High-Value Work and the Rise of Women: The Cotton Revolution and Gender Equality in China*

Melanie Meng Xue†
UCLA Anderson School of Management

This Version: March 2016

Abstract

This paper tests the hypothesis that opportunities for high-value work for women undermine the belief that women have intrinsically less value than men. Using information from historical gazetteers, I exploit variation in pre-modern cotton textile production (1300-1840)—high-value work for women at the time—across 1489 counties to identify its effect on outcomes reflecting the cultural devaluation of women in modern China. I find that a history of producing cotton textiles is negatively associated with prenatal sex selection under the one-child policy. To document the persistence, I show premodern cotton textile production is positively associated with wife heading the household and women taking high-level positions in socialist China, and with female labor force participation in pre-socialist China. I show the effects are unlikely driven by a higher level of economic development either leading to or resulted by premodern cotton textile production. An instrumental variable analysis exploiting climatic suitability for spinning and weaving, yields results highly comparable with OLS estimates. In addition, I shed light on the transformation of sexist beliefs by documenting the pattern of widow survival dating back to 1600 AD.

Keywords: Culture, historical persistence, sexist beliefs, value of work
JEL Codes: J16 N35 O33 O53

*I would like to thank Sascher Becker, John Brown, Joyce Burnett, Shuji Cao, Latika Chaudhary, Daniel Chen, Bill Collins, Lena Edlund, James Fenske, Philip Hoffman, Paola Giuliano, Remi Jedwab, Saumitra Jha, Noel Johnson, Mark Koyama, Timur Kuran, James Kung, Nan Li, Debin Ma, John Nye, Ömer Özak, Nancy Qian, Thomas Rawski, Gary Richardson, Eric Schneider, Yan Se, Nico Voigtländer, Bin Wong and audiences at ASREC, CES, “Deep Causes of Economic Development” (Utrecht), EHA, EHS, HKEA, Workshop on Institutions (Xiamen), NEUDC (Brown), PacDev (Stanford), Shanghai University of Economics and Finance, UCLA Anderson, World Congress of Cliometrics Society (Honolulu), WADES, and WEHC (Kyoto). All the remaining errors are the fault of the author.
†melanie.xue@anderson.ucla.edu
I INTRODUCTION

Most past and modern human societies are characterized by male domination. From political life, elite education, to major capitalistic enterprises, women’s entry to leadership positions is a relatively recent phenomenon and remains uncommon in most countries. The near ubiquity of male domination has led some scholars to think male domination is inevitable due to biological reasons (Goldberg, 1977). In the past few decades, in the field of philosophy, anthropology and evolutionary biology, a number of hypotheses have been put forward for the causes of the origin of male domination. These explanations range from a group’s effort to secure animal protein (Harris, 1977, 1978, 1993) to a man’s desire to control and impregnate women so as to pass on his genes (Lerner, 1986; Smuts, 1995).¹

Two closely related studies in economics are Alesina, Giuliano, and Nunn (2013) and Hansen, Jensen, and Skovsgaard (2015). Alesina, Giuliano, and Nunn (2013) attributes the origin of male domination to the use of the plough which required upper body strength, whereas Hansen, Jensen, and Skovsgaard (2015) attribute the origin of male domination, more generally, to the emergence of agriculture. According to Alesina, Giuliano, and Nunn (2013), one of the main differences in gender roles lie between former shifting agricultural societies and former plough agricultural societies. Plough, as a male-friendly technology, set the tone for millennia of female seclusion and subordination. Hansen, Jensen, and Skovsgaard (2015) takes a more stark view on the impact of agriculture on women. In their story, agricultural intensification alone was sufficient to cause women to retreat into the domestic sphere.

Both Alesina, Giuliano, and Nunn (2013) and Hansen, Jensen, and Skovsgaard (2015) are consistent with the view that more advanced agricultural societies are associated with higher levels of gender inequalities. This is certainly true for most western societies: in Europe, women’s role and their rights have changed little since the Roman times, and only began to improve in the 19th century after the emergence of modern capitalism and democracy (Ramirez et al., 1997; Bauman, 2002; Smith, 2008).² Even in today’s world,

---

¹Harris (1993) believes that male domination originated from males being stronger and more skilled in weapon use. Friedl (1975) argues that male dominance arises when a group faces economic and ecological stress. Martin and Voorhies (1975) believe matrilineal systems are adaptive in peaceful environments. Ortner (1981), Sanday (1981) and Tiger (1971) also shed light on the origin of male dominance. For a collection of essays on this topic, see Rosaldo et al. (1974).

²For example, according to the English legal scholar William Blackstone: “[b]y marriage, the husband and wife are one person in the law: that is, the very being or legal existence of the woman is suspended during the marriage, or at least is incorporated and consolidated into that of the husband: under whose wing, protection, and cover, she performs every thing.” (Blackstone, 1764, pp.442-445).
in domains of economic and political life most associated with the image of a dominant and powerful male, the presence of women remains at a low level.\(^3\) Blau and Kahn (2016) find that between 1980 and 2010, the wage gap narrowed more slowly for women at the top income and job levels than for other women. This study documents a transition in gender equality within an advanced agricultural society that happened as early as the 14th century, and explores its conditions and continuing benefits for today’s women. It suggests male domination does not seem to be inevitable, nor is it a necessary by-product of the intensification of agriculture. A transition in gender equality is likely possible with large relative productivity shocks.

According to anthropologist Mark Harris, inequalities between men and women became a matter of their relative contribution to economic production (Harris, 1993), as warfare was taken over by professionals in state systems. In other words, after participation in warfare became irrelevant for the majority of the population, relative status of women to men will be determined by contribution to economic production. Building on this argument, I hypothesize that in the absence of decentralized violence, a belief in male superiority can become obsolete when women’s contribution to economic production exceeds men’s.

The institutional environment of much of imperial China—a unified empire with a centralized army—provides an ideal setting to test this hypothesis. The cotton revolution in the 14th century was a transformative event that redefined women’s contribution to economic production in premodern China. The adoption of new spinning and weaving technologies led to the rise of domestic cotton textile production. Between 1300 and 1840, cotton textiles were produced in large quantities and sold to local, regional and national markets through decentralized household production. During this period, China accounted for 1/3 of the world’s population and 1/3-1/2 of world GDP, and had a relatively well-integrated national and regional market economy. Due to pre-existing political, economic and cultural institutions, women exclusively participated in cotton textile production throughout this period. The cotton textile boom resulted in a huge increase in the economic earning power of women in regions which were suitable for cotton textile production: the cotton revolution boosted women’s income close to or above that of their husband. Relying on rich historical information of premodern China, I document the conditions under which the transformation of sexist beliefs took place. I examine how this shock eroded the be-

\(^3\) Among S&P companies in the United States, the share of women declines from 45% of the labor force, 36.8% of the first-mid-level officials and managers, 25.1% of the executive/senior-level officials and managers, 19.2% of board seats, to 4% of CEOs. http://www.catalyst.org/knowledge/women-sp-500-companies. Following a board quota intervention, there has been no evidence that gains at the very top trickled-down (Bertrand et al., 2014).
liefs of male superiority and continues to benefit women in modern China through the transformation and transmission of those beliefs.

To accurately measure bias, especially subconscious bias, against women, experimental evidence will be ideal. In the absence of experimental evidence, I exploit an observational setting where biases against women are the most faithfully revealed: the decision to keep only one of the multiple children of different sexes in the presence of the one-child policy. Sex selection reflects deeply held cultural beliefs about the relative worth of men to women. This is the conclusion of The President’s Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavior Research of the United States which observed that the core reason for parents choosing to have boys over girls is the assignment of different values to different genders. Similarly, American philosopher Mary Ann Warren (1985) considers sex selection as ‘invariably motivated by sexist beliefs’.

In a hypothetical setting where no constraints are placed on how sex selection is achieved, sex selection should how women are valued compared to men. In practice, as sex selection is often heavily regulated by legal and moral forces, we do not always observe sex selection in spite of the underlying sexist beliefs. In addition to sex preference, Clonan et al. (2005) identify religion and technology as the critical determinants of sex selection. China in late 1990s, was close to the hypothetical setting in which there were few meaningful constraints on sex selection. Due to historical conditions, most Chinese people had no moral antipathy to sex selection via pre-natal abortions. Also, during this period, large number of Chinese were given access to sex-selection technology (Chen et al., 2013). This

4The President’s Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavior Research of the United States in 1983 came to the conclusion that “in some cases, the prospective parents’ desire to undertake the procedure (of sex selection) is an expression of sex prejudice. Such attitudes are an affront to the notion of human equality and are especially in an appropriate in a society struggling to rid itself of a heritage of such prejudices ... Surveys of parents and prospective parents indicate, however, a preference for sons (especially as the first-born child). If it became an accepted practice, the selection of sons in preference to daughters would be yet another means of assigning greater social value to one sex over the other and perpetuating the historical discrimination against women.

5 For example, Judeo-Christian cultures explicitly prohibit the killing of other humans and this prohibition encompasses infanticide. The practice of sex selection entails a high moral cost and as such it is uncommon. In the United States, on the eve of the ultrasound technology becoming widely available for sex selection, fears emerged that sex selection might take place on a large scale—the 1970 National Fertility Study shows that the sex preference ratio is as high as 124 boys every 100 girls for all women who intend to have more children (Westoff and Rindfuss, 1974). Sex ratio imbalances on that scale, however, never actually occurred, though nearly a 20 percent “excess” of male births was initially projected to follow a technological breakthrough in sex selection technology. A predecessor to present-day prenatal sex selection is female infanticide. According to the Encyclopedia of Death and Dying, “Female infanticide is a problem rooted in a culture of sexism throughout antiquity” (Howarth and Leaman, 2003).

6Lee et al. (2002) and Lee and Anderson (Lee and Anderson) document widespread infanticide in premodern China; they consider the practice as part of the “preventative check” on the population.
institutional and demographic setting motivates my use of sex ratio at birth as a main proxy for sexist beliefs in contemporary China.

To identify the causal effect of the cotton revolution on modern outcomes, I collect information on premodern cotton textile production obtained from county and prefecture gazetteers. My main sample comprises a total of 1489 counties. Next, I link this data to contemporary outcomes that reflect sexist beliefs. Examining variation across counties and individuals, I find a strong negative relationship between premodern cotton textiles and sex ratio imbalances. The baseline estimates suggest that premodern cotton textile production is associated with a reduction in sex ratio at birth by a quarter of its standard deviation (3.3 boys per hundred girls). I also find direct evidence on the positive impact of premodern cotton textile production on sexist beliefs reflected in survey questions. More specifically, premodern cotton textile production increases daughter preference and predicts the belief that women are naturally as capable as men and that women should be just as career-focused as men are.

To account for historical and modern factors that might also play a role in modern gender outcomes, in the baseline regression, I include controls for a number of historical, geographic and contemporary characteristics of each county. Some included controls are expected to eliminate alternative channels through which premodern cotton textiles might affect sex ratio at birth. I first account for factors that might have led to differential development trajectories in the past, including agricultural suitability, log population density in 1600, proximity to the major trade network, treaty port status, latitude, longitude, ruggedness and distance to coast. In the prefecture-level analysis, I can also control for economic prosperity \emph{after} the long five centuries of cotton textile production by population density in 1820, so I do not pick up norm-forming effects arising from the wealth generated by cotton textile production. In addition, I control for overall economic development and modernization (per capita GDP and men’s years of schooling), current economic opportunities available to women (share of agricultural workforce and share of service workforce), and different fertility constraints driven by local variation in one-child policy (share of non-agricultural household registration, share of ethnic population, provincial capital status, and degree of political autonomy). I also include socioeconomic macroregion fixed effects to account for any pre-existing differences in sexist beliefs formed in earlier stages of history. The nine socioeconomic macroregions contain relatively homogeneous populations, and share many cultural and social traditions in common. Province fixed effects allow me to rule out the channel that formal institutions, possibly engendered by historical cotton
textile production, directly affect sex ratio at birth.\textsuperscript{7}

In exploring alternative hypotheses, I consider the role of other economic activities favoring women, such as cotton cultivation, the production of other textiles, tea picking and rice production, as well as the role of broad economic and political environments such as the level of economic development—both prior to and after the cotton revolution—and historical state capacity. To account for the possibility that textile-suitable areas were particularly prone to modern shocks which might have also affected sex selection, I include additional controls for recent economic and political shocks. I find either early industrialization, missionary activities, or recent economic reforms hardly changes the coefficient estimate of premodern cotton textile production.

My results are robust to an instrumental variable approach. I first use a humidity-for-weaving index as my instrument. Farnie (1979) points out that relative humidity played a key role in textile production.\textsuperscript{8} Humid air makes cotton fibers more pliable and reduces the chance of breakages in the yarn. The lowest acceptable level of relative humidity for production is around 60%. That is to say, hardly any cotton textiles can be produced when relative humidity drops below 60%. Beyond 60%, relatively humidity is positively correlated with the quality of woven cloth and the efficiency of the production process. But the effect flattens out after relative humidity reaches 80%. This motivates the use of county-level relative humidity, capped at 60% and 80%, as an instrument for premodern cotton textile production. I aggregate monthly average relative humidity of each county, based on their contribution to a suitable environment for spinning and weaving, into a humidity-for-weaving index. The rationale behind this index is to approximate the number of months available each year for cotton textile production, accounting for the quality of the woven cloth and the efficiency of the production process. I also use the interaction of the humidity-for-weaving index and distance to the center of national market (Suzhou) as a second instrument. In both cases, I obtain IV estimates that are comparable to the OLS estimates, offering more assurance that these coefficients can be causally interpreted.

