

Why do Parents Abort Girls? Patrilocality and Its Historical Origins^{*}

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Abstract: Recent scholarship has documented an alarming increase in the sex ratio at birth in parts of East Asia, South Asia and the South Caucasus. In this paper, I argue that parents in these regions engage in sex selection because of patrilocal norms that dictate elderly coresidence between parents and sons. Sex ratios and coresidence rates are positively correlated when looking across countries, within countries across districts, and within districts across ethnic groups. The paper then examines the roots of patrilocality using the Ethnographic Atlas (Murdock 1965). I find that ethnic groups in areas with land conducive to intensive agriculture have stronger patrilocal norms, higher coresidence rates, and higher sex ratios at birth. The paper concludes with an examination of the expansion to old age support in South Korea. Consistent with the paper's argument, I find that the program was associated with a normalization in the sex ratio at birth.

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I. Introduction

Following the fall of the Berlin Wall in 1989, political upheaval ensued in many states of the Former Soviet Union, including in the South Caucasus region. The collapse of the guarantees associated with the Communist regime and armed conflict between neighboring Armenia and Azerbaijan led to dramatic fertility decline in both countries, falling below two births per woman. Coincident with this decline, the sex ratio at birth (males per 100 females) began an alarming rise throughout the South Caucasus, cresting above 110 in Armenia, Azerbaijan, and Georgia as a result of sex-selective abortion (Duthe et al. 2012, Guilmoto 2013). While this trend has attracted less attention than the increasing SRB in other parts of Asia, such as China and India, it is no less disturbing and arguably more puzzling. Women in the South Caucasus enjoy relatively high status: women have higher educational attainment than men, work at similar rates, and participate in civic society.¹ However, the sex ratio is similar to what is found in China and India. Why, then, do parents in the South Caucasus abort girls?

When Amartya Sen coined the phrase “missing girls” in the New York Review of Books (1990), he attributed the phenomenon to widespread “female neglect.” Others have attributed the missing women issue to cultural “son preference.” However, these descriptions are inadequate for understanding the patterns in the South Caucasus, where girls are schooled at an equal or higher rate than boys. These explanations also seem insufficient for explaining the patterns in China and India, which are unremarkable in terms of their levels of gender inequality but are responsible for the vast majority of “missing girls.” As I will demonstrate, globally, gender inequality is only weakly correlated with the sex ratio at birth, a result difficult to reconcile with an explanation that missing women are the result of widespread chauvinism. The similarity of

¹ All three countries rank in the middle of countries in terms of gender equality as measured by the World Economic Forum: <http://www.weforum.org/issues/global-gender-gap>. In fact, none of the countries with elevated sex ratios at birth are in the bottom quartile of their measures of gender equality.

the demographic patterns between the South Caucasus and other parts of Asia provides an opportunity to analyze distorted sex ratios across different social and economic contexts and identify a common factor shared by each of these regions that could potentially explain why parents abort girls.

In this paper, I argue that parents abort girls because of patrilocality: a cultural norm in which sons provide care for their elderly parents, and daughters leave the home following marriage to provide care for their in-laws. This custom implies that parents with a son will have two caregivers in their elder years, whereas those with daughters will have zero, resulting in a significant difference in the expected value of sons relative to daughters. While this is widely recognized by the literature as a factor in determining parental son preference, in this paper I demonstrate that it is the single common factor across countries with high sex ratios, and as such, should be viewed as the primary factor in explaining the phenomenon.² Patrilocality is the single feature common to the social norms of Christians in Armenia, Muslims in Azerbaijan, Hindus in India and Buddhists in China – all live with their sons when they are old.

I present several empirical results implicating the custom of patrilocality in explaining the “missing women” phenomenon. First, using international IPUMS and DHS data across 140 surveys and 107 unique countries, I find that countries where the elderly live with sons at higher rates have higher sex ratios at birth (SRBs). As shown in Figure I, *every* country with abnormally high sex ratios at birth in our samples has a high proportion of elderly living with sons. As I will later show, this correlation is robust to the inclusion of continent fixed effects, and several

