general trend of the increase in cross-border marriage is unlikely to be driven by these special groups. For example, the cross-border drivers are less than 2% of the employed population in HK. Furthermore, a survey on the new immigrants through the OWP scheme in 2011 shows that the majority of HK grooms and mainland Chinese brides know each other through relatives and marriage brokers.

difference estimation results are highly consistent with our estimation results without using Taipei as a comparison group.

A major objective of this paper is to examine which segments of the population are affected by the decrease in cross-border marriage costs and in what way. For this purpose, we use a simple matching model that predicts which group of HK residents will be mainly affected by cross-border marriages. The model predicts that cross-border marriages are more likely to be formed by HK men in the low and middle segments of the male attribute distributions because HK men at the top of HK male distribution already have local "good wives" and would not marry mainland Chinese women given the costs involved. Therefore, the model predicts the change in the marital status induced by the increase in the OWP quota and the handover should be focused on the group at the low and middle of the HK attribute distribution, while men and women in the top of the HK distribution will maintain their marriages.

The theoretical prediction thus motivates us to carry out our estimation by educational levels. We find that, in fact, most cross-border marriages involve partners with secondary education. Furthermore, our estimates show that the change in the marital status are indeed focused on the low educated group (below college). This result is consistent with our theoretical prediction. But it differs sharply from an alternative hypothesis, whereby the boom in female higher education has driven the rise in cross-border marriages because low education men prefer marrying Chinese women to highly educated HK women.

Our analysis may also explain the causes and consequences of global hypergamy. Along with the revolution in communication technologies in the past decades, cross-border marriage costs decrease, which in turn increases the demand for cross-border marriages and further stimulates the service market for such marriages. The flourishing of international marriage brokers and the Internet dating systems further reduce costs. As these effects reinforce each other, a drastic increase in the gender-asymmetric cross-border marriages takes place. Therefore, we can argue that the main cause for the global hypergamy is a combination of the decrease in costs of cross-border marriages and the gender asymmetry in marital attributes. With the global hypergamy, a new pattern of regional and gender inequality in the marriage market might emerge, whereby all men gain but all women lose in rich destination countries. On the contrary, all men lose and all women gain in poor source countries. Furthermore, men in the low tail of the marital attribute distribution in rich countries and women in the upper tail of the distribution in poor countries gain the most, whereas women in the low tail of the marital attribute distribution in rich countries and men in the low tail of the distribution in poor countries lose the most.

The remainder of this paper is organized as follows. Section 2 discusses the related

literature and Section 3 describes the background. Section 4 formulates the theoretical model. Section 5 introduces the data sets and specifies our empirical strategy. Section 6 presents our empirical results and Section 8 concludes.

2 Related Literature

We study cross-border marriages, which is a relatively new topic in the economics literature. We contribute to the research agenda in family economics that explains marriage patterns and the impact of the sex ratio on marriage outcomes and marital shares. There is little economic research that explicitly studies hypergamy. Siow (1998) discusses the effect of gender difference in fecundity on the average age gap between husbands and wives. Saint-Paul (2009) constructs a model in which women know whom their children are but men do not. In such model a marriage is more likely to occur when the husband has more human capital than the wife. We contribute to this strand of the literature by showing that different gender-asymmetric distributions of male and female marital attributes in two interrelated marriage markets can explain the gender-asymmetric cross-border marriages patterns that display a geographic manifestation of hypergamy or spatial hypergamy.

Recently, a wave of new studies has examined the consequences of changes in marriage-market conditions such as the sex ratio (e.g., Chiappori, Fortin and Lacroix, 2002; Ebenstein, 2010, 2011; Bhaskar, 2011; Edlund, Li, Yi, and Zhang, 2013; Lafortune, 2013). Our paper differs from this literature in that, following the exogenous reduction in cross-border marriage costs, the sex ratio and the composition of available types in the HK marriage market are endogenous outcomes, reflecting optimal choices of agents in HK and China to form cross-border matches based on the different attribute distributions and associated marital shares in the two regions.

3 Background

3.1 The One-way Permit, Cross-border Marriages, and Gender Imbalance in HK

Cross-border marriages have become an increasingly important element in marriages involving HK residents. Figure 1 shows the fraction of cross-border marriages of all marriages registered in HK from 1986 to 2010. The ratio shot up from 2% in 1986 to 43% in 2006, and remained at that level since then. The sharp increase in cross-border 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-border 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 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 8-10 years to obtain an OWP; however, the waiting period has decreased to 3-5 years since 1995. The shorter waiting period has greatly reduced both the material and psychological costs which in turn increased the number of cross-border marriages.

The number of cross-border marriages was significant enough to change the fundamentals of the HK marriage market. 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). The new arrivals under the OWP scheme have been a major driver of population growth in HK during the past two decades. These new arrivals constitute a lion's share of the population growth in HK. 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. Figure 2 shows 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 1995.⁷

The observed cross-border marriages are notable for their gender asymmetry. Figure 1 shows that HK men marrying mainland women outnumbered the opposite match seven times during the period 1986-2006.⁸ Therefore, the new arrivals under the OWP scheme

⁷Figure 2 shows a drop in the number of OWP arrivals in 2004. The mainland authority began to allocate the OWP quotas by provinces in the year, which resulted a mismatch between applications and quotas across different provinces. There were some over-supply of quota in some remote provinces (Bacon-Shone et al., 2008). The mainland authority has adjusted the system since 2004.

