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Marrying Up: the Role of Sex Ratio in Assortative Matching

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Marrying Up: The Role of Sex Ratio in Assortative Matching*

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Abstract

We test the effect of a change in the sex ratio on marital assortative matching by social class using a large negative exogenous shock to the French male population due to WWI casualties. We analyze a novel data set that links marriage-level data to both French censuses of population and regional data on military mortality. We instrument the sex ratio in a region with military mortality, which exhibits exogenous geographic variation. We find that men married women of higher social class than themselves (married up) more in regions that experienced larger decreases in the sex ratio. A decrease in the sex ratio from one man for every woman to 0.90 men for every woman increased the probability that men married up by 8 percentage points. These findings shed light on individuals' preferences for spouses. Rather than preferring to marry spouses from the same social class, men seem to prefer to marry higher-class spouses, but cannot do so when the sex ratio is balanced.

JEL Code: J12, N34

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1. Introduction

While the sex ratio has been shown to be an important determinant of marriage market outcomes such as marriage rates (e.g. Angrist, 2002), we still know little about the effect of the sex ratio on assortative matching. This is despite the fact that positive assortative matching by spouses' characteristics is a well-known and widespread phenomenon,[1] and has important implications for social inequality, income redistribution, fertility, education, and labor supply (e.g. Fernandez and Rogerson, 2001). The main challenges in studying the effect of the sex ratio on assortative matching are the lack of appropriate marriage-level data and the endogeneity of the sex ratio.

In this paper, we address these challenges by assembling a new marriage-level data set and using the large exogenous shock World War I (WWI) casualties caused to the French male population to test the effect of a change in the sex ratio on marital assortative matching by social class. We analyze a novel data set that links marriage-level data to both French censuses of population and regional data on military mortality. We instrument the sex ratio in a region with military mortality, which exhibits exogenous geographic variation. We find that men married women of higher social class than themselves (married up) more in regions that experienced larger decreases in the proportion of men in the population.

We exploit the regrettable fact that WWI, one of the deadliest conflicts in recent human history, produced an exogenous and unusually large shock in the French male population. Approximately 16.5% of French soldiers were reported dead or missing after the war (Huber, 1931). The First World War in France provides an ideal setting to test the effect of the sex ratio on marriage by social class for the following reasons. First, the ratio of men aged 18 to 59 to women aged 15 to 49 decreased exogenously as a result of the military mortality, from 1,087 men per 1,000 women in 1911 to 992 men per 1,000 women in 1921.[2] Second, military mortality varied substantially across regions, ranging from 10% to 20% (see Figure 1.1), largely because men served in regiments with others from their regions, and different regiments were sent to battles of different intensities. This variation generated substantial heterogeneity in sex ratios across regions, reaching 864 men per 1,000 women in some regions, which allows us to test the impact of a change in the sex ratio on assortative matching. Finally, unlike in many other wars, military mortality was essentially uniform across social classes, meaning that the distribution of social classes in the population remained largely unchanged by the war. This fact rules

[1] See, for example, Hout (1982), Mare (1991), Kalmijn (1998), McPherson, Smith-Lovin, and Cook (2001), Blossfeld and Timm (2003). See also Pencavel (1998) and Rose (2001) for trends in assortative matching in the U.S.
[2] Since this war was fought in the battlefield, civilian mortality (which is more balanced across genders) was lower than in later major wars such as the Second World War.

out the hypothesis that changes in marriage by class following the war were mechanically driven by changes in the distribution of people across classes.

Analyzing the impact of the sex ratio on assortative matching is not only interesting per se, but may also improve our understanding of the causes of the marital assortative matching observed in so many societies. There are several possible explanations for why individuals tend to marry people with similar characteristics under a balanced sex ratio. One possibility is that individuals have horizontal preferences. That is, they choose spouses with similar social status simply because they derive more utility from marrying people like themselves.[3] Alternatively, individuals may have vertical preferences, and thus prefer to marry others of higher social status, but they cannot, because people of higher social status do not want to marry them.[4] Finally, assortative matching may be a consequence of individuals having the opportunity to meet only people who share their characteristics. If individuals marry by social class because they intrinsically have horizontal preference, or because they meet only potential partners with the same background, an exogenous decrease in the proportion of men in the population would have no effect on assortative matching: men would continue to marry women of the same social class. If instead individuals prefer spouses of higher class than themselves, the same decrease in the proportion of men, which improves the position of men in the marriage market, would enable them to marry women from higher social classes, who were previously inaccessible.

Our empirical analysis uses a new data set that links non-public marriage-level data to French censuses of population and regional data on military mortality. Social classes are assigned to individuals using marriage certificate data that provide detailed information on the specific occupations of the brides, grooms, and their parents. Based on their occupations (or the characteristics of their families for women without occupations), we assign individuals to one of seven ordered social classes using the Historical International Social Class Scheme (HISCLASS) developed by van Leeuwen and Maas (2005a). This thorough and impressive scheme that maps occupations to social classes is based on several dimensions of occupation such as whether it involves supervision of others, the skill level required to perform it, whether it is manual or not, and the associated economic sector. The classes in HISCLASS were carefully constructed to categorize individuals according to their life chances and reflect their social status. We note that, while social class is correlated with income, it encompasses

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[3] Sociologists and psychologists have extensively studied people's desire to interact with others who are like them. See McPherson, Smith-Lovin, and Cook (2001) for a review of the sociology literature on homophily and its causes, and Huston and Levinger (1978) for a review of the experimental psychology literature showing how attraction is influenced by perceived similarities. Banerjee et al. (2009) show that individuals in India have very strong preferences for within-caste marriage. Rose (2005) presents several historical/anecdotal examples in which men are advised or tend to avoid marrying women of higher social status.

[4] See, for example, Burdett and Coles (1997) for a theoretical model.

several other dimensions that are relevant for marriage. For example, an individual's social class also depends on her level of skill and therefore education, and on the social status and prestige associated with her occupation.

There was considerable assortative matching by social class in France before WWI: 43% of men married women of the same social class, and the distance between the social classes of spouses was 1 or less for 68% of couples. In addition to the information used to assign social class, the marriage certificate data contain information on the place and date of the marriage, based on which we link the marriage-level data with the French censuses of 1911, 1921 and 1926. These censuses contain region-level information that allows us to construct the sex ratio for all the French départements (regional units), as well as other département-level control variables. Finally, we link the marriage data to regional military mortality data from Huber (1931).

We use two complementary empirical strategies that exploit the exogenous regional variation in war mortality to analyze the effect of a decrease in the male population on assortative matching by social class. First, we use a difference-in-differences approach where military mortality is the "treatment," to test the hypothesis that men married up more post war in regions with higher mortality. Second, we use an instrumental variable approach to test more directly the causal effect of the sex ratio on marriage outcomes. Specifically, we use the regional mortality rate as an instrument for the regional sex ratio, which may be endogenous because of factors such as non-random migration. We employ two alternative dependent variables to capture whether and to what degree men married women of higher classes (i.e., married up), namely (*i*) the difference between the social class of the bride and that of the groom; and (*ii*) a dummy for whether the groom married a bride of higher class than his.

Overall, we find that the decrease in sex ratio caused by war-related mortality allowed men to marry higher class women. Specifically, a decrease in the (instrumented) sex ratio from one man for every woman to 0.90 men for every woman corresponds to (*i*) an improvement of the average class of bride for a given class of groom of 0.25, from an average class difference of 0.32 to 0.07.; and (*ii*) an increase in the probability that men would marry up of 8.0 percentage points.

Starting with the seminal work of Becker (1973, 1974), economists have devoted considerable attention to understanding marriage markets.[5] Part of this effort has been to understand the impact of a change in the sex ratio on marriage outcomes such as marriage rates and fertility, though not assortative matching. Early examples include Cox (1940), Easterlin (1961), Guttenberg and Secord (1983). A potential problem of these studies, mitigated to a large extent in Angrist (2002), Charles and

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[5] For a review of the economics of marriages, see Weiss (1993).

Luoh (2005), Brainerd (2007), and Lafortune (2008), is that there may be reverse causality between sex ratios and marriage market outcomes.

In addition to these articles, other work has pointed out additional adjustments in the marriage market induced by a change in the relative scarcity of men or women. Rao (1993), Grossbard-Shechtman (1993), Botticini (1999), Botticini and Siow (2003) and Edlund (2000) suggest that one adjustment is through dowries. Becker (1974, 1981), Bergstrom (1994), Willis (1999), Neal (2004), among others, suggest that a consequence of the imbalance in sex ratio is the emergence of polygamy, including "serial polygamy" (divorce and re-marriage) and relationships leading to out-of-wedlock births. Becker (1973, 1981), Chiappori et al. (2001) and references therein point out that a possible adjustment is a change in the share of the surplus generated by marriage that is appropriated by each spouse. In this paper, we highlight marrying above one's own class as another important adjustment, complementary to the ones mentioned above, when the scarcity of men increases.

Another important issue in the empirical literature of the marriage market is the characterization of individuals' preferences for spouses. This characterization is difficult because equilibrium outcomes in the marriage markets are not only determined by preferences, but also by the mechanisms that match men and women. One strand of the literature deals with the identification problem by performing structural estimations of marriage models using marriage outcomes data (e.g., Wong, 2003, Bisin et al., 2004, Choo and Siow, 2006). In a second strand of the literature based on speed and online dating data (e.g., Ariely, Hitsch and Hortacsu, 2006, Belot and Francesconi, 2006, Fisman et al., 2006, Lee, 2007) or matrimonial newspaper advertisements (Banerjee et al., 2009), the identification issue is overcome by the fact that individuals' decision processes (rather than just final outcomes) are observed in environments where the matching mechanism is controlled. In our paper, the fact that men marry up more in regions with lower sex ratios suggest that, on average, individuals prefer higher-class partners. This favors the hypothesis that assortative matching occurs because in equilibrium individuals cannot marry higher-class people, although they may wish to do so. In contrast to the other papers analyzing preferences for spouse, our strategy relies on the fact that a change in the sex ratio has a different impact on assortative matching depending on people's preferences for spouses' social class.

Moreover, the social ascension of men in post-WWI France that we document enhances our understanding of the economic and social history of France after the Great War. Unbalanced sex ratios are, however, far from being limited to the past. Our paper suggests that we may observe social ascension of women in countries like China and India, where there are disproportionately many men relative to the number of women in the marriage market.

This paper is organized as follows. In Section 2 we describe the historical context surrounding WWI in France. In Section 3 we present the theoretical framework that motivates our empirical analysis of marriage by social class. Section 4 describes the data. In Section 5 we discuss how social classes are assigned to brides and grooms. In Section 6, we present the empirical strategy and results, and in Section 7 we conclude.

2. Historical Context

The First World War, or the Great War, was a global and deadly military conflict that lasted from July 1914 until November 1918. In this section, we present a brief description of the war-related mortality and its implications for the marriage market in France. The most relevant facts for our analysis are that the draft to the French army was nearly universal and the number of casualties enormous; that the sex ratio decreased dramatically; that military mortality was uniform across social classes; and that women's occupations in the period analyzed were largely unaffected by the war.

2.1 Mobilization and mortality during WWI in France: a global phenomenon

During the war, France underwent universal mobilization. Over the war period, about 8 million Frenchmen born between 1867 and 1899 were drafted or voluntarily enrolled in the army (Huber, 1931).[6] To highlight the scope of this mobilization, note that 8.8 million men aged 18 to 51 were registered in the 1911 census, and that the overall French population in 1911 was approximately 33.2 million. Exemptions to the draft were extremely rare. During the war, the French army reviewed all exempt cases and drafted a large proportion of men who were initially exempted, including those who had been injured early in the war.

As a result of this general mobilization and the violence of the conflict, military casualties were enormous. A total of 1.397 million men, or 16.5% of the enrolled soldiers and officers, were reported dead or missing in action at the end of the war. Military mortality was quite homogenous across military ranks: about 16% of French soldiers and 19% of French officers died or were reported missing. Similarly, mortality across occupations seems to have been quite uniform. Table 2.1 presents the distribution of fatalities by occupation at age 20, while Table 2.2 shows the distribution of the labor force by economic sectors from the 1906 and 1921 censuses.[7] Although the occupation categories

[6] About 7.8 million men were drafted and 0.2 million enrolled voluntarily. In addition, 0.5 million foreigners and men from the French colonies joined the French army. Note that all the numbers presented in this subsection are taken from Huber (1931) unless otherwise noted.

[7] Mortality data on soldiers' occupations when drafted are not available. Data on occupation at age 20 were recorded during each individual's military service.

differ slightly between the two tables, the distribution of fatalities by occupation is very similar to that of men in the labor force.[8] Moreover, the comparison between the 1906 and 1921 censuses in Table 2.2 shows that there were only minor changes in the distribution of the labor force by sector during that period. In particular, note that women's occupations were little affected by the war (see also Becker, 1999 and Downs, 1995).