To document the post-1840 persistence of sexist beliefs, I examine a range of other outcomes that are most likely to reveal beliefs of male superiority. These outcomes include

\textsuperscript{7}This is highly unlikely. As China entered into a period of state socialism, progressive family laws and labor laws were enacted at the national level to advance gender equality. Universal female employment was legally guaranteed and required by the state. Due to a high degree of centralization in legislation, formal institutions hardly vary from place to place, though policies are sometimes implemented with some local discretion.

\textsuperscript{8}Fairbank (1978) discusses the relationship between a relative humid climate of Jiangsu and the greater tensile strength and evenness of yarn.
the probability of women taking high-level positions, the probability of a wife heading the household, and female labor force participation during the pre-socialism periods. I find premodern cotton textile production is positively correlated with the probability of wife heading the household, the probability of women taking political and managerial roles and share of female workers at the onset of industrialization. This shows that sex selection is just one of the various ways in which sexist beliefs reveal themselves; where sex selection does not occur, due to moral, legal or technological constraints, men and women may still be valued differently driven by sexist beliefs.

I also explore the process of the cotton revolution changing the cultural valuation of women. Going back to the period at during which women’s value was reassessed following the cotton revolution, I document the market conditions, the institutional settings and women’s earnings from cotton textile production. Anecdotal evidence suggests that women in areas producing cotton textiles enjoyed greater autonomy and higher social status (Zhao, 2015). Using data collected from local gazetteers, I find a strong positive impact of cotton textile production on rates of widow survival in the Ming Dynasty (1368-1644). The ability for widows to survive independently of their husband certainly improved their well-being upon widowhood and could have been key to changing the cultural evaluation of women. Unlike widows elsewhere in the world, who are often isolated and subject to assault and persecutions, widows in areas suitable for cotton textiles generally maintained a decent standard of living and enjoyed relatively high social status. I argue that over the centuries, women’s productive work gradually reshaped beliefs of male superiority and norms of female autonomy.

This paper is organized as follows. Section II lists the related literature. Section III explains the historical context. Section IV discusses data sources and variable constructions. Section V summarizes my baseline results, a number of robustness checks, alternative hypotheses, results with additional controls for large economic and political shocks and an instrumental variable analysis. Section VI looks at sexist beliefs and the persistence of sexist beliefs after 1840. I find premodern cotton textile production, before the era of mass sex selection, consistently predicts a number of other outcomes reflecting sexist beliefs. In Section VII, I explore how premodern cotton textile production began to revise sexist beliefs in late imperial China. Section VIII concludes the paper.
II Related Literature

Going beyond traditional research on economic and political circumstances of women, recent literature has paid increasingly more attention to the role of culture and identity in determining gender outcomes (Fortin, 2005; Fernández, 2007; Fernández and Fogli, 2009; Gneezy, Leonard, and List, 2009; Alesina, Giuliano, and Nunn, 2013; Bertrand, Kamenica, and Pan, 2015; Hansen, Jensen, and Skovsgaard, 2015; Jayachandran, 2015). Fernández (2007) and Fernández and Fogli (2009) find cultural proxies have significant explanatory power for the work and fertility behavior of second-generation American women. Gneezy et al. (2009) find women compete less, but only in patriarchal societies. This study contributes to a more specific literature examining deep roots of gender bias, gender norms and gender-role attitudes. Jayachandran (2015) surveys roots of gender inequality in developing countries and finds that norms help explain the male-skewed sex ratio in India and China. This study contributes to a more specific literature that examines the deep roots of gender norms and gender-role attitudes.

Compared to previous work on the deep roots of gender norms, the historical setting of the cotton revolution is particularly attractive for the purpose of identifying the specific channel through which premodern life affects modern gender outcomes. First, the cotton revolution took place in one of the most advanced agricultural civilizations in the world. My study provides evidence in line with Alesina et al. (2013) in which gender-specific activities, rather than the intensification of agriculture (Hansen et al., 2015), has led to male domination. Unlike the plough, the adoption of more advanced spinning and weaving technologies in the context of China was not associated with more advanced stages of human civilization, typically accompanied by higher levels of inequalities and greater degree of specialization. Second, the cotton revolution proceeded in the absence of socio-political changes on a broader scale. China remained in a Malthusian environment after the cotton revolution. Textile producers were largely small businesses composed of nuclear or extended families. The wealth effects of the cotton revolution over the time was not nearly as large as in the west after the Industrial Revolution. Third, the cotton revolution increased the value of work women performed, without changing other aspects of their life. From 1300 to 1840, women continued to work from home in the same way they used to. They did not move to the cities or enter into new social networks because of work. This ensures the cotton revolution was a single shock on value of work, rather than a multi-facet shock that also affected the location or the organizational setting of work. Contrary to Alesina, Giuliano, and Nunn (2013), this study finds the effect of work does not rely on its location. Value of work can independently shape the perception women’s
productive role and their overall importance in society.

This study is also related to the “devaluation” hypothesis (England, 1992; Cohen and Huffman, 2003; England, 2010) within the sociological literature. The “devaluation” hypothesis has emerged to explain the persistent gender wage gap: if a job is done primarily by women, people tend to believe it has less value. In other words, women are culturally devalued in society, and consequently, female occupations and tasks are assumed to be less valued. Psychologists have noticed that both men and women tend to assign more worth and prestige to work performed by men (Deaux, 1985; McArther, 1985). A number of experiments reveal a tendency for both men and women to hold subconscious biases that devalue the work of women (Knobloch-Westerwick et al., 2013; Moss-Racusin et al., 2012). In a recent study, Sarsons (2015) finds women are perceived to have made less contribution with regards to group work. My study suggests the belief that women are of less intrinsic value is deeply rooted in premodern experience.

Gender norms and gender-role attitudes tend to be highly resilient. Despite increasing female labor participation, traits seen as typical of men and women have remained essentially unchanged from the 1970s to the 2000s (Spence et al., 1985; Prentice and Carranza, 2002; Oskamp and Schultz, 2005). Boudet, Petesch, Turk, and Thumala (2013) from World Bank find gender norms are relaxing in many communities, but not necessarily changing. Scholars have studied conditions under which gender norms can change. For instance, cable TV (Jensen and Oster, 2009), exposure to powerful women (Beaman et al., 2008) and state socialism (Görges and Beblo, 2015; Campa et al., 2015), are found to have helped to change gender norms and gender-role beliefs. As to whether extending economic opportunities to women can change gender-role beliefs and overcome gender stereotypes, evidence is mixed. Some studies find increased women’s earnings lead to female empowerment (Anderson and Eswaran, 2009; Aizer, 2010; Ashraf, Karlan, and Yin, 2010; Deininger, Goyal, and Nagarajan, 2010); other studies suggest gender norms can be incredibly resilient through channels including marital formation. My findings, however, supports the view that a shock large enough to economic opportunities available to women, for a sufficiently long time period, can ultimately reverse gender stereotypes and change the negative cultural valuation of women.

This study contributes to the broader literature on the historical determinants of cultural norms and beliefs. Many of these document the persistent impact of a negative shock on

---

9 For instance, Bertrand et al. (2015) find the gender identity norm where husband earns more than wife can affect marital formation and chances of divorce. Bertrand et al. (2016) find skilled women can be punished by negative social attitudes towards working women by a marriage gap.
current cultural values such as Nunn and Wantchekon’s (2011) work on the effects of the trans-Atlantic slave trade on corruption and trust today and Voigtländer and Voth’s (2012) study of the persistence of antisemitic beliefs in Germany. My study is closely related to those papers that study how past economic factors have shaped contemporary gender norms such as Grosjean and Khattar (2014) who examine conservative gender norms and its origins in historical marriage market conditions in Australia.\textsuperscript{10}

This study also contributes to the literature on sex ratio imbalance by identifying an cultural cause of observed sex ratio differences. Sex ratio imbalances, especially in India and China, have become an important topic of policy debate and attracted widespread scholarly attention. Sex selection on a large scale is held to be responsible for a great share of the ‘missing women’ evident in many parts of the world (Das Gupta and Mari Bhat, 1997; Arnold et al., 2002; Ebenstein, 2010; Lin et al., 2014). While sex ratios at birth are particularly skewed in India and China, the phenomenon is by no means limited to those countries. Daul and Moretti (2008) and Almond and Edlund (2008) find evidence for sex selection even in the United States. Edlund (1999) explicitly models sex ratios in relation to son preference, indicating several factors that contribute to unbalanced sex ratios. Jayachandran (2015) confirms the crucial importance of cultural factors in sex ratio imbalances. Gupta (2014) and Li and Lavely (2003) have studied son preference, sex-selective abortions, and changes in sex ratios in non-western countries.\textsuperscript{11} This study takes one step further by addressing the fundamental cause of son preference. In addition, by reviewing the history of widow survival in China, this paper also adds to the literature on “missing unmarried women” (Anderson and Ray, 2015; Miguel, 2005; Oppong, 2006; Sossou, 2002).

\textsuperscript{10}Other relevant studies include Jha (2013) who shows that cities in India that were medieval trading ports experienced significantly less religious riots between Muslims and Hindus in the period after 1850. Grosjean (2011) examines the persistence of a culture of honor among Americans of Scots-Irish descent. She finds that this culture of honor results in higher homicide rates among Scots-Irish in the US South and Mountain West but not elsewhere and argues that this culture has only persisted where formal institutions are comparatively weak.

\textsuperscript{11}Among non-cultural causes, scholars have identified relative adult female earnings (Rosenzweig and Schultz, 1982; Gupta, 1987; Duflo, 2003; Carranza, 2014) and biological factors (Oster, 2005) as causes of sex ratio imbalances.
III Historical Context

A Initial Conditions

A.1 Confucianism and Status of Women

Traditional Chinese society was shaped in important ways by Confucian values. A set of political and moral doctrines based on the teachings of Confucius became an important basis for the Chinese state since the Han Dynasty (206 BC-220 AD). By the late imperial period, the Chinese state standardized family practices across regions, classes and dialect groups, with far fewer time and space variation in inheritance practices, marriage rates, naming practices and patrilocality (Ebrey, 1990; Ropp, 1994).

Confucianism has a twofold impact on attitudes to women. On the one hand, the Confucian tradition strongly disfavored women. Confucianism lays a particular emphasis on continuing the family line, and only male offspring can fulfill this purpose. Daughters are seen as a liability. This cultural belief was consistent with economic reality prior to the emergence of the textile industry: daughters could not work outside home due to concern for women’s “purity”, and had to rely on family resources to survive. And unlike sons, a daughter would not be able to support her own parents once she became married as they had to move into the homes of their husband’s family and became an official family member there. As a result of the cost of dowries, too many daughters could cause serious financial distress to the household (Harrell, 1995; Watson and Ebrey, 1991). For the reasons described above, parents had an incentive to control the total number of daughters. Excess female mortality during infancy and childhood was widely observed. On the other hand, mothers and grandmothers had important and respected places in their families, and older women were often very powerful within their families.

In addition, Confucianism celebrated the virtues of hard work (Yu, 1985, 1992). It therefore elevated individuals who worked hard to provide for their family, including hard working women. This provided a path for women to earn the respect due to them for their con-

---

12 It is generally believed that a family would suffer economically from the birth of a daughter. In a play Qujiang Chi from early Yuan, the heroine refers to herself as pei qian huo, which literally means a money-losing proposition. The term is still used in Mainland China, Singapore, Malaysia, Taiwan, Macau and Hong Kong today. In 2007, the Yahoo dictionary in Taiwan was caught giving the English-language translation of the Chinese term pei qian huo as a. “a money-losing proposition” and b. “a girl; a daughter” (http://news.tvbs.com.tw/entry/305992 ).

13 Chow (1991) regards non-western women’s “purity” or “chastity” as both sexual and nationalistic.

14 Historian James Z. Lee and sociologist Cameron D. Campbell (2007) discovered that girls between ages one and five had a 20 percent higher mortality than boys.
tribution to the household. Diligent productive manual labor was seen as the virtue for all women, regardless of class (Mann, 1997). Qing China (1644–1911) enjoyed a relatively high degree of social mobility, and it was a society where it was conceivable for individuals to gain social status based on higher economic productivity.\footnote{Similar to China, Korea has a Confucian heritage. Both men and women celebrate devoted work and pursue high social status. In today’s Korea, women make up for 34% of the CEOs, compared to 9% in Western Europe and 5% in the US.}

\subsection{State and Women’s Work}

After agriculture, textile production was the most important economic activity in pre-modern societies. In China as in much of the preindustrial world, textile production was carried out by women “who spent every available moment spinning, weaving, and sewing.” (Barber, 1991). In China, spinning and weaving were perceived to be a womanly skill. “Men plow and women weave” as a form of division of labor, became formalized under the state tax system dating back to 300 AD. Under the state tax system, each household was required to pay in-kind taxes in both grain and textiles. Women were far more productive in textile production than in plough-based grain production, where as in other premodern societies male labor was more valuable. A peculiar feature of China is that a traditional command economy ensured both men and women had to work to fulfill the quota. Women’s vital role in state taxation is viewed by Bray (1997) as a positive factor in their status at home and in society.