⁸In the web appendix, Figure A1 shows the number of cross-border marriages registered in HK by residence of spouses from 1986 to 2010, and Figure A2 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.

have been dominated by females, leading to increasingly female-biased sex ratios in HK.⁹ Given the large scale of cross-border marriages and these new arrivals, the sex ratio of the HK population has become severely biased toward females.¹⁰ We thus conclude that the imbalance in the sex ratio in HK is attributable to the gender-asymmetric cross-border marriages between residents of mainland China and HK.¹¹ Therefore, the sex ratio imbalance 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).

3.2 Spousal Characteristics of Cross-border Marriages

We next consider the attributes of agents involved in cross-border marriages between residents of mainland China and HK. Recalling that resident of mainland China who engage in cross-border marriages cannot migrate to HK immediately after marriage, we cannot access their information at the micro level. However, we can check the aggregate statistics on the spousal characteristics of cross-border 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 1 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)).¹²

Table 2 tabulates the distribution of the educational attainments of the grooms and brides who married in HK by residence of spouses in 2006. Cross-border marriages mainly

⁹Figure 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. Furthermore, Figure A4 shows that the sex ratio of those new arrivals with spouses in HK was severely biased toward females, although the sex ratio of new arrivals with parents in HK was almost balanced during the 1996-2006 period.

¹⁰Figure A5 in the web appendix shows the sex ratio decreased more dramatically in censuses 2001 and 2006, in particular, for the age groups of 30-34 and 35-39. The average age of new arrivals with spouses in HK under the OWP scheme is 33.8.

¹¹Figure A6 in the web appendix shows that the sex ratio at birth has been stable and balanced in past decades. Furthermore, Figure A7 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.

¹²Figure A8 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.

involve individuals with low and middle level of education and most of them have not attained tertiary education.¹³ We do not have information on individuals' income who involve cross-border marriages. But we know that the economic gap between Mainland China and HK was huge in the 1990s. For example, when HK was handed over to Mainland China in 1997, the GDP per capita was US\$27,055 in HK, in contrast to the US\$770 in Mainland China and US\$1,800 in Guangdong (NBS, 1998).

The aggregate statistics on spousal characteristics in Tables 1a-b clearly display a geographic manifestation of hypergamy. Although the motivation for cross-border 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-border 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.

4 The Model

The purpose of the model is to explain the main forces that generate cross-border 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-border marriages between the two regions. We extend the standard model in Browning et al. (2014) to analyze cross-border marriages between two open marriage markets with cross-border marriage costs.

4.1 Marital Attributes

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

$$m_i = A(\text{age}_i, y_i, \varepsilon_i) \tag{1}$$

$$f_j = B(\text{age}_j, y_j, \varepsilon_j) \tag{2}$$

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 functions $A(\text{age}_i, y_i, \varepsilon_i)$ and $B(\text{age}_j, y_j, \varepsilon_j)$ both rise in income, but age has different non-monotonic effects on men and women. Given the cultural similarity between HK and mainland China

¹³Figure A9 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.

we may assume that the two functions are the same in the two regions. However, the distributions of the main elements can be quite different. Specifically, while the age distribution is similar, the distribution of income in HK dominates that of mainland China.¹⁴ This formulation is flexible enough to allow asymmetry by gender. Importantly, the effects of age may have opposite signs for men and women and wealth may be a more important attribute for men than for women. 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.¹⁵ Allowing gender-asymmetric attribute functions is consistent with the observed patterns of the spousal characteristics of agents involved cross-border marriages that we discussed in the previous section.¹⁶

Individuals from different regions may have different marital endowments. 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 lower y . This is not necessarily true for mainland women because wealth is less important for women than men. If the cost of cross-border marriages is not too high, there exist 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-border marriages can originate from the gender-asymmetric attribute functions and the very different distributions of the attributes between the two regions.

4.2 The Autarky Marriage Market

We first consider a situation without cross-border 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 $h(m, f)$. We further assume that the utility of a single individual equals his or her marital trait m or f so that the marital surplus is $h(m, f) - m - f$. The produced marital good can be divided between partners so that the utility is *transferable* between them.¹⁷

¹⁴Section 2.2 in the web appendix discusses the differences in the distributions of both age and wages between HK and mainland China.

¹⁵The economic implications of the gender difference in fecundity are explored in Siow (1998).

¹⁶Table 1a shows that age is an important factor for HK men who marry mainland women. Comparing HK brides- HK grooms with mainland bride-HK grooms in the table, the median mainland bride is younger than the HK counterpart, and the median HK groom who marries a mainland bride (rather than a HK bride) is older. Further, among the four marriage types, Figure A8 in the web appendix shows that Mainland bride - HK groom has the largest proportion of marriages with younger brides. In terms of education, Figure A9 shows that mainland bride - HK groom combination has the largest proportion of marriages with better-educated grooms.

¹⁷This assumption allows us to have a meaningful concept of aggregate welfare in terms of a common cardinal presentation of preferences.