Although mortality was uniform across military rank and occupation, there was substantial heterogeneity in mortality rates across geographical regions. In Section 4.3 we discuss this geographic variation in war mortality and its causes in more detail. In addition to military casualties, deaths among civilians were high during the period 1914 to 1918, with the peak of mortality being caused by the 1918 Spanish flu epidemic. Among the civilian population, the mortality rate may have been higher for men than women, and the increase in mortality rate was the most striking for individuals aged 15 to 45. This is potentially another exogenous cause of the unbalanced sex ratio in the post-WWI period. Deaths from the Spanish flu will be reflected in our measure of the sex ratio but not in our measure of military mortality.

2.2 Marriage market in France

The 19th century and the beginning of the 20th century in France were characterized by a stable celibacy rate of 10% to 13.5%, and a high marriage rate (Dupaquier, 1988). The average marriage rate of the 1908 to 1913 period (i.e., the number of new spouses per 10,000 inhabitants) was 158, putting France at a high rank among European nations. Divorce was a rare phenomenon (around 4-6% of marriages), both before and after the war (Segalen, 1981).

After the onset of the war, the total annual number of marriages diminished sharply, reaching its lowest value in 1915 (75,200 marriages compared with 247,900 in 1913). After 1915, the marriage rate started to increase again, though at a slow pace, as a system of regular permissions took place. By 1919, the marriage rate exceeded its 1913 value. More than 2 million marriages took place in the 4 years following the end of the war (Armengaud, 1965). While the marriage rate increased everywhere after the war, there was heterogeneity by region, with higher marriage rates on the Atlantic coast and in the industrial regions of Paris and Northern France (Huber, 1931).

Figure 2.1 shows the total number of first marriages for women by cohort for the period 1900 to 1950 and highlights how the war disturbed women's marriage patterns. For women born in 1891 to

[8] Beyond the numbers in Table 2.1, anecdotal evidence stresses that many elites and white collar workers perished during the conflict. Four hundred and fifty writers from the "Societe des gens de letters", a writers' organization, 833 former students of the Ecole Polytechnique and 230 from the Ecole Normale, both of which were prestigious universities, were killed during the conflict.

1895, the distribution of marriages is literally cut in half with a first part of the distribution before the conflict and the second part concentrated in a few years after the war. To some extent, the cohort 1886-1890 experienced a similar effect. For women born in 1896-1900, the distribution of marriages is characterized by a large and narrow peak after the war.

In addition to the changes in the timing of marriages due to the war, the marriage market was deeply affected by the sharp drop in the male population. The war mortality changed the sex ratio dramatically: while there were 997 men for every 1,000 women in 1911, the ratio became 909 for every 1,000 in 1921 (Huber, 1931). If we restrict to the population of marriageable age (18 to 59 years old for men and 15 to 49 years old for women[9]), the sex ratio decreased from 1,087 men per 1,000 women in 1911 to 992 men per 1,000 women in 1921, reaching 864 in some regions with high mortality rates.[10] If we focus on singles, widows and divorcees who were 30 or younger but of marriageable age, there were approximately 2 men for every 3 women (Huber, 1931).

As a consequence of the imbalance in the sex ratio, many women remained single in the post-war period. Figure 2.2 emphasizes the large increase in female celibacy rates as measured by the percentage of singles at age 50. In particular, Table 2.3 presents the results of regressions of the percentage of single women on mortality (or sex ratio) using census data (described in Section 4) and shows that more women remained single in departements with higher mortality rates.[11] Similarly, Figure 2.2 shows a large decrease in male celibacy rates among the individuals in cohorts affected by the war, suggesting that some men who would otherwise have remained single got married.

Girard (1974) provides detailed information about the ways in which spouses met. For the period 1914-1930, the most common place was in their neighborhood (21%), followed by meeting at friends' places (17%, including 10% of "arranged meetings"), at work (16%) and at a ball (13%). There was some heterogeneity across the husband's occupation. Managers, employees, skilled workers and farmers were more likely to meet their spouse in their neighborhood, while unskilled workers, salesmen and craftsmen were more likely to meet their spouse at a ball (Bozon and Heran, 1987).

3. Theoretical Framework

A robust prediction of marriage models is that the position of men in the marriage market improves with a reduction in the ratio of men to women in the population. The objective of this section

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[9] 15 and 18 years old are the minimum legal ages for marriage for women and men respectively.
[10] Authors' calculation from French census data.
[11] We classify as single all women who have never been married, are widowed, or are divorced.

is to illustrate one mechanism through which a relative scarcity of men induces them to marry women of higher class.

We consider the impact of a change in the sex ratio on marriage by class under different assumptions about individuals' preferences for characteristics in a spouse and about the constraints they face in the marriage market.[12] For concreteness, we focus on a sudden decrease in the sex ratio when initially the number of men and women in the population were equal. Consider first the cases in which (*i*) individuals prefer partners with similar characteristics to themselves, i.e., men and women prefer to marry within class (horizontal preferences) and (*ii*) individuals only meet partners from their own class. In both cases, the analysis of the impact of a change in the sex ratio on marriage by class is straightforward. Men continue to marry women of their own class. The difference relative to the initial situation is that now a fraction of the women in each class remains single.

A natural framework to analyze the effect of changes in the sex ratio on marriage behavior when individuals prefer to marry up rather than within class is that of Burdett and Coles (1997) and Bloch and Ryder (2000) who apply to the marriage market the matching framework pioneered by Mortensen (1982), Diamond (1982) and Pissarides (1990). Burdett and Coles (1997) and Bloch and Ryder (2000) consider a marriage market with search frictions and heterogeneous agents. Each individual, man or woman, is characterized by a single real number; this number corresponds to an attractiveness index that measures how attractive the individual is to potential partners. If a man and a woman marry, the woman's gain from the marriage equals the man's index and man's gain from the marriage equals the woman's index. So, individuals gain more by marrying higher-index individuals. A crucial aspect of the model is that singles in the market meet singles of the opposite sex only every now and then − the search friction. When two singles meet, they observe each other's attractiveness index and decide whether to propose or not. A marriage occurs if both singles propose. If at least one of the singles does not propose, they separate and continue searching for another partner. Search costs are embodied in a discount factor that captures individuals' impatience to get married. A single's decision to propose given contact with a potential partner depends on (*i*) the partner's index, (*ii*) the rate at which the single meets other singles of the opposite sex, and (*iii*) the single's expectation about who will propose to her (or him) upon contact.

In this marriage market, proposing today as opposed to waiting introduces a tradeoff. Waiting allows the possibility of a higher index match, but is costly since individuals discount the future.

[12] We abstract from the possibility that individuals cohabit instead of getting married because cohabitation was extremely rare in France around WWI. See Matouschek and Rasul (2008) for theory and evidence on why individuals choose to enter into a marriage contract rather than cohabit.

Classes emerge endogenously in equilibrium. Singles partition themselves into classes according to their index levels. To illustrate why this is the case, suppose that the attractiveness indices of men and women lie in the interval [0,1]. Consider now the problem faced by a man with the highest index. Every woman proposes to this man, thus he faces an unconstrained search problem. Consequently, his optimal strategy is a threshold strategy, i.e., to propose to women whose indices are above a given value, and not propose to other women. Let $w_1<1$ denote this threshold value. A consequence of this behavior on the men's side is that women with index in $(w_1,1]$ are accepted by the highest-quality men and therefore by every type of men. Thus, all women in $(w_1,1]$ face the same unconstrained search problem. As such, their optimal strategy is to accept men with indexes above a certain threshold value and reject all others. Let m_1 denote that threshold. Men with indices in $(m_1,1]$ form a class − they are the men of class one; and women with indices in $(w_1,1]$ also form a class--they are the women of class one. In equilibrium, men of class 1 only marry women of class 1, and vice versa. Consider now the highest-index woman w_1 and the highest-index man m_1 who remains on the market. Woman w_1 is accepted by any man in $[0, m_1]$ and man m_1 is accepted by any woman in $[0, w_1]$. We can thus apply the same reasoning as above to obtain threshold values w_2 and m_2. Men with indices in $(m_2, m_1]$ and women with indices in $(w_2, w_1]$ form another class, class two. Again, women of class two only marry men of class two, and vice versa. Applying the same argument in a recursive way, we can obtain all the other classes. Therefore, in equilibrium there is assortative matching; men and women only marry individuals of the same class. In this model men and women would like to marry singles of higher classes, but they cannot.

We now analyze the impact of a sudden reduction in the male population on equilibrium marriage behavior using this framework. A reduction in the male population affects the marriage market by affecting the rate at which singles meet. Assuming that a reduction in the male population (while keeping the female population constant) reduces the total number of meetings between singles, one immediately obtains that the meeting rate for single women decreases. Since a reduction in the meeting rate reduces a woman's prospects of meeting potential partners in the future, her valuation of rejecting a man in a contact and remaining single decreases. Thus, women become less selective and are willing to accept men of lower quality. Formally, with a reduction in the male population, there is a re-definition of the men's classes. Let m_1, m_2, m_3..., m_n denote the thresholds that initially define men's classes. A reduction in the male population implies a reduction in those thresholds. If that reduction is sufficiently severe, the number of classes of men may decrease.[13] If we additionally assume that with a

[13] For a formal analysis of the impact of a change in the number of men on men's classes see Bloch and Ryder (2000).

reduction in the number of men the rate at which single men meet single women increases, then women's classes also change. With a higher rate of meeting single women, a man's valuation of rejecting a woman in a given match and remaining single increases. As a consequence, men can afford to become more selective. Formally, this implies an increase in the thresholds w_1, w_2, w_3...,w_n that define women's classes. A consequence of a decrease in thresholds m_1, m_2, m_3...,m_n and/or an increase in thresholds w_1, w_2, w_3...,w_n is that men tend to marry higher-quality women. Putting it in terms of classes, and fixing classes as being those prior to the change in the sex ratio, this means that men of a given class now marry women of higher classes and women of a given class now marry men of lower classes than they did before the decrease in the male population.

Other marriage models suggest other adjustments of the marriage market as responses to a relative scarcity of men. For example, in Becker's (1973, 1974 and 1981) frictionless model of the marriage market, an increase in men's scarcity leads the average man to appropriate more of the surplus generated by his marriage. More recently, Chiappori, Fortin and Lacroix (2001) presented a model of household bargaining and the distribution of resources inside the family. In their model, a reduction in the sex ratio increases men's bargaining power both within the household and in the marriage market.[14] Unfortunately, we do not have information on relative bargaining power within the household, so we cannot test this interesting implication of these theories.

4. Data

We use data from several sources, including a non-public marriage-level data set, pre and post-war French censuses of population, and geographical data on the number of French war casualties. Because most of these data are unique and have not been used before, this section presents and discusses them in some detail.

4.1. The TRA data set

The TRA data set is the result of a survey, "l'enquête des 3,000 familles", that collected data on the descendants of 3,000 couples who got married between 1803 and 1832 in metropolitan France. This project, undertaken by the Ecole des Hautes Etudes en Sciences Sociales, aims at analyzing social and geographical mobility in France in the 19th and 20th centuries. Dupaquier (2004) presents in detail the sampling design and logistics of the data collection. We briefly summarize these below.

[14] Hoppe, Moldovanu and Sela (2009) is another recent theoretical paper that discusses the effect of the sex ratio on assortative matching. Iyigun and Walsh (2007) provide a model in which an asymmetry in the sex ratio in the marriage market produces gender differences in premarital investments and consumption.

The 3,000 families selected between 1803 and 1832 were representative of the French population at the time (one family per 10,000 inhabitants) living in mainland France. Data on birth, marriage and death certificates were collected. Geographical quotas were used to ensure geographical representativeness: the number of couples sampled per département was proportional to its population from the 1806 census.[15] Then, in each département, a random sample of couples was drawn among those whose name starts with the letters "TRA," such as Trarieux, Trabit, etc… The letters TRA were chosen to allow names from various local dialects to be represented in the sample, as well as to ensure representativeness of all the social classes (Pélissier et al., 2005). Specifically, names starting with the letters TRA are believed to cut across all social classes in France. Naturally there are other ways to randomize to ensure representativeness, but selecting TRA names is more practical than most because documents in archives are typically organized by name. The descendants of the TRA families and their spouses were followed until 1986. To avoid an exponential growth of the sample size over time, the descendants of women (who lost their TRA name upon marriage) are not included in the sample. Dupaquier (2004) points out two potential biases in the TRA data set. The aristocracy might be under-represented, and foreign males who came to France after 1832 are not included in the sample.[16]

We obtain access to data from marriage certificates in two periods around WWI: 1909-1914 and 1918-1928. These data contain the following information: year and département of marriage, ages and occupations of both spouses, and occupations of their parents.[17] In addition, we know whether the marriage took place in a rural area. We have observations on 1,688 marriages before the war and 4,509 after it.