² Other studies have generally attributed son preference to a collection of religious and cultural norms that make sons desirable, but do not single out coresidence as singularly important. For example, Zeng et al. (1993) attribute son preference to “social and cultural traditions and daily living conditions [that] make it very important for families to have a son, especially in rural areas.” To my knowledge, the only other examination of variation in coresidence patterns and sex ratios is by Guilmoto (2012) who examines Vietnam. He finds that regions with higher rates of coresidence between parents and sons have higher sex ratios at birth.

robustness checks.³ Importantly, I also find that gender equity is only weakly correlated with the sex ratio at birth across countries, and our results are robust to the inclusion of rich measures of gender equity, including relative education and employment rates. This further implicates patrilocality in explaining the “missing women” phenomenon, rather than alternative explanations focusing on expected income.⁴

Second, I examine the relationship between the sex ratio and elderly coresidence patterns within several countries. I focus on the relative proportion of elderly living with either a son or daughter, as I posit that parents are responsive to the difference in expected elderly care from a child of either gender. While parents are vastly more likely to live with sons than daughters in every country with a high sex ratio at birth, there is substantial variation within these countries in the strength of this pattern. Interestingly, I also find variation in coresidence rates and sex ratios in countries that have no aggregate bias in the sex ratio at birth. In particular, the normal overall sex ratios in African countries mask considerable variation across regions, especially in countries which are home to many distinct ancestral cultures, such as Sudan. Using variation across districts and ethnic groups across several Asian and African countries, I find higher sex ratios among groups which are more likely to live with sons than daughters.

³ Interestingly, the figure also reveals that several African countries have sex ratios below normal, the only region in the world where this is observed. I will argue in this paper that the unique pattern in Africa of “missing boys” is also related to the same set of kinship norms underlying the “missing girls” phenomenon, in which parents are highly responsive to expected benefits from children in old age. While sex selection is probably rare in Africa, in countries with high infant mortality, every day parents make choices that have relevance for determining the sex ratio of children. As I will demonstrate, most African countries have low coresidence rates with sons and daughters, which would make them relatively balanced in their treatment of children. Since boys are more fragile than girls, parents being indifferent to boys or girls will result in sex ratios below those found in developed countries with low childhood mortality (Waldron 1985).

⁴ Other scholars present compelling evidence in favor of other explanations. Qian (2008) exploits variation in the suitability of land for planting crops in which women have a relative advantage. Using the agricultural reforms in China as a ‘natural experiment’, she finds that the sex ratio at birth is sensitive to the relative wages for men and women. In this paper, I argue that relative wage considerations are of secondary importance to those related to old age care.

In light of the striking relationship between coresidence norms and modern day sex ratios, I then examine the historical origins of patrilocality. First, I present a conceptual framework that attempts to explain why son preference varies globally. The core prediction is that son preference and kinship norms favoring patrilocality will be stronger when a group's ancestors were engaged in intensive agriculture. Intensive agriculture, in which land is left fallow for shorter periods, enables a group to maintain a higher population density than extensive (or shifting) agriculture, and also requires that the group remain at a fixed location and devote substantial resources towards preparing the land for planting, and defending this land. Since sons are more loyal than sons-in-law in times of inter-clan conflict, norms develop in which sons inherit their father's land.⁵ The greater the value of one's plot, the stronger the norm will be towards ensuring the birth of a son to inherit and potentially defend the land. This will also increase the son's incentive to stay on the family land, as the higher population density means that most other plots are already being farmed.⁶ In a sense, this represents a barter in which the son is given his parent's valuable plot in exchange for his remaining nearby and caring for them in their old age.⁷

Note that this framework also generates the somewhat counterintuitive prediction that women will have greater participation in subsistence in areas with son preference. Since

⁵ An alternative explanation for why sons inherit the land is put forward by Holden and Mace (2003), who argue that sons became favored in inheritance custom as a result of the acquisition of cattle. They argue that the heterogeneity of wealth generated by cattle results in a preference to bequeath wealth to sons, who will therefore be attractive and can have multiple wives. This is similar in spirit to the Trivers-Willard (1973) hypothesis. Whether sons began to dominate inheritance as a result of the need to defend the family plot, or as a result of the heterogeneity of wealth driven by the advent of cattle, is not essential to the main argument of this paper since both conditions were present in areas which now exhibit patrilocal norms.

⁶ This interpretation of kinship norms where sons remain on the family land was first presented by Willis (1979). Rosenzweig and Wolpin (1985) present an overlapping generations model which explains the rigidity of land ownership by proposing that children stay on their parents plot so they can receive plot-specific training from their parents. This generates similar predictions but through a slightly different mechanism.