The household production function is assumed to be supermodular, indicating the complementarity of the male and female attributes.¹⁸ This important feature can be rationalized by the use of public goods or increasing returns in the household production function (Weiss, 1997).¹⁹ Becker (1973) first noted that complementarity within the household induces a positive assortative match in the marriage market at large, implying that

$$1 - F(m) = r(1 - G(f)), \quad (3)$$

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 uniform distributions for the male and female traits in each region such that $m \sim [a, a + \delta]$ and $f \sim [b, b + \delta]$. 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.²⁰ 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

$$m = rf + a + \delta - r(b + \delta) \equiv \phi(f) \text{ for } f \geq b, \quad (4)$$

$$f = \frac{m}{r} - \frac{a + \delta}{r} + (b + \delta) \equiv \psi(m) \text{ for } m \geq m_0. \quad (5)$$

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 satisfy²¹

$$u(m) = m_0 + \int_{m_0}^m h_m(\phi(t), t) dt, \quad (6)$$

$$v(f) = h(m_0, b) - m_0 + \int_b^f h_f(s, \psi(s)) ds, \quad (7)$$

where h_m and h_f are the *marginal* contributions of man m and female f to the marriage. 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. Having

¹⁸For example, a convenient supermodular form is

$$h(m, f) = m + f + mf.$$

¹⁹Boulier and Rosenzweig (1984) and Behrman, Rosenzweig, and Taubman (1994) provide supportive empirical evidence. See also Choo and Siow (2006, 2007) and Choo (2015) for the estimation of the transferable utility model of the marriage market.

²⁰Although the sex ratio at birth is balanced, a shortage in women always occurs in the marriage market. See the discussions in Siow (1998). One major reason is that women have a shorter reproductive window than men.

²¹For the derivation of the results, see Section 8.2.1 in Browning et al. (2014).

assumed that $r < 1$ and that singles consume their own "income," the "last" married man should have no rent such that $u(m_0) = m_0$. The woman who marries m_0 reaps all the marital surplus such that $v(b) = h(m_0, b) - m_0$.

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.²² This result applies to each isolated marriage market model. However, by extending the standard model to a two-marriage-market case, we shall also discuss changes resulting from substantial cross-border movement that would raise the total number of women (local and mainland Chinese women) in HK to the point that some women in HK become single.

4.3 Cross-border Marriages

We now consider HK and mainland China as two marriage markets with possible migration between them.²³ To motivate the asymmetric cross-border 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

$$a_h + \delta > a_c + \delta \geq a_h, \quad (8)$$

$$b_h + \delta > b_c + \delta \geq b_h, \quad (9)$$

where the subscript h stands for HK and the subscript c stands for mainland China. We thus assume that the top men (women) in HK 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-border 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 mainland China women: $a_h - a_c > b_h - b_c$. To simplify further, we assume the same sex ratio in the two regions 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 HK 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 $\sigma \gg 1$.

We take into account that there are costs of waiting associated with the OWP scheme.

²²See Becker (1991) and Browning et al. (2014).

²³To be consistent with the empirical analysis, we consider marriage migration only, as labor migration between HK and mainland China was highly restricted during the period we study.

During proportion w of time, the newly married partners live separately applying for the OWP. After obtaining the OWP, the partners live together during the remaining proportion $1 - w$ of the time.

Agents in each country are identified by their marital attributes. We denote by m_h (m_c) a male in HK (China) with endowment m and by f_h (f_c) a woman in HK (China) with endowment f . We then write the marital output of a cross-border marriage as

$$w(m_h + f_c) + (1 - w)h(m_h, f_c). \quad (10)$$

In our analysis, we assume that, because its population size, emigration does not affect the marital shares of women from mainland China. However, the marital shares of HK men, $u(m_h)$, and of HK women, $v(f_h)$, can change when the cross-border restriction is reduced. Specifically, 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 marry women from China. Therefore, we focus here only on the ex-ante demand for cross-border marriages at the time of the change in the policy.²⁴

Taking the autarky shares in both HK and China HK as given, a necessary condition for a cross-border marriage between a married woman in mainland China and a married man in HK is that the newly formed marriage covers at least the sum of the utilities received by the two partners in their marriage in the autarkic case:

$$w(m_h + f_c) + (1 - w)h(m_h, f_c) \geq u(m_h) + v(f_c). \quad (11)$$

This condition is necessary because otherwise at least one partner will be worse off in the new marriage. A similar condition applies to cross-border marriages between HK women and men from mainland China. However, based on the observed data, we shall focus on cross-border marriages of HK men to women from mainland China, assuming that only such cross-border marriages take place.

We are interested in the pattern of cross-border marriages that form when marriage immigration becomes possible. Starting with autarky in both mainland China and HK, the marital shares of married men in HK are given by

$$u(m_h) = m_{h,0} + \int_{m_{h,0}}^{m_h} h_{m_h}(\phi(t), t) dt, \quad (12)$$

²⁴Deriving the ex-post shares jointly with the associated marriages that will form in the equilibrium is a difficult numerical problem that is beyond the scope of this paper.

while the marital share of married women in mainland China is

$$v(f_c) = h(m_{c,0}, b_c) - m_{c,0} + \int_{b_c}^{f_c} h_{f_c}(s, \psi(s)) ds \quad (13)$$

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

Because men in HK can compete for 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 HK, implying that

$$r\sigma\left(\frac{b_c + \delta - f_c}{\delta}\right) = \frac{a_h + \delta - m_h}{\delta}. \quad (14)$$