4.2 The French censuses

The French census data for the years 1906, 1911 and 1921 are available from Inter-university Consortium for Political and Social Research (2007). The 1926 census data are available from archives at the library of the National Institute for Statistics and Economic Studies (INSEE). We link the year and département of each marriage in the TRA data set to département-level information available from the censuses. In particular, we construct for 1911, 1921, and 1926 the sex ratio in each département,

[15] Departments are administrative units similar to counties. In 1870-1914, France had 87 départements. After WWI, the number increased to 90 because territories from Alsace-Lorraine lost in the 1870s were recovered.

[16] Nobles may sometimes be classified under the letter D (because they are called "de Tra" rather than "Tra"). Some nobles might thus have escaped the original design. In addition, while the proportion of farmers is correct when considering the period over which the overall TRA data set was collected (i.e. 1803-1986), farmers seem to be over-represented in the resulting sample for the period 1970-1986. This may raise some selectivity issues. To deal with this, the descendants of 3,000 additional "TRA" couples who married between 1803 and 1832 have been followed. The sample we use is based on the data set constructed with all of the 6,000 TRA families (source: email conversation with Jean-Pierre Pélissier).

[17] Occupations are missing for about 5% of the grooms and 12% of the brides, and for over 40% of their parents.

which we define as the ratio of the number of males aged 18 to 59 to the number of females aged 15 to 49, the age groups defined by the French census as marriageable age. The average sex ratio is 1.12 in 1911 and 1.02 in 1921, when it ranges from 0.86 to 1.23.

We also construct indicators of women's occupations to capture, although imperfectly, the distribution of social class of potential brides faced by grooms.[18] Table 4.1 presents descriptive statistics of these variables for before the war (1906[19] or 1911) and after the war (1921).[20] It shows that there were few changes in the occupation structure of women. The only notable change is a shift from self-employment to working as employees.

4.3 The military mortality data

Huber (1931) provides the proportion of soldiers reported dead and missing by the military region in which they were enlisted. During WWI, continental France was separated into 22 military regions (Boulanger, 2001). While they do not exactly match administrative regions, we can allocate each département to a particular military region. We link marriages to regional mortality data based on the départements in which the marriages occurred.

Figure 1.1 shows the geographical variation in military mortality rate. This mortality rate ranges from 10.5% in the Gouvernement Militaire de Paris (Paris military region) to 20.2% in the military region of Orleans. The mean mortality rate computed over the 22 regions is 16.5%; the median is 17.4%. Regions marked in darker red have higher mortality rates. Regions marked in full white correspond to a mortality rate of 11.9% or lower and regions marked in the darkest red correspond to a mortality rate of 20% or higher.

In addition to the natural randomness associated with war casualties, a few other factors explain the regional heterogeneity in military mortality rate. During the first two years of the war, men residing in the same military region were typically sent to the same war zone. This was because soldiers served in their military regions of residence, or were sent together to the battlefront to complement the troops of the northeastern regions where most of the fighting was taking place (Boulanger, 2001; Maurin, 1992).[21] The heterogeneity in military mortality during these years may thus be explained by the fact that men from different départements participated in battles of different violence levels. Military

[18] The female occupations in the censuses are aggregated differently to our social classes. Moreover, the census occupation categories are not broken down by marital status.

[19] Comparable female occupations are not available for the 1911 census, so we use data from 1906 as our pre-war values.

[20] We present the average over 87 départements for 1906 and 90 départements for 1921 since France's territories increased after the war.

[21] For example, soldiers from Bretagne were sent to the Parisian region, while soldiers from the Parisian region went further east.

mortality in 1914 and 1915 constitutes about 49 percent of the total military deaths during WWI: 23 percent of the overall war casualties occurred in 1914, and 26 percent in 1915 (Becker, 1999). From 1916, men from different military regions were more mixed together at the battlefront, but the mixing was imperfect and some regional differences in mortality persisted.

5. Assigning social classes based on the Historical International Social Class Scheme

We use the data on individuals' specific occupations from the marriage certificates to allocate brides and grooms to social classes. To do this, we first match each of over a thousand occupations present in our data set to a code from the Historical International Standard Classification of Occupations (HISCO). HISCO is a detailed coding system designed to facilitate the comparison of historical international data. It is based on the 1968 International Standard Classification of Occupations (ISCO68), and customized for historical data (van Leeuwen et al., 2002). HISCO allocates each occupation to one of 7 sectors: (1) Professional, (2) Technical and Related Workers Administrative and Managerial Workers, (3) Clerical and Related Workers, (4) Sales Workers, (5) Service Workers, (6) Agricultural, Animal Husbandry and Forest Workers, Fishermen and Hunters and (7) Production and Related Workers, Transport Equipment Operators and Laborers. Each of these sectors is itself divided into smaller sub-sectors. For example, codes of the type 6-xx.xx correspond to the agricultural sector. Codes of the type 6-2x.xx refer to agricultural workers. This last group includes codes of the type 6-22.xx for field crop and vegetable farm workers and these, in turn, contain more specific occupational categories such as wheat farm workers (coded as 6-22.30) (van Leeuwen and Maas, 2005a). The HISCO classification contains about 1,600 occupations characterized by 5-digit codes. We allocate to all the occupations in our data set a 5-digit HISCO code using a mapping available on the History of Work Information System website (http://historyofwork.iisg.nl/).

Then, to map occupations into social classes, we use the Historical International Social Class Scheme (HISCLASS) developed by van Leeuwen and Maas (van Leeuwen and Maas, 2005a). The HISCLASS system is ideal for our purposes because it allocates each of the 1600 HISCO occupations into one of 12 social classes, where a "social class" is defined by van Leeuwen and Maas (2005a) as "*a set of persons with the same life chances*." The mapping of occupations into social classes takes into account various dimensions of social status including whether the occupation is manual, the skill level required to perform the occupation, and the degree to which the occupation involves supervision of others. This mapping is the result of a combination of the views of expert historians and the classifications given in the 1965 Dictionary of Occupational Titles (DOT). Expert historians were independently asked to classify HISCO occupations into social classes; DOT classifications are based on observations in plants and businesses that assign grades along these dimensions to over 10,000 occupation categories in US. In cases where the DOT and the experts disagreed, the experts' opinions were taken. To increase the sample size in each class, in this paper we use the version of HISCLASS condensed into the following **7 social classes** (class 1 being the highest, and class 7 being the lowest):

- Class 1: Higher managers and professionals
- Class 2: Lower managers and professionals, clerical and sales personnel
- Class 3: Foremen and skilled workers
- Class 4: Farmers and fishermen
- Class 5: Lower-skilled workers
- Class 6: Unskilled workers
- Class 7: Lower-skilled and unskilled farm workers

This 7-class classification has been used in other works, and in particular in works using the TRA data set, to study social mobility and endogamy (Pélissier et al., 2005, Holt, 2005, Bull, 2005, Schumacher and Lorenzetti, 2005, Arrizabalaga, 2005, Lanzinger, 2005, Dribe and Lundh, 2005, Van de Putte et al., 2005, Bras and Kok, 2005, van Leeuwen and Maas, 2005b, 2005c). Table 5.1 provides examples of occupations for each of the classes for men and women.

In Table 5.2, we present the distribution of brides and grooms when classified according to the above 7 social classes. Classes 3 and 5 are the most numerous among brides, while classes 3 and 4 are the most numerous among grooms.

This occupation-based classification does not assign classes to brides without occupations (34% of the brides in our data). We use three alternative ways to deal with this issue. First, we exclude brides without occupations from the analysis. Second, we impute class for brides without occupations based on the individual and location characteristics that predict class for brides with occupations (see Table A1 in Appendix A). Specifically, we first use pre-war marriage data for brides with occupations to estimate the relationship between bride's class and the classes of their groom, father, and mother; indicators for whether parents' classes are missing and for whether parents are dead at the time of the wedding; an interaction of these variables with an indicator for whether the wedding took place in a rural area; bride's age; and city size. Then, we use this relationship to impute classes for brides without occupations. We note that for brides without occupations, however, we do not want to use groom's class to impute bride's class because this will impose the same relationship between spouses' classes pre and post war, whereas vertical preferences imply that this relationship differed pre and post war. Therefore, for the imputation of the class of brides without occupations, we use the relationship we estimated above, but, in place of the class of the groom, we use the pre-war average class of the grooms among brides without occupations in the departement. The underlying assumption is that the average class of these grooms pre-war is informative about the classes of the brides without occupations in a given region. The average imputed class of brides without occupations is 3.87 before the war, and 3.85 after.[22] Finally, as a robustness check, we use an alternative imputation method: we impute the classes of brides without occupations with their fathers' classes. The main drawback of this second approach is that father's class is often missing (37.0% of the observations among brides without occupations), and not necessarily at random.

There are a few potential issues with using occupations as a measure of social class to compare assortative matching before and after the war. First, the unbalanced sex ratio could potentially induce individuals to change their occupations. This does not seem to have occurred in the short period analyzed in this paper, as the occupation distribution of men and women in the labor force changed very little after the war (see Table 2.2). Furthermore, we control for the distributions of women's occupations in each department to account for department-specific potential changes in women's labor force opportunities. Second, the unbalanced sex ratio may change age at marriage, which in turn may affect occupation at marriage. To address this potential issue, we control for the ages of brides and grooms, which allows us to capture the effect of the sex ratio on social class that goes beyond its effect on age.

6. Empirical strategy and results

If men and women prefer higher class spouses, then we would expect men (women) to marry higher class women (men) when the sex ratio, i.e. the ratio of men of marriageable age to women of marriageable age, is lower (higher). Table 6.1 presents the average class of the brides for each groom's class before and after the war. It shows that, outside of class 3 grooms, men married women of higher class (lower index) after the war than before the war.

Before testing our main hypothesis, we establish that before WWI people tended to marry within class. We then use a difference-in-differences approach to test whether men married women of higher social class than themselves (married up) more post war in regions where more men died. Finally, we instrument the sex ratio in a region with military mortality to test more directly the effect of the sex ratio on assortative matching.

[22] A simpler imputation method would be to use the pre-war average class of the grooms of brides without occupation to define the "class" of brides without occupation. The approach we take uses not only the information provided by the pre-war average class of the grooms, but also individual-specific characteristics such as the location of marriage and the classes of the parents.

6.1. Pre-war assortative matching by social class

We use pre-war data to test whether people marry within class as opposed to randomly. We do so by examining the distribution of social distance, defined as the class of the bride minus the class of the groom, among pre-war marriages. When people marry within class, the social distance is zero.

To implement this test, we compare the realized distribution of social distance with the distribution we would expect under the null hypothesis that pre-war grooms married randomly. Using a bootstrapping method, we construct 95% bootstrap confidence intervals for the distribution of social distance under the null hypothesis of random matching. Specifically, denote the number of pre-war marriages in our sample by N. From the distribution of groom classes, we draw N grooms randomly with replacement; from the distribution of bride classes we draw N brides randomly with replacement. We match the list of grooms with the list of brides, and derive the distribution of social distances for this simulated set of marriages. We repeat this process 1000 times and construct the 95 percent confidence interval. The *observed* points in Figure 6.1 show the actual distribution of pre-war social distance for the marriages in our sample. The observed distribution lies outside the confidence interval for most social distances. For brides and grooms of the same class, the observed proportion is nearly twice as large as the upper boundary of the confidence interval. For the other social distances between -4 and +4, the observed proportions lie close to or below the lower bounds of the confidence intervals. For the extreme social distances, the observed proportions are approximately zero.

Overall, the figure clearly rejects the null hypothesis of random matching. Grooms in the pre-war period were much more likely to marry brides of their own social class than chance would dictate, and were much less likely to marry brides who were socially distant from them.

6.2 The effect of military mortality on assortative matching: difference-in-differences approach

To test the hypothesis that men married up more post war in regions with high mortality, we estimate difference-in-differences regressions where military mortality is the "treatment." In particular, we estimate:

$$Y_{ijt} = \lambda_M M_j + \lambda_P PW_t + \lambda M_j \times PW_t + \mu X_{jt} + \delta Z_{ijt} + \varepsilon_{ijt}, \qquad (1)$$

where *i* is a marriage, *j* is a military region, and *t* is the year of the wedding. We use two alternative dependent variables *Y*: (1) the difference between the class of the bride and the class of the groom (a lower value means the man married up more); and (2) a dummy for whether the groom married a bride of his own class or higher.[23]

M_j is the mortality rate due to the war in military region *j*, PW_t is a post-war dummy variable that equals one if the wedding took place after the war and zero otherwise, which captures aggregate factors that would cause changes in *Y*. $M_j \times PW_t$ is the interaction of these two variables. The coefficient of interest is therefore λ. X_{jt} are other controls that vary across geography and time, such as variables capturing the occupational distribution of the population of women in the area. Z_{ijt} are additional controls that vary at the individual level such as groom class dummies, age and whether the marriage took place in a rural area. The variables used in the analysis are described in more detail in Appendix B. We cluster standard errors at the military region level.