⁷ Consistent with this interpretation, I find that in countries with high sex ratios at birth, children are raised in two-parent families at extremely high rates (Figure A1). Notably, in Africa the coresidence rates are low between elderly fathers and middle-age sons, and also are low between fathers and sons under 5 years old. One interpretation is that, at the margin, fathers are less inclined to raise their sons if they do not anticipate receiving care their old age.

intensive agriculture requires more frequent cropping, the participation of women in agriculture will be necessary. As argued by Boserup (1965), intensive agriculture is associated with a lower marginal product of labor than other types of farming, since so much effort is necessary to prepare the land for planting.⁸ With shifting agriculture, the land is often cleared by fire, which is essentially costless. This provides more opportunity for leisure, as found in many African tribes engaging in less intensive agriculture, where Boserup cites figures of women only participating a couple hours a week in agriculture. Similarly, the relative advantage of men in pastoralism may be greater than in agriculture; shepherds were often male and women in these societies were often relegated to more modest contributions towards subsistence. For example, this was found to be the case among Bedouin and other nomadic tribes, where society dictated they spend most of their time engaged in home production given that they were not necessary in helping to provide subsistence. In intensive agriculture, both men and women are required to work long hours to maintain the land and sustain a higher population density. Insofar as gender roles exhibit time persistence, countries with modern-day high sex imbalances will have relative gender *equality* in comparison to countries which practiced shifting agriculture or pastoralism.⁹

I explore these predictions using a codified data set of 1,267 ethnographic societies classified by Murdock (1965, 1967). In these data, I observe a rich set of attributes regarding the modalities of life in each society including whether they practiced matrilocal versus patrilocal residence, the fixity of their settlement, and the frequency of conflict with their neighbors. The core predictions of the framework are borne out by the data. The ancestors of ethnic groups which today engage in sex selection were patrilocal, and were more likely to participate in

⁸ Boserup explicitly singles out agriculture in China and India for having particularly labor intensive agriculture. She writes that in some regions of China, the labor input was six hundred working days per hectare.

⁹ See, for example, Alesina et al. (2013) who argue that modern gender norms are related to the adoption of plough-based agriculture.

intensive agriculture and animal husbandry. They were also more likely to have armed conflict than groups with normal modern sex ratios, possibly explaining why sons were particularly prized. Further, the data reveal that women in these groups participated significantly in agriculture, as dictated by the demanding needs of intensive agriculture. While causal inference is difficult in this context, these facts paint a broad picture in which son preference emerges as a result of intensive agriculture and the concomitant features of this lifestyle. The groups which practice sex selection today had ancestors with valuable land that needed to be defended, was passed to sons, and supported a high population density.

The Ethnographic Atlas also provides a central location of each group, enabling a more rigorous analysis into the relationship between intensive agriculture, patrilocal norms, and “missing women”. I bring together GIS data on land qualities with data from the Atlas on kinship norms, and modern data from IPUMS and DHS of coresidence patterns and sex ratios of children. This allows me to examine variation within countries, and in the case of many countries in Africa, compare groups with different traditions that today inhabit the same country. The results indicate that for ethnic groups in areas with land amenable to intensive agriculture, the legacy of patrilocality is stronger, and the descendants of these groups continue to exhibit higher coresidence rates with sons. Specifically, I analyze the principal cereal crops in China, India, and the Sudan. I find that areas with land that was amenable to cropping cereal were more likely to be home to tribes with patrilocal norms, have higher coresidence rates, and higher sex ratios at birth.

The analysis then shifts to a longer-term historical analysis where I exploit data collected by Putterman (2008) on the timing of the Neolithic transition in different parts of the world. In these data, we can observe the timing of the transition to agriculture for each country.

