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ABSTRACT

In the marriage market, families make investments on behalf of their young so that they are able to form a household with their preferred partner. We analyze marriage markets in a central region of China between about 1300 and 1850 through the lens of a model of marriage matching and intergenerational transmission of inequality. For both female and male children, marriage patterns are far from being random, instead, there is positive assortative matching. This is present for the entire income distribution, though at the highest levels matching on income is thirty times of what it is at low income levels. Over the sample period the degree of matching falls, and more so for young females, although from a lower level than young males. Lower marriage matching in the 18th and 19th centuries is accompanied by lower inequality across households, yielding a positive time series correlation between sorting and inequality. There are also intergenerational matching returns. Children of parents who are strongly matched tend to be able to marry into relatively high-income in-law families, conditional on the incomes in both the father's and the mother's families. Matching in the parent generation pays off more strongly for male than for female children. Second, marriage matching by the parents raises child income. Thus, parental marriage investments affect the income distribution from one generation to the next. Finally, we show that intergenerational matching returns have declined over the sample period, further strengthening evidence that incentives for parental marriage investments in China became weaker over time.

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1 Introduction

In the marriage market, families make investments on behalf of their young so that they are able to form a household with their preferred partner.[1] Is there any evidence of changes in the extent of these investments, and do marriages today exhibit more positive assortative matching, with like marrying like, than at other times? A trend towards more marital sorting may be concerning if it would impact marriage rates, inequality across households, and child welfare (e.g., Carbone and Kahn 2014). And yet, relatively little is known about marriage markets, how they fit into the broader picture of parental investments and inequality, and even whether there truly can be drastic differences in the extent of marital sorting between one economy and the next. In this paper, we analyze marriage matching for a population in China over a relatively long time period, presenting evidence on the returns of marital sorting and the intergenerational transmission of inequality.

The study uses genealogical data from biographies of seven extended families (clans) living in Tongcheng County, China. For brevity, we will refer to these families as the Tongcheng individuals or clans.[2] There is information on more than 14,000 couples together with their parents and children. While the majority of these marriages took place during the Qing dynasty (1644 - 1911), our sample period spans more than five centuries roughly back to the year 1300. Importantly, while Chinese genealogies are patrilineal and thus cover men in a much more detailed way than women, we observe we observe a measure of the income of the in-law family both for brides and grooms. This allows us to study marriage matching by gender.[3]

Our analysis yields evidence for strong positive assortative matching in China. Consistent with parental marriage investments for both genders, the marriage patterns of both women and men are far from being random. Low-income Tongcheng men tend to marry low-income women from other clans, while high-income Tongcheng women have high-income men from other clans as their spouses. Furthermore, while marital sorting is present across the entire income distribution, quantitatively we find it to be stronger at the top. In particular, for low-income couples the extent of positive assortative matching relative to the baseline of random matching is eight percent, in contrast to an excess over random matching of more than threehundred percent at the very top of the income distribution (top 0.1%). Finally, we document a substantial fall in marital sorting over the sample period. The extent of positive assortative matching declined from the pre-1650 period to the beginning of the 19th century by about fifty percent. This evolution of marital sorting is consistent with lower investments in the marriage market towards the 18th and 19th centuries. We show that the lower marital sorting is accompanied by lower inequality across households over the sample period, yielding a positive relationship between inequality and marital sorting. Comparing across gender, the extent of marriage matching for young males fell somewhat stronger than for young females, consistent with the idea that parental investments sons were more strongly reduced than for daughters, albeit investment in sons had been at a higher level.

[1] We employ the terms marriage and household formation interchangeably in this paper.

[2] Note that many other clans lived in Tongcheng county during this period.

[3] Chinese genealogical data and the Tongcheng genealogies in particular are described in Shiue (2016).

We also offer an analysis of intergenerational marriage matching returns, defined as the effects of marital sorting in the parent and grandparent generations on outcomes of the child. First, children of parents who are strongly matched tend to be able to marry into a relatively high-income in-law family, conditional on the income levels of both the father's and the mother's families. Quantitatively, however, marital sorting in the parent generation pays off more strongly for male than for female children. Second, we find that the degree of positive assortative matching in a family is correlated across generations. With a coefficient of about 0.6, there is intergenerational persistence in marital sorting, especially at higher income levels. Third, sorting in the parental and grandparental generation significantly raises the income of the son, conditional on the income of the father. Finally, just as for marital sorting in a given generation mentioned earlier, the evidence shows that intergenerational matching returns have declined over the course of the sample period, in line with the hypothesis that incentives for parental marriage investments became weaker over time.

This paper contributes to research in three different areas. There is, first, a relatively small literature on marriage markets in historical societies. In 15th century Italy, for example, transfers from the bride family to the groom family (dowries) increased as brides married 'down' into poorer groom families (Botticini 1999).[4] Hamilton and Siow (2007) present evidence for positive assortative matching in a study of class and marriage in 18th century New France (Quebec), while research in sociology has studied positive assortative matching ("homogamy") in small Scandinavian societies during the late 18th and 19th centuries (Bull 2005, Dribe and Lundh 2005). Abramitzky, Delavande, and Vasconcelos (2011) show that changes in sex ratios due to men's death in WWI impacted marriage patterns in early 20th century France. We present new quantitative evidence for a large part of the world on which comparatively little is known on marriage patterns to date. Our extended sample period enables us to shift the focus to the role of marriage in processes that manifest themselves over comparatively long periods of time (several generations). We also propose a new source of data for the study of marriage markets, namely family histories.

Second, a large body of work studies sorting, both in marriage and in other markets.[5] Do economies differ in the degree of marriage matching, and what is the relationship is between marriage matching and inequality? See Schwartz (2013) for a survey. From the 1930s to the 1970s positive assortative matching on education has tended to increase in the US (Mare 1991), although there is no consensus for the US on whether posititive assortative matching has increased since the 1970s nor whether it has raised family earnings inequality since that time (Carbone and Kahn 2014, Cornelson and Siow 2016, and Greenwood, Guner, Kocharkov, and Santos 2016). The pre-industrial setting without changes in birth control and technology (Goldin and Katz 2002 and Greenwood, Guner, Kocherkov, and Santos 2016), for example, eliminates a number of explanations for the observed changes in marital sorting. Our finding that changes in marital sorting are positively correlated with

[4]On dowries, see also Botticini and Siow (2003).

[5]For example, labor economists study sorting and inequality as workers match with firms (Abowd, Kramarz, and Margolis 1999, Song, Price, Guvenen, Bloom, and van Wachter 2019).

changes in inequality complements Fernández, Guner, and Knowles' (2005) cross-sectional finding of this correlation across 34 countries in the late 20th century with long-run time series evidence for a given population.

With a few notable exceptions, the literature on sorting and inequality focuses on returns to the spouses themselves. This poses a challenge because models of marriage will typically imply that inequality and marital sorting are both endogenous, and to establish cause and effect can be challenging. In Fernández, Guner, and Knowles (2005), for example, earnings inequality affecte marital sorting, whereas Carbone and Kahn (2014) ask whether household inequality affects marriage matching. To make progress on this issue we examine matching returns from one generation to the next (intergenerational matching returns). By taking a longer-run view we hope to contribute to a better understanding of the role of marriage matching in the intergenerational transmission of inequality. This analysis of intergenerational marriage returns is based on data linked across generations, which is typical for genealogies but also linked census data. Our finding of a decline in marital sorting over time complements recent evidence for increasing social mobility in China through the lens of a model of human capital investments and intergenerational mobility (Shiue 2019). Parents invest into the marriage prospects as well as into the human capital of their children; the two returns are influenced by some of the same factors, and will as a result change in similar ways.

The remainder of the paper is as follows. Section 2 describes a model of search in the marriage market which is useful to interpret the relationship between of marital sorting and inequality and other findings of our analysis. The following section 3 provides the necessary background for the economy that we examine, and provides information on the data, with more details given in the Appendix. We also discuss the theoretical framework in the context of the Tongcheng economy and observables in the data in this section. Section 4 examines the extent of marital sorting, providing evidence that parents invest into the marriage partner search of their child, both female and male. We also document that over the sample period the extent of marital sorting was falling, as was the degree of inequality across households. The following section 5 shows evidence for intergenerational returns to marital sorting, both in terms of the marriage success and in terms of income of the marrying person, finding important differences by gender and over time. The section also presents evidence in intergenerational persistence in marital sorting. Section 6 provides a concluding discussion, and the Appendix contains analyses of the data including its reliability and representativeness.

2 Theoretical Framework

To fix ideas consider the framework of Fernández, Guner, and Knowles (2005) who integrate the analysis of who matches with whom in the marriage market with human capital investments and the intergenerational transmission of inequality. Individuals live for three generations. In the first, young agents decide whether to become skilled or unskilled. After the educational choice, agents meet in the marriage market. Here they meet another agent with whom to form a household, observing both

the agent's skill type (and hence the agent's expected future income) and a match-specific quality. In the second and third period, agents have children, pay their education debts (if any), and consume.

Agents' utility is increasing in income and match quality. The quality of a match, q, is single-dimensional and summarizes all the reasons (physical, cultural, and others) why marriage between two particular agents might yield a higher or lower utility level.[6]

Matching is random and in two rounds: in the first, agents are matched with any skill group, while in the second round agents meet only others of the same skill group. Central to the sorting behavior is whether a skilled agent matches with an unskilled agent in the first round. Matching with an unskilled agent will yield lower household income than with a skilled agent, which is assured in round two. This is the benefit of more 'search' in the marriage market. At the same time, if the match quality in the first round is sufficiently high relative to skilled-to-unskilled wage difference and the expected match quality in the second round, the skilled agent will marry the unskilled agent in the first round. Thus, there is a trade-off between "love" (high match quality in the first round) and "money" (higher income from waiting to match with a skilled agent in the second round).

Fernández, Guner, and Knowles (2005) employ this framework to study the effect of greater inequality on marital sorting. The latter is high when there are many same-skill households, and conversely, marital sorting is low if there are many mixed-skill households, relative to the random first-round matching. Inequality is primarily interpreted in terms of the skilled-to-unskilled wage, w_s/w_u. In this economy, an exogenous increase in inequality, e.g. technological change that raises w_s relative to w_u increases marital sorting. A higher relative skilled wage, or skill premium, means that skilled agents will reject a higher proportion of first-round matches with unskilled agents, and sorting increases.

Also of interest is the impact of changes in the population shares of skilled and unskilled agents in the economy; let λ be the share of skilled, $\lambda = L_s/L$, where L_s and L are the number of skilled and all workers, respectively. A change in λ directly affects w_s/w_u, but it also affects the probability that a skilled worker meets an unskilled worker in the first round of matching. A decrease in the share of skilled agents in the economy, λ, can be shown to increase marital sorting.[7]

Fernández, Guner, and Knowles (2005) show that across any equilibrium, steady state or not, the model predicts a positive relationship between inequality and marital sorting. Independent from the model's dynamics, this follows from the static result that a higher relative skilled wage induces skilled workers to reject a higher proportion of first-round matches with unskiled workers. The authors document a robust positive relationship between inequaltiy and sorting across 34 advanced countries in the 1990s.

[6]For example, Becker's (1974) theory predicts that the returns from marriage depend on the relationship between various traits of agents. If the relationship is complementary, marriage returns are high with positive assortative matching, while if they are substitutes marriage returns are highest with negative assortative matching.

[7]A decrease in the share of skilled workers raises the the skill premium and thus marital sorting, even though the decline in λ may be associated with a higher (not lower) share of households in which both agents are skilled.

A second prediction is that for countries with similar technologies (steady-states), GDP per capita and marital sorting are negatively related. This follows because high sorting is associated with a low share of skilled agents, and GDP per capita will be low with a low share of skilled agents. There is support for this prediction as well although generally, addressing differences in the steady state of economies is often a challenge for empirical work.[8]

In the light of this model, the analysis below can be seen as systematically evaluating the prediction of a positive relationship between positive assortative matching and inequality in the time series. We will compare samples of the Tongcheng economy at different points in time over roughly the period 1300 to 1900. In addition, we extend the intergenerational dimension by analyzing the returns of matching in one generation for both marriage success and income in the next generation. To date there is no theory specifically addressing such intergenerational marriage matching returns, to our knowledge, though we conjecture that close inspection of the transitional dynamics of a model similar to Fernández, Guner, and Knowles (2005) may yield predictions that can be used to evaluate our empirical results.

3 Historical Context and Empirical Approach

3.1 Background

In China, as was true in Europe, marriage was a mechanism through which social and economic inequality was perpetuated to the next generation. In both regions, marriage markets served to strengthen or preserve status hierarchies and networks among individuals and families as the rich sought to increase their advantages by marrying the rich. In European marriages, however, almost everyone apart from aristocrats and the nobility exercised relatively independent choice of spouse. Individuals, both male and female, worked and saved their earnings until a time when they could afford to set up a separate household from their parents.

In contrast, in China, marriages were arranged by the parents or through a marriage broker or go-between. Even though during the High Qing of the 17th century, a small percentage of gentry women were more likely to have been increasingly literate and there was a rising incidence of "companionate marriages" (Ko 1994), the salient feature of marriage matching was that the search and selection was directed by household heads and elders on behalf of their children. So clear is the mandate that in the Qing Code, which summarizes the laws of the empire, we know that property belonged not to the individual but to the family unit, which was in turn controlled by elder household heads. According to Qing law, if children decided on their own marriage, revoking the choice of the parents and grandparents, they were to be punished by 80-100 floggings of the bamboo. Yet the law was merely a reflection of what the dominant Confucian culture sought to enforce, a situation where marriages were first and foremost a parental or corporate family decision as a general rule.