Table 6.2 shows the estimation results of equation (1). The regressions suggest that men were more likely to marry up after the war in places with higher mortality rates, as the coefficients of mortality interacted with the post-war dummy are of the right sign and statistically significant at 1% in all the specifications. For example, in the regressions predicting whether the groom married up (columns 3 and 4), the coefficient on military mortality interacted with the post-war dummy is 0.021 in the specification excluding brides without occupation, and 0.018 in the specification where the class of the brides without occupation is imputed. This coefficient implies that in a region where the military mortality is 20%, the probability that a given groom marries up is 18 percentage points higher than in a region where the military mortality is 10%, from a pre-war average of marrying up equal to 59.5%.[24]

We note that in all the regressions, the coefficient associated with the mortality rate is not statistically significantly different from zero, suggesting that the pre-war marriage patterns in regions that experienced low mortality during the war were similar to those in high mortality regions.

We include as independent variables the percentages of the female labor force in the different occupations available from the censuses to reflect the composition of the pool of brides available to a groom. The coefficients indicate that men tended to marry women of higher class when the

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[23] Note that our regressions include only men who actually married, so we face a sample selection issue. Although this means we are unable to test the model's prediction that low class women will be more likely to remain single when men are more scarce, it does not affect our testing of the prediction that men will marry up more when men are more scarce.

[24] Note that the estimations do not take into account the proportion of injured by military regions, since no such data are available. A potential concern is that men who were severely injured might have had less marriage opportunities, which may affect our results. After the war, 920,000 of the survivors were eligible to receive a pension from the state because of their disability (Corvisier, 1992). As a simple exercise, consider the limit case in which all those receiving a pension were unable to get married. Military mortality totaled 1,227,796 men, so the sum of mortality plus injured is 2,147,796. Treating all these men as military deaths implies we should scale our coefficients by (1,227,796 / 2,147,796), which is equal to 0.57. Hence, under this extreme assumption, the coefficients would decrease in magnitude by 43%.

percentages of proprietors (typically owners of very small stores) and employees were higher. We also include an indicator for whether the wedding took place in a rural area, where marriage patterns might have been different. We find that, everything else equal, grooms in rural areas married lower class brides than grooms in urban areas. Finally, we control for the ages of the bride and groom to address the fact that older grooms or brides may have better occupations, and may thus be of higher class. Table 6.2 shows that, everything else equal, older men and men marrying younger brides were more likely to marry up.[25]

Our results are robust to the alternative imputation method for brides without occupation; Table A2 in Appendix A shows similar results when we use father's class to impute bride's class for brides without occupations. In all the specifications with imputed bride classes, the coefficient of interest tends to be smaller in magnitude than that obtained when excluding the brides without occupation. This may be due to measurement error in the imputed classes of the brides without occupations that biases the coefficient toward zero.

Placebo regressions

As a robustness check, we use pre-war data to estimate difference-in-differences "placebo" regressions, in which we falsely assume that the war took place between 1911 and 1912. This allows us to test for pre-existing regional differences in marriage patterns. We expect this placebo treatment to have no effect on marriage patterns. Table 6.3 presents the estimation results. The coefficients associated with mortality rate interacted with the post-1911 dummy are small and statistically indistinguishable from zero. This suggests that the results presented in Table 6.3 are not driven by changes in marriage patterns that occurred right before the war.

6.3. The effect of the sex ratio on assortative matching: an instrumental variable approach

To directly test the effect of the sex ratio on assortative matching, we instrument the sex ratio in a region with regional military mortality rates. We need to instrument for the sex ratio because, as pointed out in the literature (e.g., Angrist, 2002, Kerwin and Luoh, 2005), studies that analyze the impact of the sex ratio on the marriage market may suffer from omitted variable bias and possibly reverse causality. For example, in our context, a low sex ratio may indicate strong male out-migration. If migrants are selected positively or negatively according to unobservable variables that are relevant

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[25] As an additional robustness check, we control for whether the bride or the groom was remarrying (results not presented). The coefficients on these controls are small and insignificant, and their inclusion does not affect the coefficients on the mortality rate.

for marriage outcomes (e.g., groom's ability or health), the random error term in a simple OLS regression of marriage outcomes on the sex ratio may be correlated with the sex ratio.[26]

For our strategy to be valid, we need an instrument that predicts the sex ratio but is not directly related to marriage outcomes. We use military mortality, which exhibits exogenous geographical variation, as an instrument for the département-level sex ratio. Given the universality of the military draft, military mortality is correlated with the post-war sex ratio. However, we do not expect military mortality to have a direct effect on marriage by social class.

In the first stage, we regress the sex ratio on military mortality interacted with post war and on the same controls used in the second stage. The second stage of our IV specification is:

$$Y_{ijt} = \lambda S_{jt} + \mu X_{jt} + \delta Z_{ijt} + \alpha_j + \beta_t + \varepsilon_{ijt}, \qquad (2)$$

where *i* is a marriage, *j* is a military region, and *t* is the year of the wedding and the dependent variable *Y* is defined as before. The independent variable of interest is the sex ratio S_{jt}, which is instrumented with military mortality. We set military mortality to zero for marriages that occurred before the war. The sex ratio is not measured at the time of the wedding, but rather at the census year closest to the wedding.[27] This introduces some measurement error that will be identical for all weddings taking place in the same year and region. We thus cluster the standard errors at the level of the marriage year interacted with military region.

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[26] Take for example the case of health (denoted here by H_{ijt}) as an omitted variable that is correlated with the sex ratio because of migration. The correct OLS specification should be:

$$Y_{ijt} = +\lambda S_{jt} + \mu X_{jt} + \delta Z_{ijt} + \eta H_{ijt} + \alpha_j + \beta_t + \varepsilon_{ijt}. \quad (3)$$

where *i* is a marriage, *j* is a military region, and *t* is the year of the wedding and the dependent variable *Y* is defined as before. The independent variable of interest is the sex ratio. If equation (3) is the correct specification but we omit H_{ijt} from the estimation, the expected value of the estimator of λ will be:

$$E\left(\hat{\lambda}\right) = \lambda + \eta \frac{\operatorname{cov}\left(S_{jt}, H_{ijt}\right)}{\operatorname{var}\left(S_{jt}\right)}.$$

We expect good health to improve the groom's position in the marriage market, i.e. if Y_{ijt} denotes the dummy for marrying up, we expect $\eta > 0$. The direction of the omitted variable bias thus depends on the sign of $\operatorname{cov}\left(S_{jt}, H_{ijt}\right)$, where S_{jt} denotes the sex ratio. If migrants tend to be in better health than non-migrants, we expect to find men in better health than average in places with high sex ratios ($\operatorname{cov}\left(S_{jt}, H_{ijt}\right) > 0$), in which case the estimator of λ will be biased upward. If migrants tend to be in poorer health than non-migrants, the estimator of λ will be biased downward. Note that when we use the difference between the class of the bride and the class of the groom or a dummy for whether the groom married a low class bride as dependent variables, we expect $\eta < 0$ to capture that good health improves the groom's position in the marriage market. In the regressions with those dependent variables, we therefore expect a downward bias if migrants are more likely to be in good health than non-migrants, and an upward bias if migrants are more likely to be in poor health.

[27] Marriages in the period 1909 to 1914 use the 1911 sex ratio, marriages in the period 1918 to 1923 use the 1921 sex ratio, and marriages in the period 1924 to 1928 use the 1926 sex ratio.

The regression includes military region dummies α_j and marriage year dummies β_t. As an alternative specification, we replace the year dummies with a post-war dummy. Otherwise we include the same controls as in the difference-in-differences estimation.

Tables 6.4 and 6.5 show the estimation results when excluding and when imputing brides without occupations, respectively. The results suggest that men were more likely to marry up after the war in places with lower sex ratios. The coefficient associated with the instrumented sex ratio is statistically significant at conventional levels in all specifications. The IV regression predicting class difference (column 1 of Table 6.5) suggests that a decrease in the sex ratio from one man for every woman to 0.90 men for every woman would improve the expected class of bride married by a given groom by 0.25 from an average class difference of 0.32 to 0.07. Columns 3 and 4 of Tables 6.4 and 6.5 present the IV regression results predicting whether the groom married up. In column 3, Table 6.5, the coefficient on the sex ratio is -0.804, implying that a decrease in the sex ratio from one man for every women to 0.90 men for every woman would increase the probability a given groom married up by 8.0 percentage points.

Using year dummies or a post-war dummy does not change the coefficients. The results are similar when using father's class for brides without occupations (Table A3 in Appendix A), though the coefficients are less precisely estimated.

Tables A4 and A5 show the estimation results of equation (2) estimated by OLS. The coefficient associated with the sex ratio mostly has the right sign but is much smaller in magnitude. This could suggest that endogeneity of the sex ratio is important. The difference between the IV and the OLS estimates is consistent with migrants being positively selected (e.g., in better health).

Some potential concerns when using sex ratio in the year of marriage are that a groom may choose when he marries in order to face a more advantageous sex ratio, and that marriages may be decided on some time before they actually occur. These issues may inflate the coefficients we find on the sex ratio. To deal with them, we use an alternative definition of the sex ratio. We allocate to each marriage the sex ratio closest to the time when the groom turned 18, i.e. when he became legally allowed to get married.[28] Tables 6.6 and 6.7 show that our results are unchanged when using this alternative definition of the sex ratio.

The results in this section and Section 6.2 show that men marry up more in places with higher mortality and lower sex ratio. We take this as evidence that on average men prefer women of higher

[28] We, however, do not allocate pre-war sex ratios to post war marriages, because it seems implausible that men pre war would have predicted the high military mortality rate and thus delayed marriage in order to face less competition in the marriage market.

class, i.e. that men have vertical preferences. As discussed in Section 3, if grooms had horizontal preferences a decrease in the sex ratio, which improves men's position in the marriage market, would not lead grooms to marry up more. Rather, it would leave assortative matching unchanged. Thus, our results favor the hypothesis that the assortative matching by social class that we observe at the beginning of the 20th century in France occurred because in equilibrium individuals could not marry higher-class people, although they preferred to do so.

We have presented our empirical results under the perspective of men marrying up. However, the counterpart is that women marry down. Our results thus shed light on women's preferences for being married: women prefer marry men of a lower social class than to remain single.

7. Conclusion

Although the similarity of spouses to each other along various dimensions has been documented, we know little about its causes. This paper uses an exogenous shock to the sex ratio created by WWI mortality in France to identify the underlying mechanisms responsible for marital assortative matching by social class. Overall, we find that the decrease in the proportion of men in the population due to war-related mortality allowed men to marry higher class women. Men experienced "social ascension" by marrying women from classes to which they had little chance of marriage before the war. Similarly, the change in sex ratio led women of higher classes to marry grooms from lower classes than they would have under pre-WWI standards. A decrease in the sex ratio, instrumented for by military mortality, from one man for every woman to 0.90 men for every woman: (a) increased the probability that men married women of higher social class than themselves by 8.0 percentage points, (b) improved the expected class difference for a given groom by 0.25. Our results favor the hypothesis that assortative matching occurs because, although individuals would rather marry higher-class people, they do not receive marriage proposals from them.

This paper illustrates a forgotten consequence common to brutal wars and imbalances in the sex ratio such as the one observed nowadays in China: the change in social mobility through change in marriage behavior. One may wonder whether the war induced a transitional or permanent change in social mobility and social integration. This is left for future research. On this specific front, an obstacle to overcome is the occurrence of WWII which may hinder the analysis of the long-term implications of WWI on social mobility. Another natural extension is to examine the extent of marrying up in other countries that participated in WWI. Such a study could shed light on the differences in social mobility across countries.

References

Angrist, Joshua. 2002. “How Do Sex Ratios Affect Marriage and Labor Markets: Evidence from America’s Second Generation.” *Quarterly Journal of Economics*, 117: 997-1038.

Ariely, Dan, Guenter Hitsch, and Ali Hortacsu. 2006. “What Makes You Click? Mate Preferences and Matching Outcomes in Online Dating.” Working Paper.

Armengaud, André. 1965. *La Population Francaise au 20e Siecle*. Paris: Presses universitaires de France.