Hence, the prospective mainland wife of man m_h in HK is

$$f_c(m_h) = \delta + b_c + \frac{m_h - \delta - a_h}{r\sigma}. \quad (15)$$

Rewriting the necessary condition (11) as

$$w(m_h + f_c(m_h)) + (1 - w)h(m_h, f_c(m_h)) \geq u(m_h) + v(f_c(m_h)) \quad (16)$$

will guarantee that it is also a sufficient condition because, by construction, the match between m_h and $f_c(m_h)$ cannot be blocked by another cross-border match as m_h is already matched to the best Chinese women he can get.²⁵ This condition also guarantees that the mainland Chinese woman $f_c(m_h)$ can be "bribed" by man m_h to move to HK and form a cross border marriage with him.²⁶

Given its complexity, the model does not yield analytically tractable solution. We then simplify our model by assuming "*exogenous outside option payoffs*" for mainland Chinese women.²⁷ Specifically, we assume that $v(f_c(m_h))$ is exogenous such that $v(f_c(m_h)) = v$. This assumption can be justified as follows. The population size (mass) of mainland Chinese women is huge. The size of the mainland Chinese women involving cross-border marriages is very small. Thus, (1) the emigration of these women will not affect the distribution of marital payoffs of the Chinese people as in the autarky case; (2) these women constitute just one point (snapshot) of the distribution of women in mainland China. They are thus assumed to be homogenous and have the same payoff as in the autarky case, which we denote by v . (3) The injection of Chinese women is large enough to change the sex ratio in HK which shifts to $r_h^+ > 1$.²⁸

²⁵See Roth and Sotomayor (1992, ch.1)

²⁶Note further that woman $f_c(m_h)$ cannot use the offer from m_h to raise her share in China because there is a very close substitute for her in China.

²⁷We thank the editor and an anonymous referee for the suggestion.

²⁸The assumption of exogenous outside option payoffs is held only for a given period. With the change

Denote the best HK man involved in cross-border marriages as $m_{h,1}$. Then, by solving

$$w(m_{h,1} + f_c) + (1 - w)h(m_{h,1}, f_c) - u(m_{h,1}) - v = 0. \quad (17)$$

we have $m_{h,1} < a_h + \delta$, because we assume that the quality of the top HK woman is higher than that of the top mainland Chinese woman (Equation (8)). We further assume that w is sufficiently low such that $m_{h,1} > m_{h,0}$, where $m_{h,0}$ is the last married HK man in the autarky case. Thus, we can pin down the cross-border marriage pattern as follows.²⁹ The HK men in the range $[m_{h,1}, a_h + \delta]$ marry to the same HK women as in the autarky case, and those in the range of $[a_h, m_{h,1})$ marry to mainland Chinese women. The HK women in the range $[f_h(m_{h,1}), b_h + \delta]$ marry to the same HK men as in the autarky case, whereas those in the range of $[b_h, (m_{h,1}))$ remain single.³⁰

Given the model, we now examine how the model responds to changes in parameters. We are particularly interested in the decrease in the cost of waiting time w , because it is directly affected by the OWP scheme. The increase in OWP quotas decreases the waiting time (the value of w).³¹ Therefore, our main interest centers on identifying its impact on the marriage market and household. The reduction in cross-border marriage costs can have a large effect on the assignment patterns and gains from marriage in HK.

We first examine the effect of the waiting time on the assignment patterns. With an exogenous outside option payoff for mainland Chinese women, the decrease in cross-border marriage costs increases the number of cross-border marriages. Totally differentiating Equation (17) with respect to w , we have

$$\frac{\partial m_{h,1}}{\partial w} = \frac{h(m_{h,1}, f_c) - m_{h,1} - f_c}{w + (1 - w)f_c - \frac{\partial u(m_{h,1})}{\partial m_{h,1}}} > 0, \quad (18)$$

where $w + (1 - w)f_c$ is the marginal contribution of $m_{h,1}$ to the marital output of the potential cross-border marriage, and $\frac{\partial u(m_{h,1})}{\partial m_{h,1}}$ is the marginal contribution to his share in the autarky case. Equation (18) shows that a decrease in cross-border marriage costs is associated with more HK men involving in cross-boundary marriages. At the same time,

in economic development of mainland China, the outside option payoffs for mainland Chinese involving in cross-border marriages may change.

²⁹Essentially, we assume that, following the opening of the HK for immigration, an exogenous mass of women from mainland China migrate to HK with the intention to find a match with local men there. Consequently, the ratio of women to men in HK rises significantly to $r^+ > 1$.

³⁰Admittedly, the case we consider is a special one with a series of strong assumptions. But this special case is tractable and maintains the main features of cross-border marriages between HK and mainland China. A more general case with weaker assumptions and the simulation results are discussed in Section 2 of the web appendix.

³¹So far, we literally interpret w as the waiting time. In reality, w can be broadly interpreted as a searching cost. After the handover, the socioeconomic integration between mainland China and HK could also decrease the searching cost between the two regions, and accordingly w .

more HK women become single when w decreases. This result is summarized in our first hypothesis.

Hypothesis 1. *The decrease in cross-border 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 married rates.*

Importantly, our model further predicts which segments of the population are affected by the decrease in cross-border marriage costs induced by the increase in the OWP quota and the handover. Specifically, women (men) in the upper part of the distribution, $f_h \in [f_h(m_{h,1}), b_h + \delta]$ ($m_h \in [m_{h,1}, a_h + \delta]$), maintain their marriage. This result is summarized in our second hypothesis.