\subsection{The Cotton Revolution}

In early times, silk and hemp were two main fabric for clothing. Silk was the most valued of all fabric; silk was mainly used in more expensive clothes and sold to international markets. Hemp was the predominant fiber for day-to-day clothes. Around 1300, as new spinning and weaving technologies for processing the cotton were put into use, cotton textile production became economically efficient for the first time in history (Bray, 1997; Kang, 1977). Huang Dao Po, a Shanghai native (1245–1330 AD), acquired new spinning and weaving technologies from an ethnic group Li residing on the Hainan Island and brought them back to her hometown.\footnote{Contemporary Li people still use those technologies for textile production. The production scene is an important part of tourist attractions for the Hainan Island.} On the spinning side, the new spinning wheel had three spindles as opposed to one. Women used both their hands and feet to keep the wheel spinning as opposed to just using hands. The multi-spindle design is a similar idea to that of the Spinning Jenny—the latter was invented in 18th Century England, and
was a predecessor to subsequent technologies used in textile manufacturing and was one of the earliest milestones for the British Industrialization Revolution. The adoption of the new spinning wheel in 14th Century China dramatically increased spinning productivity, which was a key bottleneck to increasing the productivity of the cotton textile industry—without the new spinning wheel, every weaver had to be matched with three to four spinners given the speed of spinning.\footnote{Other technology improvements include new techniques in cotton fluffing and crushing, and weaving insights in mixed cotton fabrics, colored fabrics and fabrics with mixed warp and weft fibers.} Following this technological breakthrough, cotton textile production rapidly expanded in the following two centuries. Due to its attractive properties, such as being durable and good for the cold-weather season, cotton quickly gained popularity over hemp. This was especially true for ordinary Chinese people and the imperial army stationed in frigid North China during the winter. Gradually, cotton textiles began to dominate the market of day-to-day clothes.

\section*{C Market, Trade and Women’s Income}

\subsection*{C.1 Long-Distance Trade}

The introduction of new weaving and spinning technologies led to greater productivity. The production capacity of individual textile producers exceeded the clothing needs of their family members. Parallel to proto-industrialization in Europe, there was an expansion of domestic industries producing goods for non-local markets (Ogilvie and Cerman, 1996). Cotton cultivation and spinning and weaving faced different constraints. The former called for a relatively dry climate with little rain during the growing season, and the later called for a more humid climate. Long-distance transportation of both cotton and cotton textiles emerged in response to differential endowments across regions. Part of the long-distance transportation of cotton textiles was conducted by the state as part of the traditional command economy. Huang (1964) estimates that in the early 17th century, at least one million bolts of cotton cloth were transported through the Grand Canal as tax payments to Ming Government.\footnote{1 bolt of cotton cloth is 33.33 meters in length. One million bolts of cotton cloth were worth half a million teals at the time.} For much of the Ming Dynasty, cotton textiles accounted for a large portion of taxes in kind, second only to grain. By late Ming, however, market exchange of cotton textiles became more prevalent as a market economy developed further with the “single whip” reform. The reform replaced per capita taxes and taxes in kind for most regions, which led to the further growth of a money economy and a great expansion of commerce. A booming money economy promoted domestic trade and increased the
market size for cotton textiles. The textile sector became increasingly commercialized and specialized.

C.2 Ownership Structures and Women’s Earnings

A core feature of premodern cotton textile production is its highly decentralized production and ownership structure. The basic unit of production were textile-producing households. Those households were essentially small businesses. Compared to silk, benefits of centralized production were much less clear for cotton textile production, as the economy of scale remained highly limited given the level of technology, and the quality and consistency of cotton textiles were not the most desired features by the majority of the consumers at the time. Even after the mid-19th century, after a significant part of spinning began to be displaced by foreign yarn, weaving by individual weavers remained competitive. Fairbank (1978, pp.15-28) documents that in the 19th century, rural China kept using handicraft cloth due to its lower prices and less wear and wear. Foreign merchants and consular officials in the late nineteenth-century China complained about difficulty of penetrating the Chinese market, especially in the interior provinces.

Premodern cotton textile production in China bore many similarities with the proto-industry in other advanced premodern economies such as 18h century England. The following key differences, however, deserve emphasis. (a.) Chinese households typically owned the machines rather than renting them. Households occasionally owned more than one machine and hired help, but on a very limited scale. (Fairbank, 1978) (b.) Few concurrent technology shocks occurred during the time frame (1300-1840). The cotton revolution took place in an agrarian economy, and the economy remained largely agrarian for the next sixth centuries. (c.) A relatively small number of regions had the geo-climatic conditions suitable for spinning and weaving, and especially, for weaving. (d.) Though the goods market was dense and highly sophisticated in both countries, the labor market was far from being a free labor market. Emperors in Ming and Qing instituted strict laws on labor mobility. The clan system continued to keep individuals tied to their extended families (as discussed in Greif and Tabellini, 2010, 2015). This constrained the reallocation of labor to areas suitable for cotton textile production. (e.) A higher percentage of Chinese families owned land than British families working under the putting-out system in the 18th century. Despite periodic increases in land concentration ratio as part of the dynastic cycle, China had no equivalent of the movement of enclosure Britain experienced (1600-1850). The majority of Chinese families were small landowners. Male labor was absorbed

---

19The Single Whip Law was initiated in the early 16th century, and promoted to the entire empire in 1580 by Zhang Juzheng (Flynn and Giráldez, 1995).
by grain production, for which women did not have the comparable physical strength. With land ownership, men often had to do field work to pay in-kind taxes and to realize the production value of land. Together (b.), (c.) and (d.) ensured that prices of cotton textiles stayed reasonably high—cotton textile prices hovered at a level that generated enough income for a skilled textile worker to support a family of four, whereas (a.) and (e.) led women to reaping most of the benefits from this revolution.20

Additional evidence confirms that women’s earnings from cotton textile production and trade were substantial. Li (1997) shows a woman’s textile work around the year was enough to feed 2.7 people. Pomeranz (2002) provides an even more optimistic estimate: a woman could earn four times as much as a man. Allen’s (2011) wage regressions indicate that textile workers earned a wage premium compared with workers in construction or agriculture. Women who had the skills to weave artisan cloth could earn an even higher income.21

C.3 Women as Primary Income Earners

Following the cotton revolution, women in textile regions became able to earn enough to support a household independently for the first time. Chinese women did productive work—in addition to reproductive work—even before the cotton revolution; nevertheless, the cotton revolution allowed women to produce for non-local markets and take on a new role as the major income earner of the household. By the late Ming period, women began to predominantly produce for the market, regardless of their marital status, and in many cases their income became the main source of family incomes. Pomeranz (2005) argues that women became more respectable due to their highly productive manual labor in textile production.22 Women’s ability to support themselves was frequently tested in the case of widowhood during the period when remarriage was discouraged: widows in textile regions remained solvent.

20 Allen (2009) shows one day’s work by a weaver in the late 17th century produced 7,684 calories, which was adequate to support a family.

21 The production of artisan cloth was backed up by popular demand of weddings and funerals in premodern China. Its production requires both higher skills of weavers and longer hours.

22 Man (2011) provides a summary of depictions of female breadwinners being tough and dependable. Her sources include: (Chen et al., 1991; Gu, 1995; Xu, 1987). In Xu (1987), Xu’s wife proudly proclaims that she single-handedly supports the family and is a ‘strong woman’, ‘she-husband’. Apparently, her husband is just passionate about literary writing and paintings, and clueless to how to make both ends meet.
IV Data

I construct my main variable, premodern cotton textile production, from thousands of local gazetteers published in historical times. I also construct contemporary measures of gender equality, historical and contemporary county characteristics from a large number of modern censuses, historical sources and GIS files, and climatic and geographic characteristics from the Climate Research Unit of University of East Anglia, FAO and NASA. From the digital world map collection of Harvard University, CHGIS, I obtain shape files that contain historical characteristics for the counties within China. For modern outcome variables, I use the county-level National Population Censuses (1990, 2000, 2010) and the 2004 Industrial Census from the China Geo Explorer, the Chinese City Statistical Yearbooks, individual-level census data (1982, 1990) from IPUMS-International, and Chinese General Social Surveys (2005, 2010). To construct large political and economic shock variables as well as past outcome variables, I tap into local gazetteers and make use of economic censuses and statistics compiled by missionaries in the early twentieth century.

In this section, I mainly focus on data used in my county-level analysis, where a total of 1489 counties, 198 prefectures, 15 provinces, and 8 socioeconomic macroregions are used. Data sources for other historical, geographic and contemporary variables can be found in the data appendix.

A Explanatory Variable: Premodern Cotton Textiles

Based on local gazetteers between 1368 and 1840, I construct an indicator variable on premodern cotton textile production at a county level.23 Local gazetteers were published by prefecture governments and county governments, containing information on locally-produced goods. I go through county-level and prefecture-level gazetteers to extract information on cotton textiles.

It is possible a county that started textile production first would see a larger impact of textile production in shaping values and beliefs. However, local gazetteers were not published regularly enough for me to pinpoint the timing of adoption by county. Due to similar data limitations, I cannot examine the quantitative dimension of textile production for most counties. I also do not have the full knowledge of the quality of cotton textiles. As quantity and quality can be potential sources of heterogeneity in the treatment effect,

---

23 The low availability of local gazetteers prior to the Ming Dynasty (1368-1644) leads to the decision of choosing 1368 AD as the starting point of data collection
the estimates should be interpreted as average treatment effect of premodern cotton textile production.

![Figure 1: Premodern Cotton Textiles](image)

B Main Proxy: Sex Ratio at Birth

I use sex ratio at birth from the 2000 Census. The reason for mainly using sex ratio at birth in the 2000 census is that (a.) sex selection technologies became widely available. While China started to import ultrasound scanners as early as 1980s, they only became cheap and widely available after 1990. By the mid-1990s, the majority of county-level hospitals, township-level clinics and local family planning agencies were equipped with ultrasound scanners (Chen et al., 2013). (b.) regional variation in the content and enforcement of the one-child policy was largely limited to two categories: urban versus rural hukou (household registration). After 2000, some counties began to experiment with a two-child policy for parents that were both the only child of their parents. (c.) marriage rates remained near universal, and voluntary infertility was relatively rare. This helps to reduce the bias from women from progressive regions opting out of marriage and motherhood. (d.) data quality of the 2000 census is reportedly higher than subsequent censuses. After 2000, due
to the emergence of a floating population composed of 200-million temporary migrants, the credibility of the population census declined. After controlling for contemporaneous economic forces, I expect sex ratio at birth in the 2000 Census to accurately reveal the underlying sexist beliefs, i.e. the belief that men are intrinsically worth more than women. There is considerable variation in the extent of sex ratios.

Data on sex ratios at birth are available at the county level. My main outcome variable is sex ratio at birth. In 2000, at the county level, sex ratios at birth range from 81:100 to 196:100. With the exclusion of five autonomous regions, there remains to be a wide range of sex ratios (92:100 to 193:100) across counties.

C Descriptive Statistics

I construct my data set as follows. I exclude five autonomous regions, as well as autonomous prefectures and counties in other provinces, that historically comprise ethnic minorities. Descriptive statistics for the county-level analysis can be found in Table A.1.

Table A.1 gives an overview of the key variables in the main sample. A total of 1489 counties are included. Sex ratio at birth is for Year 2000. Most modern variables are for 2000 as well, unless otherwise noted. About 40% of the counties had some form of cotton textile production before 1840. Average sex ratio at birth for 2000 is 118.9 boys per 100 girls, with a standard deviation of 14.2. Roughly 10% of the counties are on a major trade network (Grand Canal or Yangtze). An average county has a value of 4.398 on the humidity-for-weaving index, with a standard deviation of 2.277.

V Main Results

Having constructed a county-level measure of premodern cotton textile production, I can examine the relationship between premodern cotton textiles and gender equality in present-day China. I begin by examining variation at the county level. My outcome variable is sex ratio at birth. I test my hypothesis by estimating the following equation:

\[
\text{Sex ratio at birth} = \alpha + \beta \text{premodern cotton textiles}_c + X^H_c \Omega + X^G_c \Lambda + X^C_c \Pi + \epsilon_c, \quad (1)
\]

To deal with the challenge arising from tracking temporary migrants, the 2010 Census had to the recording method of “recording every individual encountered”. It was not usual to double count an individual in the place (by physical residence) he worked and in his hometown (by household registration).