Arrizabalaga, Marie-Pierr. 2005. “Pyrenean Marriage Strategies in the Nineteenth Century: The French Basque Case.” *International Review of Social History*, Supplement 50.

Banerjee, Abhijit, Esther Duflo, Maitreesh Ghatak and Jeanne Lafortune. 2009. “Marry for what? Caste and Mate Selection in Modern India.” Working Paper.

Becker, Gary. 1973. “A Theory of Marriage: Part I,.” *Journal of Political Economy*, 81: 813–46.

Becker, Gary. 1974. “A Theory of Marriage: Part II.” *Journal of Political Economy*, 82: S11–S26.

Becker, Gary. 1981. *A Treatise on the Family*. Cambridge, MA: Harvard University Press.

Becker, Jean-Jacques. 1999 “Les deux guerres mondiales et leurs conséquences” in Jean-Pierre Bardet and Jacques Dupaquier (Eds) *Histoires des Populations de L’Europe, Les temps Uncertains 1914-1998*. Fayard, France.

Belot, Michele and Marco Francesconi. 2006. “Can Anyone be ‘The’ One? Evidence on Mate Selection from Speed Dating.” IZA Discussion Papers 2377, Institute for the Study of Labor (IZA).

Bergstrom, Ted. 1994. “On the Economics of Polygyny.” University of California Working Paper.

Bisin, Alberto, Giorgio Topa, and Thierry Verdier. 2004. “Religious Intermarriage and Socialization in the United States.” *Journal of Political Economy*, 112: 615–664.

Bloch, Francis, and Harl Ryder. 2000. “Two-Sided Search, Marriages, and Matchmakers.” *International Economic Review*, 41: 93-116.

Blossfeld, Hans-Peter, and Andreas Timm. 2003. *Who Marries Whom? Educational Systems as Marriage Markets in Modern Societies*. Amsterdam: Kluwer Academic.

Botticini, Maristella. 1999. “A Loveless Economy? Intergenerational Altruism and the Marriage Market in a Tuscan Town,1415-1436.” *Journal of Economic History*, 59: 104-121.

Botticini, Maristella and Aloysius Siow. 2003. “Why Dowries?” *American Economic Review*, 93: 1385-1398.

Boulanger, Philipe. 2001. *LA FRANCE DEVANT LA CONSCRIPTION - Géographie Historique D'une Institution Républicaine 1914 - 1922*. Economica, Paris.

Bozon, Michel and François Héran. 1987. “La découverte du conjoint: I. Evolution et morphologie des scènes de rencontre.” *Population*, 42(6): 943-985.

Brainerd, Elizabeth. 2007. “Uncounted Costs of World War II: The Effect of Changing Sex Ratios on Marriage and Fertility of Russian Women.”

Bras, Hilde and Jan Kok. 2005 “"They Live in Indifference Together": Marriage Mobility in Zeeland, The Netherlands, 1796-1922.” *International Review of Social History*, Supplement 50.

Bull, Hans Henrik. 2005. “Deciding Whom to Marry in a Rural Two-Class Society: Social Homogamy and Constraints in the Marriage Market in Rendalen, Norway 1750-1900.” *International Review of Social History*, Supplement 50.

Burdett, Ken and Melvyn G. Coles. 1997. “Marriage and Class.” *The Quarterly Journal of Economics*, 112: 141–168.

Chiappori, Pierre-Andre, Bernard Fortin, and Guy Lacroix. 2001. “Marriage Market, Divorce Legislation, and Household Labor Supply.” *Journal of Political Economy*, 110: 37-72.

Choo, Eugene and Aloysius Siow. 2006. “Who Marries Whom and Why.” *Journal of Political Economy*, Vol. 114, No. 1: 175-201.

Corvisier, André. 1992. “Le peuple français en guerre,” in André Corvisier (Ed) *Histoire militaire de la France de 1871 à 1940*. Presse Universitaire de France, Paris.

Cox, Oliver C. 1940. “Sex Ratio and Marital Status among Negroes.” *American Sociological Review*, 6: 937-947.

Diamond, Peter. 1982. "Wage Determination and Efficiency in Search Equilibrium." *Review of Economic Studies*, 49: 1217-1227.

Downs, Laura Lee. 1995. *Manufacturing Inequality: Gender Division in the French and British Metalworking Industries, 1914-1939*. Cornell University Press, NY.

Dupaquier, Jacques. 1988. *Histoire de la Population Francaise*, 1re éd. Paris: Presses universitaires de France.

Dupaquier, Jacques. 2004. “L’Enquête des 3000 Familles.” *Annales de démographie* historique, 107: 7-18.

Dribe, Martin and Christer Lundh. 2005. “Finding the Right Partner: Rural Homogamy in Nineteenth-Century Sweden.” *International Review of Social History*, Supplement 50.

Easterlin, Richard A. 1961. “The American Baby Boom in Historical Perspective.” *American Economic Review*, 51: 1-60.

Edlund, Lena. 2000. “Marriage Squeeze Interpretation of Dowry Inflation: A Comment.” *Journal of Political Economy*, 108: 1327-1333.

Fernandez, Raquel and Richard Rogerson. 2001. “Sorting and Long-Run Inequality.” *The Quarterly Journal of Economics*, 116: 1305–1341.

Fisman, Raymond, Sheena S. Iyengar, Emir Kamenica, and Itamar Simonson. 2006. “Gender Differences in Mate Selections: Evidence from a Speed Dating Experiment.” *Quarterly Journal of Economics*, 121: 673–679.

Girard, Alain. 1974. *Le choix du conjoint*. Presse Universitaire de France, Paris.

Goldin, Claudia. 1990. *Understanding the Gender Gap: An Economic History of American Women*, University of Chicago Press.

Goldin, Claudia and Lawrence Katz. 2002. “The Power of the Pill: Oral Contraceptives and Women’s Career and Marriage Decisions,” *Journal of Political Economy,* 110: 730-70.

Goldin Claudia. 2006. “The ‘Quiet Revolution’ That Transformed Women’s Employment, Education, and Family,” *American Economic Review* (Ely Lecture), 96: 1-21.

Grossbard-Shechtman, Shoshana. 1993. *On the Economics of Marriage.* Boulder, CO: Westview Press.

Guttentag, Marcia, and Paul F. Secord. 1983. *Too Many Women? The Sex Ratio Question.* Beverly Hills, CA: Sage Publications.

Holt, Katherine. 2005. "Marriage Choices in a Plantation Society: Bahia, Brazil." *International Review of Social History*, Supplement 50.

Hoppe, Heidrun, Benny Moldovanu, and Aner Sela. 2009. "The Theory of Assortative Matching Based on Costly Signals." *Review of Economic Studies.*

Hout, Michael. 1982. "The Association Between Husbands' and Wives' Occupations in Two-Earner Families." *American Journal of Sociology*, 88: 397-409.

Huber, Michel. 1931. *La Population de la France Pendant la Guerre.* Paris: Presses Universitaires de France.

Huston, Ted and George Levinger. 1978. "Interpersonal Attraction and Relationship." *Annual Review of Psychology*, 29:115-56.

Inter-university Consortium for Political and Social Research. DEMOGRAPHIC, SOCIAL, EDUCATIONAL AND ECONOMIC DATA FOR FRANCE, 1833-1925 [Computer file]. ICPSR07529-v2. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [producer and distributor], 2007-02-16.

Iyigun, Murat, and Randall Walsh. 2007. "Building the Family Nest: Pre-Marital Investments, Marriage Markets and Spousal Allocations." *Review of Economic Studies,* 74: 507-35.

Kalmijn, M. 1998. "Intermarriage and Homogamy: Causes, Patterns and Trends." *Annual Review of Sociology*, 24: 395-421.

Kerwin, Charles and Ming Luoh. 2005. "Male Incarceration, the Marriage Market and Female Outcomes." University of Michigan Working Paper.

Lafortune, Jeanne. 2008. "Making Yourself Attractive: Pre-Marital Investments and the Returns to Education in the Marriage Market." Working Paper.

Lanzinger, Margareth. 2005. "Homogamy in a Society Oriented to Stability: A Micro Study of a South Tyrolean Market Town, 1700-1900." *International Review of Social History*, Supplement 50.

Lee, Soohyung. 2007. "Determinants and Consequences of Marital Sorting: Evidence From a Korean Matchmaking Service." Stanford Working Paper.

Mare, Robert D. 1991. "Five Decades of Educational Assortative Mating." *American Sociological Review*, 56: 15-32.

Matouschek Niko and Imran Rasul. 2008. "The Economics of the Marriage Contract: Theories and Evidence." *Journal of Law and Economics*, 51: 59-110.

Maurin, Jules. 1992. "Les combattants face à l'épreuve de 1914-1918," in André Corvisier (Ed) *Histoire militaire de la France de 1871 à 1940*. Presse Universitaire de France, Paris.

McPherson, Miller, Lynn Smith-Lovin, and James Cook. 2001. "Birds of a Feather: Homophily in Social Networks." *Annual Review of Sociology*, 27: 415-44.

Mortensen, Dale. 1982. "The Matching Process as a Noncooperative Bargaining Game," in *The Economics of Information and Uncertainty*, John J. McCall, ed. Chicago: University of Chicago Press.

Neal, Derek. 2004. "The Relationship between Marriage Market Prospects and Never-Married Motherhood." *The Journal of Human Resources*, Vol. 39, No. 4: 938-957.

Pélissier, Jean-Pierre, Danièle Rébaudo, Marco H.D. van Leeuwen, and Ineke Maas. 2005. "Migration and Endogamy According to Social Class: France, 1803-1986." *International Review of Social History*, Supplement 50.

Pencavel, John. 1998. "Assortative Mating by Schooling and the Work Behavior of Wives and Husbands." *American Economic Review*, 88: 326-329.

Pissarides, Christopher. 1990. *Equilibrium Unemployment Theory*. Oxford: Blackwell.

Rao, Vijayendra. 1993. "The Rising Price of Husbands: A Hedonic Analysis of Dowry Increases in Rural India." *Journal of Political Economy*, 101: 666–77.

Rose, Elaina,. 2001. "Marriage and Assortative Mating: How Have the Patterns Changed?" University of Washington Working Paper.

Rose, Elaina,. 2005. "Education and Hypergamy, and the "Success Gap" University of Washington Working Paper.

Schumacher, Reto and Luigi Lorenzetti. 2005. ""We have no proletariat": Social Stratification and Occupational Homogamy in Industrial Switzerland. Winterthur 1909/10-1928." *International Review of Social History*, Supplement 50.

Segalen, Martin. 1981. *Sociologie de la famille*. Armand Colin, Paris.

Van de Putte, Bart, Michel Oris, Muriel Neven, and Koen Matthijs. 2005. "Migration, Occupational Identity and Societal Openness in Nineteenth-Century Belgium." *International Review of Social History*, Supplement 50.

van Leeuwen, Marco H.D., Ineke Maas and Andrew Miles. 2002. *HISCO: Historical International Standard Classification of Occupations*. Leuven: Leuven University Press.

van Leeuwen, Marco H.D., and Ineke Maas. 2005a. "A short note on HISCLASS." Working Paper available at http://historyofwork.iisg.nl/docs/hisclass-brief.doc.

van Leeuwen, Marco H.D., and Ineke Maas. 2005b. "Total and Relative Endogamy by Social Origin: A First International Comparison of Changes in Marriage Choices during the Nineteenth Century." *International Review of Social History*, Supplement 50.