The rationales in the context of so-called "matching doors" in marriage–in which families sought

[8] See, e.g., the analysis of the conditional convergence prediction of the neoclassical growth model in Keller (2000).

matches between couples of comparable social backgrounds–aligns with economic arguments on positive assortative matching. Marriage was seen as an opportunity for establishing kinship ties that were advantageous for both families. Betrothal gifts (from the groom's family to the bride) and dowry (items accompanying the bride when she moved in with the groom's family) were to be of roughly equal value. Families tried to avoid marrying down, while at the same time avoiding to give the appearance of having to use a large wedding gift or dowry to "purchase" a spouse (Mann 1997). If during the Ming-Qing period, wedding gifts and dowries were frequently gestures of good faith, rather than significant economic investments, wealthier families may still have been able to offer higher dowries, and marry families further distance, while maintaining ties with the families of their son-in-law. Meanwhile, the poor had little, or no dowries, and may not have had any long-standing ties to their wives' families (Watson 1981).[9]

Marriage markets served to strengthen and preserve status hierarchies. The highest status was reserved for those men who had passed the civil service examinations, and would thereby obtain official positions. By the 17th century, these high status positions could not be inherited directly, and thus the situation in China was thus qualitatively different from the landed aristocrats in other parts of the world who could pass on titles to their children. Because status could not be passed on directly from parents to their children, the economic success of the next generation depended to a greater extent on the investments parents made, and with that, the match made at the time of marriage. Marriages, and the associated investments through searching for a good marriage, can be seen as a channel through which this wealth is passed on to the next generation.

Marriages also presented opportunities for clans to redistribute resources between families (Watson and Ebrey 1991). Usually one person, typically the wife, would leave the residence of her natal family to join her marital family.[10] Well connected in-laws or an educated wife could provide benefits for the next generation because of access to well-connected networks of knowledge, and an educated mother would have been the first teacher to the young males of the next generation. Women who could spin or weave also provided productive manual labor for her marital family. For her part, the wife has a claim to the privileges of the ancestral rites of the husband. One indication of this can be seen in the genealogies, where women are listed with their vital statistics in far greater detail in their husband's clan genealogies than in their father's clan genealogies.

Two additional trends of the 17th and 18th century marriage market are worth noting. First, unbalanced sex ratios meant that there were fewer women than men, leading to an excess of single men. This is consistent with other empirical evidence. Brides could reasonably expect to marry up in these demographic circumstances when there are fewer women than men. However, there does not appear to have been significant changes to this ratio of adult men to adult women. Second, marrying

[9]Ebrey (1991) suggests that the high dowries observed in the Tang Dynasty (618-907 A.D.) were less common by the Song Dynasty (960-1279). The trend towards high dowries, it is argued, declined in part due to the decline from the Tang to the Song in inherited aristocratic titles. Over the following dynasties, China never became a society where dowries were necessary for marriage.

[10]In less frequent cases, an adult man might move to the family residence of his wife, with the understanding that their children would take on her parents' surname since they had no male heir.

up or at least obtaining a "matching-door" marriage will likely require a higher dowry than marrying down. Whether the higher dowry is worthwhile, from the perspective of the woman's family, is likely to depend on whether the prospective husband is likely to be successful, how much competition there is for political office. A declining likelihood of success in the civil service examinations meant not only that there was a smaller pool of elite scholarly families who were traditionally the most well-off among all of society, but that prospects of a young man to attain one of those positions would be small.

While this pattern had long-term consequences for the returns to education, it also impacted the marriage market.[11] As the returns for education declined (because of the increasing difficulties in succeeding in the national examinations), fewer families would have found marital matching a productive channel of investment. Since positive assortative matching requires search, declining likelihood of success in officialdom decreased the returns to any given-sized dowry. Thus, not only did investments in education of the son become less attractive because of the declining probability of his success in the civil service examinations, but the investments in the marriage of the daughter to a son-in-law aspiring to take the civil service examinations likely became less attractive as well. Meanwhile, the costly expenses of investments in education for sons competed with the costs of dowry in marriage.

Thus, among the reasons for the decline in marital sorting we document below are the overall trend greater occupational fluidity as well as the overall trends to more equality that characterized Qing society, compared to the earlier Ming period. It is also consistent with the downward social mobility of elites, which was based on scholar-officialdom, and which was increasingly more difficult to attain for all men (see Shiue 2019 on mobility changes in this context).

Girls in high status families often were taught to read and write next to their brothers. In a society where literacy was an essential accoutrement of elite male status, despite the fact that women could not hold official position, high status mothers were the first to teach their sons how to write and recognize their first characters, and thus such education did serve a purpose in marital matching. Other evidence suggests that marriage was one of the ways in which different families maintained connections with each other. Beattie provides anecdotal accounts showing that scholarly or political connections, in addition to marriage over successive generations, helped to increase the bonds of the relationship between two families formed in Tongcheng over the 16th and 17th centuries (Beattie 1979, pp. 40-41).

The importance of marriages can be seen by the fact that genealogies are not only organized according the the male patrilineal line, but the more detailed information on individuals is organized by married couples. We also know which of the men married, and which did not. Among the men who married, we know how many wives they had, and, through examining their death dates, we can determine if the wives were alive at the same time or whether the marriages happened sequentially. The importance of descent can also be confirmed through the fact that genealogies list the children

[11] Shiue (2017) examines the relationship between returns to education and fertility control.

that were born to each wife separately. In cases where adoption occurred, we know who the birth parents were. While the actual date of marriage is not recorded, and would in any case seem to be less important in a society where marriages are arranged and child brides are not uncommon, we can use the birth date of the first born child (minus 9 months) to proxy for the age at which couples married.

3.2 Data

The data on marriage are from genealogies of Tongcheng County in Anhui Province. Anhui Province belonged to one of the more developed and densely settled regions of the Lower Yangzi. Although the importance of the production of agricultural products ensured that landownership and government administration underpinned the wealth of the elites, especially in the 15th century, by the 17th century there is evidence that Tongcheng became more diversifed. Not only rice and grains, but tea, textile fibers, paper, and growing numbers of market towns give evidence of expanding commercialization of the Yangzi (Beattie 1979, pp. 30-35). Yet the expansion of population along with the greater social mobility that the population was experiencing in Tongcheng was likely reflected in the overall trend in China over these centuries.

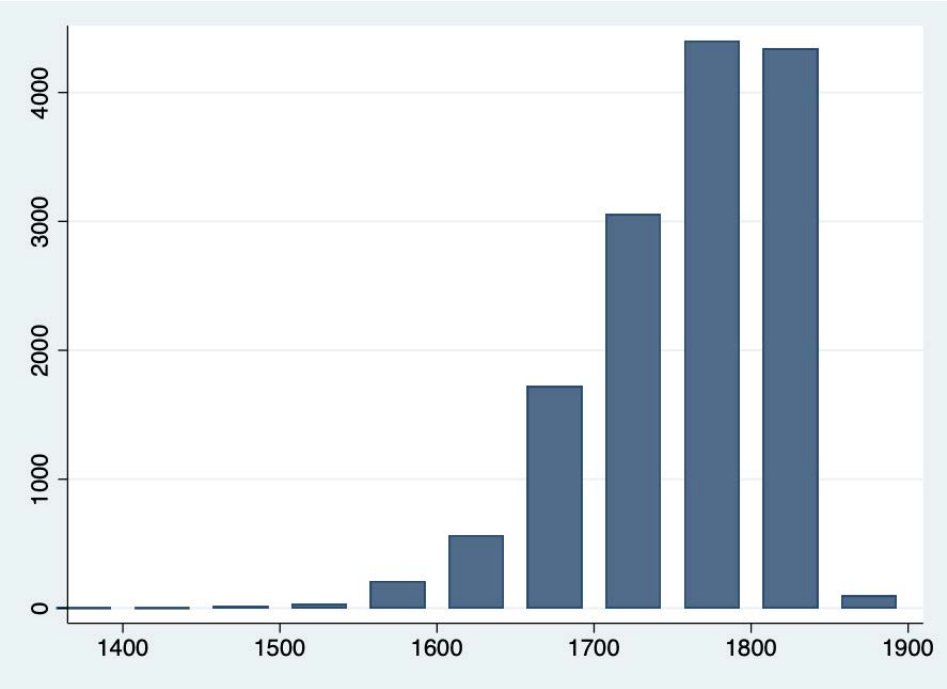
Generally, genealogies provide information on male lineage members, their wives, and their children. The dataset is created from genealogies of seven clans (extended families with the same surname).[12] Typically, genealogies start with the progenitor, the person who first settled in the county and who later descendants consider to be their common ancestor. The earliest date of birth observed in our sample is in the year 1298, with an average coverage of 18 consecutive generations and a maximum of 21. The latest death recorded in our data set is 1925. Although the Chinese genealogy follows the patrilineal descent, and for example, tend to be more diligent in recording the number of sons compared to the number of daughters born to the lineage, an interesting by-product of the focus on matters of critical importance to the male line of descent is that marriages are a critical centerpiece of the genealogy.

The genealogy fulfilled several aims for the extended family. First, it allowed the family to carry out obligations of ancestral worship. Second, beyond ritual elements, genealogies had an economic function to the extent that the descriptions of the land and members of the group created, by virtue of its existence, a record of the cooperative, that is, the members who belonged to the group. In the case of the genealogy, this was the record of men and women related by blood and marriage. Thus, it can be understood why the genealogist went to the trouble of recording not only the surname of the in-marrying wife in so many cases, but also when it was called for, the status of her father—the father-in-law link preserved in the genealogies provides yet another indication of the significance attached to the marital match.

Figure 1 shows the frequency distribution of the marriage data with information on the income of the spouses by periods of fifty years.

[12] General features of the Tongcheng genealogies are described in Shiue (2016).

Figure 1: Marriages in the Sample Period



Notes: Shown is the distribution of N = 14,434 marriages for which information on income by spouse is available. The first period is all marriages for which the father's birth year is before 1400, the last period all marriages for which father's birth year is after 1850.

It is clear that the majority of the sample provides information on marriages that chronologically were formed during the Qing dynasty (1644 - 1911). Additional sample information, especially on our measures of income, is given in Appendix A.

3.3 From Theory to Empirics

This section discusses the framework of Fernández, Guner, and Knowles (2005) laid out in section 2 in the context of the Tongcheng economy and the data that we observe. To begin with, while in the model the extent of matching is in terms of the agents' wages according to their skill levels, in the Tongcheng economy we analyze matching in terms of incomes of the parents of the agents (referred to as own income and in-law income below). In the context of the Tongcheng agents, parents would be heavily involved with the choice of the marriage partner, and much of the search investment would be taken by the parents. Thus, this difference is explained by context but we do not expect that it would require major changes to the framework.

Second, a related point is that the income (or status) of a woman is not observed. The best proxy for her income is the income of her father. While this is a consequence of the patrilineal structure of the genealogies, and ultimately of Chinese society at this time, it does not raise a major challenge. The age at marriage was typically low compared to today in this economy, in the lower 20s, and the income of these women in their twenties, to the extent they had any, would mean fairly little for

their marriage behavior. Employing instead the incomes of the father and the father-in-law in the analysis of marriage matching addresses the unavailability of income data for women.[13]

A limitation is that we do not observe income variation over time. Instead, we observe to which income group a particular man (for our purposes these are the fathers, fathers-in-law, maternal grandfathers, and paternal grandfathers) belongs, see section A of the Appendix. Also, while some broad trends in incomes for particular groups are clear from historical accounts, there is no consistent individual-level data over time. Thus, while the cross-country inequality variation in Fernández, Guner, and Knowles (2005) is given by the 1990s skill premia across 34 economies, this variation does not exist across time in our analysis. Instead, our measure of inequality is based on the distribution of income groups in the economy. This means that our measure of inequality reflects to some extent both the skill premium and the skill composition in the model.[14]

One advantage of our income data is that it provides information on permanent (or, lifetime) income. As a consequence, there is no need to try to eliminate life-cycle effects from the income data, which may be challenging if life-cylces differ across economies for various reasons (such as pension systems).[15] In addition, given that our information comes from a single source the income data is relatively consistent across families and over time. We also note that in historical studies of marriage matching to distinguish five income groups is not a particularly small number, given that studies typically distinguish only two groups, typically a high and a low class. Exploring our results for a more aggregate set-up with only two groups we find broadly the same results as for the baseline five groups shown below.

4 Matching Returns in the Marriage Market

We begin by documenting the extent of income matching in the sample, both for female and for male children of the Tongcheng clans. Matching may lead to higher household income for the marriage partners themselves, as described in the framework of section 2. We also describe changes in the extent of income matching in the sample over time. Furthermore, we present evidence on the evolution of inequality in the Tongcheng economy.

4.1 The Extent of Marriage Matching

Table 1 gives information on marriage matching patterns for N = 14,434 that are in the data. Given on the left is the income of one of the marriage partners, denoted by "Own Income", where five income classes are distinguished (0 to 4). The columns indicate the same five income classes for the

[13]Note that Fernandez, Guner, and Knowles (2005) similarly do not employ male and female income in their empirical matching analysis, but rather years of education. They mention that in reality female labor supply decisions are affected by social norms and other factors, making years of education the better measure. On differential labor supply decisions by gender in the presence of negative labor shocks, see, e.g., Keller and Utar (2020).

[14]That is, inequality in our empirical analysis reflects aspects of w_s/w_u and $\lambda = L_s/L$ in Fernández, Guner, and Knowles (2005); on the relationship between these variables, see section 2.

[15]Fernández, Guner, and Knowles (2005) address this by studying certain cohorts such as the 36 to 45 year olds.

Table 1: Marriage Patterns by Income

		In-law Income					N
		0	1	2	3	4	
Own Income	0	11,587	154	383	63	2	12,189
		(91.4)	(37.3)	(41.5)	(16.1)	(6.3)	84.45
	1	424	76	122	35	4	661
		(3.3)	(18.4)	(13.2)	(9.0)	(12.5)	(4.6)
	2	582	132	313	144	11	1,182
		(4.6)	(32.0)	(34.0)	(36.8)	(34.4)	(8.2)
	3	76	39	92	129	11	347
		(0.6)	(9.4)	(10.0)	(33.0)	(34.4)	(2.4)
	4	7	12	12	20	4	55
		(0.1)	(2.9)	(1.3)	(5.1)	(12.5)	(0.4)
N		12,676	413	922	391	32	14,434
Percent		100	100	100	100	100	100

Notes: Table gives the frequency and share of marriages by five income classes (0 to 4). Shares, given in parentheses, sum to 100 by column.

marriage partner's spouses, denoted by "In-law Income". All marriage partners for whom Table 1 gives Own Income are children of one of the seven clans whose genealogies we employ in this analysis. Their spouses come from a total of more than 100 clans (this includes the seven genealogy clans). Note that at this time in China marriage takes place at a relatively young age and parents are heavily involved in the choice of the marriage partner, consistent with the idea that marriage matching is one of the investments parents make on behalf of their children. Thus, the relevant income levels for Own and Spouse Income are those of the respective families. we approximate family income with the permanent income of the father (Own Income) and the permanent income of the father-in law for own and spouse income, respectively.