I can derive an alternative measure of sex ratio imbalances by taking the natural log of the deviation of sex ratio at birth from the normal sex ratio. Results are very similar with this alternative measure.
where $c$ denotes a county. Premodern cotton textiles$_c$ is my measure of premodern cotton textile production at a county level. $X_c^H$ is a vector of historical controls, and $X_c^G$ and $X_c^C$ are vectors of geographical and contemporary controls respectively, each measured at the county level.

$X_c^G$ and $X_c^H$ are intended to capture geographic and historical characteristics that may have been correlated with premodern cotton textiles and may still affect present-day outcomes. I control for whether the county is on the Grand Canal or the Yangtze River—the major trade networks at the time—as access to market was apparently a factor in the production of commercialized premodern cotton textiles, and is likely to shape the past of a country in a variety of ways. I include in $X_c^H$ agricultural suitability and estimated population density in 1600. For an agrarian economy, agricultural productivity can have deep implications for economic fundamentals and social structures. For example, extreme poverty can induce infanticide as a survival strategy (Li, 1991), which might affect modern outcomes through attitudes towards sex selection. Population density in an agricultural society is a good proxy for economic development, and continues to affect modern populations through ancestral traits (Putterman and Weil, 2010). Due to a lack of historical population data at the county level, I use estimated population density in 1600 from Goldewijk et al. (2010) and Klein Goldewijk et al. (2011). In addition, to address a recent intervention—the establishment of treaty ports after 1840—I also include treaty port status as a control.\footnote{Treaty ports featured western institutions and a more industrialized economy. Jia (2014) finds a long-lasting impact of treaty ports established in the 19th century.}

To account for geographic differences across counties, I include in $X_c^G$ the natural log of distance to coast and the natural log of ruggedness plus one, latitude, longitude and their interaction. To deal with value of work done by women aside from cotton textile production, norms such as patrilocality and concern for women’s purity (Jayachandran, 2015) and other differences (e.g. rice vs. wheat culture) across regions, I include region fixed effects corresponding to socioeconomic macroregions defined by Skinner and Berman (2013).\footnote{Skinner’s socioeconomic macroregions capture deep-rooted differences across regions, and bisect provincial boundaries in many cases. Deeper roots of socioeconomic macroregions can date back to neolithic times (Appendix).}

The contemporary control variables $X_c^C$ include economic characteristics such as the natural log of a county’s per capita GDP measured in 2000, share of agriculture workforce, share of service workforce, share of urban hukou (household registration), social characteristics such as men’s years of schooling and share of ethnic population, and political characteristics including degree of political centralization of the prefecture containing the
Table 1: Premodern Cotton Textiles and Sex Ratio Imbalances: OLS Results

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of Dep. Var.</td>
<td>118.3</td>
<td>118.3</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
</tr>
<tr>
<td></td>
<td>(0.670)</td>
<td>(0.714)</td>
<td>(0.730)</td>
<td>(0.746)</td>
<td>(0.774)</td>
<td>(0.773)</td>
</tr>
<tr>
<td>Log per capita GDP</td>
<td>-2.775***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.474)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>agricultural</td>
<td>0.351</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.382)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>service</td>
<td>0.155</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.271)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men’s years of schooling</td>
<td>-2.662***</td>
<td>-5.015***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.725)</td>
<td>(0.556)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethnic</td>
<td>-0.676***</td>
<td>-0.820***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.251)</td>
<td>(0.248)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provincial capital</td>
<td>2.881***</td>
<td>2.104**</td>
<td>-0.299</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.006)</td>
<td>(0.980)</td>
<td>(0.959)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-governed</td>
<td>-3.988***</td>
<td>-0.343</td>
<td>5.449***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.324)</td>
<td>(1.113)</td>
<td>(0.898)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governed by province</td>
<td>-2.614**</td>
<td>-0.826</td>
<td>4.035***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.260)</td>
<td>(1.179)</td>
<td>(1.081)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Historical controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic Macroregion FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.149</td>
<td>0.229</td>
<td>0.365</td>
<td>0.347</td>
<td>0.304</td>
<td>0.288</td>
</tr>
<tr>
<td>Observations</td>
<td>1622</td>
<td>1622</td>
<td>1489</td>
<td>1489</td>
<td>1489</td>
<td>1489</td>
</tr>
</tbody>
</table>

Notes: The table reports the impact of premodern cotton textiles on sex ratio imbalances. The unit of observation is a county in 2000 Census. The dependent variable is sex ratio at birth. Column 1 reports estimates with only socioeconomic macroregion effects. Column 2 reports estimates with both socioeconomic macroregion and province effects. Column 3 includes all controls. “Historical controls” are treaty port status, agriculture suitability, and whether a county was on the Grand Canal or the Yangtze River (major trade network). “Geographic controls” are log of ruggedness plus 1, log of distance to coast, latitude, longitude and their interaction. Column 4-6 sequentially drops potentially endogenous modern controls. Economic controls are omitted from Column 4, social controls from Column 5, political controls from Column 6. Robust standard errors are used in all specifications. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
county, self-governance status of the county, and provincial capital status. Men’s years of schooling is included to proxy modernization. Average years of schooling is a more common proxy for modernization, but in this context, men’s years of schooling is used in lieu of average years of schooling, as women’s years of schooling is likely endogenous to differential parental investments motivated by sexist beliefs. As sex selection be a function of economic opportunities available to adult males and females (Rosenzweig and Schultz, 1982), I control for sectoral composition, i.e. share of agricultural workforce and share of service workforce. I use share of urban *hukou* to proxy urbanization, as well as to capture an important source of variation in the one-child policy. Degree of political centralization of the prefecture containing the county, self-governance status of the county, provincial capital status are intended to capture another important source of variation in the one-child policy through political control. Both share of urban *hukou* and self-governance status could have an effect on sex ratios through the one-child policy (Ebenstein, 2010). In addition, as there is a clear cultural component in son preference peculiar to the Han Chinese, I control for share of ethnic minority population to reduce composition bias.

OLS estimates of equation (1) including above controls are reported in Table 1. Column 1 reports estimates with only socioeconomic macroregion effects. Column 2 reports estimates with both socioeconomic macroregion and province effects. Column 3 includes all controls. From Column 4 to Column 6, potentially endogenous controls are dropped respectively, namely, log per capita GDP for Column 4, log per capita GDP, logged share of urban *hukou*, logged share of agricultural workforce and log share of service workforce for Column 5, logged share of ethnic population for Column 6.

The estimates show that in counties with premodern cotton textile production, fewer girls are missing today. The coefficient estimates are both statistically significant and economically meaningful. I start my analysis with socioeconomic region fixed effects only (Column 1), and then both socioeconomic region fixed effects and province fixed effects (Column 2). When I include the full set of controls in Column 3, the size of the coefficient barely changes relative to Column 1 (from -3.686 to -3.551). Premodern cotton textile

---

28 Chinese prefectures and counties underwent institutional reforms after 1982. Political centralization and self-governance status started to vary across prefectures and counties. Degree of political centralization of the prefecture takes the value of one when a prefecture has a prefecture-level government; zero, otherwise. Self-governance status of the county takes one when it is governed by the prefecture-level government, two when it is self-governed, and three when it is governed by the province-level government.

29 While the one-child policy was strictly enforced among Chinese citizens with urban hukou, a more lenient version was enforced among those with rural *hukou*.

30 Autonomous counties and prefectures, which are predominately resided and governed by ethnic minorities, are already excluded from the main sample.
production is associated with a decrease of sex ratio at birth by 3.551 boys per hundred girls, which is a quarter of the standard deviation of sex ratio at birth. Column 3 serves as a baseline regression for the rest of this study. Figure 2 shows a partial correlation plot corresponding with the baseline regression. I exclude economic controls in Column 4. The coefficient estimate remains highly similar, suggesting that the strength of the coefficient for textile production does not depend on whether I control for per capita GDP, log share agricultural workforce, log share service workforce and log share urban hukou. In Column 5, I exclude social characteristics including men’s years of schooling and share of ethnic population. In the last column, I exclude political variables, provincial capital status, degree of political centralization and self-governance status of a county. I expect them to affect sex ratio at birth through fertility, which is a function of the enforcement of the one-child policy. However, those variables can certainly be endogenous to historical conditions. After omitting political controls, I find my coefficient estimate remains highly similar to those in previous columns.

Results with different clustering rules can be found in the appendix. A wild cluster bootstrap-t procedure is used to improve inferences with clustered errors in cases where only a small number of clusters are present, i.e. clustering at the level of socioeconomic macroregion (eight clusters) or province (fifteen clusters). Cameron et al. (2008) show that this procedure performs quite well even when the number of clusters is as few as six. I show results are not sensitive to how standard errors are clustered.

To estimate the degree of selection on unobservables, I use the approaches suggested by Altonji et al. (2005) and Oster (2014). In the appendix, I show that ratio of selection on unobservables relative to selection on observables has to be two to eighteen times larger to explain away my results. Based on the assumption made in Altonji et al. (2005) that unobservables should not be more important than observables in explaining the treatment,

---

31 The specification is also robust to the inclusion of the squared term of log per capita GDP. Chung and Gupta (2007) suggests income levels play a key role in unbalanced sex ratios and that sex ratios can change in nonlinearity through different stages of development. Jayachandran (2014) attributes worsening sex ratios with economic development to the desire for small families. Overall, this should not be a concern for this study, as fertility is fixed by the one-child policy.

32 Though large sex ratio imbalances are a relatively new phenomenon in China, the underlying sexist beliefs are not, and per capita GDP could have been negatively affected by past gender discrimination. Sex ratio imbalances per se can also affect GDP through increasing saving rates (Wei and Zhang, 2011). In either case, controlling for log per capita GDP will constitute the case of “overcontrolling” [pp.64-68] (Angrist and Pischke, 2008).

33 Share of ethnic population might have become more endogenous to the dependent variable in the past few decades due to the differential application of the one-child policy on Han Chinese and ethnic minorities. It is documented that inter-ethnic marriages have become more common under one-child policy (Potash, 2016), as ethnic minorities are often not subject to birth quota.
this is highly unlikely.

A Robustness Checks

A.1 Subsamples

I first check the robustness of my results to the use of alternative samples. The Yangtze Delta is of special importance to Chinese economy, both in the past and in the present (Skinner, 1980; Li and Li, 1998). I test to see if my results are robust to the control or the omission of the Yangtze Delta.

Next, I look at counties with different rates of migration. Historically, labor mobility was low due to the long-standing clan system. In modern China, the speed of migration has increased. Gender norms in the less developed regions of China could have become more entrenched if more progressive individuals are more likely to move to more developed areas. Hence my results could be biased if past locations of cotton textile production are correlated with unobserved characteristics of counties that are now home to migrants. For robustness, I control for net in-migration, or omit counties with positive net in-migration.

Table A.4 in the appendix summarizes the results. Coefficient estimates are slightly bigger for counties outside of the Yangtze Delta and for counties with no net in-migration.
A.2 Sex Ratios at Birth for Older Cohorts

In the main analysis, I focus on sex ratio at birth in the 2000 Census. A natural question arises whether the same pattern holds for slightly older cohorts subject to similar conditions, including strict enforcement of the one-child policy and widespread ultrasound screening, or it is just one-time phenomenon for 2000. Based on 2000, I construct two additional variables from the 2000 Census: sex ratio for aged 1 to 4, sex ratio for aged 5 to 9. I find in Table A.5, coefficient estimates are of a similar percentage of, as well as move in the same direction as the mean of the sex ratio at birth. Overall, I find premodern cotton textile production affects the cohorts born after 1990—when ultrasound screening became widely available—in a consistent manner. The relationship between premodern cotton textiles and sex ratio at birth revealed by the 2000 census is unlikely just a fluke or a mere artifact of underreporting of female newborns.\(^{34}\)

A.3 Additional Outcomes and Placebos

Table A.6 examines alternative gender outcomes from the same census. I find premodern cotton textile production is also positively associated with women’s educational attainment. As gender-specific economic opportunities are already controlled for in the regression, I interpret this mainly as evidence for underinvestment in girls’ education by their parents driven by sexist beliefs. In 2000, premodern cotton textile production is associated with an increase of 0.113 years of schooling for women. The coefficient estimate remains virtually the same and in fact, increases slightly to 0.117, after controlling for men’s years of schooling. In Column 3, I replace women’s years of schooling with men’s years of schooling, and I do not find a significant effect, and the coefficient is slightly negative (-0.0042). This shows premodern cotton textile production has a very specific effect on women, rather than a general development effect.

B Competing Hypotheses

B.1 Economic Activities Favoring Women

**Cotton Cultivation** Cotton cultivation precedes spinning and weaving. Compared to plough-based grain production, cotton cultivation does not demand as much upper body

---

\(^{34}\) Underreporting happens when parents conceal the identity of newborns and leave them unregistered. A share of such female children with concealed identity will recover their identity at school age and thereafter, they will be recorded in the census. To note, underreporting, albeit not equal to sex selection, is still a reflection of gender inequality. Unregistered individuals have limited access to most public goods, such as education and medical services.
strength. Women, in theory, have no clear disadvantage in cotton cultivation compared to men and were likely involved in cotton picking historically. In a setting where cotton cultivation occurs alongside spinning and weaving, it would be difficult to separate two effects if women are involved in both. However, as the locations of cotton cultivation often do not overlap with the locations of spinning or weaving, due to very different climatic conditions being required by each of those activities, I can separate the two effects using geographic variation. I use cotton suitability to proxy the probability of growing cotton in each county, and find no significant effects of cotton cultivation on my dependent variable (Columns 1). This is not surprising as a key difference between cotton cultivation versus spinning and weaving, is that the latter is higher value-added. Picking cotton did not seem to advance women’s position as much as the more lucrative activities—spinning and weaving—did.