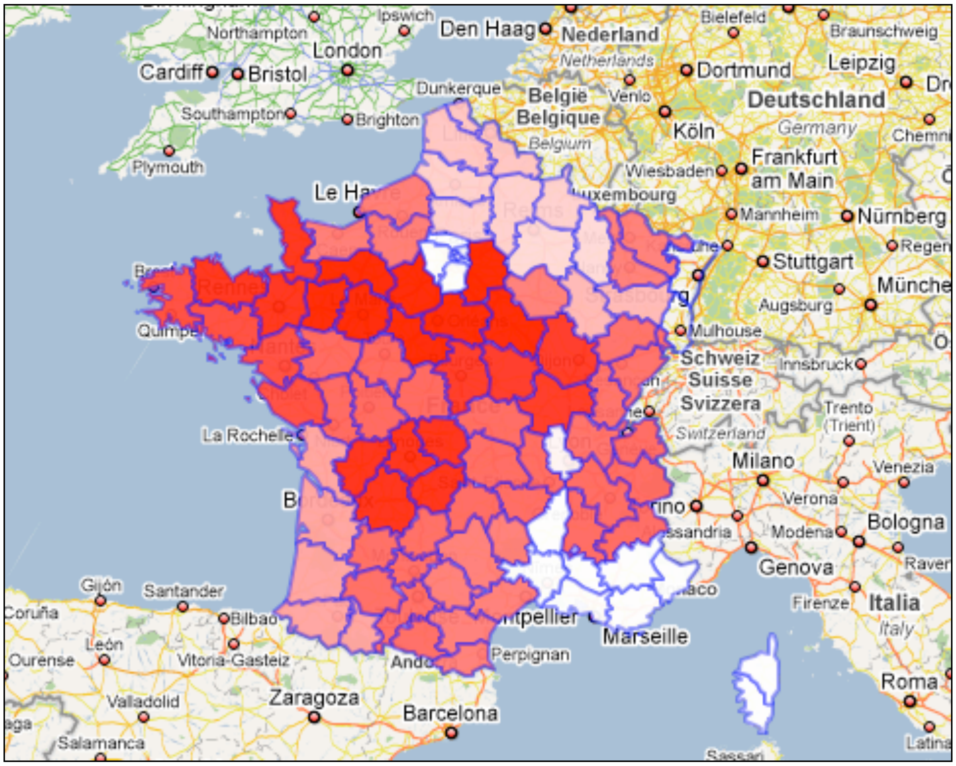
van Leeuwen, Marco H.D., and Ineke Maas. 2005c. "Endogamy and Social Class in History: An Overview." *International Review of Social History*, Supplement 50.

Weiss, Yoram. 1993. "The Formation and Dissolution of Families: Why Marry? Who Marries Whom? And What Happens Upon Divorce," in *The Handbook of Population and Family Economics,* Mark R. Rosenzweig and Oded Stark, ed. Amsterdam: North Holland.

Willis, Robert J. 1999. "A Theory of Out-of-Wedlock Childbearing." *The Journal of Political Economy*, Vol. 107, No. 6, Part 2: S33-S64.

Wong, Linda Y., 2003. "Structural Estimation of Marriage Models." *Journal of Labor Economics*, 21: 699–727.

Figure 1.1: The geographic variation in military mortality rates



This map shows the geographic variation in the percentage of soldiers killed. Totally white corresponds to a mortality rate of 11.9%, the 5th percentile; totally red corresponds to a mortality rate of 20.0%, the 95th percentile.

Figure 2.1: Number of first marriages per 1,000 women by birth cohorts and years

Source: Henry (1966)

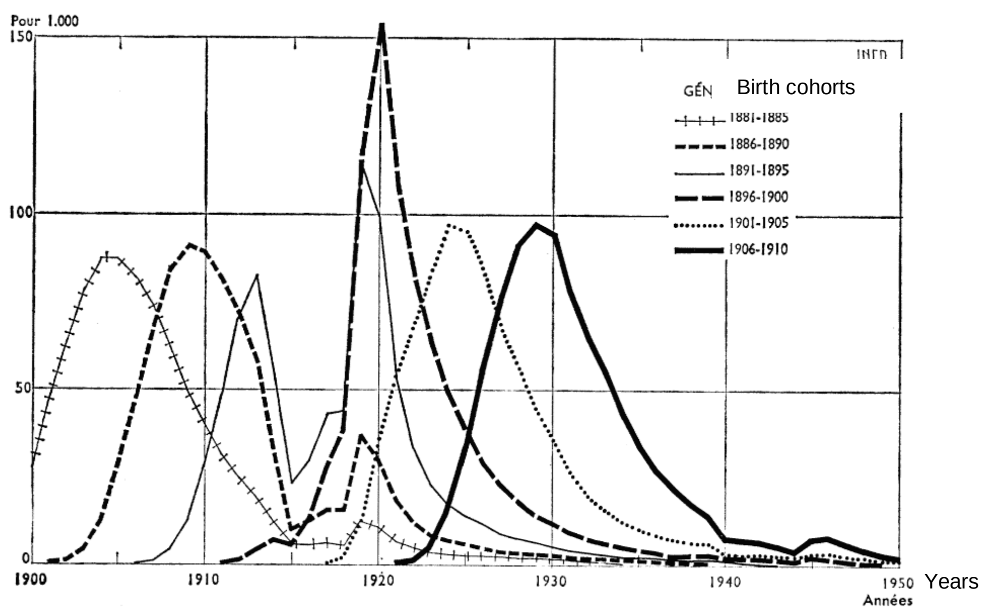


Figure 2.2: Percentage of singles at age 50 by birth cohort

Source: Roussel (1971)

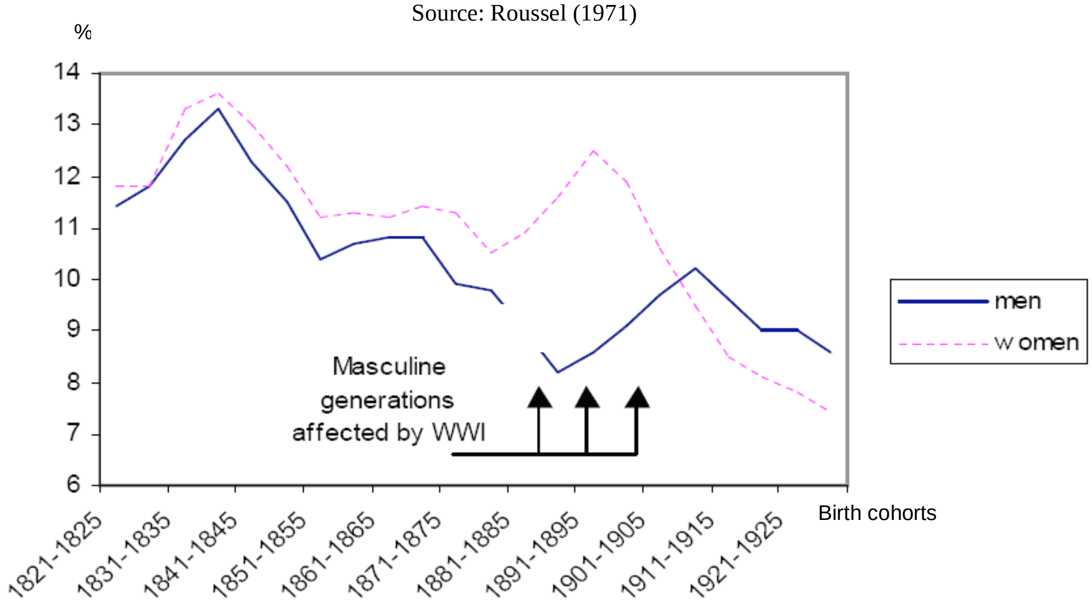


Figure 6.1: Pre-WWI matching was assortative

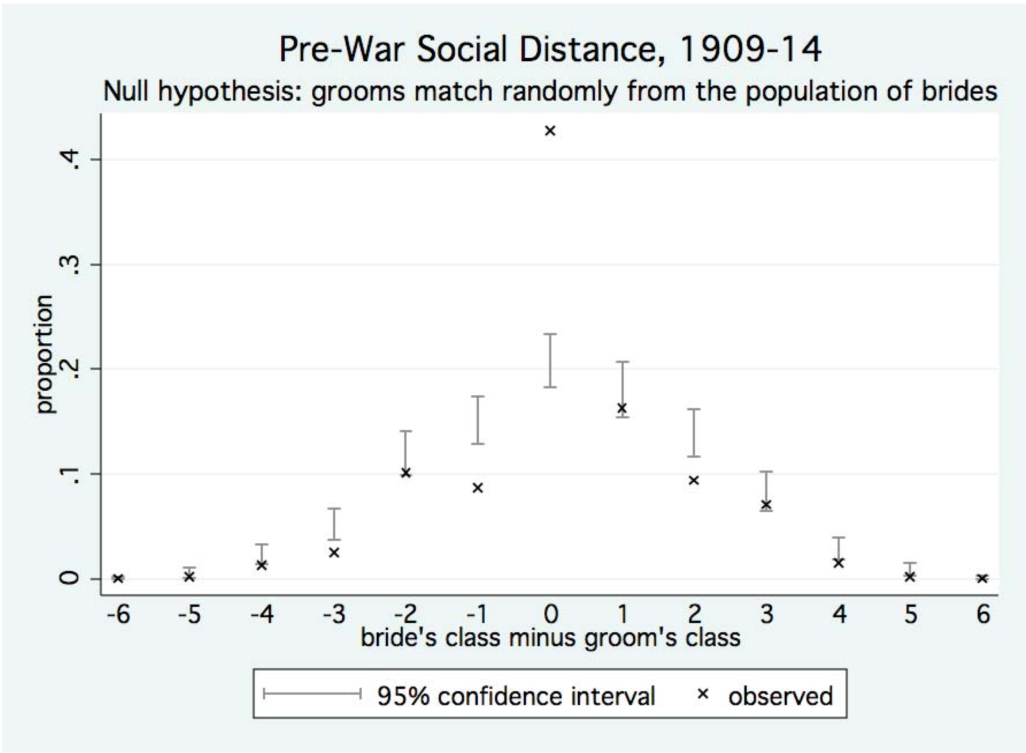


Table 2.1: Distribution of fatalities by occupation at age 20 (in %)

Source: Huber (1931)

Occupation	% dead
Agriculture	41.5
Industry/Alimentation/Construction/Transportation	35.7
Sales	9.5
Liberal professions	2.4
Civil servant	1.3
Domestic	4.2
Clergy	0.2
Without profession	0.5
Others	4.6
Total	100.0

Table 2.2: Distribution of the labor force by sector (in %)

Source: Huber (1931). Repartition using 1906 territory for both years

	1906		1921	
Sectors	males	females	males	females
Fishing	0.6	0.1	0.6	0
Agriculture and forestry	43.8	43.2	39.9	45.9
Industry and transportation	37.9	32.7	41.8	28.7
Sales	10.4	10.1	10.4	11.7
Liberal professions	2.4	2.5	2.3	3.4
Public service	3.5	1.3	4.2	2.3
Domestic	1.4	10.1	0.8	8
% of the pop. in the labor force	68.2	39.0	71.2	42.6

Table 2.3: Women were more likely to be unmarried in areas with higher mortality rates and lower sex ratios

Dependent variable: fraction of women who aren't married

	(1)	(2)
% of Soldiers Killed * Post War	0.002***	
	(0.000)	
Sex Ratio		-0.295***
		(0.023)
Departement Dummies	Yes	Yes
R-Squared	0.911	0.911
Observations	256	260

Notes: Each column is an OLS regression where an observation is a departement in a census period (1911, 1921 or 1926). The sex ratio is defined as men aged 18-59 divided by women aged 15-49 in the departement. Unmarried women include women who have never been married, widowed women, and divorced women. Standard errors are given in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table 4.1: Summary statistics

	Pre War		Post War	
	Mean	*Standard deviation*	Mean	*Standard deviation*
Sex ratio	1.12	*0.09*	1.02	*0.08*
% Female managers	43.3	*13.0*	41.5	*12.5*
% Female employees	3.8	*1.2*	7.6	*3.3*
% Female workers	29.3	*7.7*	29.9	*7.9*
% Self-employed females	23.1	*7.2*	19.6	*5.5*
% Unemployed females	0.5	*0.5*	1.4	*1.4*

The pre-war statistics are from 1911 for the sex ratio and 1906 for the female occupations; the post-war values are all from 1921.