Considerable variation exists in the timing due to variation in weather patterns, exposure to disease, and topography.¹⁰ Interestingly, China, India, and the countries in the South Caucasus all had Neolithic transitions roughly 9,000 years ago, making them some of the oldest civilizations in the world.¹¹ Insofar as the paper's main argument is valid, and patrilocality emerged from the adoption of intensive agriculture, the variation in the timing of this phenomenon will be correlated with coresidence rates today. Presumably, older norms will be more rigid and more deeply ingrained. Indeed, I find that the timing of the agricultural revolution is correlated with both modern-day coresidence rates and sex ratios at birth. This also suggests a mechanism for why son preference is so strong today in these countries: their ancestors spent thousands of years (and hundreds of generations) in agrarian modalities of life where kinship norms that dictated parents live with sons were a critical aspect of life. When modernity arrived in these countries, it pushed against very longstanding traditions of sons providing old age support, even if the roots causes of patrilocality were no longer relevant.

In the paper's final section, I consider the unique experience of South Korea, which historically had a very high sex ratio at birth (Choe 1987). If, as this paper claims, high sex ratios are due to patrilocal norms where the son provides parental old-age support, dissolving these norms should lead to a correction in the sex ratio at birth. I test this using Korea data, where rapid expansions in national pension programs during the 1990s provide a unique opportunity to

¹⁰ In a recent paper, Alsan (2013) argues that the exposure of Sub-Saharan Africa to the Tse Tse fly prevented adoption of agriculture for thousands of years. Ashraf and Galor (2011) use the timing of the neolithic transition to test the Malthusian prediction that population growth reduces the standard of living. Ashraf and Galor (2011) demonstrate that the timing of the revolution is related to biogeographical factors, such as prehistoric domesticability of species of wild plants and animals.

¹¹ The exact timing and diffusion of the Neolithic transition is the subject of academic debate. While agriculture is thought to have developed first in the Fertile Crescent roughly 12,000 years ago, this region would not necessarily have developed son preference like other regions, because climatic changes resulted in a drier context that led inhabitants to take their domesticated animals with them in search of better conditions. The groups that remained, like the Bedouin, were less likely to practice intensive agriculture given the reduced land quality and therefore would not have been as concerned with bequeathing their land and more concerned with bequeathing their cattle. These groups would presumably be patrilocal but have weaker customs of coresidence, since cattle can be taken to new land.

test the importance of coresidence in explaining high sex ratios. If the theory is correct, targeted groups will have falling rates of elderly coresidence and falling sex ratios at birth. I test this hypothesis in a differences in differences setup, where I exploit differences in program expansion for self-employed versus salaried workers, who had been required to participate prior to the expansion. As predicted, the groups targeted in the expansion experienced a large decline in the sex ratio at birth. Since these cohorts are still in their childbearing years, it is infeasible to test whether this group will also have lower coresidence rates. However, the data available implicate the large scale social insurance program in Korea led to a normalization of the sex ratio at birth.

The rest of the paper is organized as follows. In Section II, I present the paper's conceptual framework. In Section III, I present the empirical results on the relationship between coresidence and sex ratios using IPUMS and DHS data. In Section IV, the paper turns to an analysis of the historical origins of patrilocality using the Ethnographic Atlas and GIS data. In Section V, I present an examination of South Korea's expansion to old age insurance and its impact on the sex ratio at birth. I conclude in section VI.

II. Conceptual Framework

The first human societies are believed to have been based on matrilineal descent. As first described by Bachofen (1861), humanity's forebears are thought to have lived in a context of promiscuity, where sexual partners were shared among community members (Lubbock 1870). The resulting ambiguity over paternity would have led to stronger bonds forming between mothers and children, and weaker ties between children and their fathers. This led to a matrifocal (mother-centered) structure with strong kinship ties among those sharing the same mother. Evidence of these patterns is found among primate social groups like chimpanzees, in which

food-sharing takes places with matrifocal groups rather than between sexual mates (Engels 1902). However, at some point in history, sexual norms began to evolve, with pre-historical promiscuity giving way to family structures that took forms more similar to those found in modern history, including monogamy, polygyny and polyandry (Morgan 1877). Kinship norms also began to evolve, taking on very different rules across different groups. What determined the evolution of kinship norms, and which groups would have adopted patrilineal lines of descent?

In this paper, I focus on a line of thought first put forward first by Engels, who argued that the intensification of agriculture led to a shift from matrilineal kinship norms to patrilineal lines of descent.¹² In his view, the emergence of private property and the mastery of animal husbandry and intensive agriculture allowed men to seize control of this wealth, and claim exclusive paternity of their children.¹³ While Engels was more concerned with understanding the timing of the shift toward patrilineal descent (and questioning its morality), in this study I am more concerned with understanding the determinants of its intensity. If the modern day issue of “missing women” is the result of the result of the pre-historic intensification of agriculture, as this paper claims, several empirical results should be readily found in the data.