Income is given in terms of five clearly distinct levels, where level 0 should be thought of as roughly subsistence level while level 4 is the income that comes with a top-level position (based on a *jin-shi* degree) in this society. Notice that more than 80% of individuals belong to the lowest income class, in line with other evidence. See Appendix A for more on these income levels. [16]

Table 1 provides initial evidence on marriage matching. For example, more than 91% of income-level 0 spouses marry partners who have also income level of 0. At the same time, a spouse from a top-income class has a 12.5% chance of marrying a top-income partner even though they account for less than 0.4% of all marriage partners.

Table 2 gives information on marriage patterns in terms of income by gender. we observe N =

[16]The analysis of Shiue (2019) allows for more than five income groups and shows that the results are generally similar. In the present context, the patrilineal focus of genealogies implies that there is less information on in-law families than own families, requiring a slightly more aggregate analysis. This does not affect our key findings.

Table 2: Income Marriage Patterns by Gender

		Men						Women					
		In-law Income					N	In-law Income					N
		0	1	2	3	4		0	1	2	3	4	
Own Income	0	5,895	64	196	36	1	6,192	5,690	90	187	27	1	5,995
		(91.0)	(30.1)	(39.0)	(15.9)	(7.1)	(83.3)	(91.8)	(45.0)	(44.5)	(16.4)	(5.6)	(85.7)
	1	215	41	69	19	0	344	209	35	53	16	4	317
		(3.3)	(19.3)	(13.8)	(8.4)	(0)	(4.6)	(3.4)	(17.5)	(12.6)	(9.7)	(22.2)	(4.5)
	2	326	76	173	85	6	666	255	5	140	59	5	515
		(5.0)	(35.7)	(34.5)	(37.6)	(42.9)	(9.0)	(4.1)	(28.0)	(33.3)	(35.8)	(27.8)	(7.4)
	3	37	26	57	72	5	197	39	13	35	57	6	150
		(0.6)	(12.2)	(11.4)	(31.9)	(35.7)	(2.7)	(0.6)	(6.5)	(8.3)	(34.6)	(33.3)	(2.1)
	4	4	6	7	14	2	33	3	6	5	6	2	22
		(0.1)	(2.8)	(1.4)	(6.2)	(14.3)	(0.44)	(0.1)	(3.0)	(1.2)	(3.6)	(11.1)	(0.3)
N		6,477	213	502	226	14	7,432	6,196	200	420	165	18	6,999
Percent		100	100	100	100	100	100	100	100	100	100	100	100

Notes: Table gives the frequency and share of marriages by five income classes (0 to 4). Shares, given in parentheses, sum to 100 by column. Male Tongcheng genealogies children on the left, female Tongcheng genealogies children on the right.

7,432 marriages for which the Tongcheng genealogies partner is a man (left side), while for N = 6,999 marriages the Tongcheng genealogies partner is a woman (right side).

In general, information from genealogies tends to be more comprehensive for males than for females. At the same time, studies have found the Tongcheng genealogies to be of high quality and useful for studying various topics (Telford 1986, Shiue 2017, 2019). In any case, given the general paucity of information on marriage patterns from the viewpoint of women examining gender differences, if any, is important.

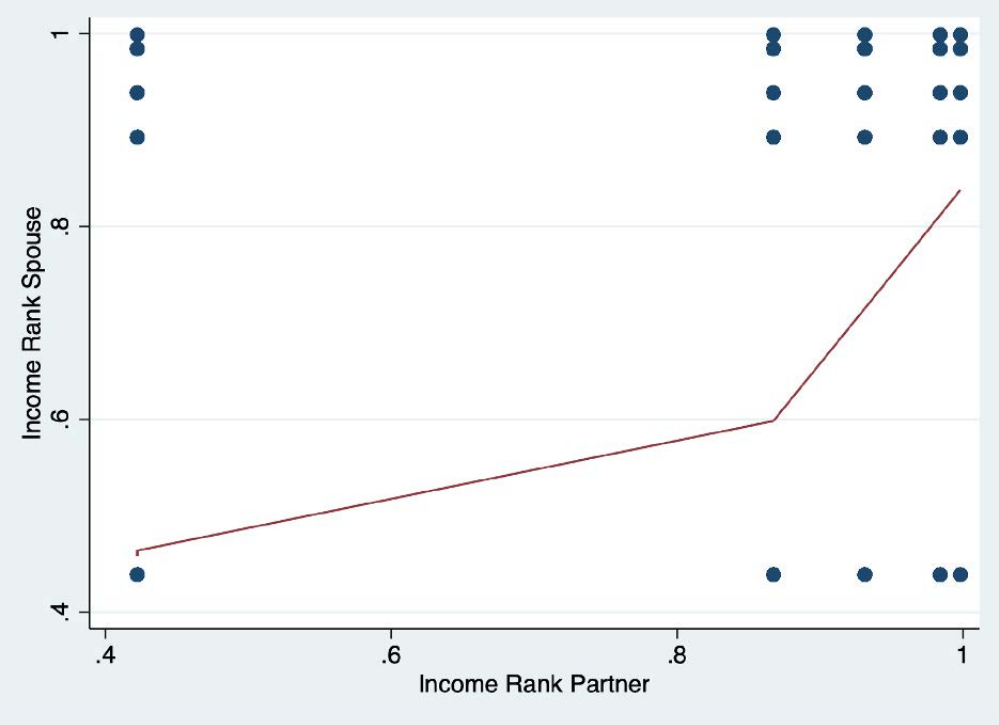
As Table 2 shows, gender differences appear to be limited in terms of sample composition. In particular, 83.3% of Tongcheng men are of income level 0, compared to 85.7% of Tongcheng women, and for income level 1 the numbers are 4.6% for men and 4.5% for women. At the top of the income distribution, 0.4% of men are in income level 4, compared to 0.3% of women. This is not too surprising given that these men and women are children of the same (Tongcheng) families. At the same time, the similarity rules out that male and female children are included in the genealogies based on entirely different criteria.

Turning to marriage matching, Table 2 does not show large gender differences. For example, of all partners who marry spouses of income level 0, 91% have income level zero for men and 92% have level zero for women. Among men with income level 2, six marry a wife with income level 4, while conversely of all women from a income level 2 family five marry a husband with income level 4. The gender difference in overall marital sorting appears to be limited according to these figures.[17]

[17]Note that this is not a mechanical finding due to an adding-up constraint, because these male and female children of Tongcheng clan families predominantly marry outside of the seven Tongcheng clans whose genealogies constitute our data source.

One concern of employing the indicator of income level 0 to 4 in the analysis is that the groups vary strongly in size; level zero has more than 80% of all individuals, whereas less than 1% belong to income level 4. To address this and other issues, we convert income levels into the percentile rank of the distribution (Chetty, Hendren, Kline, and Saez 2014, Shiue 2019). Every individual in a particular income level is assigned the midpoint of the cumulative income distribution (incomes at the individual level are not available). For example, with 84% of all partners belonging to income level 0, the percentile income rank of each of them is 0.42. The marriage patterns presented in Table 1 in graphical format for percentile income ranks are given in Figure 2. The figure confirms that marriage partners and spouses match according to their income levels. Furthermore, the degree of positive marriage matching may be higher at levels above partner level of about 0.8. In particular, the relationship between partner income and spouse income is under-proportional for partner income levels below 0.85 and over-proportional above that rank.

Figure 2: Marriage Matching Patterns

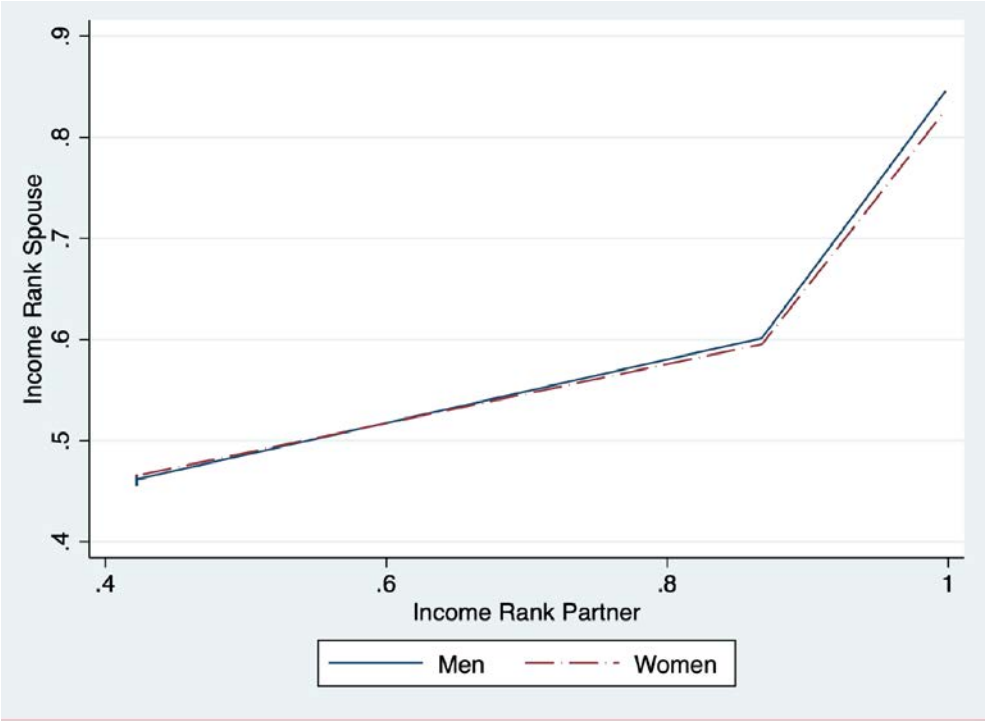


Notes: Figure presents the income percentile ranks in the marriages of Tongcheng genealogies partners and their spouses. Based on N = 14,434. Lowess smoother shown.

The relationships between the income ranks of partner and spouse in the marriage by gender is shown in Figure 3. It confirms earlier results that gender differences are limited. Only at very high income levels do women seem to have a slight disadvantage in marrying high-income spouses compared to men.

Furthermore, to account for changes in the prevalence of each of the five income levels over the several centuries long sample period we will also results that adjust for the income distribution of

Figure 3: Marriage Matching by Gender



Notes: Figure presents the income percentile ranks in the marriages of Tongcheng genealogies partners and their spouses. Based on N = 7,432 for Tongcheng genealogies men, and N = 6,999 Tongcheng genealogies women. Lowess smoother shown.

a particular sub-period. In Figure 4 we divide the overall sample period into four sub-periods with equal number of marriages. For example, the four points in the lower left of the figure are marriages where both partner and spouse come from income-level zero families. However, level-0 families are not in every sub-period 84% of the sample as they are in the sample overall, so that some of the data points are above and others below 0.42. Defining the income rank of a person relative to the sub-period distribution accounts for the influence of changes in the income levels.

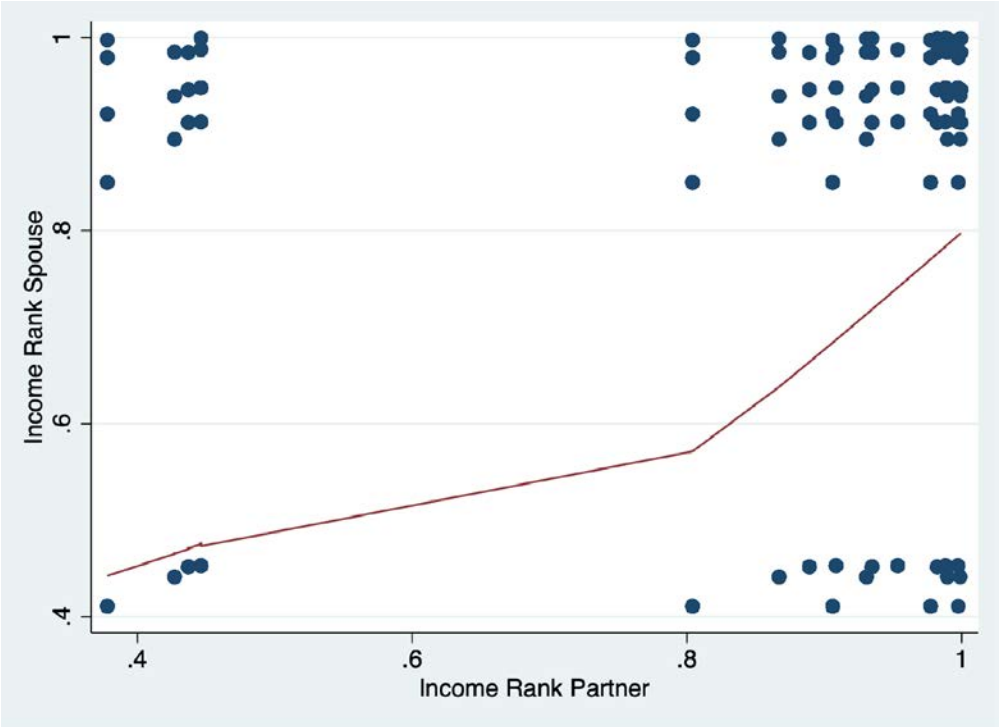
Generally, we find that results are similar whether a person's rank is defined for the overall or the sub-period income distribution. Comparing Figures 1 and 3, there is no large difference in the pattern of marriage matching using either income rank definition.