All textiles To separate out the effects of cotton textile production from that of general textile production, such as the spinning and weaving of silk and hemp, I include a control for general textile production. Compared to cotton textile production, hemp was produced for a much lower unit value, and also at a lower quantity. Hemp-based textiles did not generate nearly as much incomes as cotton textiles did. While low-quality silk was produced at home, high-quality silk was produced at state-owned workshops in just a few urban areas. I find general textile production has no significant impact on sex ratio at birth (Column 2), after controlling for cotton textile production.

Tea Production Women have a historical role in tea picking (Lu, 2004). Qian (2008) finds that in modern China, a short-term increase in tea prices can enhance women’s household bargaining power and increase the share of surviving girls. To account for the potential long-term effects of premodern tea picking, I include tea suitability in Columns 3 and find no significant effects of premodern tea production. The coefficient estimate of premodern cotton textile production barely changes after the inclusion of tea suitability. Compared to cotton textile production, tea-picking was more seasonal and occasional, and unlikely to generate as much market incomes as cotton textile work. This shows, from another angle, that the value of women’s work, in addition to women’s participation in work, indeed played an important role in shaping the view of women.
Table 2: Competing Hypotheses

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of Dep. Var.</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
</tr>
<tr>
<td></td>
<td>(0.732)</td>
<td>(0.811)</td>
<td>(0.732)</td>
<td>(0.735)</td>
<td>(0.731)</td>
<td>(0.734)</td>
<td>(0.737)</td>
<td>(0.730)</td>
<td>(0.733)</td>
</tr>
<tr>
<td>Cotton</td>
<td>0.224</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.038)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All textiles</td>
<td>0.146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.900)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tea</td>
<td></td>
<td>0.194</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.684)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td></td>
<td>-0.541</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.487)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plough</td>
<td></td>
<td></td>
<td>4.087***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.579)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neolithic Settlements</td>
<td></td>
<td></td>
<td></td>
<td>-2.103**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.903)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-1300 commerce</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0215</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.0959)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#courier routes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.444</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.370)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern textile industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.429</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.279)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic Macrot Region</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.365</td>
<td>0.365</td>
<td>0.364</td>
<td>0.364</td>
<td>0.368</td>
<td>0.367</td>
<td>0.365</td>
<td>0.365</td>
<td>0.366</td>
</tr>
<tr>
<td>Observations</td>
<td>1478</td>
<td>1489</td>
<td>1484</td>
<td>1484</td>
<td>1489</td>
<td>1489</td>
<td>1489</td>
<td>1489</td>
<td>1489</td>
</tr>
</tbody>
</table>

The table reports the results of testing competing hypotheses. The unit of observation is a county in 2000 Census. The dependent variable is sex ratio at birth. Baseline controls are those used in Column 3 of baseresults. Pre-1300 commerce is measured by log (commercial tax quota in 1077+1). # courier routes refers to number of courier routes passing a county historically. Robust standard errors are included in all specifications. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Rice Cultivation  Compared to wheat cultivation, women had a certain degree of participation in rice cultivation. The type of rice that was grown in China proper was mostly wetland rice. The area suitable for wetland rice was highly concentrated in the south. I, therefore, include a dummy for rice cultivation, taking the value of zero when wetland rice suitability equals zero, and the value of one when wetland rice suitability is greater than zero. In Column 4, I find wetland rice indeed decreases sex ratio at birth, but its coefficient is insignificant. The change in the coefficient size of interest is negligible (from -3.381 to -3.387).

B.2 The Use of Plough

The plough was widely used in much of China proper with little variation. Yet, it remains possible that the plough is related to the production of cotton textiles. One benefit of using the plough is usually higher productivity. Cotton textiles were likely to be produced in order to offset lower productivity associated with non-plough agriculture. If that is true, I might be picking up the effects of not using the plough, rather than the effects of producing cotton textiles. In Column 5, I include a measure of ancestral plough use as my control. I find ancestral plough use is indeed associated with a more skewed sex ratio at birth, but only a small decrease in my coefficient of interest.

B.3 The Neolithic Revolution

Intensification of agriculture since the Neolithic Revolution is said to be correlated with the deterioration of women’s status (Hansen, Jensen, and Skovsgaard, 2015). Years since the Neolithic Revolution can be used to proxy exposure to intensification of agriculture, but is typically only known at the country level or above. Instead I use a measure of settlements during the late Neolithic Period to proxy exposure to advanced agriculture. I do not find neolithic settlements to be correlated with a more skewed sex ratio. This is most likely due to the migration from neolithic settlements to more peripheral regions over thousands of years. My coefficient of interest remains more or less the same as the baseline estimate.

B.4 Pre-1300 Commercial Networks

Prior to the cotton revolution, Song China (960-1279) was a highly developed commercial society. Overall economic development and commercialization could have led to both cotton textile production and progressive gender norms. I include the pre-1300 commercial

35Following Alesina, Giuliano, and Nunn (2013), I use a 200km radius to determine the territory of a ethnic group listed in Ethnographic Atlas.
tax quota in Column 7 of Table 2 and find only a small increase in the size of coefficient of premodern cotton textiles. The coefficient estimates of pre-1300 commercial tax quota is insignificant. In contrast to Bertocchi and Bozzano (2015), I do not find past commerce per se to be conducive to the status of women.

B.5 Historical State Capacity

Historically, the state played a key role in the relationship between cotton textile production and women. As noted in Section III, the division of labor “men plow and women weave” was ensured by a traditional command economy that required in-kind taxes. Cotton textiles became an in-kind tax shortly after 1300, just like traditional textile products such as silk and linen. Also, local governments could have also directly affected the adoption of new textile technologies. Despite the ubiquitous nature of today’s Chinese state, one might still suspect there is a degree of persistence in state capacity or culture of compliance. If so, historical state capacity could affect the enforcement of state policies in modern China, such as the one-child policy or the compulsory education reform launched in 1986. Therefore, historical state capacity can simultaneously influence locations of premodern cotton textile production and gender outcomes in contemporary China. I include number of historical courier routes through a county as a proxy for historical state capacity, or a dummy variable. This is a similar idea to Acemoglu et al. (2015). Historically, courier routes in China were used and managed by the central government for conveyors and messengers to fast deliver high-profile news (Yang et al., 2006). In Columns 8 of Table 2, I find historical state capacity is negatively correlated with sex ratio at birth. Greater state presence does improve relative outcomes of women. However, the coefficient estimate of premodern cotton textiles barely changes when historical courier routes are controlled for, suggesting that the two effects are most likely independent of each other.

B.6 Modern Industrial Composition

One possibility is that premodern cotton textiles could shape gender outcomes through the persistence in industrial composition. With the availability of modern humidification technologies, there is little reason to think textile companies continue to locate only in humid areas. However, being in a naturally humid area might still attract modern textile companies due to cost-saving considerations. In addition, human capital accumulated in premodern cotton textile production might find its ways into modern textile production, attracting companies to locate close to where talents are. In this case, current textile production is an outcome of premodern cotton textile production. But it stands as a separate channel from the proposed mechanism, i.e. premodern cotton textile production affects
gender outcomes by reshaping sexist beliefs. In Column 9 of Table 2, I include number of textile companies or a dummy variable as a control. I find the scale of modern textile production indeed reduces sex ratio imbalances. The size of the coefficient of interest falls only by 0.1. This suggests only a tiny proportion of premodern cotton textile production affects women’s status in contemporary China through the economic opportunities provided by the modern textile industry.

C Post-1840 Political and Economic Shocks

C.1 Early Industrialization

After 1840, China began to slowly modernize and industrialize. However, industrialization in China was highly limited and isolated (Fairbank, 1978). During the late Qing and Republican era, much of the rural and hinterland China continued to perform household production and their traditional lifestyles. In 1933, almost a hundred years after the first treaty port was established, the handicraft industry still made up for 61% of the total industry output.

In spite of industrialization being limited for China at least until 1949, it can still have an impact for the affected region. If counties with premodern cotton textiles overlapped with areas that experienced early industrialization, which in turn affected women’s position in society, it could bias my results. Using the knowledge that much of 19th century industrialization took place in treaty ports, I include treaty port status as a proxy for early industrialization (treaty port status is already included in the baseline regression. Columns 1 through 3 of Table 3 shows my coefficient of interest is controlling for or omitting treaty ports. Treaty port status has an independent effect on sex ratio imbalances. The interaction term between treaty port status and premodern cotton textiles is close to zero and insignificant, suggesting premodern cotton textile production has no differential impact on modern sex ratio imbalances by treaty port status. The coefficient size of premodern cotton textiles increases slightly when all treaty ports are excluded in Column 3.
Table 3: Post-1840 Political and Economic Shocks

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of Dep. Var.</td>
<td>118.6</td>
<td>118.6</td>
<td>119.1</td>
<td>118.8</td>
<td>118.8</td>
<td>119.4</td>
<td>118.6</td>
<td>118.6</td>
<td>118.6</td>
<td>118.8</td>
<td>118.6</td>
<td>118.8</td>
<td>118.6</td>
<td>118.6</td>
<td>118.8</td>
</tr>
<tr>
<td>(0.730)</td>
<td>(0.761)</td>
<td>(0.764)</td>
<td>(0.878)</td>
<td>(1.401)</td>
<td>(1.012)</td>
<td>(0.729)</td>
<td>(0.779)</td>
<td>(0.794)</td>
<td>(1.399)</td>
<td>(0.877)</td>
<td>(1.399)</td>
<td>(1.399)</td>
<td>(1.399)</td>
<td>(1.399)</td>
<td>(1.399)</td>
</tr>
<tr>
<td>(1.046)</td>
<td>(1.281)</td>
<td>(1.478)</td>
<td>(1.470)</td>
<td>(2.020)</td>
<td>(1.064)</td>
<td>(1.065)</td>
<td>(1.422)</td>
<td>(2.040)</td>
<td>(1.473)</td>
<td>(1.473)</td>
<td>(2.871)</td>
<td>(2.871)</td>
<td>(2.871)</td>
<td>(2.871)</td>
<td>(2.871)</td>
</tr>
<tr>
<td>× Treaty port</td>
<td>-0.466</td>
<td>-0.980**</td>
<td>-0.449</td>
<td>-0.980**</td>
<td>1.188*</td>
<td>0.997</td>
<td>-0.955**</td>
<td>0.997</td>
<td>-0.670</td>
<td>-0.670</td>
<td>-0.670</td>
<td>-0.670</td>
<td>-0.670</td>
<td>-0.670</td>
<td>-0.670</td>
</tr>
<tr>
<td>Baseline controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Macroeconomic FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.365</td>
<td>0.365</td>
<td>0.390</td>
<td>0.355</td>
<td>0.356</td>
<td>0.371</td>
<td>0.365</td>
<td>0.366</td>
<td>0.362</td>
<td>0.357</td>
<td>0.355</td>
<td>0.355</td>
<td>0.355</td>
<td>0.355</td>
<td>0.355</td>
</tr>
<tr>
<td>Observations</td>
<td>1489</td>
<td>1489</td>
<td>1289</td>
<td>993</td>
<td>993</td>
<td>766</td>
<td>1489</td>
<td>1489</td>
<td>1260</td>
<td>993</td>
<td>993</td>
<td>993</td>
<td>993</td>
<td>993</td>
<td>993</td>
</tr>
</tbody>
</table>

Notes: The table reports the impact of premodern cotton textiles on sex ratio at birth accounting for political and economic shocks. The unit of observation is a county in 2000 Census. The dependent variable is sex ratio at birth. Baseline controls are those used in Column 3 of baseresults. Christianity is measured by log (communicants per 10,000+1). “on the coast” refers to a county within 50 kilometers of the coast. Column 3 drops all treaty ports. Column 6 drops all counties with more than 10 out of 10,000 individuals being communicants. Column 9 drops all coastal counties. Column 10 include all interaction terms. Column 11 includes only baseline controls and uses the same sample as Column 10. As part of the baseline controls, treaty port status and provincial capital are controlled for in all specifications. Robust standard errors are included in all specifications. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 


C.2 Expansion of Christianity

Missionaries came to China to spread Christian religions in the 19th Century. They built churches, schools and hospitals. While only a small share of Chinese populations were converted, some of them might have had a disproportional influence on the rest of society. Christianity values life, and assigns value to women in a different way that Confucianism or traditional Chinese religions does. Conversion to Christianity might have changed attitudes towards infanticide and the view of women. To check this, I first include logged number of communicants per 10,000 plus 1 in the regression in Column 4. As expected, the higher representation of communicants in the population reduces sex ratio at birth. The size of the coefficient of interest increases by roughly one-fifth, suggesting some of the effects of premodern cotton textile production might have been masked by missionary activities in counties with no history of cotton textiles. I then interact log number of believers per 10,000 plus 1 with premodern cotton textiles in Column 5. The coefficient is positive for the interaction term, but not significant. This implies the effect on premodern cotton textiles is smaller for counties with a higher representation of communicants, and likewise, the effect of Christianity is smaller for counties with premodern cotton textiles. In Column 6, I drop all counties with more than 10 out of 10,000 residents being communicants. Within this subsample, my coefficient of interest increases in size. However, since neither missionary activities nor conversion was randomly assigned, it is hard to interpret the exact cause of a greater impact of premodern cotton textiles in counties with few believers in Christianity.