First, societies (or tribes) that exhibit son preference today will have patrilocal ancestors that engaged in intensive agriculture. This will be manifest in more extensive use of the plow, in their practice of animal husbandry, and in their reliance on cereals for subsistence. The more conducive the land is to intensive agriculture, the higher population density will be, and the greater the need to have a son to inherit the land. Therefore, any groups that currently engage in

¹² Alternative theories for the factors that contribute to the adoption of matrilocal versus patrilocal norms focus on the relative contribution of men and women to subsistence (Murdock 1949). However, empirical support for these theories is limited (Ember and Ember 1971). In a more recent paper, Guha (2010) argues that patrilocality emerged as a way of dealing with paternity ambiguity, since the men working in the fields would have been unable to monitor their wives sexual activity, requiring the husband’s parents to maintain this role.

¹³ Evidence in favor of Engel’s hypothesis is substantial. For example, Holden and Mase (2002) find that the innovation of cattle directly led Bantu- and Bantoid speaking tribes from Sub-Saharan Africa to switch from matriliney to patriliney.

sex selection will have ancestors who resided in complex societies with fixed settlements. Second, tribes that exhibit son preference today will have been engaged in frequent military conflict. Since intensive agriculture requires repeated cropping of land, it generates a fixity of settlement that requires defense of one's land. Attacks by nomads would have led to both the need for sons for defense, and patrilocal norms, as they would need to remain nearby for defense. Note that concerns over frequent attacks by nomadic groups were a primary motivation for the construction of the Great Wall of China.¹⁴ Therefore, son preference and a history of conflict will be deeply connected.

Third, tribes that exhibit son preference will have strong norms regarding male inheritance of land. As described earlier, the custom of the son inheriting the land and his obligation to take care of his parents when they are old will be intimately tied. The valuable land will create strong ties between fathers and sons, where fathers need their sons in times of war and as caregivers in their old age, and sons need their fathers' land. Often, this implicit barter will be further reinforced by religious norms that develop to enforce the agreement, such as Confucianism's focus on filial piety, or the need for a son to pray for the dead in Hinduism. While some scholars have looked at these ideologies as factors explaining son preference, I would argue that they are more appropriately thought of as symptoms of the economic system which requires faithful participation by each generation. The central role of respect for elders in Confucian society is logical, and particularly important because intensive agriculture generates a retirement window. Unlike African or Native American tribes where people worked until their death, intensive agriculture provides the elderly an asset (the land) that can provide income even after they are unable to work.

¹⁴ Globally, many agricultural groups feared attacks by nomadic groups during harvest. This occurred frequently among Native American tribes in North America, where conflict between groups with a fixed location and nomadic tribes was frequent (Flannery and Marcus 2012).

Fourth, societies with intensive agriculture will have relative gender equality. As mentioned earlier, this is a consequence of the lower marginal productivity of labor in intensive agriculture relative to shifting agriculture. Intensive agriculture requires *everyone* to participate in preparing the land for cropping. However, as outlined by Boserup (1965), less intensive agriculture or nomadic tribes will have longer fallow periods for their land, meaning they can spend less time preparing it for cultivation. Furthermore, they will have less need for women to participate in subsistence and possibly be able to relegate women to home production. For nomadic tribes, as a result of their itinerant nature, they will have weaker norms about the role of sons in land inheritance and in providing old age support. Similar to hunter/gatherers, the lack of value of land will prevent son preference from becoming intense. This will presumably serve to dampen the strength of son preference.¹⁵

III. “Missing Women” and Kinship Patterns

A. Data

The data are taken from all IPUMS and DHS countries that are available, with the most recent sample used in each instance. This forms a sample of 140 surveys from 107 unique countries (Figure II).¹⁶ In these data, I calculate for each country the coresidence rates between elderly (age 60+) men and their adult children of each sex (age 25+), with coresidence defined as either living with a son, living with a daughter, living without any children, or living with both sons and daughters. I also calculate the sex ratio of children (ages 0-5), and several measures of

¹⁵ In fact, the framework’s prediction is that patriarchal norms will actually be strongest among those participating in pastoral forms of subsistence, such as shepherding. Since shepherds have significant wealth, and wealth will be heterogenous in the population, it stands to reason that men will dominate society, for the reasons outlined earlier. However, shepherds will have weaker incentives to bequeath their land to their children given the absence of a fixed land area. This may explain why many Middle Eastern countries have normal sex ratios at birth but much stricter norms against female involvement in the labor force or public affairs.