4.2 Matching over Time

In addition to the general pattern of marriage matching as well as possible gender differences, it is interesting to examine the evolution of marriage matching over time. Let i, i = 1,. . . , 14,434 index marriage, while p indexes partner and s indexes spouse. Further, let $r_p(i)$ be the income rank of the partner in marriage we, while $r_s(i)$ is the income rank of the spouse in marriage i. we define the degree of marital sorting in a marriage as the product of their income ranks,

$$m(i) = r_p(i) \times r_s(i), \forall i. \tag{1}$$

Figure 4: Marriage Matching with Local Income Distribution



The value of m(i) ranges between 0 and 1. It is increasing in the similarity of the spouses' income ranks, as well as in their levels. The value of m(i) captures the degree of marriage matching, because for a given average rank in the marriage—that is, 0.5* $[r_p(i) + r_s(i)]$ --, m(i) is higher the more similar are the ranks. Further, the ranks vary from 0 to 1 with a mean value of 0.5 by construction. Thus, higher values of m(i) indicate a higher level of marriage matching.

Let the subperiods be indexed by t, t = 1,. . . , 4, and

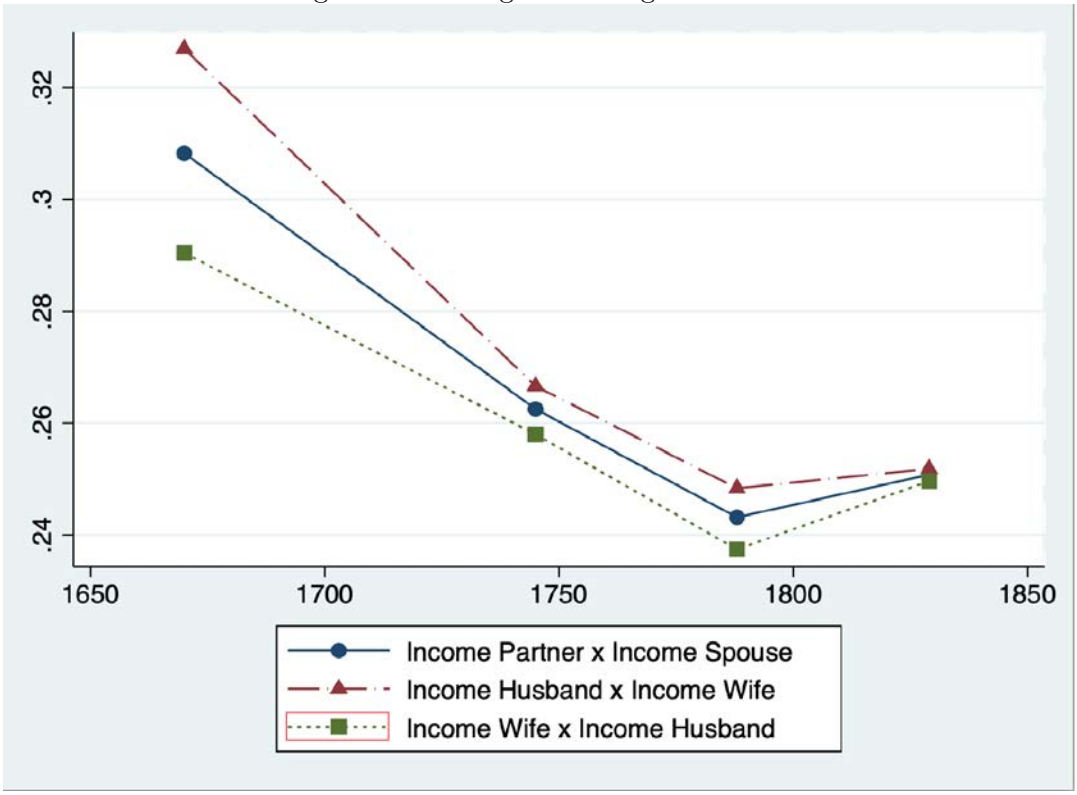
$$m_t = \frac{1}{N_t} \sum_{i \epsilon t} m(i).$$

where N_t is the number of marriages in period t. Figure 5 shows the average of m(i) for four subperiods that are equal in the number of marriages.[18] There is evidence for less sorting in the marriage market over time, as Figure 5 indicates.

While in the first sub-period the value of m(i) is typically around 0.3, from the late 18th century on the match value is substantially lower, at 0.26 or even below. Furthermore, the decline in the marriage match value is present for both marriages in which the partner is a woman (squares) and in which the partner is a man (triangles), although it is more pronounced for the latter marriages. Our indicator of marital sorting, the product of the percentile ranks of partner and spouse, equation (1), yields similar results over time as the Pearson correlation coefficient proposed by Fernandez,

[18]Given that we observe more marriages during the Qing than earlier periods (see Figure 1) this means that the first sub-period is relatively long in calendar time compared to the later subperiods.

Figure 5: Marriage Matching over Time



Notes: Shown is average of the product of the income ranks of marriage partner and spouse for four subperiods with equal number of marriages each; mean birth year of father shown on horizontal axis. First marriage is in year 1391.

Guner, and Knowles (2005).[19]

Ranking income over several centuries might influence these results to the extent that there is a secular trend of rising or falling incomes over time, and moreover such a trend could vary by gender. To account for this, the following Figure 5 presents the gender-specific relative match value, defined as

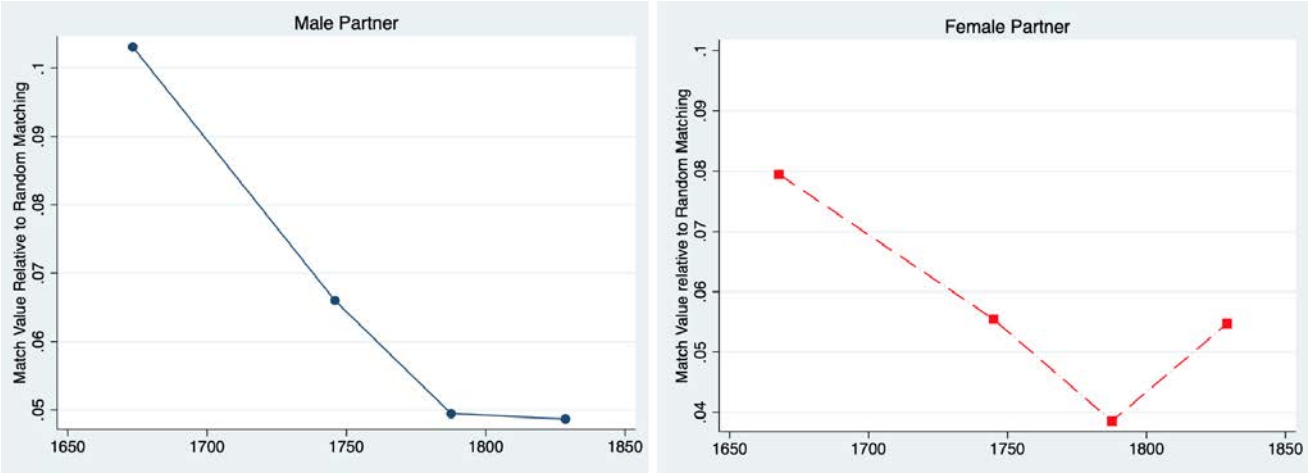
$$rm_t^g = \frac{m_t^g}{r_{p,t}^g \times r_{s,t}^g},$$

Where g indexes gender, g = M, F, and $r_{p,t}^g$ is the average income rank of partners of gender g in period t, while $r_{s,t}^g$ is, correspondingly, the average income rank of spouses of gender g in period t. By multiplying the averages of partner and spouse ranks in a given period, the denominator of this expression can be thought of as the match value when matching is random.

Figure 6 shows results for male marriage partners on the left and female marriage partners on the right. Qualitatively, the results are similar to before, with match values falling for both gender. A difference is that now the decline for men is monotonic while for women there is no clear trend past

[19]The correlation coefficients are, from first the fourth sub-period: 0.55, 0.53, 0.49, and 0.52.

Figure 6: Marriage Matching over Time by Gender Relative to Random Matching



Notes: Subperiod average of product of percentile ranks of partner and spouse relative to product of sub-period average of percentile income rank of partner and percentile income rank of spouse. Local income distribution.

1750. Perhaps more interesting, the comparison with random matching indicates that the decline in marital sorting is substantial: for men, the (relative) degree of sorting is cut in half from the early period to the 19th century, while for female partners (relative) sorting in the first period are higher by at least 25% compared to any of the later periods.

The findings on declining marital sorting in Figure 5 are based on percentile income ranks. Corresponding results based on income levels (0 to 4) and on local percentile income ranks are similar (see Appendix). A declining degree of marital sorting over time is interesting because it is consistent with the hypothesis that the importance of marriage matching has not been constant over time.

4.3 The Evolution of Inequality

We have shown in the the previous section that the degree of marital sorting has fallen over our sample period in China. This section examines the evidence on inequality in the sample. To do so, we report results on inequality in income over time employing two well-known measures of inequality, the Gini coefficient and the Theil index, and the percentile rank of marriage partners, $r_p(i)$.[20] Specifically, Figure 7 shows the inequality measures over time for 20 subperiods with equal number of observations. It is clear from these results that inequality has fallen over time during the sample period. For example, the Gini coefficient around the year 1600 was somewhat above 0.2 while by the early 19th century it was less than half that figure. Furthermore, the findings for the Gini and the Theil measures are similar as Figure 7 indicates. We conclude that the decrease in marriage matching was accompanied by a decline in inequality in China. Our evidence that inequality and marital sorting are positively correlated in the time series is in line with the cross-country findings to the same effect of Fernandez, Guner, and Knowles (2005).

[20] We find similar results for inequality in spouse income, father income, and grandfather income.

Figure 7: Income Inequality over Time

Notes: Shown are the Gini coefficient and the Theil Index of percentile income rank of marriage partner by twenty subperiods with equal number of observations.

Our evidence on falling inequality over time is in line with Shiue's (2019) study on social mobility in China. In that framework, not only falling inequality but also higher social mobility in China between 1300 and 1900 are driven by a reduced incentive of parents to invest into the human capital of their children because the income elasticity of human capital is falling.[21] Our results so far are consistent with the hypothesis that the evolution of China's economy over the sample period – including population growth, changes to the civil service examinations, and lack of industrialization– may have also reduced parental incentives to invest into the search of their children to find marriage partners.

5 Intergenerational Matching Returns

This section has several of the main results of the paper. We begin by laying out the main determinants of marriage success during our sample period before focusing on the role of marriage matching in determining (1) marriage quality and (2) income in the next generation.

5.1 Determinants of Marriage Success

We first provide evidence on the determinants of marriage success, defined as being able to marry a person of high income. As before, the income of the spouse in the marriage is measured by the

[21] Becker and Tomes (1979, 1986) provide the classic analysis.

lifetime income of his or her father. we consider characteristics of the marriage partner's father, mother, siblings, as well as grandparents using bi-variate correlations. Furthermore, we distinguish between male and female marriage partners. Table 3 shows the results.

The first result is that in-law income is positively correlated with own income, as expected given the results in Figures 1 and 2 above (own income of the marriage partner is measured by his or her father's lifetime income). The OLS coefficient on own income is 0.5, with a constant at 0.25 (column 1). This means that a marriage partner with lowest income rank (rp of about 0.42) can expect to marry a person of 0.25 + 0.5*0.42 = 0.46; this is in line with the results in Figure 1 above. Furthermore, there is no evidence that the results significantly depend on whether the marriage partner is a man or a woman: the coefficients on the Female indicator variable as well as the Female x Own Income interaction variable are close to zero and not significant at standard levels.[22]

Turning to father characteristics, we see that the child tends to marry higher income individuals if the father has a long life (column 2), although the correlation is not strong as the R2 indicates. The father's birth order is not significantly correlated with the child's marriage success, and neither is the distance between father's burial location and his residence, a measure of mobility (column 4). Children marry better if the father had multiple wives (either sequentially, due to death, or simultaneously; column 5). Number of wives is positively correlated with household income and wealth, so the result is not very surprising.

Mother income is not observed separately of the income of the father in Chinese genealogies, however, there is information on other characteristics in the case of households with multiple women.

Table 4: Income by Status of Mother

	N	Income Rank of in-Law Family
Only wife	11,392	0.486
First wife of several	812	0.592
Second wife, first died	1,481	0.503
Second wife, first alive	38	0.587
Concubine	216	0.753
Bethrothed only	63	0.516

Given that the large majority of mothers are the only wife to their husbands it is clear that the income rank of the families in which their children marry is close to 0.5 (Table 4). Otherwise, the marriage success of children of different-status mothers reflects largely the income of their families. For example, while a child from a mother who is first wife of several has relatively high marriage success (0.592), the child of a second wife with the first alive has quite similar marriage success (0.587). That is, the discount of being a child from the second wife, perhaps receiving a lower level of investments, is virtually fully compensated by the relatively high income the husband in

[22]Results for the sample for which grandparent information is observerd (N = 14,002) is very similar.

Table 3: Determinants of Marriage Success - Bivariate Analysis and Gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
		Father				Mother				Siblings			Grandfather	
Variable	Own Income	Longe-vity	Birth Order	Mobi-lity	# of Women	Rank in HH	Birth Order	Longe-vity	Mobi-lity	# of Siblings	Number of Brothers	# of Sisters Same Mother	Income Parental	Income Maternal
Female	0.016	-0.006	-0.008+	-0.004	-0.011	-0.011	0.003	-0.010	-0.003	-0.005	-0.007	-0.002	0.033**	0.046**
	(0.010)	(0.014)	(0.005)	(0.004)	(0.008)	(0.010)	(0.006)	(0.013)	(0.004)	(0.007)	(0.006)	(0.005)	(0.008)	(0.011)
Variable	0.496**	0.001**	0.000	-0.001	0.054**	0.034**	0.005*	0.001**	-0.001	0.003**	0.001	0.002	0.396**	0.470**
	(0.014)	(0.000)	(0.001)	(0.001)	(0.005)	(0.006)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.013)	(0.016)
Variable x	-0.034	0.000	0.002	-0.001	0.005	0.006	0.004	0.000	-0.002+	0.000	0.001	-0.002	-0.069**	-0.088**
Female	(0.021)	(0.000)	(0.002)	(0.001)	(0.007)	(0.009)	(0.004)	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)	(0.019)	(0.024)
N	14,431	11,814	13,997	11,856	13,998	13,999	6,680	11,132	11,208	14,000	14,000	14,002	14,000	11,163
R^2	0.285	0.006	0.000	0.001	0.033	0.008	0.005	0.005	0.002	0.002	0.000	0.000	0.206	0.230

Notes: Dependent variable is income of in-law. Estimation by OLS. Constant not reported. Robust standard errors in parentheses. **/*/+ significant at the 0.01/0.05/0.10 level.

such a family must have. In addition, a husband who has a second wife because his first died will typically have a lower income than a husband with multiple wives alive, and this is reflected in the higher marriage success of their children. Similarly, the extraordinary marriage success of children of concubines will be related to the relatively high income levels of households in which concubines are present. This indicates that it will be important to account for family income in this analysis (see below).