D Post-1979 Economic Reforms

The Chinese State has relaxed its control on economy and society since 1979. In amidst of economic development, previously hidden gender inequality has since surfaced (Li and Lavelle, 2003). On one hand, there remains very little variation in either labor laws or maternity leave law at a local level. On the other hand, the recent thirty years of growth in China could have led some regions to develop temporary rules or measures that increase or decrease gender equality as a byproduct of economic growth. I am less interested in the manifestation of existing gender bias, as this could just be endogenous to premodern cotton textiles. Rather, I attempt to address the effect of heterogeneous economic growth on economic, legal and social institutions.

China’s export-led economy in the past 30 years has rendered coastal regions a tremendous growth advantage. The Yangtze Delta and the Pearl River Delta are home to million of exporters. Besides, the central government created the earliest special economic zones all
on the coast too. I exploit the varying exposure to economic reforms between the coastal and non-coastal region, to estimate the impact of recent economic reforms on sex ratio at birth. In the baseline regression, I already control for per capita income, along with other economic and social controls. In Columns 7-9, I include the coastal region as a dummy, interact the coastal region with premodern cotton textiles, and drop the coastal region from the sample. In Column 9 I simply drop all coastal regions, and find the coefficient size of interest increases by roughly a third. This suggests that premodern cotton textile production has a larger effect of reducing sex ratio imbalances in the non-coastal region than in the coastal region.

I include controls for large political and economic shocks and interacted them with premodern cotton textiles in Column 9. This results in a sample of 993 counties. I find premodern cotton textile production reduces sex ratio imbalances by 5.6 boys per hundred girls in places with no exposure to any of the large political and economic shocks, when those shocks are taken as exogenous. Within the same sample, in Column 10, premodern cotton textile production reduces sex ratio imbalances by 3.6 boys per hundred girls.

### E Instrumental Variable Strategy

In spite of a detailed examination of alternative hypotheses and external shocks, I still cannot rule out all possible omitted variable bias. Below I use an instrumental variable strategy that allow me to circumvent the problem of omitted variable bias. A potential concern with the OLS estimates is that the counties in which cotton textiles were produced may have a higher likelihood of adopting textile technologies due to economic or political factors. It is possible that counties that were economically more developed were more likely to have adopted textile technologies, and counties closer to the market or transportation routes were more likely to sustain its production and make greater profits. If these counties had less sexist beliefs to start with, this would bias the OLS estimates away from zero. Though a set of variables (agricultural suitability, log population density, distance to the major trade network, distance to the coast, ruggedness and socioeconomic macroregion fixed effects) have been included in the baseline regression, I am unable to address likely issues caused by unobservable characteristics, such as attitudes towards women prior to textile production at a county level. Besides, due to imperfect data on premodern cotton textile production, some of the coefficient estimates can suffer attenuation bias due to measurement error.
E.1 Logic of the Instrument

A few factors are known to be crucial for producing cotton textiles for non-local markets, such as a wet climate and a reasonable distance to the major trade network. Besides, proximity to the technology center—Songjiang—was clearly a factor in technology diffusion. I use a relative humidity index and the interaction of the relative humidity index and distance to the center of national market (Suzhou) as instruments for the treatment of cotton textile production.

Relative humidity is of particular importance to spinning and weaving. Scientists, engineers and industry experts highlight the importance of relative humidity in producing textiles. In a report on the textile industry in China (1909), the word “humidity” occurs more than 100 times, suggesting the pivotal role of humidity in the textile industry. Spinning and weaving takes place far more smoothly in humid climates. When spinning and weaving is carried out in spite of unfavorable climates, finished products are of much poorer quality compared to those produced in more favorable climates. Historically, low humidity severely hampered a county’s performance in the high-ended markets, as top-notch cotton cloth could only be produced when relative humidity was close to or greater than 70%. Apart from average relative humidity, variance in relative humidity also affects production decisions. For places with the same average humidity, higher variance could imply the actual amount of time available for production is less. This applies to the day, month and year. A spinning wheel represents a fixed cost. For a family the total amount of time suitable for textile production is a key consideration to owning a spinning wheel in the first place. Motivated by the thinking that variance also matters, I use month-level relative humidity to calculate my humid index, rather than average yearly relative humidity. The intent is to approximate the number of months wet enough for spinning and weaving. The measure is likely to pick up the quality and quantity dimension of cotton textile production as well, which is an improvement over my categorical treatment variable.

The logic behind the inclusion of distance to the center of national market as part of an instrument is straightforward. Without access to national market, the scale of cotton textile production would be limited to for the use of family members. In an county farther away from the center of national market, despite a high potential to produce, women were likely to produce cotton textiles for home use or for local markets only. This would limit the realization of market incomes and lead to different assessments of women’s value.
E.2 Construction of the Instrument

I first construct a relative humidity index to capture the suitability information for weaving. The index is termed the “humidity-for-weaving” index. The Climate Research Unit of University of East Anglia provides 30-year monthly average relatively humidity data across 10 arc-minute by 10 arc-minute grid cells globally. I construct my humidity-for-weaving index in the following way: first, I measure suitability for weaving at the monthly level. This monthly measure decreases in suitability (capped at 60% and 80%); second, I aggregate values of the monthly measure over twelve months; finally, I take the inverse of the total to create a humidity-for-weaving index such that the index increases in suitability for weaving. One benefit of having a relative humidity index specific to weaving is that I can extract useful information from relative humidity while avoiding additional biases. Figure 5 shows the distribution of humidity-for-weaving index at a county level. Darker shades represent higher relative humidity and hence, higher weaving suitability. Missing values are shaded white.

![Humidity-for-Weaving Index](image)

Figure 3: IV: Humidity-for-Weaving Index
Table 4: The Impact of Humidity-for-Weaving on Placebo Outcomes

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premodern Silk or hemp</td>
<td>Cotton</td>
<td>Rice dummy</td>
<td>Tea</td>
<td>Ag suitability</td>
<td>Pop. density in 1600</td>
<td></td>
</tr>
<tr>
<td>Mean of Dep. Var.</td>
<td>0.480</td>
<td>0.741</td>
<td>2.182</td>
<td>0.498</td>
<td>82.51</td>
<td>4.798</td>
</tr>
<tr>
<td>Humidity-for-weaving</td>
<td>0.640***</td>
<td>0.245</td>
<td>-0.401</td>
<td>0.668**</td>
<td>-37.40</td>
<td>-0.538</td>
</tr>
<tr>
<td>(0.178)</td>
<td>(0.168)</td>
<td>(0.748)</td>
<td>(0.260)</td>
<td>(36.28)</td>
<td>(0.610)</td>
<td>(0.363)</td>
</tr>
<tr>
<td>Baseline controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic Macroregion FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.440</td>
<td>0.344</td>
<td>0.629</td>
<td>0.841</td>
<td>0.811</td>
<td>0.616</td>
</tr>
<tr>
<td>Observations</td>
<td>1489</td>
<td>1489</td>
<td>1482</td>
<td>1484</td>
<td>1484</td>
<td>1489</td>
</tr>
</tbody>
</table>

Notes: The table reports falsification tests of humidity-for-weaving index. The unit of observation is a county in the 2000 Census. All controls in Column 3 of Table 1 are included, with the exception of the one that happens to be the dependent variable in that specification. Socioeconomic macroregion and province fixed effects are included in all specifications. Robust standard errors are included in all specifications. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

### E.3 Validity of the Instrument

For the instrumental variable strategy to work, my humidity-for-weaving index has to affect long-run outcomes only through premodern cotton textile production. One concern is that relative humidity may have affected the productivity of other economic activities women were engaged in, such as cotton cultivation, tea and rice production. Another concern is that relative humidity may have had direct effects on sex ratio at birth through other ancestral traits of the modern population which were shaped by past economic environment, such as agricultural productivity and population density in the past. While the humidity-for-weaving index is built around the ideal condition for weaving, the ideal condition for weaving can be correlated with ideal conditions for other economic activities as well.

To address the above concerns, I regress my relative humidity on cotton suitability, tea suitability or rice suitability, overall agricultural suitability and population density in 1600, respectively. I show in Table 4 that the instrument is strongly correlated with premodern cotton textile production, but not correlated with cotton suitability, tea suitability or rice suitability, overall agricultural suitability or population density in 1600.

To create a more exogenous source of variation in premodern cotton textile production,
I also use the interaction of the humidity-for-weaving index and the interaction of the humidity-for-weaving index and distance to Suzhou as my other IV.

E.4 Instrumental Variable Results

I begin my IV estimation by testing the relationship between my instruments and premodern cotton textile production. As my treatment variable is binary, I use Probit-2sls as my estimation strategy. Probit-2sls uses a Probit model for the first stage. Properly modeling the relationship between the humidity-for-weaving index and premodern cotton textile production using a Probit model can best mitigate the problem of weak instruments due to omitted nonlinearity (Henderson and Parmeter, 2015).

Panel A of Table 5 shows the estimates from the first stage: my instrument is positively correlated with premodern cotton textile production. Second-stage results are reported in Panel B. Column 1 contains my OLS estimates. Column 2 report my IV estimate with humidity-for-weaving index being the instrument. My IV estimate is that a one-standard-deviation increase in premodern cotton textiles leads to a reduction of sex ratio at birth by 3.59 boys per hundred girls (3.59 = 7.34 * 0.49). This is slightly greater than the OLS estimate. I argue the increase in coefficient estimates can be partly explained by the removal of attenuation bias due to the use of better measured data. The gap between my OLS estimate and IV estimate narrows significantly when I use the interaction term of humidity-for-weaving index and distance to Suzhou.

VI Sexist Beliefs and the Persistence of Sex Beliefs

A Sexist Beliefs: Evidence from CGSS

Thus far I have examined the effects of premodern cotton textile production on sex selection, which can be interpreted as an ad-hoc revelation of the assessed value of women.

---

36 I follow a three-stage procedure recommended in Wooldridge (2002, pp.623-626). The procedure including the following steps: first, use probit to regress the treatment on the instrument and exogenous variables; second, use the predicted values from the first step in the first stage of an regular 2sls procedure, together with the exogenous variables; third, run the second stage as in a regular 2sls procedure.

37 Henderson and Parmeter (2015) instruments that may be strong in a nonlinear relationship with the treatment could be weak when a linear relationship is imposed upon. An alternative method to address nonlinearities is to use a nonparametric instrument. However, Newey (2013) shows that nonparametric IV estimation only works well when the strength of the instrument is very high. He shows that when the reduced form R-squared is low, and a linear IV slope can be estimated, the variance of the coefficients of nonlinear terms will be very high.
Table 5: Pre-Modern Textiles and Sex Ratio at Birth: Instrumental Variable Analysis

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS IV</td>
<td>OLS IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity-for-weaving</td>
<td>Humidity-for-weaving (inverse)</td>
<td>Humidity-for-weaving × dist. to Suzhou</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premodern cotton textiles</td>
<td>-3.387***</td>
<td>-7.347**</td>
<td>-3.564***</td>
<td>-5.830*</td>
</tr>
<tr>
<td></td>
<td>(0.731)</td>
<td>(3.375)</td>
<td>(0.741)</td>
<td>(3.047)</td>
</tr>
<tr>
<td>Humidity-for-weaving (inverse)</td>
<td>-0.00677</td>
<td>-0.00509</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00856)</td>
<td>(0.00853)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dist. to Suzhou</td>
<td></td>
<td></td>
<td>-1.361***</td>
<td>-1.189***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.388)</td>
<td>(0.394)</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.363</td>
<td>0.352</td>
<td>0.351</td>
<td>0.362</td>
</tr>
</tbody>
</table>

**Second Stage**
Dependent variable: Sex ratio at birth

**First Stage**
Dependent variable: Premodern cotton textiles

<table>
<thead>
<tr>
<th></th>
<th>Humidity-for-weaving</th>
<th>4.941***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1.676)</td>
</tr>
<tr>
<td>Humidity-for-weaving (inverse)</td>
<td>-0.0012***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>× dist. to Suzhou</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>Rice dummy</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Baseline controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Socioeconomic Macroregion FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1463</td>
<td>1463</td>
</tr>
</tbody>
</table>

Notes: The table reports IV estimates. The unit of observation is a county in the 2000 Census. Humidity-for-weaving index is used as an instrument. The dependent variable is sex ratio at birth. Baseline controls are the same as in Column 3 of Table 1. Robust standard errors are included in all specifications.
Next, I examine sexist beliefs reflected in surveys. CGSS 2010 (Chinese General Social Surveys) provides an unprecedented opportunity to examine sexist beliefs among the Chinese. The survey contains questions regarding beliefs of women’s ability and worth. In addition, the CGSS includes information on age group, gender, urban/rural site, marital status, education attainment, party member status and urban hukou (household registration status).