¹⁶ Details on the data set are available in the online data appendix.

gender equality: completed years of schooling, rates of employment, and literacy rates among those ages 20-40. Summary statistics for all countries are available in the online appendix.

There are several comments on the data worth making prior to reporting the summary statistics. First, the paper's key insight regarding coresidence patterns was facilitated greatly by the IPUMS family relationship pointer variables, which enable a user to identify relationships between family members.¹⁷ A similar method of using household relationship codes was applied to the DHS, which generated pointing variables between parents and children using the household roster. The details of this process and code are made available in the online appendix. Second, it is worth noting that the analysis will focus on the sex ratio of children under 5. This essentially treats any discrimination that leads to higher female mortality similarly, whether that is through abortion, infanticide, or deprivation of resources. Strong evidence suggests that the vast majority of "missing girls" are aborted, but the child sex ratio without assumption regarding how they went "missing" will include discrimination of any form that leads to lower fractions of girls in the population of children under 5. Third, my primary measure of coresidence is the fraction of men over 60 who live with their son who is at least 25 and do *not* live with a daughter who is at least 25. The results are very robust to logical alternative to this choice, such as defining "elderly coresidence" as only occurring between a married son and his parents, or considering a parent to be coresiding if there are both adult sons and adult daughters in the household. Note also that the choice of a person's father as defining coresidence instead of a mother was less critical, as divorce is rare in the countries in question, implying that fathers and mothers both live with adult sons. Last, the decision that a son who is 25 is "coresiding" is rather

¹⁷ <https://usa.ipums.org/usa/chapter5/chapter5.shtml>

arbitrary. The results are highly robust to using different assumptions regarding the exact definition of coresidence.¹⁸

B. Summary Statistics

In Table I, I present sample averages for select IPUMS and DHS countries. In Panel 1, I report summary statistics for the countries in the sample with high sex ratios, including China, India, Armenia, and Vietnam. Notably, all have high rates of elderly coresidence with sons. The countries are not however, remarkable in terms of gender equality. For example, Armenian women earn more years of schooling than Armenian men (13.34 versus 12.99 years). Chinese women enjoy employment rates of 90%. While gender equality is still a challenge in these countries, and women are by no means equal in these countries, they are unremarkable in their relative standing in our group of countries. In Panel B, I report summary statistics for countries where women appear to enjoy lower equity: Iran, Morocco, Turkey, and Pakistan. In all four, men are more educated and have much higher employment rates. For example, in Turkey, women are 44 percentage points less likely to work and have 2 fewer years of education. The contrast is even sharper in Morocco, where women are 62 percentage points less likely to work. Yet the sex ratio in Turkey and Morocco is normal. Interestingly, both countries have elderly coresidence rates that are more balanced than the countries with higher sex ratios. For example, 22% of Moroccan elderly live with sons and 14% live with daughters, suggesting parents are able to coreside with a child of either gender.

C. Examining Variation Across Countries

In Table II, I examine the relationship across countries between coresidence rates and sex ratios of children. The left-hand side in every regression is the sex ratio of children (males per

¹⁸ Results using different ages, or excluding unmarried sons, are available upon request.

100 females) and the right-hand side is the share of elderly men living with an adult son. In the first specification, which includes all countries and weights them equally, I estimate that an additional 10 percentage points of men who coreside with a son is associated with 1.3 more boys per 100 girls. To give a sense of what this implies, note that in Table I it was reported that China has roughly 6 boy more per 100 girls than the US (110 versus 104), implying that the entire difference in sex ratios between China and the US could be explained by the additional 40 percentage points of those living with sons (48% versus 12%). The results are highly robust to weighting the regressions (column 2), continent fixed effects (column 3), changing the sample to only IPUMS (columns 4-6), only DHS (7-8), or dropping OECD countries (9)-(11).