Returning to the determinants of marriage success in Table 3, a mother's rank in the household is positively correlated with the marriage success of her child in part because a number higher than 1 reflects husband income (column 6). Mother's longevity and birth order are positively correlated with child's marriage success, while distance between mother's burial site and residence does not matter. Note that the number of observations in these regressions varies due to data availability. There is no strong evidence that the gender of the child who is marriage partner matters for marriage success in terms of these mother characteristics. Next, we turn to another aspect of family size, namely the number and composition of siblings of the child who is marriage partner. Overall, though, the evidence that sibling characteristics have a major influence on the marriage success of a child is limited (this could be because of multiple influences going into opposing directions; columns 10 to 12).

There is evidence that grandfather income matters for marriage success of the child, and this is the case for both paternal and maternal grandfather income (columns 13 and 14). Grandfather income is measured by the grandfather's lifetime income, and we view it as a proxy of long-run income of the family, while father's income (see columns 1,2) is a measure of short-run income of the family. Interestingly, maternal grandfather income is more strongly correlated with child marriage success than paternal grandfather income (0.4 for paternal and 0.47 for maternal, see columns 13 and 14). This may be because maternal grandfather income reflects how resources outside the patrilines affect family success, and as such it is highly predictive of the marriage success –which is also establishing cross-family relations outside the patriline—of the child.

Interestingly, marriage success of male and female marriage partners does not depend on long-run family income in the same way. In particular, if the child is male marriage success depends more strongly on grandfather income than if the child is female (notice the significantly negative interaction coefficients in columns 13 and 14). The premium of high grandfather income is consistent with a "money" versus "love" (or "fertility") story, and it is interesting that there is evidence for this for long-run but not for short-run family income (grandfather versus father income, compare columns 13 and 14 with column 1).

In order to see which determinants are the most important, the following Table 5 shows multivariate regression results.

Table 5: Determinants of Marriage Success

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own Income	0.478**	0.485**	0.476**	0.291**	0.282**	0.290**	0.283**
	(0.012)	(0.012)	(0.011)	(0.014)	(0.016)	(0.015)	(0.016)
Father Longevity	-0.00				0.000		
	(0.000)				(0.000)		
Mother Longevity	0.000**				0.000**	0.000*	0.000**
	(0.000)				(0.000)	(0.000)	(0.000)
# of Women	0.007+				0.004		
	(0.004)				(0.007)		
Father Mobility		-0.000			0.000		
		(0.001)			(0.001)		
Mother Mobility		0.000			0.001		
		(0.001)			(0.001)		
Mother Rank in HH		0.001			0.001		
		(0.005)			(0.009)		
# of all Siblings			0.000		-0.000		
			(0.001)		(0.001)		
# of all Sisters			0.001		0.001		
			(0.001)		(0.002)		
Grandfather Income Paternal				0.118**	0.123**	0.122**	0.121**
				(0.011)	(0.012)	(0.012)	(0.012)
Grandfather Income Maternal				0.220**	0.227**	0.222**	0.222**
				(0.014)	(0.015)	(0.015)	(0.015)
Child First Wife							0.017*
							(0.008)
Child Second Wife, First Dead							0.006
							(0.006)
Child Second Wife, First Alive							(0.075)
							0.121
Child of Concubine							0.121
							(0.177)
Child of Bethrothed Wife							-0.056
							(0.035)
N	10,673	10,678	14,000	11,163	8,590	9,049	9,049
R^2	0.289	0.289	0.281	0.347	0.363	0.362	0.364

Notes: Dependent variable is income of in-law. Estimation by OLS. Constant not reported. Robust standard errors in parentheses. **/*/+ significant at the 0.01/0.05/0.10 level.

Because of its obvious importance, all specifications include the marriage partner's own income as a determinant of marriage success as measured by income of the in-law family (income of the spouse's father). We see in column 1 that mother longevity is positively correlated with marriage success, while father longevity is not. Also marginally significant is the number of women in the marriage partner's father's household; greater than one is here a sign of wealth.

Father and mother mobility, mother rank, as well as the number of siblings are not significantly determining marriage success (columns 2 and 3). In contrast, grandfather income is strongly positively correlated with marriage success (column 4). It may be surprising at first to see that maternal grandfather income is more strongly correlated with marriage success than paternal grandfather income. However, father income is relatively strongly correlated with paternal grandfather income .The smaller paternal than maternal grandfather coefficient reflects that father income is included in the regression as separate variable (the Own Income variable). Also notice that the coefficient on Own Income falls from 0.48 to 0.29 with the inclusion of the grandfather variables. This reflects the intergenerational correlation in incomes in this society (see Shiue 2019 on intergenerational mobility in China during this period).

Columns 5 and 6 show that except for mother longevity, own and grandfather incomes are the only significant determinants of marriage success in this analysis. Including the mother's status indicators shown in Table 5, we see that conditional on family income (short-run and long-run), only if the marriage partner is the child of a first wife is there a significant premium in terms of marriage success (the omitted category is children from the only wife). Moreover, with a premium of 1.7 percentage points this effect is relatively small.

Turning to an analysis of marriage success by gender, we have seen above that gender differences exist primarily for family income (both short- and long-run). Table 6 provides results by gender.

Table 6: Marriage Success by Gender

	Women	Men
Own Income	0.316**	0.270**
	(0.022)	(0.019)
Grandfather Income	0.092**	0.140**
Parental	(0.017)	(0.015)
Grandfather Income	0.178**	0.255**
Maternal	(0.020)	(0.019)
Constant	0.209**	0.166**
	(0.009)	(0.007)
N	5,197	5,996
R^2	0.297	0.396

Notes: Dependent variable is income of in-law. Estimation by OLS. Robust standard errors in parentheses. **/*/+ significant at the 0.01/0.05/0.10 level.

First, notice that the regression accounts for more variation in marriage success for male marriage partners than for females; the R2 are about 0.4 versus 0.3, respectively. Also recall from above that the average marriage success for male and female marriage partners is similar, at about 0.5. Females,

it turns out, have a relatively high unconditional marriage 'success', with a constant of 0.21, versus 0.17 for males. Female marriage partners benefit overall less than male marriage partners from the income of their own family. At the same time, females benefit relatively more from short-run (Own Income) and relatively less from long-run (Grandfather Income), compared to male marriage partners.

Overall, the key findings of this analysis are that family income is the most important determinant of marriage success, and women benefit from high family income less than men in their matches with their respective spouses.

5.2 Marriage Matching and Future Marriage Success

In this section we examine matching returns in terms of the quality of the marriage of the offspring. Marital sorting is defined as the product of the long-run incomes of a marriage partner's parents. This is measured as grandfather income on the paternal and maternal side, and the previous section has shown that individually, both variables affect the quality of a person's marriage.

Formally, let the long-run marital sorting of the partner in marriage (i), $lr_p(i)$, be defined as

$$lr_p(i) = lr_p^{pat}(i) \ \times \ lr_p^{mat}(i),$$

where $lr_p^{pat}(i)$ and $lr_p^{mat}(i)$ are the the long-run income ranks of the marriage i's partner, measured as the percentile income ranks of the partner's paternal and maternal grandfathers, respectively. Long-run marital sorting is increasing in the similarity of paternal and maternal grandfather rank, holding constant their average.

We now show results for extending the previous specification explaining marriage success, measured by the income rank of the in-law family, to include the long-run marital sorting in the marriage partner's family. Marriage success of the family can be seen as a return to marital sorting in earlier generations of the family. Table 7 shows the results.

First, notice that introducing long-run marital sorting enters with a positive coefficient, indicating that in addition to the level of paternal and maternal grandfather income it is the combination of the two that is associated with marriage success for the offspring (column 1). One return of marriage matching in the family's past is to increase future marriage success. As seen from the results, the linear long-run income terms are smaller once their product, long-run marital sorting, is introduced, and the paternal grandfather income coefficient is now close to zero. This means it is predominantly children from closely matched high-income parents that have marriage success. In contrast, the short-run income coefficient (own income) is hardly changed.

Next, we present evidence on changes in the influence of long-run marital sorting on marriage success over time. For the years from 1391 to 1718, we estimate a coefficient on long-run marital sorting of 0.237. In contrast, from the first half of the 18th century the marital sorting coefficient is only about 0.19, and further, starting from 1770 it is only marginally significant. This is consistent

with a decline in the return of matching for the offspring's success in the marriage market. Thus, investments of past generations towards a better marriage match have generated lower returns in the 18th and 19th centuries than they did in the 14th to 17th centuries.

Table 7: Matching Returns in Form of Marriage Success

Years	(1)	(2) 1391-1718	(3) 1719-1768	(4) 1769-1807	(5) 1808-1860
Own Income	0.287**	0.261**	0.296**	0.259**	0.333**
	(0.014)	(0.026)	(0.029)	(0.032)	(0.030)
LR Income Paternal	0.003	0.029	0.000	0.017	-0.037
	(0.028)	(0.055)	(0.053)	(0.055)	(0.061)
LR Income Maternal	0.082*	0.059	0.058	0.117+	0.088
	(0.035)	(0.073)	(0.066)	(0.070)	(0.070)
LR Marital Sorting	0.206**	0.237*	0.190*	0.187+	0.197+
	(0.049)	(0.097)	(0.097)	(0.100)	(0.108)
N	11,163	2,495	2,824	2,952	2,892
R^2	0.349	0.400	0.306	0.343	0.310

Notes: Dependent variable is income of in-law. Estimation by OLS. Own Income is percentile rank income of father. LR Income Paternal (Maternal) is grandfather's percentile income on the paternal (maternal) side. LR Marital Sorting is LR Income Paternal x LR Income Maternal. Specifications (2) to (5) split the sample into subperiods of approximately the same number of observations. Robust standard errors in parentheses. **/*/+ significant at the 0.01/0.05/0.10 level.

We now turn to an analysis of the impact of marital sorting on marriage success by the gender of the partner. See Table 8 for the results.

Consider first the results by gender for the entire sample period (columns 1 and 4). We see that long-run marital sorting influences marriage success both when the marriage partner is a man and when she is a woman. At the same time, there is evidence that marital sorting is more important for the marriage success of men, in the sense that the point estimate on long-run marital sorting is higher in column 1 than in column 4 (and also more precisely estimated). Furthermore, for both men and women the marital sorting coefficient is higher in early compared to the late sub-period (columns 2, 3, 5, and 6). Thus, the return to marital sorting falls for both gender. This decline is more pronounced when the marriage partner is a woman, and long-run marital sorting is not significantly affecting marriage success any longer for women starting in 1770 (column 6).

Recall our earlier finding that men's marriage success depends more strongly than women's on the long-run level grandfather income (paternal and maternal). The results of Table 9 extend this by stating that it is not only the level of long-run incomes but the extent of their match that raises marriage success of the male offspring, compared to what it does for female offspring.[23]

[23]Similar results are found if we focus the analysis on local instead of global percentile income ranks, see Appendix

Table 8: Matching Returns as Marriage Success by Gender

	Men			Women		
	(1)	(2) 1391-1768	(3) 1769-1860	(4)	(5) 1391-1768	(6) 1769-1860
Own Income	0.266**	0.257**	0.272**	0.313**	0.299**	0.335**
	(0.019)	(0.026)	(0.028)	(0.022)	(0.028)	(0.034)
LR Income Paternal	0.010	0.028	-0.009	-0.004	-0.018	0.005
	(0.037)	(0.051)	(0.055)	(0.041)	(0.056)	(0.061)
LR Income Maternal	0.100*	0.096	0.106	0.064	0.001	0.111
	(0.047)	(0.067)	(0.067)	(0.050)	(0.071)	(0.071)
LR Marital Sorting	0.232**	0.237**	0.221*	0.171*	0.221*	0.148
	(0.066)	(0.091)	(0.098)	(0.072)	(0.098)	(0.108)
N	5,966	2,898	3,068	5,197	2,421	2,776
R^2	0.399	0.429	0.350	0.299	0.292	0.302

Notes: Dependent variable is income of in-law. Estimation by OLS. Own Income is percentile rank income of father. LR Income Paternal (Maternal) is grandfather's percentile income on the paternal (maternal) side. LR Marital Sorting is LR Income Paternal x LR Income Maternal. Specifications (2) to (5) split the sample into subperiods of approximately the same number of observations. Robust standard errors in parentheses. **/*/+ significant at the 0.01/0.05/0.10 level.

Table 9: Marriage Matching: The Intergenerational Relationship

	(1)	(2)	(3)	(4)	(5)
Years		1298-1699	1700-1751	1752-1785	1786-1859
Marital Sorting (-1)	0.563**	0.627**	0.676**	0.477**	0.467**
	(0.016)	(0.027)	(0.031)	(0.030)	(0.038)
Constant	0.111**	0.092**	0.091**	0.127**	0.136**
	(0.004)	(0.006)	(0.007)	(0.006)	(0.009)
n	5,002	908	1,350	1,385	1,359
R^2	0.411	0.507	0.456	0.374	0.299

Notes: Dependent variable is Marital Sorting of generation 0. Estimation by OLS. Local percentile income ranks. Robust standard errors in parentheses. **/*/+ significant at the 0.01/0.05/0.10 level.

5.2.1 Marriage Matching and the Extent of Future Marriage Matching

Another return to marriage matching may be the marital sorting in the offspring's marriage. Given that male children reappear as adults in our genealogical data it is straightforward to link marital sorting in couples across multiple generations.