The first measure of sexist beliefs is constructed from each respondent’s view of the following question: “Do you agree with the following statement: men are naturally more capable than women?” The second measure comes from the question: “Do you agree with the following statement: men should focus on career; women should focus on family?” The respondent can choose from a scale of 1 to 5 ranging from “completely disagree” to “completely agree”. In addition, I create a measure from two questions on the subjective assessment of how many sons and daughters one wants to have. For those who answer they want more daughters than sons, daughter preference takes on the value of 1. For those who are indifferent between sons and daughters, or want the same number of sons and daughters, or want more sons than daughters, daughter preference takes on the value of 0. I take a subsample of CGSS to match the geographic coverage of the main sample used in Section V. Summary statistics are available in Table A.8.

I regress premodern cotton textile production on sexist beliefs with the same controls used in Column 3 of Table 1. Robust standard errors are clustered at the county level for all specifications. Table 6 summarizes the results. Column 1 through 6 report OLS results for beliefs about women. Column 7 through 9 focus on daughter preference. Columns 1, 4, 7 contain no individual controls; Columns 2, 5, 8 include basic individual controls such as age group, gender and education attainment; Columns 3, 5, 9 contain a full set of individual controls. Individuals in counties with premodern cotton textile production are more likely to disagree with the statement that men are naturally more capable, or the statement that women should focus on family, and more likely to have daughter preference. Results suggest that premodern cotton textile production is systematically correlated with more progressive gender norms and daughter preference.
Table 6: Gender-role Attitudes and Son Preference in Contemporary China:
Evidence from CGSS

<table>
<thead>
<tr>
<th></th>
<th>Men naturally more capable</th>
<th>Women focus on family</th>
<th>Daughter preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) OLS</td>
<td>(2) OLS</td>
<td>(3) OLS</td>
</tr>
<tr>
<td>Mean of Dep. Var.</td>
<td>3.006</td>
<td>3.006</td>
<td>3.006</td>
</tr>
<tr>
<td>Premodern cotton textiles</td>
<td>-0.244*** (0.0614)</td>
<td>-0.243*** (0.0527)</td>
<td>-0.239*** (0.0570)</td>
</tr>
<tr>
<td>Age group</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Female</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Education</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Female × Education</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Individual controls</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Baseline controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Region FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$/Pseudo $R^2$</td>
<td>0.0287</td>
<td>0.0952</td>
<td>0.102</td>
</tr>
<tr>
<td>Observations</td>
<td>6161</td>
<td>6156</td>
<td>6146</td>
</tr>
</tbody>
</table>

Notes: The table reports the impact of premodern cotton textiles on gender-role attitudes and daughter preference. The unit of observation is a survey respondent in CGSS 2010 (Chinese General Social Surveys). Baseline controls are the same as in Column 3 of Table 1. Robust standard errors are included in all specifications. Standard errors in parentheses *

$\pm p < 0.15$, ** $p < 0.05$, *** $p < 0.01$
B The Persistence of Sexist Beliefs—Gender Inequalities Before Mass Sex Selection

B.1 Women and Power

I turn to a micro-level analysis that examines variation in women’s representation in high-powered professions and women’s position in the family across individuals, using the 1990 Population Census available at the IPUMS - International. The time frame of the 1990 Census allows an investigate gender norms just before the planned economy era reached an end. An additional feature of this census is that they are particularly suitable for studying gender outcomes prior to mass sex selection. The 1990 Census also has quite high data quality in the sense that the size of the floating population was negligible at the time.

I construct the following two outcomes of interest: holding political or managerial positions and wife being the head of the household. I construct a binary variable for “holding political or managerial positions”. The variable takes the value of 1 for “legislators, senior officials and management”, 0 for other occupations. Missing values are assigned in the case that an individual is listed as “NIU (not in universe)”. For “head of the household variable”: the variable takes the value of 1 for individuals listed as “head of the household”, 0 for individuals listed as “spouse”.

Table A.7 in the appendix describes my sample based on the 1990 Census. For an average prefecture, 41% of its population live in places with premodern cotton textile production. 1.7% of the individuals hold political or managerial positions. 56% of the individuals are head of the household; the rest 44% are listed as a spouse.

---

38In the mass sex selection era, as part of the gender bias has already been reflected in sex selection, outcomes of the survivors—a pre-selected group— might not reflect the full extent of gender inequalities in society. Lin et al. (2014); Hu and Schlosser (2015)

39The US Census used to have the “Head of the household” and an accordanent variable “Relationship to head of the household”. But it has now switched to “Person 1” and “Relationship to first person listed on the questionnaire”. https://www.census.gov/history/www/through_/h/decades/index_of_questions/1980_population.html I interpret wife heading the household for a currently married couple to be an indicator of her power in the family.

40Geographic coverage of my 1990 Census sample is comparable to that of the 2000 Census sample used in my county-level analysis. More than 98% of the individuals within the geographic coverage are Han Chinese, higher than the national average of 93%. This is to be expected as five autonomous regions and autonomous counties are not included in my analysis. In my micro analysis, I further restrict the sample to Han Chinese individuals.
My estimation equation is

\[ y_{i,p} = \alpha + \beta \text{premodern cotton textiles}_p + \vartheta \text{Female}_i + \zeta \text{premodern cotton textiles}_p \times \text{Female}_i 
+ X^H_p \Omega + X^C_p \Lambda + X^C_p \Pi + X^I_i \Gamma + \epsilon_{i,p} , \]

(2)

where \( p \) denotes a prefecture.\(^{41}\) My outcome variables are “holding political or managerial positions” and “head of the household”. premodern cotton textiles\( _p \) is my prefecture-level measure of premodern cotton textile production.\(^{42}\) My variable of interest is the interaction term between premodern cotton textiles and female. If premodern cotton textiles were effective in shaping gender norms in favor of women, I should see the interaction term being significant. \( X^H_p, X^C_p \) and \( X^C_p \) are the same controls as in the county-level analysis.\(^{43}\) \( X^I_i \Gamma \) denotes current individual-level controls: age group, marital status, employment status and literacy. Robust standard errors are clustered at the prefecture level for all specifications.

Estimation results based on logit regressions are reported in Table 7. Coefficient estimates of premodern cotton textiles interacted with female are statistically significant for all columns. This is consistent with the hypothesis that premodern cotton textile production enhances women’s position in society and at home. Coefficients of premodern cotton textiles suggest premodern textile production has little effect on men’s probability to take political or managerial positions, suggesting that there is no systematic difference between premodern cotton textile production and availability of political or managerial positions in general. In all specifications, women are far less likely to either take political or managerial positions, or be the head of the household. This suggests that despite the socialist laws in favor of gender equality and the rich set of political and economic tools available to the state during the planned economy era, women’s position in society and at home was still not fully equitable with men’s. In Column 1 and 2, I find premodern cotton textile production increases women’s probability of holding political or managerial positions. As I restrict the sample to individuals living in a households with at least one married couple and who are currently married in Column 3 and 4, the finding should be interpreted as a wife heading the household rather than denoting female-headed households comprising

\(^{41}\)In the IPUMS 1990 census data, individual residence is only recorded at the prefecture level.

\(^{42}\) I aggregate the county-level indicator of premodern cotton textile production to the prefecture level weighted by county population. A prefecture unit is constructed from counties belonging to the sample used in the county-level analysis.

\(^{43}\) \( X^C_p \) are county-level census data aggregated to the prefecture level weighted by county population. For \( X^C_p \) most controls from the census year 2000 are replaced with controls from the census year 1990. GDP per capita 2000 is replaced by GDP per capita 1989.
Table 7: Pre-Modern Textiles and Status of Women: 1990 Census

<table>
<thead>
<tr>
<th></th>
<th>Political or Managerial Position</th>
<th>Head of the Household</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Pre-modern textiles</td>
<td>-0.00767 (0.0913)</td>
<td>-0.0130 (0.0798)</td>
</tr>
<tr>
<td>Female</td>
<td>-1.991*** (0.0776)</td>
<td>-2.018*** (0.0795)</td>
</tr>
<tr>
<td>Pre-modern textiles</td>
<td>0.218* (0.118)</td>
<td>0.232* (0.122)</td>
</tr>
<tr>
<td>× Female</td>
<td>(0.122)</td>
<td>(0.375)</td>
</tr>
<tr>
<td>Individual controls</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Contemporary controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Historical controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Region FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>2666125</td>
<td>2666125</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.172</td>
<td>0.195</td>
</tr>
</tbody>
</table>

Notes: The table reports the impact of premodern cotton textiles on women’s position in society at home. The unit of observation is an individual in the 1990 Census. The dependent variable is binary. All estimates are based on logit regressions. Contemporary, historical and geographic controls are the same as in Table 1, but contemporary controls here are from the census year 1990 instead. Individual controls include age group, marital status, employment status and literacy. Only married individuals are included in the sample for Column 3 and 4. Robust standard errors are clustered at the prefecture level. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
women who have never married or divorced women.

B.2 Post-1949 State Socialism—a Cohort Analysis

China has been promoting gender equality through laws, policies and institutions for over half a century (Johnson, 2009). As gender equality has an important role in the communist ideal, China passed the marriage law in 1950 to grant women the right to free marriage and divorce, inherit property, and control of their children. The role of Chinese women changed from a “family private person” of traditional society to a “social person”, and Chinese women gained the same legal status as men. The Constitution of the People’s Republic of China enacted in 1954 expressly stated that women and men enjoy equal rights. China also mandated equal entry to the labor market and instituted equal pay for equal work for men and women (Entwisle and Henderson, 2000; Hannum and Xie, 1994; Johnson, 2009; Yang, 1999), and those equalization policies worked relatively well during the planned economy era.

A cohort analysis provides evidence that socialist reforms weakened pre-existing gender norms and gender-role attitudes. The effect of premodern cotton textiles is significantly larger for the cohort born before 1935 than for the cohort born after.

C The Persistence of Sexist Beliefs—Gender Inequalities Before 1949

From 1840 onwards, China began to industrialize at a slow pace. Manufacturing jobs emerged and they typically required workers to work outside home. Conservative gender norms and concern for “purity” of women would predict few women would take manufacturing jobs. In reality, female labor force participation was extremely uneven across regions. The presence of women in industrial plants was much more common in Jiangsu, Zhejiang and Shanghai, where women even outnumbered men. Women working outside the home was extremely rare in Zhili, Shanxi and Shaanxi. Would premodern cotton textiles influence women’s decision to participate in the labor force? Ideally, I would like having disaggregated data at the very onset of industrialization to examine how women’s initial responses to industrial job opportunities differed. Unfortunately, a still largely premodern and agrarian Chinese state at the time, did not possess the full capacity to collect detailed labor statistics. One of the earliest censuses available that can help answer this question is the 1916 Economic Census published during the Early Republican Era. The census documents number of male and female workers working in a factory by province and industry, excluding household production workers. Table A.9 provides summary statistics. As seen in the table, in an average province-industry pair, roughly 19% of the total workers were
female, but with high variance.

To investigate the role of premodern cotton textile production in female labor force participation, I regress share of female workers on premodern cotton textiles. Table 8 suggests that in provinces with a higher percentage of population with a history of cotton textile production, a large share of women worked in factories. A few possible explanations are (a.) Persistence in specific skills. Women who understood household production of textiles had an advantage in industrial production of textiles. (b.) Persistence in physical mobility. premodern cotton textiles provided women with opportunities to engage in market exchange. Women likely enjoyed a higher level of physical mobility than their counterparts in other places. (c) Persistence in the role of bread-winning females. Families used to incomes generated by women had to adapt to new economic realities that manufacturing jobs were better jobs for women to support a family.

I rule out (a.) being the only explanation by showing that a larger share of female workers was found not only in textile manufacturing plants, but also in other industries. In fact, premodern cotton textile production is positively correlated with the share of female workers in most industries, except for fur making. To further distinguish between (b.) and (c.) I would need higher quality data. Either (b.) or (c.) would be consistent with the hypothesis that premodern cotton textile production generated gender norms in favor of women and influenced a range of later outcomes through the channel of modified gender norms.