Table 5.1. Examples of common occupations within each class

Class	Women	Men
1	Accountant, professor	Accountant, engineer
2	Store employee, bank employee	Railway company employee, store employee
3	Seamstress, cook	Mechanic, constructor
4	Farmer, winegrower	Farmer, winegrower
5	Domestic, linen maid	Driver, domestic
6	Factory worker, worker	Factory worker, worker
7	Day laborer, farm worker	Day laborer, farm worker

Table 5.2: Distribution of grooms and brides by class

	Grooms		Brides	
Classes	Pre-WWI	Post-WWI	Pre-WWI	Post-WWI
1	5.4	7.1	0.7	1.2
2	17.8	20.3	6.3	10.5
3	24.1	24.2	20.1	13.3
4	22.9	22.3	9.8	10.5
5	19.9	16.8	21.9	18.2
6	5.4	5.4	4.2	4.1
7	4.0	3.2	2.7	1.8
No occupation	0.6	0.8	34.4	40.5
N	*1,605*	*4,254*	*1,482*	*3,950*

Table 6.1. Average class of the brides for each groom's class before and after the war

	Average bride's class	
Groom class	Pre-war	Post-war
1	3.4	3.2
2	3.6	3.4
3	3.7	3.8
4	4.2	4.1
5	4.2	4.1
6	4.6	4.6
7	5.2	4.9

Table 6.2: Men marry up more where military mortality was higher (OLS)

Dependent variable:	class difference		married up	
	actual	imputed	actual	imputed
% of Soldiers Killed * Post War	-0.073***	-0.058***	0.021***	0.018***
	(0.025)	(0.019)	(0.007)	(0.005)
% of Soldiers Killed	0.018	0.027	0.010	-0.001
	(0.026)	(0.020)	(0.012)	(0.008)
Rural	0.300***	0.265***	-0.061*	-0.067***
	(0.101)	(0.055)	(0.030)	(0.019)
% Female Proprietors	-0.013**	-0.012***	-0.000	0.000
	(0.005)	(0.003)	(0.002)	(0.001)
% Female Employees	-0.054***	-0.050***	0.014***	0.013***
	(0.014)	(0.009)	(0.005)	(0.003)
% Female Self-Employed	-0.011	-0.010	0.005	0.002
	(0.009)	(0.006)	(0.003)	(0.002)
% Female Unemployed	-0.025	-0.026**	0.006	0.009**
	(0.017)	(0.012)	(0.006)	(0.004)
Groom's Age (/100)	0.128	0.318	0.271*	0.117
	(0.342)	(0.206)	(0.130)	(0.079)
Bride's Age (/100)	-0.395	0.038	-0.205*	-0.150*
	(0.420)	(0.307)	(0.117)	(0.079)
Post-War Dummy	Yes	Yes	Yes	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
R-Squared	0.195	0.174	0.214	0.395
Observations	3,122	4,997	2,998	4,834

Notes: The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The first and third columns exclude brides without occupations; the second and forth columns impute the classes of brides without occupations as described in Section 5.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table 6.3: Placebo regression pretending the war took place between 1911 and 1912 (OLS)

Dependent variable:	class difference		married up	
	actual	imputed	actual	imputed
% of Soldiers Killed * Post 1911	0.025	0.008	-0.009	-0.002
	(0.019)	(0.014)	(0.010)	(0.007)
% of Soldiers Killed	-0.045	-0.019	0.018	0.007
	(0.044)	(0.032)	(0.018)	(0.013)
Rural	0.323**	0.265***	-0.077	-0.079**
	(0.145)	(0.091)	(0.048)	(0.029)
% Female Proprietors	-0.004	-0.005	-0.002	-0.002
	(0.009)	(0.006)	(0.003)	(0.002)
% Female Employees	-0.086	-0.077	-0.013	0.000
	(0.073)	(0.050)	(0.030)	(0.020)
% Female Self-Employed	0.010	0.004	-0.002	-0.000
	(0.013)	(0.008)	(0.004)	(0.003)
% Female Unemployed	-0.140	-0.102	0.105	0.053
	(0.174)	(0.117)	(0.081)	(0.055)
Groom's Age (/100)	0.419	0.580	0.045	-0.032
	(0.727)	(0.456)	(0.252)	(0.160)
Bride's Age (/100)	-0.066	0.329	-0.036	0.026
	(0.744)	(0.477)	(0.202)	(0.184)
Post-1911 Dummy	Yes	Yes	Yes	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
R-Squared	0.192	0.182	0.265	0.377
Observations	915	1,356	871	1,303

Notes: The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The first and third columns exclude brides without occupations; the second and forth columns include brides without occupations and impute their classes as described in Section 5.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table 6.4: Men marry up more when the sex ratio is lower, brides without occupation excluded (IV)

Panel A: Stage 1 regressions				
Dependent variable: Sex Ratio				
% of Soldiers Killed * Post War	-0.010***	-0.009***	-0.010***	-0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Rural	0.004*	0.003	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
% Female Proprietors	0.001*	0.001	0.001**	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Employees	-0.000	0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Self-Employed	0.002***	0.001*	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Unemployed	-0.007***	-0.012***	-0.007***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)
Groom's Age (/100)	0.013	0.006	0.015	0.007
	(0.011)	(0.011)	(0.011)	(0.012)
Bride's Age (/100)	-0.018	-0.024*	-0.022*	-0.027**
	(0.012)	(0.013)	(0.012)	(0.013)
Dummies as in Stage 2	Yes	Yes	Yes	Yes
R-Squared	0.790	0.775	0.794	0.778
Panel B: Stage 2 regressions				
Dependent variable:	class difference		married up	
Sex Ratio	3.320**	3.613**	-1.454**	-1.564**
	(1.640)	(1.778)	(0.618)	(0.666)
Rural	0.216***	0.223***	-0.043*	-0.046**
	(0.065)	(0.064)	(0.023)	(0.022)
% Female Proprietors	-0.009*	-0.009*	0.003	0.002
	(0.005)	(0.005)	(0.002)	(0.002)
% Female Employees	-0.037***	-0.042***	0.016***	0.018***
	(0.012)	(0.013)	(0.004)	(0.005)
% Female Self-Employed	-0.030***	-0.026***	0.014***	0.012***
	(0.008)	(0.007)	(0.003)	(0.003)
% Female Unemployed	0.017	0.050**	-0.005	-0.023***
	(0.018)	(0.020)	(0.006)	(0.007)
Groom's Age (/100)	0.273	0.298	0.260*	0.236*
	(0.397)	(0.397)	(0.138)	(0.138)
Bride's Age (/100)	-0.458	-0.418	-0.207	-0.224
	(0.419)	(0.423)	(0.145)	(0.146)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.213	0.207	0.226	0.218
Observations	3,122	3,122	2,998	2,998

Notes: Panel A shows the first stage of the IV regressions, where the sex ratio is regressed on military mortality interacted with post war, and controls; Panel B shows the second stage, where marriage outcomes are regressed on the instrumented sex ratio and controls.
The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The sex ratio is defined as men aged 18-59 divided by women aged 15-49 in the departement and census period. Brides without occupations are excluded.
The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses.
Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table 6.5: Men marry up more when the sex ratio is lower, full sample (IV)

Panel A: Stage 1 regressions				
Dependent variable: Sex Ratio				
% of Soldiers Killed * Post War	-0.009***	-0.009***	-0.009***	-0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Rural	0.003	0.002	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
% Female Proprietors	0.001	0.000	0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Employees	0.001	0.002	0.000	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Self-Employed	0.003***	0.002***	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Unemployed	-0.007***	-0.013***	-0.007***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
Groom's Age (/100)	0.018*	0.011	0.019*	0.012
	(0.010)	(0.010)	(0.010)	(0.010)
Bride's Age (/100)	-0.019*	-0.026**	-0.022**	-0.029**
	(0.011)	(0.012)	(0.011)	(0.012)
Dummies as in Stage 2	Yes	Yes	Yes	Yes
R-Squared	0.758	0.738	0.759	0.738
Panel B: Stage 2 regressions				
Dependent variable:	class difference		married up	
Sex Ratio	2.489**	2.662**	-0.804*	-0.865*
	(1.204)	(1.292)	(0.477)	(0.514)
Rural	0.206***	0.206***	-0.051***	-0.051***
	(0.038)	(0.037)	(0.014)	(0.014)
% Female Proprietors	-0.008**	-0.008**	0.000	-0.000
	(0.003)	(0.003)	(0.001)	(0.001)
% Female Employees	-0.033***	-0.037***	0.009***	0.011***
	(0.008)	(0.009)	(0.003)	(0.004)
% Female Self-Employed	-0.024***	-0.022***	0.008***	0.007***
	(0.005)	(0.005)	(0.002)	(0.002)
% Female Unemployed	0.015	0.034**	-0.001	-0.012**
	(0.012)	(0.016)	(0.005)	(0.006)
Groom's Age (/100)	0.398	0.418	0.128	0.110
	(0.276)	(0.275)	(0.102)	(0.102)
Bride's Age (/100)	0.022	0.032	-0.170	-0.173
	(0.312)	(0.314)	(0.112)	(0.112)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.188	0.185	0.402	0.399
Observations	4,997	4,997	4,834	4,834

Notes: Panel A shows the first stage of the IV regressions, where the sex ratio is regressed on military mortality interacted with post war, and controls; Panel B shows the second stage, where marriage outcomes are regressed on the instrumented sex ratio and controls.

The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The sex ratio is defined as men aged 18-59 divided by women aged 15-49 in the departement and census period. Brides without occupations have their classes imputed as described in Section 5.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table 6.6: Men marry up more when the sex ratio at age 18 is lower, brides without occupation excluded (IV)

Panel A: Stage 1 regressions				
Dependent variable: Sex Ratio at age 18				
% of Soldiers Killed * Post War	-0.009***	-0.009***	-0.009***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Rural	0.003	0.003	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
% Female Proprietors	0.000	0.000	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Employees	-0.002*	-0.002	-0.002*	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Self-Employed	0.002***	0.001***	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Unemployed	-0.003***	-0.004***	-0.003***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Groom's Age (/100)	-0.004	-0.007	-0.001	-0.004
	(0.012)	(0.012)	(0.012)	(0.012)
Bride's Age (/100)	-0.008	-0.010	-0.013	-0.015
	(0.012)	(0.012)	(0.012)	(0.012)
Dummies as in Stage 2	Yes	Yes	Yes	Yes
R-Squared	0.812	0.809	0.815	0.811
Panel B: Stage 2 regressions				
Dependent variable:	class difference		married up	
Sex Ratio at age 18	3.568**	3.785**	-1.571**	-1.652**
	(1.767)	(1.846)	(0.671)	(0.704)
Rural	0.217***	0.222***	-0.044*	-0.046**
	(0.065)	(0.064)	(0.023)	(0.023)
% Female Proprietors	-0.009*	-0.009*	0.002	0.002
	(0.005)	(0.005)	(0.002)	(0.002)
% Female Employees	-0.031***	-0.033***	0.013***	0.015***
	(0.011)	(0.011)	(0.004)	(0.004)
% Female Self-Employed	-0.030***	-0.028***	0.014***	0.013***
	(0.008)	(0.008)	(0.003)	(0.003)
% Female Unemployed	0.005	0.022	0.000	-0.011**
	(0.018)	(0.014)	(0.006)	(0.005)
Groom's Age (/100)	0.332	0.345	0.236*	0.218
	(0.401)	(0.401)	(0.139)	(0.139)
Bride's Age (/100)	-0.489	-0.465	-0.197	-0.206
	(0.417)	(0.420)	(0.145)	(0.145)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.212	0.208	0.225	0.219
Observations	3,122	3,122	2,998	2,998

Notes: Panel A shows the first stage of the IV regressions, where the sex ratio when the groom was aged 18 is regressed on military mortality interacted with post war, and controls; Panel B shows the second stage, where marriage outcomes are regressed on the instrumented sex ratio and controls.

The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The sex ratio at age 18 is defined as men aged 18-59 divided by women aged 15-49 in the departement and census period when the groom was 18. Brides without occupations are excluded.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table 6.7: Men marry up more when the sex ratio at age 18 is lower, full sample (IV)

Panel A: Stage 1 regressions				
Dependent variable: Sex Ratio at age 18				
% of Soldiers Killed * Post War	-0.009***	-0.009***	-0.009***	-0.009***
	(0.001)	(0.002)	(0.002)	(0.002)
Rural	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
% Female Proprietors	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Employees	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Self-Employed	0.003***	0.003***	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Unemployed	-0.003***	-0.005***	-0.003**	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Groom's Age (/100)	0.000	-0.002	0.003	-0.000
	(0.010)	(0.010)	(0.010)	(0.010)
Bride's Age (/100)	-0.012	-0.015	-0.016	-0.019*
	(0.011)	(0.011)	(0.011)	(0.011)
Dummies as in Stage 2	Yes	Yes	Yes	Yes
R-Squared	0.786	0.783	0.788	0.784
Panel B: Stage 2 regressions				
Dependent variable:	class difference		married up	
Sex Ratio at age 18	2.637**	2.761**	-0.855*	-0.902*
	(1.274)	(1.334)	(0.507)	(0.537)
Rural	0.207***	0.206***	-0.051***	-0.051***
	(0.038)	(0.037)	(0.014)	(0.014)
% Female Proprietors	-0.007**	-0.008**	-0.000	-0.000
	(0.003)	(0.003)	(0.001)	(0.001)
% Female Employees	-0.030***	-0.031***	0.008***	0.009***
	(0.007)	(0.008)	(0.003)	(0.003)
% Female Self-Employed	-0.024***	-0.023***	0.009***	0.008***
	(0.005)	(0.005)	(0.002)	(0.002)
% Female Unemployed	0.006	0.014	0.002	-0.006
	(0.012)	(0.010)	(0.005)	(0.004)
Groom's Age (/100)	0.441	0.454	0.115	0.099
	(0.277)	(0.276)	(0.102)	(0.102)
Bride's Age (/100)	0.007	0.004	-0.166	-0.164
	(0.311)	(0.312)	(0.112)	(0.112)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.188	0.185	0.403	0.400
Observations	4,997	4,997	4,834	4,834

Notes: Panel A shows the first stage of the IV regressions, where the sex ratio when the groom was aged 18 is regressed on military mortality interacted with post war, and controls; Panel B shows the second stage, where marriage outcomes are regressed on the instrumented sex ratio and controls.