In Table III, I examine the hypothesis further that gender inequality does not explain missing women as well as an explanation that focuses on coresidence and kinship patterns. In column 1, I reproduce a preferred specification from Table II, in which I use the full sample of IPUMS/DHS countries and weight each sample by the number of observations. I then add an increasing rich set of measures of gender equality, adding relative education, employment rates, and literacy rates in columns 2-4. The coefficients are actually larger once controls are included. This may be surprising but since education gaps are actually *lower* in countries with high sex ratios, it leads to a negative sign on the education ratio, increasing the point estimate of coresidence (see Figure III). I estimate with controls that an additional 10 percentage points of coresidence would increase sex ratios by 1.0 – 2.4 male children per 100 female children. Finally, I perform an additional check of running the regressions separately for all countries in Asia versus those in non-Asia, including all the gender controls. The coefficient estimates are surprisingly similar (24.5 vs 20.7) between the two groups, suggesting that coresidence is correlated with sex ratios even outside of Asia.

D. *Examining Variation Within Countries*

In Table IV, I examine the relationship between coresidence patterns and sex ratios exploiting variation within countries. I examine this across districts in China, India, the Sudan, and the South Sudan. While the choice of China and India is obvious, as these two countries are host to the vast majority of missing women, the choice of Sudan and South Sudan requires explanation. Since Sudan is home to many different cultures and tribes (which was partly responsible for their recent division), it is particularly well suited for examining the paper's hypothesis. If skewed sex ratios are indeed tied to cultural norms related to patrilocality, countries with different groups living side by side with one another will allow me to test the hypothesis by comparing groups only differing in the cultural roots of patrilocality.

For this analysis, I adopt a slightly different measure of coresidence. I use the ratio of the percent of elderly living with sons to the percent of elderly living with daughters. This is superior to only focusing on the sons in the respect that parents are presumably considering the *relative* probability of living with a son versus daughter when evaluating the expected value of having a son versus daughter in terms of old age support. As shown in the table, elderly parents are 8 and 17 times more likely to live with sons than daughters in China and India respectively (Figure IV). The rates are somewhat more balanced in Sudan and South Sudan, with coresidence ratios of 1.99 and 1.46 respectively, suggesting many households have weaker tendencies towards patrilocality relative to India or China. However, there is considerable variation across ethnic groups and regions within the countries. The results indicate that across China's prefectures, India's regions, and counties in the Sudan and South Sudan, higher relative coresidence rates with sons is associated with higher sex ratios of children (Figure V). The results are estimated with and without the aforementioned gender controls. The results are statistically significant at

the 5% level in all but two of the specifications: across India's regions without gender controls and across China's prefectures with gender controls the result is only significant at the 10% level. This suggests that even within these countries, son preference varies with the strength of coresidence norms favoring sons, and leads to regional variation in the sex ratio.

In Table V, I use microdata for each of these countries to examine the relationship between sex ratios of children and coresidence patterns. This enables me to exploit variation within sub-districts of countries, or across ethnic groups within districts. This exploits variation across China's ethnic groups, India's religions, and across counties within Sudan and South Sudan's states. In each regression, the dependent variable is an indicator for the child being male. The independent variable is the ratio of the share elderly parents living with sons to daughters defined for each sub-group. For example, for a child born to Jain parents in India, the child is assigned the coresidence ratio among Jain elderly. For a child born in a particular county in Sudan, the coresidence ratio assigned is the average among elderly in that county. I find that even within these narrowly defined groups or regions, coresidence ratios are correlated with the male fraction of children. The one specification which fails is found in China, where I do not find a correlation among minorities within a prefecture. This may be due to the confounding effect of the One Child Policy, which grants waivers to certain minority groups, lowering the sex ratios of their births (Ebenstein 2010). However, the table provides evidence supporting the claim that son preference is tracking the measures of coresidence closely. While causality is not demonstrated by these results, they demonstrate that coresidence norms are intimately linked to the cultural roots of son preference. In the next section, I examine the origins of these norms.

IV. Historical Origins of Patrilocality and its Persistent Effects

In light of the evidence that the ‘missing girls’ phenomenon is related to the custom of patrilocality, it begs the question: why do elderly parents live with sons and not daughters? In this section, I explore the proximate determinants of this custom and its relationship to modern day sex ratios.¹⁹ First, I present summary statistics comparing the ancestors of the ‘missing girls’ to other groups in terms of kinship norms, subsistence methods, and political and social characteristics. I then examine patrilocality more broadly, and show that it is intimately related to the forms of agriculture practiced historically in different parts of the world. Then, I examine the relationship between the roots of coresidence and modern sex ratios.