Results from relating marital sorting in generation (m) to marital sorting in generation (m-1) are shown in Table 10.

Notice that with a coefficient of 0.56 there is a substantial amount of persistence in a family's marital sorting from one generation to the next (column 1).

Furthermore, as the non-parametric relationship plotted in Figure 8 indicates, especially at the top end of marital sorting there is a high degree of intergenerational marital sorting persistence. If there is a lot of income matching of a man's grandparents, there is also a high degree of income matching among the man's parents. Given that marriage matching is a parental investment strategy on the part of their children, these results mean that there is persistence in parental investment strategies for a given family.

The remaining specifications of Table 10 present evidence on the intergenerational marital sorting relationship for different time periods. We see that before 1700 the coefficient is 0.63, rising to 0.68 during the first part of the 18th century before falling to around 0.47 after 1750. Thus the overall trend is towards less persistence. During the early period, families retained a relatively high level of marriage matching from one generation to the next, whereas later during the sample period there is more variation in marital sorting from one generation to the next.

(TBD).

Figure 8: Intergenerational Relationship of Marital Sorting

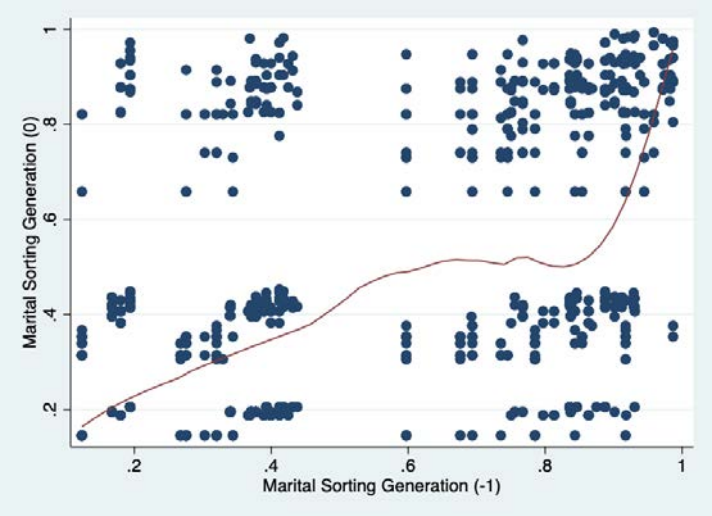


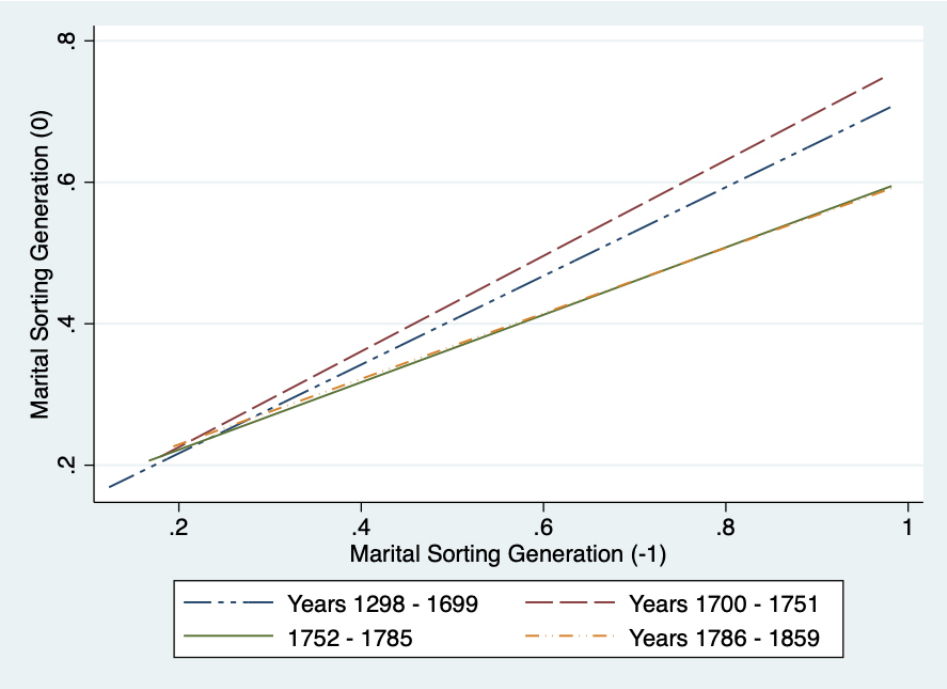
Figure 9 shows the intergenerational relationship in marital sorting over time. The relationships are smoothed to facilitate the difference across subperiods. It is clear that towards the sample period, the intergenerational sorting relationship has become less steep. For example, while before 1750 a marital sorting of 0.6 in generation (-1) is typically followed by a marital sorting of around 0.5 in generation (0), or 10 percentage points, by the early 19th century the expected drop in marital sorting from 0.6 is 20 percentage points. Interestingly, there does not seem to be strong evidence that the decline in expected sorting over time is higher for higher match values, at least proportionately. At the same time, there is no change over time in the intergenerational sorting relationship at low marital sorting levels of around 0.2.

5.3 Marriage Matching and Future Income

This section examines the relationship between marital sorting in a marriage and the income of the male child. This can be thought of as another return to marriage marital sorting. We begin by relating the permanent income of a married man, or husband, to that of his own father and to the father of his wife. To the extent that the income of the man's father and father-in-law are similar, there is marriage matching in the previous generation. we am interested in whether conditional on father- and father-in-law income levels the marital sorting of the families, measured by the product of father and father-in-law income, is correlated with the husband's income. Furthermore, we will study whether marriage matching in the grandparent's generation is correlated with the income of the husband (see section B). Table 10 shows the results.

First, both father and father-in-law income enter with a positive coefficient in the regression (column 1). Notice that this a generalization of the familiar intergenerational regression of income son on income father. Specifically, regressing income son on income father, one finds a coefficient

Figure 9: Intergenerational Marital Sorting over Time



Notes: Predicted marital sorting in generation (0) given marital sorting in generation (-1). Local percentile income rank. Lowess-smoothed series.

of 0.53 in this sample, or, any advantage that one father has over another is roughly halved in one generation (Shiue 2019). When the incomes of both father and father-in-law are included, we see from column 1 that he sum of the two coefficients is about 0.6, so that intergenerational persistence is somewhat higher when marriage matching is factored in. Further, the contribution of father income is somewhat larger coefficient but in-law income is clearly substantial. Of key interest here is whether in addition to each respective family-- own and in-law husbands benefit from the match of the two families. we examine this by forming the product of [Father Income x Wife's Father's Income], referred as (generation-0) marital sorting. As shown in column 2, husband income is increasing in the marital sorting of his parents. This is consistent with marital sorting raising the income level of the offspring. Notice that the coefficients on both father income and father-in-law income fall as marital sorting is included.

To address the possibility that the income of the husband is affected by generations coming before his parents we include income of paternal and maternal grandfathers in columns 3 and 4. Note that both enter with positive coefficients. The inclusion of grandfather variables does not cut into the coefficient of marital sorting of the parents but the role of father and especially father-in-law declines. When marital sorting at the grandparents level is included, it enters with a positive point estimate but is not significant, and also maternal grandfather income turns insignificant (column 5).

However, we have seen above that marital sorting in generations (0) and (-1) are highly correlated.

Table 10: Marriage Matching and Future Income

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Years							1518-1699	1700-1751	1752-1785	1786-1859
Father's Income	0.317**	0.213**	0.173**	0.134*	0.137*	0.187**	0.108	0.162*	0.167**	0.245**
	(0.018)	(0.047)	(0.050)	(0.053)	(0.054)	(0.036)	(0.076)	(0.071)	(0.060)	(0.082)
Wife's Father's Income	0.280**	0.155**	0.111+	0.076	0.079	0.136**	-0.027	0.166+	0.108	0.236*
	(0.020)	(0.057)	(0.059)	(0.062)	(0.062)	(0.044)	(0.095)	(0.085)	(0.073)	(0.096)
Father's Income x Wife's Father's Income		0.180*	0.182*	0.195*	0.189*					
		(0.077)	(0.081)	(0.086)	(0.087)					
Grandfather Income Paternal			0.101**	0.089**	0.071+	0.032	0.014	0.026	-0.029	0.144*
			(0.014)	(0.016)	(0.039)	(0.031)	(0.065)	(0.060)	(0.054)	(0.069)
Grandfather Income Maternal				0.073**	0.050	0.002	-0.176*	0.015	-0.065	0.189*
				(0.019)	(0.048)	(0.038)	(0.087)	(0.072)	(0.062)	(0.083)
GF Income Paternal x GF Income Maternal					0.033					
					(0.069)					
Marital Sorting (0, -1)						0.205*	0.522*	0.246	0.271	-0.109
						(0.100)	(0.210)	(0.190)	(0.175)	(0.228)
N	6,215	6,215	5,785	5,004	5,004	5,004	908	1,349	1,388	1,359
R^2	0.330	0.332	0.340	0.328	0.328	0.327	0.333	0.383	0.263	0.313

Notes: Dependent variable is husband percentile rank income. Global income rank percentiles. GF Income Paternal (Maternal) is grandfather income rank percentile on paternal (maternal) side. marital sorting (0, -1) is average of [Father Income x Mother Income] and [Grandfather Income Parternal x Grandfather Income Maternal].
Specifications (7) to (10) split the sample into four subperiods. Significance Levels: + 0.10, * 0.05, ** 0.01.

To capture a multigenerational measure of marital sorting of the family we employ the simple average of the match qualities of generations (0) and (-1). It is positively correlated with husband income, entering with a point estimate that is larger than parent marital sorting (column 6). This is consistent with the idea that it captures both marital sorting in the parent and in the grandparent generation. The remaining columns of Table 10 show results with that specification for four roughly equal-sized subperiods. We see that marital sorting is positive and significant at about 0.5 in the earliest period, mainly the 16th and 17th centuries. During the 18th century the broad marital sorting point estimate is positive albeit imprecisely estimated, while into the 19th century the marital sorting coefficient moves closer to zero and eventually negative (not significant). This is evidence for a falling impact of marital sorting on husband income over time.

6 Conclusions

We have shown evidence for strong positive assortative matching in China. Consistent with parental marriage investments for both gender, the marriage patterns of both women and men are far from random. Low-income clan men tend to marry low-income women from other clans, while high-income women have high-income men from other clans as their spouses. Furthermore, while marital sorting is present across the entire income distribution, quantitatively we find it to be stronger at the top. In particular, for low-income couples the extent of positive assortative matching relative to the baseline of random matching is eight percent, in contrast to an excess over random matching of more than threehundred percent at the very top of the income distribution (top 0.1%). Finally, we document a substantial fall in marital sorting over the sample period. The extent of positive assortative matching declined from the pre-1650 period to the beginning of the 19th century by about fifty percent. This evolution of marital sorting is consistent with lower investments in the marriage market towards the 18th and 19th centuries. We show that the lower marital sorting is accompanied by lower inequality across households over the sample period, yielding a positive relationship between inequality and marital sorting. Across gender, the extent of marriage matching for the male young fell somewhat stronger than for the female young, consistent with the idea that parental investments into men were more strongly reduced than for women, albeit from a higher level.

To the best of our knowledge, the paper presents also one of the first analysis of intergenerational marriage matching returns, defined as the effects of marital sorting in the parent and grandparent generation on outcomes of the child. As we have seen, a child of parents who are strongly matched is able to marry into a relatively high-income in-law family, conditional on the income levels of both father and mother families. Quantitatively, marital sorting in the parent generation pays off more strongly for male than for female children. Furthermore, we find that the degree of positive assortative matching in a family is correlated across generations. With a coefficient of about 0.6, there is intergenerational persistence in marital sorting, especially at higher income levels. Third, sorting in the parental and grandparental generation significantly raises the income of the son conditional on the income of the father. Finally, the evidence shows that intergenerational matching returns have declined over the course of the sample period, in line with the hypothesis that incentives for parental marriage investments became weaker over time. While clearly much remains to be done, our analysis provides new evidence that household formation may play a key role for the performance of the economy in areas where intergenerational transmission plays a key role.

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Appendix

A Data

A.1 Chinese Genealogies as Data Source

This section summarizes briefly Chinese genealogies as a source of information for research in Economics. A broader discussion is provided in Shiue (2016).

The tradition of compiling genealogies began around the time of the Song Dynasty (960-1279) (Zhao 1997).[24] While there are different forms of genealogies they all share some general principles, which can be seen by comparing genealogies with census data. Census data records information at a certain point in time, and in the ideal case, the information in the census gives a complete representation of all strata of the population. In contrast, genealogical data is retrospective, and the non-administrative nature of the compilation may affect inferences. The accuracy and representativeness of the data are among the major concerns, and will be examined below. At the same time, to date research on marriage matching with survey or census administrative data –going back to the 18th century– is typically based on samples comparable in size to the present study (see Bull 2005, Dribe and Lund 2005, and Hamilton and Siow 2007). Analyses based on large, highly reliable individual-level datasets are the exception and limited to modern times.

A.2 Income Categories

The analysis in the text employs five income groups.[25] This section introduces the main reasons for that classification. We begin by describing the most disaggregated information in the data, which distinguishes twenty-three groups before turning to the aggregation into six groups employed in the text. This classification has the advantage that the five groups have distinct income levels that can be clearly ranked. The categories draw on work by Chang (1955, 1962), Eberhard (1962), Ho (1967), and Telford (1986, 1992). Table A.1 shows the baseline classification into six groups in column (1) and the more disaggregated classification in column (2). Columns (3) and (4) provide information on the groups' importance in the sample, while column (5) gives a short description of the individuals' sources of income.

The data entry includes information on the major stages of each man's life, evidence of high income and wealth, various aspects of elevated status, certain functions, and specific actions such as large donations or setting up ancestral estates. There is also information on a person's education and whether he was a government official (and if so at which rank). Crucially to our analysis, the

[24] Originally the genealogy was a valuable private record, stored for safekeeping in the hometown of the family — in the home of an elder or in the ancestral halls — they were never meant for public exhibition. Typically, genealogies start with the progenitor of the clan from which all following clan members descend. The members were related by birth or by marriage, where not only women, but men sometimes married into a clan and adopted the surname of their spouse's family.