The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The sex ratio at age 18 is defined as men aged 18-59 divided by women aged 15-49 in the departement and census period when the groom was 18. Brides without occupations have their classes imputed as described in Section 5.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table A1: Regression for the imputation of bride's class for brides without occupations

Dependent variable: bride's class	coefficient	standard error
Class 1 Father	-0.872*	(0.455)
Class 2 Father	-0.522**	(0.247)
Class 3 Father	-0.092	(0.208)
Class 4 Father	0.063	(0.232)
Class 5 Father	0.178	(0.224)
Class 6 Father	0.093	(0.233)
Class 7 Father	0.005	(0.503)
Class 1 Mother	-0.384	(0.562)
Class 2 Mother	-0.992***	(0.277)
Class 3 Mother	-1.059***	(0.252)
Class 4 Mother	-0.064	(0.283)
Class 5 Mother	-0.076	(0.175)
Class 6 Mother	0.172	(0.246)
Class 7 Mother	-0.525	(1.262)
Father has missing occupation because he's dead	0.025	(0.174)
Mother has missing occupation because she's dead	-0.010	(0.160)
Father has no Occupation	0.248	(0.446)
Mother has no Occupation	-0.135	(0.179)
Rural	0.325	(0.303)
Rural Interacted With:		
Class 1 Father	0.265	(0.673)
Class 2 Father	-0.040	(0.570)
Class 3 Father	-0.130	(0.393)
Class 4 Father	-0.003	(0.347)
Class 5 Father	-0.241	(0.388)
Class 6 Father	-0.145	(0.759)
Class 7 Father	0.172	(0.582)
Class 1 Mother	0.350	(1.101)
Class 2 Mother	1.150*	(0.597)
Class 3 Mother	1.245**	(0.498)
Class 4 Mother	-0.263	(0.358)
Class 5 Mother	0.140	(0.271)
Class 6 Mother	0.771	(0.515)
Class 7 Mother	1.278	(1.299)
Father has missing occupation because he's dead	-0.103	(0.308)
Mother has missing occupation because she's dead	-0.120	(0.270)
Father has no Occupation	0.477	(0.774)
Mother has no Occupation	-0.410	(0.326)
Paris	-0.249*	(0.142)
Big City	0.033	(0.191)
Medium Sized City	0.131	(0.153)
Bride's Age	-0.107***	(0.030)
Bride's Age Squared	0.168***	(0.047)
Groom's Class	0.255***	(0.029)
R-Squared	0.2655	
Observations	943	

Notes: Observations are pre-war marriages where the bride's class is not missing. The omitted category for parent's class is missing class for unknown reason. The omitted category for city size is small city or other area.

Table A2: Men marry up more where military mortality was higher, imputing brides without occupation with father's class

Dependent variable:	class difference imputed	married up imputed
% of Soldiers Killed * Post War	-0.053*	0.014**
	(0.026)	(0.006)
% of Soldiers Killed	0.020	0.004
	(0.020)	(0.009)
Rural	0.236***	-0.052**
	(0.076)	(0.020)
% Female Proprietors	-0.017***	0.002*
	(0.003)	(0.001)
% Female Employees	-0.055***	0.015***
	(0.010)	(0.004)
% Female Self-Employed	-0.016*	0.006*
	(0.009)	(0.003)
% Female Unemployed	-0.012	0.002
	(0.020)	(0.006)
Groom's Age (/100)	0.054	0.200*
	(0.265)	(0.100)
Bride's Age (/100)	-0.272	-0.222*
	(0.510)	(0.129)
Post-War Dummy	Yes	Yes
Groom Class Dummies	Yes	Yes
R-Squared	0.194	0.198
Observations	4,297	4,151

Notes: The dependent variable in the first column is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the second column is a dummy variable for whether the groom married a bride of higher class than himself. Bride class is imputed for brides with no occupation using the class of the bride's father.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table A3: Men marry up more when the sex ratio is lower, imputing brides without occupation with father's class (IV)

Panel A: Stage 1 regressions				
Dependent variable: Sex Ratio				
% of Soldiers Killed * Post War	-0.009***	-0.009***	-0.009***	-0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Rural	0.003	0.003	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
% Female Proprietors	0.001	0.000	0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Employees	0.000	0.001	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
% Female Self-Employed	0.002***	0.002***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
% Female Unemployed	-0.007***	-0.012***	-0.007***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)
Groom's Age (/100)	0.019*	0.011	0.021*	0.012
	(0.011)	(0.011)	(0.011)	(0.011)
Bride's Age (/100)	-0.026**	-0.035***	-0.030**	-0.039***
	(0.012)	(0.013)	(0.012)	(0.013)
Dummies as in Stage 2	Yes	Yes	Yes	Yes
R-Squared	0.758	0.739	0.759	0.740
Panel B: Stage 2 regressions				
Dependent variable:	class difference		married up	
Sex Ratio	1.476	1.704	-0.662	-0.751
	(1.700)	(1.791)	(0.604)	(0.621)
Rural	0.160***	0.162***	-0.036**	-0.036**
	(0.054)	(0.054)	(0.017)	(0.017)
% Female Proprietors	-0.007	-0.007*	0.001	0.001
	(0.005)	(0.004)	(0.002)	(0.002)
% Female Employees	-0.036***	-0.040***	0.013***	0.015***
	(0.011)	(0.011)	(0.004)	(0.004)
% Female Self-Employed	-0.029***	-0.027***	0.012***	0.011***
	(0.007)	(0.007)	(0.003)	(0.003)
% Female Unemployed	0.017	0.038*	-0.005	-0.016**
	(0.018)	(0.021)	(0.006)	(0.007)
Groom's Age (/100)	0.203	0.232	0.194	0.173
	(0.384)	(0.385)	(0.128)	(0.129)
Bride's Age (/100)	-0.340	-0.328	-0.236*	-0.243*
	(0.416)	(0.418)	(0.140)	(0.139)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.209	0.207	0.207	0.203
Observations	4,297	4,297	4,151	4,151

Notes: Panel A shows the first stage of the IV regressions, where the sex ratio is regressed on military mortality interacted with post war, and controls; Panel B shows the second stage, where marriage outcomes are regressed on the instrumented sex ratio and controls.

The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. Brides without occupations are given the classes of their fathers.

The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table A4: Men marry up more when the sex ratio is lower, brides without occupation excluded (OLS)

Dependent variable:	class difference		married up	
Sex Ratio	0.587	0.421	-0.096	0.028
	(0.648)	(0.632)	(0.218)	(0.212)
Rural	0.228***	0.235***	-0.048**	-0.050**
	(0.065)	(0.065)	(0.023)	(0.022)
% Female Proprietors	-0.005	-0.005	0.000	-0.000
	(0.004)	(0.004)	(0.002)	(0.002)
% Female Employees	-0.028***	-0.029***	0.012***	0.012***
	(0.010)	(0.011)	(0.004)	(0.004)
% Female Self-Employed	-0.026***	-0.023***	0.012***	0.011***
	(0.007)	(0.007)	(0.003)	(0.002)
% Female Unemployed	0.007	0.023	-0.001	-0.009*
	(0.018)	(0.015)	(0.006)	(0.005)
Groom's Age (/100)	0.312	0.321	0.239*	0.223
	(0.398)	(0.396)	(0.139)	(0.137)
Bride's Age (/100)	-0.525	-0.515	-0.170	-0.171
	(0.413)	(0.413)	(0.146)	(0.145)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.218	0.215	0.236	0.232
Observations	3,122	3,122	2,998	2,998

Notes: The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The sex ratio is defined as men aged 18-59 divided by women aged 15-49 in the departement and census period. Brides without occupations are excluded.
The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Table A5: Men marry up more when the sex ratio is lower, full sample (OLS)

Dependent variable:	class difference		married up	
Sex Ratio	0.448	0.382	-0.071	0.000
	(0.373)	(0.368)	(0.135)	(0.133)
Rural	0.213***	0.213***	-0.053***	-0.053***
	(0.038)	(0.038)	(0.014)	(0.014)
% Female Proprietors	-0.005**	-0.005**	-0.001	-0.001
	(0.003)	(0.003)	(0.001)	(0.001)
% Female Employees	-0.026***	-0.026***	0.006**	0.007**
	(0.007)	(0.007)	(0.003)	(0.003)
% Female Self-Employed	-0.019***	-0.018***	0.007***	0.006***
	(0.004)	(0.004)	(0.002)	(0.002)
% Female Unemployed	0.008	0.012	0.001	-0.004
	(0.012)	(0.010)	(0.005)	(0.004)
Groom's Age (/100)	0.439	0.449	0.112	0.097
	(0.275)	(0.273)	(0.103)	(0.102)
Bride's Age (/100)	-0.031	-0.043	-0.148	-0.142
	(0.305)	(0.305)	(0.112)	(0.111)
Year Dummies	Yes	No	Yes	No
Post-War Dummy	No	Yes	No	Yes
Groom Class Dummies	Yes	Yes	Yes	Yes
Military Region Dummies	Yes	Yes	Yes	Yes
R-Squared	0.193	0.191	0.406	0.404
Observations	4,997	4,997	4,834	4,834

Notes: The dependent variable in the first two columns is the class of the bride minus the class of the groom (thus a greater class difference indicates the groom married a lower class of bride); the dependent variable in the third and fourth columns is a dummy variable for whether the groom married a bride of higher class than himself. The sex ratio is defined as men aged 18-59 divided by women aged 15-49 in the departement and census period. Brides without occupations have their classes imputed as described in Section 5.
The female occupation variables are expressed as percentages of the female labor force for the departement; the omitted category is workers. Standard errors, clustered at the military region x marriage year level, are presented in parentheses. Asterisks denote significance at: * 10%, ** 5%, *** 1%.

Appendix B: Variable definitions

Dependent variables:
Bride minus groom class: This variable is a marriage-level variable equal to the class of the bride minus the class of the groom.
Married up: This variable is a marriage-level dummy variable that takes the value 1 if the bride is in at least as high a class as the groom.
See Section 5 for **class** definition.

Main independent variables:
Military mortality (percentage of soldiers killed): We use Huber's (1931) data on the percentage of soldiers (excluding officers) reported dead or missing. These data are available by the military region in which the soldiers enlisted. We map military regions to départments and thus marriages.
Sex ratio: The sex ratio is defined as the number of men aged 18 to 59 years divided by the number of women aged 15 to 49 years. It is defined at the département level for each census period, namely 1911, 1921 and 1926. Thus marriages in the period 1909 to 1914 take the value from 1911, marriages in the period 1918 to 1923 take the value from 1921, and marriages in the period 1924 to 1928 take the value from 1926.
Sex ratio at age 18: This variable is the same as the sex ratio. Marriages are assigned sex ratios of the census year which is the closest to when the groom turn 18. We however do not allocate pre-war sex ratios to post war marriages, because it seems implausible that men pre war would have predicted the high military mortality rate and thus delayed marriage in order to face less competition in the marriage market.

Other control variables:
Military regions: We use the 22 military regions that existed at the end of WWI. Of the three départements Moselle, Bas-Rhin and Haut-Rhin, which were gained from Germany in 1919, only Moselle is allocated to a military region and thus a military mortality rate. However, we do not have département-level data for Moselle pre war, so only its post war marriages are included in the regressions.
Female occupation variables (% proprietors, % employees, % unemployed, % self-employed): In the censuses of 1906, 1921 and 1926, the female labor force is categorized into five groups: proprietors (typically owners of very small stores), employees, workers, unemployed and self-employed. With workers as the omitted category, we use four variables for the percentage of the female labor force that falls into each of the other categories at the département level. Marriages in the period 1909 to 1914 take the values from the 1906 census. Marriages in the period 1918 to 1923 take the values from the 1921 census; marriages in the period 1924 to 1928 take the values from the 1926 census.
Rural: This a dummy variable defined at the marriage level. It is defined in terms of the administrative status of the place of marriage, which may take the values *chef lieu de département*, *chef lieu d'arrondissement*, *chef-lieu de canton*, and *rural*. We consider the category *rural* to indicate a rural marriage, and the other three categories to indicate urban marriages.
Groom's age: The age of the groom is constructed from three marriage-level variables: the age of the groom, the year of the marriage and the groom's year of birth. If the stated age of the groom falls in the range 10 to 89, this is the value used. If it does not, or the age of the groom is missing, we use the difference between the year of marriage and the groom's year of birth if this falls in the range 10 to 89. Otherwise the groom's age is missing.
Bride's age: Same as groom's age.