### VII COTTON REVOLUTION AND THE RISE OF WOMEN

#### A Cotton Revolution as a Natural Experiment

##### A.1 A Shock to the Value of Women’s Work

Textile production following the cotton revolution, represented an new opportunity for women to earn monetary income, and contribute to household income. As return to producing textiles was sufficiently high, women were induced to switch away from solely performing non-market domestic work or producing non-market fabrics. Due to the appearance of a new technology and the presence of both a well-functioning market and historically-specific government institutions, women in textile regions had unparalleled

---

This can be understood in the context of Pomeranz’s research on economics of respectability. In describing the role of daughters in a family, he notes that a family’s capacity to survive and to profit from its work relied upon “an optimal mix of family members of particular ages and sexes” (Pomeranz, 2005).
Table 8: Persistence since 1840: Evidence from the 1916 Economic Census

<table>
<thead>
<tr>
<th></th>
<th>Share of Female Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Mean of Dep. Var.</td>
<td>0.197</td>
</tr>
<tr>
<td>Premodern cotton textiles</td>
<td>0.137**</td>
</tr>
<tr>
<td></td>
<td>(0.0541)</td>
</tr>
<tr>
<td>Log Total Population</td>
<td>No</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>No</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.0244</td>
</tr>
<tr>
<td>Observations</td>
<td>170</td>
</tr>
</tbody>
</table>

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The table reports the impact of pre-modern textiles on share of female workers in the early 20th century. The unit of observation is an industry within a province. The dependent variable is share of female workers. #workers refers to the total number of workers in an industry within a province. Robust standard errors are used in all specifications.

earning opportunities by the standard of past agrarian societies.

Holding constant women’s role in reproduction, an increase in value of women’s work can eventually lead to a reappraisal of women’s overall value. In models of cultural evolution, relative payoffs of cultural traits are crucial to the choice of behavioral rules (Boyd and Richerson, 1985). This implies the adoption of the different cultural beliefs does evolve based on relative costs and benefits. The relative productivity shock engendered by the cotton revolution could lead to an adjustment of sexist beliefs and the breakdown of existing norms.

In the long run, as a result of the process of reassessing the value of women, parents may change their attitudes towards the birth of female children. As women become productive members of the economy in their own right, it is likely less mentally stressful and financially costly for parents to accept a daughter into the family. The prospect of high-earning jobs for adult daughters can lead to a more optimistic assessment of the fate of very young female children.

A.2 Corresponding Norms

A common gender identity norm is that husband should earn a higher income than wife is relatively common. Bertrand et al. (2015) discusses the importance of this gender identity
norm in marital formation and chances of divorce. In a context where a large number of women begin to earn comparable or higher incomes than their male counterparts, it is plausible to think that this gender identity norm could break down under the pressure of this large relative income shock. After all, when only a small number of women earn a higher income than men, men who are influenced by this norm can choose to marry other women. However, when women ubiquitously earn more, this gender identity is likely to become untenable, and men and women are likely to succumb to the new reality and to simply accept the fact that wife now earns more than husband. This is especially true given that marriage was near-universal for women in premodern China.

B The Case of Widow Survival, 1368-1644

Unlike the Europe Marriage Pattern (De Moor and Van Zanden, 2010; Voigtländer and Voth, 2013), premodern China featured universal marriage and early marriage. Unmarried and married women alike had limited opportunities to participate in society on their own. However, widows were given a certain amount of autonomy in making economic decisions for the household, despite the overall conservative family and property ownership laws in premodern China (Afeng, 2002). However, prior to the cotton revolution, women typically lacked the means to support themselves after their husband’s death. Remarriage was quite common. Things took another turn after the 11th century. Influenced by Song-Ming Neo-Confucianism first developed in the Song Dynasty (960-1279), on one hand, inheritance laws became more unfriendly to women, creating barriers for women to inherit wealth from their deceased husband; on the other hand, remarriage became stigmatized. Both changes greatly limited options available to widows. The difficult circumstances faced by widows are not unique to premodern China. Widows in developing countries today continue to face more or less similar problems: widows not only lose the main breadwinner of the household, but also are restricted access to economic resources due to property ownership laws and employment norms. Many studies document the role of widowhood in excess mortality for unmarried adult women (Anderson and Ray, 2015; Miguel, 2005; Oppong, 2006; Sossou, 2002).

The cotton revolution in the fourteenth century greatly improved the prospect of widows. Ming and Qing China witnessed an unprecedented number of widows who participated in a

---

45 They find that in fear of making more money than her future husband does, wife is more likely to give up on work in order to start a marriage. Meanwhile, dissolution of marriage is far more likely among couples who violate this important gender identity norm. Bertrand et al. (2016) discuss a theoretical model in which the negative social attitudes towards working women might contribute towards the marriage gap for skilled women.
wide range of economic and social activities. The precondition to widows’ participation in economic and social activities is survival. Stable incomes derived from textile production played a conducive role in widows’ survival. Relying on those incomes, widows not only survived, but had the financial latitude to support their children and in-laws (Zurndorfer, 1998; Sommer, 2000; Elvin, 1984). Another aspect of textile incomes was economic independence. A strong financial position critically shaped a widow’s status in the family of her deceased husband’s, and sometimes, in her natal family. Between 1300 and 1850, the improvement of widow well-being, which was closely related to cotton production, contributed to the broadening of women’s space in society. (Pomeranz, 2004; Bray, 1997; Zhao, 2015).

Data on the number of widows and their mortality in historical times are hard to come by. But the records counties and prefectures kept on “virtuous” women—a state-sponsored historical institution to commemorate widows with high morals—can be illuminating on the topic of widow survival. In the spirit of Song-Ming Neo-Confucianism, women were praised for maintaining female chastity after their husband’s death. Those women were called “virtuous” women and often documented in local gazetteers for their “virtuous” behavior. Before 1300, among all “virtuous” women, half of the women were “chaste widows” who provided for her in-laws and children for an number of decades, the other half were “heroic widows” who committed suicide upon their husband’s death to demonstrate their exemplary character (Jiazun, 1979). I hypothesize that cotton textiles reduce the demand for heroic widowhood, as widows can now live a decent life through work.

To test the relationship between cotton textile production and widow suicide, I search local gazetteers for records on “virtuous” women. To circumvent the problem of varying local standards of awarding “virtuous women” status, I only use records on imperial testimonials of merit (jingbiao) by the central government. To have a sense of the timing of transition—from when cotton textiles began to positively shape women’s life trajectories—I focus on records of jingbiao from the Ming Dynasty (1368-1644), and use cotton textile production information from Ming prefecture-level gazetteers as well. I perform the search on prefecture-level gazetteers available on zhongguo fangzhi ku (China’s Gazetteer Database), Series I, and restrict my sample to prefectures that had at least one prefecture-level gazetteer (within the database) composed in the Ming period. As prefectures can have very different tastes in the selection of materials for their gazetteer, a prefecture needs to have at least one jingbiao record to be included in the sample.

Table 9 summarizes the results. Column 1 shows an unconditional relationship between premodern cotton textiles and widow suicide. Column 2 includes province fixed effects.
Table 9: *jingbiao*: Widow Suicide

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of Dep. Var.</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
</tr>
<tr>
<td>Premodern cotton textiles</td>
<td>-0.268</td>
<td>-0.338</td>
<td>-0.461</td>
<td>-0.594</td>
<td>-0.621</td>
<td>-0.665</td>
<td>-0.581</td>
</tr>
<tr>
<td></td>
<td>(0.290)</td>
<td>(0.369)</td>
<td>(0.293)</td>
<td>(0.381)</td>
<td>(0.377)</td>
<td>(0.389)</td>
<td>(0.352)</td>
</tr>
<tr>
<td>Log (dist. to Qufu)</td>
<td>-0.722***</td>
<td>-0.712***</td>
<td>-0.814***</td>
<td>-0.756***</td>
<td>-0.242</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.172)</td>
<td>(0.172)</td>
<td>(0.196)</td>
<td>(0.183)</td>
<td>(0.420)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pop. density in 1600</td>
<td>0.181</td>
<td>0.316</td>
<td>0.224</td>
<td>0.345</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.274)</td>
<td>(0.322)</td>
<td>(0.338)</td>
<td>(0.390)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture suitability</td>
<td>-0.106</td>
<td>-0.178</td>
<td>-0.177</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0892)</td>
<td>(0.139)</td>
<td>(0.137)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruggedness</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Latitude</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Longitude</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Latitude × Longitude</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Province FE</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>-0.000668</td>
<td>0.326</td>
<td>0.482</td>
<td>0.465</td>
<td>0.465</td>
<td>0.461</td>
<td>0.526</td>
</tr>
<tr>
<td>Observations</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

Notes: The table reports the impact of premodern cotton textiles on widow suicide. The unit of observation is a prefecture on the 1911 prefecture map. The dependent variable is number of search records related to women receiving the title of “virtuous women” (*jingbiao* for committing suicide following husband’s death. Qufu is the birthplace of Confucius. A prefecture needs to have at least one *jingbiao* record to be included in the sample. Outliers in either widow suicide and chaste widowhood are not included in the sample. Robust standard errors are used in all specifications. Standard errors in parentheses $+ p < 0.15$, $* p < 0.10$, $** p < 0.05$, $*** p < 0.01$.
From Column 3 to Column 7, I sequentially add the natural log of distance to Qufu plus one, population density in 1600, agricultural suitability, ruggedness, and latitude, longitude and their interaction term. Across the columns, I find premodern cotton textile production is consistently associated with a lower number of records on heroic widows. In the spirit of Kung and Ma (2014), I use distance to Qufu—the birthplace of Confucius—as a proxy for the cultural demand for “virtuous” behavior on the part of women. The coefficient estimates of premodern cotton textiles are close to conventional cutoffs of statistical significance once controlling for distance to Qufu.

These numbers provide tentative evidence that premodern cotton textile production reduced widow suicide. As cotton textiles enable women to maintain a livelihood in the absence of their husband, from the perspective of parents, a daughter’s ability to support herself under adverse circumstances reduces their mental and financial exposure to the fate of their daughter. This is especially relevant as premodern China was characterized by higher uncertainty. As cotton textile production created a class of financially empowered, capable and dependable adult women, the notion that women can be productive and independent members of society began to be self-reinforcing.

VIII Concluding Remarks

This paper provides evidence that a portion of the variation in sexist beliefs in modern day China can be accounted for by premodern cotton textile production. It suggests that sexist beliefs can be shaped by large and long-lasting relative productivity shocks.

I use both OLS and IV to estimate the impact of premodern cotton textile production on today’s sex ratio imbalances. The results are robust to the exclusion of Yangtze Delta, a region famous for premodern cotton textile production and a host of features associated with a highly developed economy both in the past and in the present. I also extend my analysis to include other variables more commonly discussed in the context of gender equality, such as literacy and education. My finding from county-level regressions cannot be explained by alternative hypotheses such as other economic activities favoring women, the use of plough, neolithic settlements, pre-1300 commerce, historical state capacity, or modern textile industry. I examine a number of post-1840 political and economic shocks including early industrialization, expansion of Christianity and recent economic reforms.

---

46 Bossler (2000) finds evidence for a continued relationship between a married woman and her natal family. While a woman became a member of her husband’s extended family upon marriage, her natal family could still be involved in times of crisis. This includes cases in which a widowed woman in poverty imposed a financial burden on her natal family.
After acknowledging the role each of those shocks in gender bias reflected in sex ratio imbalances, I find coefficients of premodern cotton textile production remain significant and similar in magnitude to baseline estimates. Had there been none of those shocks, premodern cotton textile production might have reduced sex ratio imbalances by five boys per hundred girls rather than three boys per hundred girls.

I find premodern cotton textile production is systematically correlated with more progressive gender norms and daughter preference. To show the persistence of sexist beliefs since 1840, I investigate sexist beliefs prior to mass sex selection. Sexist beliefs could be felt even under the strict form of state socialism. I find that premodern cotton textile production helps to explain women’s position even during the socialist period. In the 1990 census, premodern cotton textile production is positively associated with women taking high-level positions and wife heading the household. Another historical period I examine is the onset of industrialization in post-1840 China. I find premodern cotton textile production is positively associated with share of female workers in manufacturing jobs. I interpret this as a reflection of more relaxed gender norms in places with premodern cotton textile production that allowed more women to work outside home to take advantage of new economic opportunities.

To illustrate the transition to updated beliefs about women, I return to the formative period of current sexist beliefs. I find evidence that an adaptation in gender norms to the cotton revolution could have occurred as early as the Ming period (1366-1644). Premodern cotton textile production is associated with lower rates of widow suicide. Based on the fact that widows, compared to married women, were more poised to making independent decisions and as well as being visible in public space, the elevated status of widows could have had a profound impact on how women were viewed and whether they were seen as productive members of society.
References


Bossler, B. J. (2000). "a daughter is a daughter all her life": Affinal relations and women’s networks in song and late imperial China. *Late Imperial China* 21(1), 77–106.


Deininger, K., A. Goyal, and H. Nagarajan (2010). Inheritance law reform and women’s access to capital: evidence from India’s Hindu succession act.


Grosjean, P. and R. Khattar (2014). It’s raining men! hallelujah?


Li, B. (1997). "men farms and women weaves” and the formation of the role of ”half the sky” of women in peasant family economy: a study of women’s work in jiangnan during the ming-qing times. *Researches in Chinese Economic History* 3, 001.


Prentice, D. A. and E. Carranza (2002). What women and men should be, shouldn’t be, are allowed to be, and don’t have to be: The contents of prescriptive gender stereotypes. *Psychology of Women Quarterly* 26(4), 269–281.

Puterman, L. and D. N. Weil (2010). Post-1500 population flows and the long run determinants


Yang, M. M.-h. (1999). *Spaces of their own: women’s public sphere in transnational China,*