[25] The following is related to analysis in Shiue (2019).

Table A.1: Income Groups with High Level of Disaggregation

(1)	(2)	(3)	(4)	(5)	(6)
Income	Income-23	N	% of Sample	Description	Educated
0	0	6,320	71.08	No title, degree, and evidence of wealth	0
0	1	35	0.39	Honorary or posthumous title; village head; other honors	0
0	2	741	8.33	Multiple wives in consecutive marriage (two or more not living at the same time)	0
0	3	824	9.27	Evidence of moderate wealth of 1st degree family, incl. minor and expectant official, lower level degree *(sheng-yuan*, *jian-sheng*), and official student	0
0	4	20	0.22	Wealthy family member 2nd degree, incl. offical, *ju-ren*, *gong-sheng*, and *jin-shi*	0
0	5	31	0.35	Wealthy family member 1st degree, incl. official, *ju-ren*, *gong-sheng*, and *jin-shi*	0
1	6	145	1.63	Educated, scholar, no degrees or office; editor of genealogy; refused office, or prepared but did not pass exam	1
1	7	79	0.89	Concubinage (two or more wives or concubines at the same time)	0
1	8	11	0.12	Substantial evidence of wealth and property; set up ancestral estates, large donations, philantrophy; wealthy farmer, landowner, or merchant	0
1	9	163	1.83	Official student	1
1	10	1	0.01	Military *sheng-yuan*, minor military office	0
2	11	133	1.50	Purchased *jian-sheng* and/or purchased office	0
2	12	93	1.05	Student of the Imperial Academy (non-purchased)	1
2	13	48	0.54	Civil *sheng-yuan*; minor civil office	1
2	14	95	1.07	Expectant official; no degrees	0
2	15	4	0.04	Expectant official one of the lower degrees	1
2	16	23	0.26	Military *ju-ren*, *jin-shi*; major military office	1
3	17	38	0.43	Civil official with no degree, minor degree, or purchased degree	0
3	18	23	0.26	*ju-ren*, *gong-sheng*, with no office	1
3	19	47	0.53	*ju-ren*, *gong-sheng*; with expectant office	1
3	20	0	0.00	*jin-shi*, no office	1
4	21	11	0.21	*jin-shi* with official provincial post or expectant official	1
4	22	7	0.08	*jin-shi* with top-level position in Imperial bureaucracy (Hanlin Academy, Grand Secretariat, Five Boards, Prime Minister)	1

Notes: Table gives information on a man's permanent income. Sample shown is all married sons that can be linked over three generations (son, father, and grandfather; N = 8,892). Income groups based on Telford (1986, 1992), Chang (1955, 1962), Ho (1967), and Eberhard (1962).

entry also lists the man's wife (or wives) as well as each couples' children. If there is nothing other than vital statistics in the individual's biography, and this person had no titles, degrees, or evidence of wealth, then he is coded with income group 0 (see Table A.1).

Notice that 84% of the men belong to the lowest income group. This indicates that this data is not primarily a record of the lives of the elites. Furthermore, the classification reveals that higher income in society was correlated with passing the tournament-style civil service exam and obtaining an office in the government. There were a number of different degrees. The *sheng-yuan* degree was the lowest of the recognized categories of government education, conferred upon those who had passed the local (district or prefectural) degree threshold. The *sheng-yuan* who were scholastically more competent were awarded with the *gong-sheng*, "imperial student" title; above them in rank were the *ju-ren* (graduate of the provincial examinations), and above the *ju-ren* were the *jin-shi* (graduate

of the national metropolitan examinations). The levels are building up on each other, that is, in order to have the *jin-shi* degree one must have the *ju-ren* and the *sheng-yuan*, and in order to be *ju-ren* one must have passed the *sheng-yuan* examination.[26] Not all *sheng-yuan* advanced to the next levels, and those who didn't may have given up and turned instead to working for officials in a secretarial capacity, or, helping to manage local affairs—settling disputes, organizing local public goods projects, improving welfare and security interests, or providing education in their community (Chang 1962).

The disaggregated information of column (2) in Table A.1 is available for all (male) members of the Tongcheng clans, which for present purposes is the husbands, fathers, and grandfathers. The same lifetime income information is also available on the father's of the Tongcheng clan wives. Importantly, the data record the income of the Tongcheng couples' childrens' spouses (in-law income), as the income of the father of the spouse. We know the income of the children themselves, namely, the income of their father. Thus, we can study marriage matching for more than 14,000 marriages (see Tables 1 and 2). The information on in-law income does not, however, provide indirect evidence on family wealth, corresponding to income groups 3, 4, and 5 in Table A.1, column (2) above. For this reason we allocate these income groups together with the lower groups 1 and 2 income the lowest income group (group 0, column (1)).

What was the role of higher income not related to government office? Even though there were rich landowners and merchants in Tongcheng, as elsewhere in China, they would often seek to acquire official government positions due to the additional income it would generate. The fraction of wealthy landowners, farmers, or merchants in our sample is only 0.12 percent (Table A.1, column (4)); this is the group that did not also held official degrees or government positions. For example, several of the Cohong merchants engaged in the lucrative bi-lateral monopoly trading relationship with Western countries in Canton (Guangzhou) in the early 1800s sought to rise to the highest government offices requiring *jin-shi* degrees, without success, so they stayed at *ju-ren* level positions (Chang 1955).

Income Individual-level income is virtually never available in historical studies of marriage markets. Nevertheless we do know how rank in society translates into income differences. This section provides a brief synthesis (see Chang 1955, 1962, and Ho 1967 for additional discussions). First, the income of a man is determined by two factors, the level of civil service exam he passed and the type of government office he obtained (if any). These factors were the most important determinants of where a household stood in the societal income distribution. The paper matches the degrees earned and government positions to potential earnings based on historical evidence. As noted in Table A.1 above, there were local, provincial, and national (or metropolitan) exam levels, with corresponding degrees called *sheng-yuan*, *ju-ren*, and *jin-shi*, respectively.

Having passed a certain level of degree would make a person eligible for a certain level of official

[26]There were no age requirements or limitations for advancement, but since the examinations required a high level of literacy and years of study, the earliest that one could attain the *jin-shi* degree would be in the early twenties, and it was not unheard of for a man in his fifties to still be a *sheng-yuan*.

position. For example, there were nine levels of civil positions during the late 19th century (Chang 1962, Table 1). A district magistrate would be seventh-ranked civil official, while a provincial governor would be a second-level civil official. The mapping between degree and official position is not deterministic, however, the level of office is increasing in the degree that a man has obtained. Becoming a top-level official in the imperial bureaucracy with only a *sheng-yuan* (local) degree is almost impossible, and conversely, most *jin-shi* have better-paid positions than being a district magistrate. The level of degree is useful to study income because there is a relatively small number of them, and they are consistently mentioned in the data.

As Table A.1 shows, our income groups capture the relationship between civil service examination degree and official position. The ranking is also consistent with the fact that military offices generated lower incomes than civil offices. For example, the highest civil official had a salary of 180 *taels* per year, while the highest military office came with only 82 *taels* (see Chang (1962, Tables 1 and 2). The challenge in estimating the incomes of men in the higher ranks of Chinese society includes the fact that official salary, on which there are detailed records, is only one of several income sources. Passing the examination at any level also meant income because it would make the individual eligible for providing teaching and managerial services. Teaching income has been about half of the officeholding income in the late 19th century (Chang 1962, Table 26). Officials received customary bonuses as well as in-kind support, partly for running their offices. Customary bonuses were substantial; for example, the full dress of a *hsien* magistrate might have cost 3,000 *taels*, versus the official salary of 45 *taels* a year (Chang 1962). At the same time, officials and high-income individuals more generally were expected to contribute to public goods, and the higher their income the higher was the expected contribution.

Because individual-level income is unobserved our analysis allocates all men into six distinct income groups. While this is relatively coarse it amounts to more income differentiation than other work on historical mobility in China (only two groups, high versus low; Campbell and Lee 2003, Mare and Song 2014). Arguably the best information on differences across income groups comes from assessment schedules of clans to their members who have reached extraordinary income levels. This can be thought of a tax on the clan member who has achieved a significant amount of income. There exist multiple assessment schedules for different clans and times that broadly yield the same patterns (see Chang 1962). Furthermore, there is little reason to believe that the clans' assessment schedule would not be consistent with the income generated by each of these achievements.

A good estimate of incomes can be obtained from the assessment schedule of the Chang clan, with annual assessments are given in column (5) of Table A.2.

Two income groups, level 0 and 1, are not determined by the clan assessments. Income group 1 includes those individuals who are educated because they prepared for the civil service exam but they did not pass (neither did they obtain official position). The major income source of these individuals is teaching. We estimate their income to be one quarter of that of income group 3, that is, 500 copper cash per year (based on Chang 1962, Table 26). We estimate that income group 0 has

Table A.2: Chang Clan Assessment Schedule

(1) Group	(2) %	(3) Description	(4) Source	(5) Annual Copper Cash	(6) Annual Income	
					Tael	*Tael* (All Groups)
0	71.1	No evidence of extraordinary income or wealth	Chang (1962), p. 12		5	5
1	19.8	Educated w/o passing exam	Chang (1962), Table 26	500		7.5
2	2.9	Official student (Government student)	Clan Assessment	1,000		15
3	4.5	Imperial Student	Clan Assessment	2,000		30
4	1.2	*Ju-ren* (provincial degree)	Clan Assessment	4,000		60
5	0.2	*Jin-shi* (national degree)	Clan Assessment	8,000		120

Notes: *Tael* is silver currency; clan Assessments for Chang clan, late 19th century; see Chang (1962), page. 28.

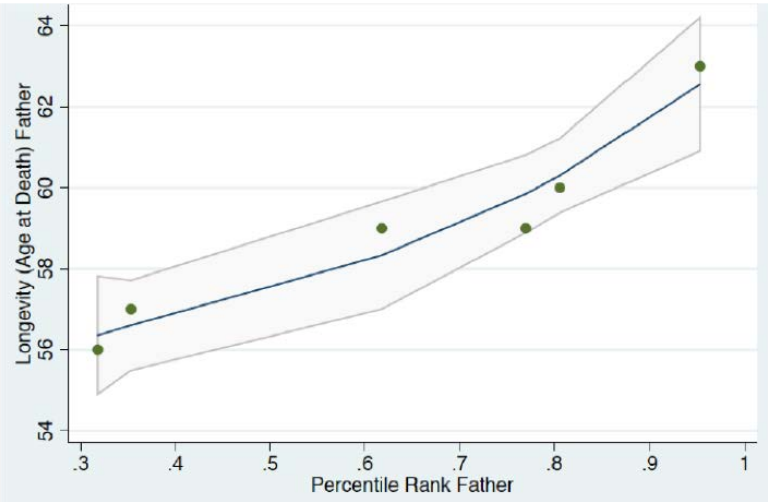
5 *taels* per year, on the low end of the range of annual income of a laborer (between 5 and 10 *taels*, Chang 1962, p.12). The income difference between groups 0 and 1 is pinned down by the average per-capita income reported by Chang (1962), which is 7.4 *taels* per year (page 328). With an annual income of 7.5 *taels* for group 1, the sample distribution (see column 2 of the table) yields an average of 7.8 *taels* per year. A 50% difference in annual income between groups 0 and 1 is plausible. The last column of Table A.2 is the six-group aggregation employed in Shiue (2019). As noted above, in the context of marriage we combine parts of group 1 with group 0 because we miss some information on indirect income sources for the in-law families.

Correlation of Longevity and Income A simple check on the income groups is to examine the relationship between income and longevity. The latter can be computed from vital information on birth and death in the data source. One would expect that richer men tend to live longer. Figure A.1 shows the result of relating income and longevity across the six groups. Low-income men lived typically about 56 years, compared to men with the highest income who typically reached an age of 63 years.[27]

Income and Future Education A second check is to examine the relationship between income and education. Figure A.2 shows the probability that the son is educated by income group of the father. Here, education is measured with an indicator variable, shown in column (6) of Table A.1. Sons from a high-income family have a substantial advantage over sons from low-income families. In particular, the probability to become educated for a son that is born to a lowest-income family is close to zero, while it is around 50% for a son of a *jin-shi*. Furthermore, the probability that the

[27]These are statements about averages; the person with the highest lifespan in the sample, 91 years, was in the lowest income group. Also, these ages are higher than life expectancy at birth in China during our sample period. This is because our sample is based on men who survive past childhood and who succeed to marry.

Figure A.1: Permanent Income and Longevity



Notes: Figure shows median percentile rank and longevity for all men for whom there is information on birth and death year; 90% confidence interval shaded.

Table A.3: Summary Statistics on Father Month of Birth and Death

	N	Average	Std. Dev.
Year of Birth	8,893	1732.04	70.85
Month of Birth	8,893	6.92	3.49
Year of Death	8,658	1787.44	70.59
Month of Death	8,658	6.47	3.43

Notes: Information according to Chinese lunar dates has been converted to solar dates following Shiue (2002).

son is educated is 14% if the father is in the top two quintiles, compared to 1% when the father is in the lower half of the distribution. The relationship appears to be stronger at the high end of the income distribution.