Hypothesis 2. *The change in the marital status should be focused on the group at the low tail of the HK distribution, while men and women in the top will maintain their marriages.*

Finally, with a decrease in cross-border marriage costs, our model also predicts that the marital share of all men rises while the marital share of all women declines. Specifically, the new shares for HK men $m_h \in [m_{h,1}, b_h + \delta]$ and HK women $f_h \in [f_h(m_{h,1}), a_h + \delta]$ are:

$$u(m_h) = h(f_h(m_{h,1}), m_{h,1}) - m_{h,1} + \int_{m_{h,1}}^m h_m(\phi(t), t) dt, \quad (19)$$

$$v(f) = m_{h,1} + \int_{f_h(m_{h,1})}^f h_f(s, \psi(s)) ds, \quad (20)$$

Comparing to the shares in the autarky case (Equations (6) and (7)), HK men $m_h \in [m_{h,1}, b_h + \delta]$ are better off following the injection of mainland Chinese women; at the same time, HK women $f_h \in [f_h(m_{h,1}), a_h + \delta]$ are worse off. For HK women $f_h \in [a_h, f_h(m_{h,1})]$, they are also worse off. At the same time, for HK men $m_h \in [b_h, m_{0,1})$ and $m_h \in [b_h, m_{h,1})$, they are better off because the former group changes from singles to being married, and the latter group forms better matches with mainland Chinese women. The result is summarized in our third hypothesis.

Hypothesis 3. *The intrahousehold power tilts toward men with the decrease in cross-border marriage costs.*

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 marriage, 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.

Before discussing our model implications of the gender-asymmetric cross-border marriages for HK residents' labor market behavior, we argue that the simple matching theory above can well explain the descriptive patterns presented in the background section. First, column (2) in Table 1 shows that among four marriage types, the mainland bride - HK groom marriages have the largest husband-wife age gap by 9 years. Our theory predicts that with a decrease in cross-border marriage costs, men in HK can choose between local HK women and mainland women. As mainland women are less educated than local HK women (Table 2), they are more likely to be chosen if they are young.

Second, Figure 1 shows the proportion of HK men involved in cross-border marriages has been rising until 2005 stabilized between 2005 and 2010, while the proportion of HK women involved in such marriages continued to rise mildly. This diverging profiles can be rationalized by our model via a process of replacement of local women by imported women, creating a pool of local single women, which in turn reduced the incentive of HK men to import more women from China.

4.4 Model Implications for the Labor Market

The empirical analysis below focuses on testing the three hypotheses which are directly derived from our model. In addition, some indirect testable implications will also be examined. Although we do not directly observe the marital shares that men and women receive in marriage, we expect the changes in the relative position of men and women in the marriage market to affect some observed household outcomes, such as the relative amount of market work performed by husbands and wives. Specifically, the decrease in cross-border marriage costs changes the men and women's incentives in the labor market. For example, the female labor force participation rate increases relative to that of men. Furthermore, the incentive effects are larger for women with low education than for women with high education.³² In this sense, the effect of the increase in gender-asymmetric cross-border marriages on HK residents' labor market performance is similar to the effect of the decrease in sex ratios. But in contrast to the literature, the change in sex ratio in the HK marriage market is an endogenous outcome. It is the outcome of gender-asymmetric cross-border marriages induced by the increase in OWP quotas and the handover.

³²In the marital attribute function (Equations (1) and (2)), an individual's quality is determined by both age and income. This prediction focuses on education because we control for age in the regression analysis below. We then use education as a proxy variable for the individual's potential earning ability.

4.5 The Education Boom as an Alternative Model

The hypotheses and implications above can be used to compare and differentiate our theory to an alternative theory that addresses the increase in gender-asymmetric cross-border marriages. The major alternative explanation for the rapid growth of cross-border marriages is the boom of female higher education (Kawaguchi and Lee, 2012). Indeed, 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). But this trend has some different implications from those derived from our model. In contrast to hypothesis 2, the education boom hypothesis would suggest that the change in marital status should mainly occur within the group with a high education. In contrast to hypothesis 3, the boom model predicts increases in the power of women because they have more outside options with the increase in female educational attainment.

5 Data and Empirical Framework

5.1 Data

Our empirical analysis below mainly involves comparisons of the HK marriage market across four census years 1991, 1996, 2001, and 2006. There were almost no cross-border marriages in 1991 (Figure 1). 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-border marriages. To examine empirically the consequences of the decrease in cross-border marriage costs in the marriage market, within the household, and in the labor market in HK, we draw on comprehensive census data sets from HK and Taiwan. We first describe these census data sets.

5.1.1 HK (By-)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 and aged 24-55 in

the census year.³³ Most of the immigrants to HK during the past two decades have arrived through cross-border marriages between residents of mainland China and HK. Cross-border marriages are endogenous outcomes; hence, including immigrants that arrived through cross-border 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 hypotheses 1 and 2, we use three variables to measure marital outcomes: currently married, ever-married, and currently divorced.³⁴ To test hypothesis 2 regarding the relative decision power of husband and wife, we use a dummy variable of being a household head as a proxy for intrahousehold power. It is an appropriate proxy variable. 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 power.³⁵ Because the by-census 2006 codes the household head differently from others, we drop this by-census in our analysis with respect to intrahousehold power. Only 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. To examine the incentive effects of the decrease in cross-border marriage costs on the labor market, we construct four labor market outcomes: labor force participation, employment status, wage,³⁶ and whether the individual holds a second job.