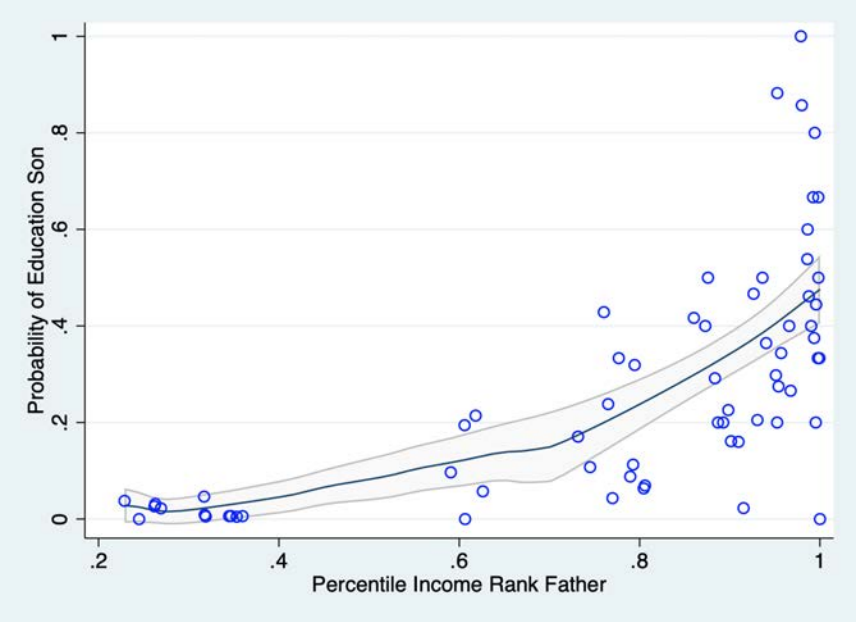
Overall, higher father income translates into more education of the child.

A.3 Data Accuracy

This section examines the accuracy of the data, and whether there is evidence for certain biases, including recall bias. Additional results are presented in Shiue (2016). Table A.3 lists extended information on vital statistics by giving the men's birth and death months. The average for either is close to 6.5, which is what one might expect if the timing of births and deaths are random events and there is no artificial age heaping.

The result is not very surprising because dates in genealogies are in terms of traditional calendrical symbols, not in numerical format, and traditional calendrical symbols are difficult to falsify (Zhao 1997). This increases the reliability of the recorded dates, which are key to forming birth cohorts as well as calculating each man's longevity (see above).

Figure A.2: Income and Next-Generation Education



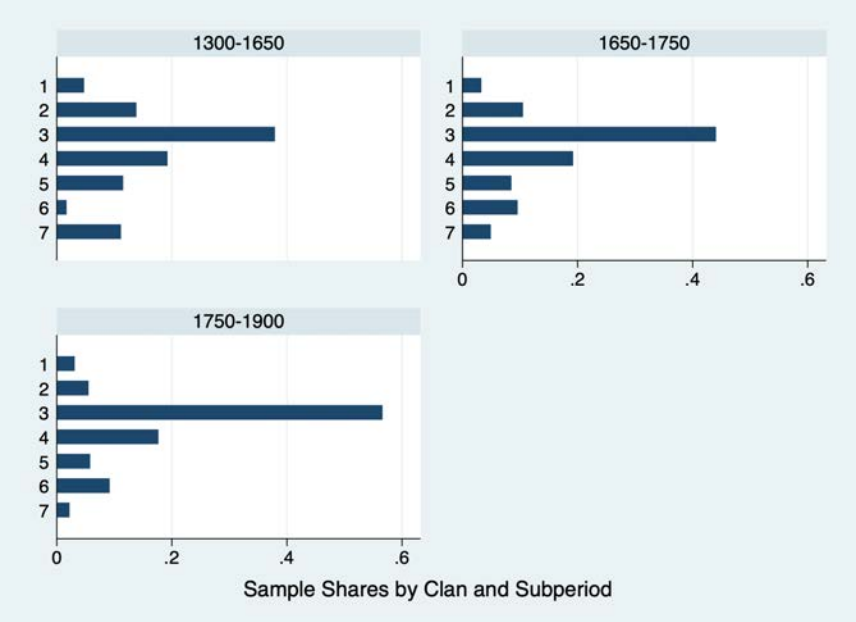
Notes: Figure shows relationship between income rank of father and son education across birth cohorts; 90% confidence interval shaded.

We have also directly compared the list of people who are recorded to have obtained the *jin-shi* degree against other known lists of degree holders from Tongcheng County (Fang 2010; Cao 2016; Wang 2017). There were over 51,000 *jin-shi* degree holders from the Yuan, Ming, and Qing. Information on top degree holders can be cross-checked for accuracy by referring to known lists of *jin-shi* degree holders from the Chinese state, which give the name, the date on which someone received his degree, and his hometown. We have verified that the information on the 18 *jin-shi* in our Tongcheng sample is consistent with the information of these official lists.

Differences across Clans Variation across clans is useful for asking whether a particular person is more likely to be included in the genealogy than another. The following examines various forms of sample selection using differences across clans. While there were a number of different reasons why the genealogical tradition emerged, one relevant concern here is that genealogies begin with a particularly noteworthy man, who then becomes the progenitor of the clan. Part of his noteworthiness might come from a high level of education, which is one of the most important signs of income and one of the most consistently reported characteristics of noteworthy persons. Alternatively, perhaps later generations were more likely to select a noteworthy progenitor. In either case, the implication would be a strong trend of declining income over time.

In the Tongcheng genealogical sample, there are three clans whose records begin with an educated progenitor: the Chen (progenitor born in 1298), the Wang (1358), and the Ma (1408). However, the

Figure A.3: Clan Size Over Time



Notes: Clan names are as follows: 1 is Chen, 2 is Ma, 3 is Wang, 4 is Ye, 5 is Yin, 6 is Zhao, and 7 is Zhou.

status of these three progenitors was not more than what might be considered an intermediate level, not the highest level (*jin-shi*). For the other four Tongcheng clans, the highest levels of income are typically found nine generations after the inception of the dynasty. Thus, the income patterns in the data do not simply reflect particularly noteworthy individuals that started the clan records as progenitors. Figure A.3 shows the size of the seven clans in three different sub-periods. We see that all clans are present in all sub-periods.

Selection would also arise if genealogical records contain more entries of success compared to failure. If a genealogy were more apt to record success, we might expect that it would do this on multiple measures. One way to check for this would be to see if clan size and average income are correlated. The correlation between clan size and average income group is virtually zero. Thus, there is no evidence that on average, richer clans have included more entries in their genealogies. We can also check if this kind of effect might be present over time to see if it is true that periods during which a clan is successful are also those when relatively many clan members are recorded. Breaking down the overall sample period of 1300 to 1900 into twelve birth cohorts yields a correlation between income and the number of clan members of close to zero (and negative, -0.10).

Furthermore, because the updating of the genealogy was retrospective one might believe that it is in times right after a clan had been relatively successful when a relatively high number of clan members would be recorded. This might happen if the appearance of a high-income individual correlates with a better memory of all the family members who were related to this locally famous individual, compared to periods when no one in the clan was particularly successful or famous. However, there is no positive relationship between the number of clan members recorded and the

average clan income (the correlation is insignificant at -0.09).

Additionally, it is possible to examine whether high-achieving clans tend to be overrepresented towards the end of the sample, as would be the case if there was survivor bias. If so, one would expect that clans with high income account for a relatively large share of the post-1800 observations in the Tongcheng data. Across clans, however, I do not find a strong relationship between average income and the share of post-1800 observations (insignificant correlation of 0.07).

Overall, these analyses provide evidence that the data is of high quality and that recall and other biases do not seem to play a major role.

A.4 External Validity

Another question is whether the Tongcheng sample can be considered as nationally representative for China. A first way to assess this is to consider mortality rates by age group. Population figures at the regional level are typically based on gazetteers, which are local histories about a certain place.[28] In addition, there are official accounts for subsets of the population, such as the Qing population registers, which are the product of the Eight Banner registration system.[29] Telford (1990) compares demographic patterns in the Tongcheng genealogical data and the Banner populations for 1774 to 1873, when the latter starts to become available. He finds a very similar variation in the probability of dying for different age categories across the two sources (see Telford 1990, Figure 2).[30]

Another way to gauge the representativeness of the Tongcheng sample is to look at the number of top income individuals as a percentage of the population. Much of the available estimates focuses on the upper groups as a percent of the population. While there is no consensus on who should be considered to belong to the upper income groups there is wide agreement that education and success in the civil service examinations were important. Chang (1955) takes the view that *sheng-yuan* holders and above were in the upper class, and estimates that they were in the top 2% of the total population in the later half Qing period. In this analysis, the part of the population corresponding to Chang's (1955) definition account for 3.3% of the sample, which is comparable.[31] Fei (1946) presents another, wider estimate of the upper income groups, which he placed at 20%. In our analysis, groups 2 to 22 in Table A.1 correspond to Fei's definition of high income—and the share of these groups in our sample is 20.2%. Both these comparisons suggest that the Tongcheng genealogies are fairly representative of China's population as a whole with respect to the size of top income groups as well as the relative size of higher versus commoner groups.

[28] Three county-level gazetteers about Tongcheng cover the period under analysis: *Tongcheng xian zhi* (1490), *Tongcheng xian zhi* (1696), *Tongcheng xuxiu xian zhi* (1827).

[29] These data are available for areas in China's northeast, in today's Liaoning and Heilongjiang Provinces, these lands were organized under the Imperial Household Agency and the Jilin Military Yamen, an office in the General Office of the Eight Banner Command. See https://www.icpsr.umich.edu/icpsrweb/ICPSR/series/265. For the imperial household dynasty, there are observations going back to the seventeenth century (Lee et al. 1993).

[30] Campbell and Lee (2002) compare data from genealogies of Liaoning to the household registers. They find evidence of higher mortality rates in the genealogies compared to what was reported in the registers. This contradicts the idea that mortality in underreported in the genealogical sample. It also not what one would expect if more privileged and educated men would be more likely included in the genealogies.

[31] In Table A.1, column (2), they are groups 13 and above.

Given the genealogy is a written document, if literate individuals only recorded information about themselves their and immediate kin, the percentage of top income people in the genealogy should be very high. Alternatively, if genealogies recorded extended family who were not of high income—rules of ritual say that all adult male members are eligible, regardless of education or income—the percentage should typically be low. How does the share of top income groups in our sample compare with other evidence? In his classic study based on national lists of *jin-shi*, which are extremely reliable, Ho (1967) reports that during the Qing in Anhui there were 41 *jin-shi* per one million population, or, 0.0041 percent. There were regional variations, and the province of Anhui was below the provincial average in terms of *jin-shi* per capita in Qing China (Ho 1967, p. 228). In our sample, there were a total of 14 *jin-shi* during the Qing, which comes to 0.045 percent of the population in the data.[32] Thus, there are about ten times more *jin-shi* in the Tongcheng sample than in Qing Anhui overall. The reason for this is that Tongcheng was an important urban center in Anhui that had a well-known reputation for producing high-achieving individuals during the Qing (Beattie 1979).

At the same time, *jin-shi* were rare, and some parts of Anhui province did not produce a single *jin-shi* over centuries. Furthermore, Tongcheng was not among the areas of China where top individuals were most prevalent. Some areas had a number of *jin-shi* that was higher by an order of magnitude compared to Tongcheng.[33] Therefore, while the number of men in the highest income group in Tongcheng was higher than in the local surrounding area, Tongcheng was noteworthy at a local, perhaps provincial level, but it was not an unusual region in China.

Moreover, the variation in *jin-shi* across clans in the Tongcheng sample dwarfs differences in the population. At the top of the list, the Ma clan had 9 *jin-shi* relative to 627 men, a ratio of 1.4%, whereas other Tongcheng clans do not have a single *jin-shi*. Put simply, the potential sample selection in the genealogy, as a genre, is likely to be minor in comparison to the rather large and pronounced differences that we see in the achievements of different clans.

This analysis of the representativeness of top income in the sample can be supplemented by examining the representation of other income levels. There may be a tendency to exaggerate the income of people in the genealogy, or to drop the poorest segments of the clans—in both cases there would be many more officials or educated people in the genealogical sample than in the society at large. While there exists no generally agreed-upon income classification for China, another comparison to other sources is that in the Liaoning sample during the Qing dynasty starting in the

[32] There are 8,291 married men during the Qing in the sample. Telford (1986) finds that the proportion of unmarried men in Tongcheng during a somewhat earlier period of the Ming was above 20%. I assume that 20% of all men did not marry , and that the Qing population was composed of below-age-of-marry/men/women to one-third each. This gives a scaling factor of 3.75: 14 *jin-shi*/(8,291 x 3.75) = 0.045 percent. If there are 20% of men not marrying, and there is universal marriage of women, then there must be 20% fewer daughters than sons, and 20% fewer women than men.

[33] Zhejiang and Jiangsu were among the provinces with high densities of *jin-shi*. Ho (1967) reports that a single prefecture in China could have as many as 1,004 *jin-shi* during all years of the the Qing. With typically seven counties to a prefecture, this means that there could be as many as 1,004/7 = 143 *jin-shi* per county during the Qing. Compared to this, the 14 *jin-shi* in our sample are not exceptional.

mid-18th century, 98% of males had "No Status" while 2% were "Officials".[34] This compares to about 71% of men with the lowest income level in the Tongcheng sample, while about 1.4% have an official position. The relatively high fraction of "Officials" in the Liaoning data might be related to the fact that it was a less densely populated area in the North of China.

Apart from income groups, we have checked whether the percentage of successful examinees in the Tongcheng genealogies broadly lines up with national averages. The most systematic evidence on education in China during Ming-Qing is related to the civil service examinations. In particular, the number of *sheng-yuan*, the individuals that passed the local examination, was about 500,000 in the year 1700 (Elman 2000), or roughly 0.3% of the population. In the Tongcheng sample, about 0.76% of the men around the year 1700 were *sheng-yuan*. Accounting for women, children, and elderly indicates that the fraction of *sheng-yuan* in Tongcheng was similar, or perhaps somewhat lower than in China as a whole.

In summary, overall comparisons of degree holders, upper income groups, and mortality rates suggest that the income distribution in the Tongcheng sample is not very different from what one might expect from a randomly drawn sample. Genealogies were compiled for ancestral rituals, so there would not be an obvious incentive to systematically create false entries. There is no evidence that major biases exist in this Tongcheng sample of seven clans. Systematic checks of internal consistency and external validation of the Tongcheng data suggests that while measurement error is no doubt present the records appear to be fundamentally sound. Furthermore, information in the sample is consistent with what we know and expect based on other sources for larger parts of China. To a significant extent this is because the sample is based on seven genealogies that each describe rather different local clans.

[34]Source: Author's computations from the China Multigenerational Dataset, Liaoning 1749-1909, http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/27063.