5.1.2 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,

³³Most individuals would complete their college after age 23.

³⁴It is preferable to use the variables newly married and newly divorced to measure the change in marital status in response to the policy change. The HK censuses do not provide information on marriage year but in the age group we use, 22-55, death is negligible. Thus, the difference-in-differences estimates of the currently married, ever-married, and currently divorced that we employ reflect mainly new marriages and new divorces.

³⁵The HK censuses do not contain information in household expenditure or individual consumption. Thus, household head is the only variable which we can use to measure the relative decision power of husband and wife.

³⁶We only include the wage from the primary job.

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. However, the Taiwan censuses do not contain information on individual’s labor market outcomes as in the HK censuses.³⁷

5.2 Empirical Framework

It is beyond the scope of the paper to structurally estimate the model because of the data limitation. There exists no documentation of cross-border marriage data at the individual level. Moreover, 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. More modestly, we test the theoretical predictions just described in reduced form. Specifically, we empirically test the effects of the decrease in the cost of waiting time w , because it is directly affected by the OWP scheme and the handover.

Our econometric analysis involves cross-time, cross-gender, and cross-region 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-border 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-border activities and then decrease cross-border marriage searching costs.

Specifically, our first regression equation is a DD estimator which explore the richness of the four waves of HK census and by-censuses (1991, 1996, 2001, and 2006)

$$Y_i = \alpha_0 + \alpha_1 female_i + \alpha_2 T_i + \alpha_3 female_i * T_i + X_i \alpha_4 + trend + u_i. \quad (21)$$

The dependent variable Y measures the marital, intrahousehold, or labor market outcome of individual i . The independent variable $female$ indicates the individual’s gender. It is equal to one if the individual is female otherwise it equals zero. We use the variable T to indicate the post-treatment period. T equals one 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-border 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 HK in 1995 were actually married to local residents several years before because of the waiting time. Furthermore, the local marriage market in 1996

³⁷The definitions of household head are different between HK and Taiwan censuses. So we do not use the information on household head in Taiwan censuses.

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-border marriages may be lagged by one or two years.³⁸ X is a vector of variables that measure the individual's characteristics such as age, age squared, and schooling years. $trend$ is a survey year trend. u is the error term.

We are interested in the estimated coefficient α_3 in Equation (22). The estimate coefficients of α_1 and α_2 pick up the gender and time period differences in individual outcomes. The estimated γ_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 (22) is to examine whether cross-gender and cross-census changes in the marriage and labor market behavior are related to the cross-census changes in the gender-asymmetric cross-border marriages, induced by the discrete increases in the OWP quotas and the handover. So, the identification assumption is that, without the changes in the OWP quotas and the handover, the changes in HK men and women's marital, intrahousehold, and labor market behavior is the same between 1991-1996 and 2001-2006 after controlling for the time trend. Under this assumption, the estimates of α_3 allow us to test hypotheses 1 and 3 and other implication derived from our model. 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 negative. To test hypothesis 2, we estimate Equation (22) using the highly and lowly educated subsamples, respectively. For example, if we use currently married as a dependent variable, hypothesis 2 predicts that the magnitude of α_3 (in terms of absolute value) is larger for the lowly educated subsample.

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.

We now examine the common trend assumption used in the DD estimator. Panels (a)-(c) in Figure 3 show the proportion of persons who are currently married, ever-married, and currently divorced by gender in HK across censuses 1991, 1996, 2001, and 2006. We find a clear gender-divergent pattern since 1996. The gender differences in the currently

³⁸Our empirical results remain almost the same after dropping the 1996 census from the estimation sample.

married, ever-married, and divorced and not remarried rates changed little from 1991 to 1996. Since 1996, for example, the currently married rate experienced a substantial increase for males. On the contrary, for females, the currently married rate decreased.³⁹ Given that (1) both the sex ratio at birth (Figure A6 in the web appendix) and the sex ratio of the residents born in HK (Figure A7) have been stable and balanced in the past decades, and (2) marriage is a kind of one-to-one match, these gender-divergent trends in the marriage status across HK residents since 1995 can be well explained by cross-border marriages.⁴⁰

Our second regression equation is a triple-difference estimator using Taiwan as a comparison group

$$Y_i = \beta_0 + \beta_1 HK_i + \beta_2 T_i + \beta_3 female_i + \beta_4 HK_i * T_i + \beta_5 HK_i * female_i + \beta_6 T_i * female_i + \beta_7 HK_i * T_i * female_i + X_i \beta_8 + trend + \epsilon_i, \quad (22)$$

where the dependent variable Y measures individual i 's marital status. We use HK 1991 and 2001 censuses and 1996 and 2006 by-censuses, Taiwan 1990 and 2000 censuses in estimating Equation (22). Taipei 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 Taipei. We use T to indicate the post-treatment period, which is equal to one if the individual is included in the HK 2000 census, 2006 by-census, or the Taipei 2001 census. If the individual is included in the 1991 HK census, 1996 by-census, or the 1990 Taipei census, T is equal to zero. The variables $female$, $trend$, and the vector X are defined in the same way as in Equation (21). ϵ is an error term.

The coefficient of primary interest is β_7 . It measures the cross-regional, cross-time, and cross-gender changes in the outcomes driven by changes in gender-asymmetric cross-border marriages. If we assume that, without the discrete changes in the OWP quota and the handover, the gender difference between HK and Taipei local residents shares the same time trend of marriage behavior, β_7 has a causal interpretation. Furthermore, the estimate of β_7 provides us with direct tests of hypothesis 1. For example, to test hypothesis 1, we use the indicator of being currently married as the dependent variable. Hypothesis 1 then predicts that β_7 is negative. To test hypothesis 2, we estimate Equation (22) by using the highly and lowly educated subsamples, respectively. For example, if we

³⁹It is important to note that the currently married rate for males surpassed that for females in the 2006 by-census (Panel (a)), although historically, the currently married rate for the females has been higher than that for males across almost all societies (Becker, 1991).

⁴⁰We also control for the 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).

use currently married as a dependent variable, hypothesis 2 predicts that the magnitude of β_7 is more negative for the lowly than for the highly educated subsample.

We believe that Taipei residents serve as a reasonably good comparison group for HK residents for several reasons: First, Taipei, HK, and the mainland share the same Chinese cultural background. Second, the Taipei government did not change its marriage immigration policies during the 1990s. Although it strengthened its immigration policies to discourage marriage immigration in 2004, this does not affect our empirical analysis because we only use Taipei census 2000 as the post-treatment period. Third, Taipei and HK experienced similar macroeconomic fluctuation during the 1990s, such as the 1997 East Asian financial crisis. Fourth, mainland China has been the dominant region for both Taipei and HK residents to source brides.

The identification assumption in estimating Equation (22) is that HK and Taipei residents share a same trend of gender difference in marriage behavior. We now examine this common trend assumption. Figure 4 depicts the gender differences in currently married rates (males minus females) in HK and Taipei, respectively, during our study period. We find that HK and Taipei residents indeed share a same trend of gender difference in currently married rates during the pre-treatment period. This fact establishes Taipei as a good comparison group for HK in our empirical analysis.

Despite the good reasons and statistic facts that favor our identification strategy of using Taipei as a comparison group, we exercise two cautions. On one hand, both Taipei and HK source brides from mainland China, which may lead to some potential general equilibrium effects. We argue these potential general equilibrium effects may not be a main threat to our identification strategy. The official languages used in HK are English and Cantonese. So, about 86% of the brides are from Guangdong, the province neighboring HK (Bacon-Shone, et al., 2008). Guangdong is one of the two provinces in China where the residents speak Cantonese. In contrast, the main languages used in Taiwan are hokkien and mandarin, and thus the majority of brides are from Fujian province where the residents speak hokkien.⁴¹

On the other hand, Figure 4 shows that relative to females, the males' currently married rate increased by more than 10 percentage points in Hong Kong in the 1990s. During the same period, the males' currently married rate relative to females increased by about 2 percentage points in Taipei. The decrease in the gender difference in currently married rate in Taipei might be due to the some unknown immigration policy changes

⁴¹ Although HK and Taipei source brides from different provinces in China, the general equilibrium effect may still exist. For example, if women in Guangdong and Fujian provinces marry to HK and Taipei men, men in Guangdong may compete with Fujian men by sourcing brides from other provinces in China. These potential general equilibrium effect may be small considering the huge population size in mainland China relative to those in HK or Taipei.

which may decrease the cross-border marriage cost between Taipei and Mainland China and, correspondingly, increase the cross-border marriages during this period. If this is the case, Our DD estimates can be interpreted as a lower bound of the effects of the reduction in cross-border marriage costs on the marital outcomes in Hong Kong.

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, intra-household, and labor market behavior between the male and female HK residents, and to relate these to the decrease in cross-border marriage costs induced by the increase in the OWP quota and the handover. Our empirical analysis provides us with an opportunity to not only test the hypotheses derived from our theoretical model but also distinguish them from the hypothesis derived from the alternative boom hypothesis in explaining the increase of cross-border marriages.

6 Empirical Results

6.1 Marital and Intrahousehold Outcomes

This subsection reports our main empirical results on testing hypotheses 1-3. Table 4 presents the DD estimates of Equation (21). These estimates capture the gender differences in outcomes after the discrete increases in the OWP quota and the handover. The top panel shows that, compared with HK men, HK women’s currently married and ever-married rates decreased by 8.8 and 6.8 percentage points, respectively, whereas their currently divorced rate increased by 1.8 percentage points following the increases in the OWP quota and the handover. All estimates are statistically significant at least at the 1% level (column (1)). These results are consistent with hypothesis 1, suggesting that the decrease in cross-border marriage costs reduces the marriage rate for women relative to men. 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.

When the whole sample is divided into two subsamples by education levels, we find that women with an educational attainment lower than college level are more likely to be affected by cross-border marriages (columns (2)-(3)). The magnitudes (in terms of absolute values) of the three estimates for the highly educated group are much smaller for the highly educated group than the less educated group. Furthermore, the estimates of the currently married and ever-married rates are statistically significant. These results are consistent with hypothesis 2.⁴² The change in the marital status should be focused

⁴²The differences in the estimates between the highly and lowly educated groups are statistically

on the group with a low education. Our result contradicts the education boom as an alternative explanation for the increase in cross-border marriages, because it predicts the change in the marital status focuses on the group with a high education.

HK women's intrahousehold power decreased compared with HK men during the same period. The middle panel of Table 4 reports that, relative to HK men, the probability of being a household head decreased by 8.5 percentage points for the HK women after the discrete increases in the OWP quota and the handover, suggesting a decrease in their intrahousehold power. The estimate is statistically significant at a high level of 1%. This result is consistent with hypothesis 3 and again contradicts the boom hypothesis, because the latter predicts an increase in women's intrahousehold power.

When we split the sample by education levels, we find that the decrease in the intrahousehold power is marginally larger for highly educated women than that for the poorly educated ones. This result is different from what we observe from the marriage market outcomes above, in which the negative effect of cross-border marriages focuses on group with a low education. This apparent puzzle can be explained by our theoretical model. Both poorly and highly educated HK women lose intrahousehold power with the decrease in cross-border marriage costs, because they are no longer at the short side of the marriage market. However, the poorly educated women may lose less than the highly educated group for two reasons. First, women with low education may "married down" with the increase in cross-border marriages. Hence, their education relative to the husbands rises, which can partly offset the overall decrease in their intrahousehold power. Second, the highly educated women are married to the same husbands after the increase in cross-border marriages.

Combining the results reported in both the top and middle panels, we conclude that the HK women with a high education are worse off only at the "intensive" margin because of the loss in the intrahousehold power.⁴³ However, the HK women with a low education 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 power. The previous discussion indicates that the welfare loss at the intensive margin is larger for women with a high education than that for women with a low education. 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.

significant.

⁴³ Although the rate of being currently divorced increased for highly educated women, Table 4 reports insignificant effects of the decrease in cross-border marriage costs on the rates of being currently married and ever married.

In Table 4, we focus on the gender differential change in the outcomes of the HK residents by estimating Equation (21) that does not use Taipei as the comparison group. It is possible that the time trend in marriage and household behavior is different between HK men and women even without the increases in the OWP quota and the handover. A potential candidate is the East Asian financial crisis which happened in the same year as the handover. These considerations motivate us using Taipei as a comparison group for our analysis.

Table 5 reports the tripe-difference estimates of Equation (22) (β_7) using Taipei as the comparison group. Column (1) shows that the change in gender difference in marital status is consistent with those reported in the top panel of Table 4, confirming hypothesis 1. Relative to men, the currently married and ever-married rates for women decreased by 6.2 and 4.7 percentage points respectively, whereas the currently divorced rate increased by 1.4 percentage points. The three estimates are statistically significant at the 1% level. Comparing to Table 4, the three estimates (in terms of absolute values) are marginally smaller. When we divide the sample by education levels, the results reported in columns (2) and (3) are consistent with those reported in Table 4, confirming hypothesis 2. Columns (4)-(6) replicate columns (1)-(3) by adding the time trend. We find that the estimates experience little changes after controlling for the time trend.

6.2 Labor Market Outcomes

Although our model does not explicitly address labor supply, we also examine some labor market outcomes. The estimates are reported in the lower panel of Table 4. Relative to men, HK women were more likely to participate in the labor market, to be employed, and to take a second job after the discrete increase in the OWP quota and the handover. All three estimates are statistically significant at the 1% level. We also find that women's monthly wage income from their first job increases relative to men, but the estimate is statistically insignificant. We conclude that the results show a negative effect on HK women's labor market opportunities, as implied by our theoretic model. First, while 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. This result implies that 6.8 percentage points of HK women who participated in the labor market were unemployed. Second, relative to men, HK women worked harder. Their probability of holding a second job increases by 0.6 percentage points. Although females' wage income increases by 0.6%, the estimate is imprecisely measured. These results are consistent with our theoretical model in which the welfare of all HK women is negatively affected by the decrease in cross-border marriage costs.

In columns (2) and (3), we divide the whole sample into the lowly and highly educated sub-samples. The magnitudes of the estimates are larger for the lowly educated group.

Moreover, the estimate of labor force participation is statistically insignificant for the highly educated group. These results are consistent with our theoretical prediction that HK women in the low tail in the distribution are more likely to be affected by the increase in cross-border marriages.

7 Discussion and Conclusion

We theoretically and empirically investigated cross-border 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 that when cross-border marriage costs decrease, more gender-asymmetric cross-border 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.

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-border marriages was the change in the OWP scheme and not the rise in female education. For females in the low tail of the distribution, 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-border marriages.⁴⁴ The decrease in cross-border 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-border 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.

We focus on only two interacting marriage markets. The cross-border marriage between mainland China and HK could be put in a global context. 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-border marriages. If the well-being of local female residents deteriorates after the increase in cross-border marriages, women will be more likely to leave HK to other developed regions such as Canada and the US. Therefore, we may observe a chain of geographic manifestations of hypergamy. Specifically, the increase in cross-border marriages could generate emigration from HK to the US and Canada that is biased toward

⁴⁴See Bhaskar and Hopkins (2015) for a general characterization of the marriage market condition and pre-marital human capital investment.

females.⁴⁵

Our model is potentially applicable to cross caste marriages, where social norms create "borders" between social groups. In this case, one may consider reduction in costs as norms change. See Banerjee et al. (2013) for the case of India. The model might also be used to explain the rural-to-urban marriage migration in China which is also dominated by women (Ebenstein, 2010, 2011).

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-border 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.

⁴⁵Section 3 in the web appendix tests the repercussion effect. The results are consistent with our predictions.

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