A. Summary Statistics describing the Ancestors of the ‘Missing Girls’

In Table VI, I present summary statistics for the ethnic groups that were the ancestors of groups currently engaging in sex selection against girls. These data are taken from the Standard Cross-Cultural Sample (SCCS), a subset of 186 ethnic groups taken from the Ethnographic Atlas that are meant to be representative of the overall sample.²⁰ I compare them on dimensions that are traditionally recorded by anthropologists: residence norms after marriage, subsistence methods, and fixity of settlement. The table indicates that the groups which currently engage in sex selection had several common features. These were groups that all engaged in patrilocality, relied on agriculture and animal husbandry, and had greater fixity of settlement. Interestingly, however, these groups did not have significantly lower participation of women in agriculture. Insofar as gender norms exhibit persistence (Alesina et al. 2013), these results may help explain why gender equity is not correlated with the phenomenon of “missing girls.” While the need for

¹⁹ See Das Gupta et al. (2003) for a thorough discussion of the kinship systems in countries with high sex ratios.

²⁰ The SCCS is meant to overcome sample selection issues associated with closely related tribes that results in ‘Galton’s Problem’ by analyzing these data without correcting for clustering (Murdock and White 1969).

a son to defend and inherit land is clear, women in these societies have historically contributed substantially to subsistence.

B. Patrilocality and Methods of Subsistence

As shown in Figure VI, patrilocal norms (instead of norms towards balance or matrilocality) are increasingly more common with respect to each ethnic group's reliance on agriculture and animal husbandry, and declining with respect to their reliance on hunting gathering and fishing. This is consistent with the notion that patrilocality is rooted in the value of land, as societies with agriculture and animal husbandry will be less likely to be nomadic and will invest more heavily in their land. Scholarship has found evidence that residence norms vary across groups even in close proximity to one another, such as in African tribes (Murdock 1959). As shown in Figure VII, in Sudan, different tribes adopted different residence norms, possibly related to the forms of subsistence in which they engaged.

I examine this hypothesis more formally in Table VII, in which I predict the probability that a given ethnic group will practice patrilocality using their subsistence methods as explanatory variables. I also test whether this result is robust to the inclusion of continent (column 2) or country fixed effects (column 3). Note that in the case of models with country fixed effects, I am exploiting variation within the same modern national boundaries, implying that these groups were living in relatively close proximity to each other.²¹ As shown in Table VII, I find in Panel A that groups engaging in intensive agriculture are significantly more likely to have patrilocal norms. I measure the intensity of agriculture by classifying the members of the ethnographic atlas in four groups: 0 (no agriculture), 1 (casual agriculture), 2 (shifting agriculture), and 3 (intensive agriculture). Roughly half of the sample practices patrilocality, so

²¹ This is determined by the location of the centroid of the group, which is provided as a latitude-longitude coordinate in the Ethnographic Atlas.

the coefficient in column 1 indicates that moving from no agriculture (index=0) to intensive agriculture (index=3), the probability of practicing patrilocality increases 48.9 percentage points (or roughly the sample mean). Even with country fixed effects, I estimate that groups are 3.87 percentage points more likely to be patrilocal for each unit increase in the agricultural intensity index. In Panel B, I examine the relationship between an ethnic group's reliance on more basic subsistence methods, with the prior that groups engaging in hunting/gathering/fishing will have little inheritance, and will be unlikely to need a son to protect their land and inherit their property. Indeed, we observe that in all specifications, reliance on these basic methods is negatively associated with the adoption of patrilocal norms, and this result is robust to the inclusion of either continent or country fixed effects.

Finally, in Panel C, I examine the role of animal husbandry in inducing the adoption of patrilocality. I find, as anticipated, that greater reliance on animal husbandry significantly increases the propensity to have patrilocal residence norms. This is logical and consistent with the paper's thesis that patrilocal norms emerge from a desire to bequeath land to sons. The use of animals in agriculture allows for higher land productivity. Cattle are specifically well suited for agriculture, since cattle can be used for more productive plowing and also generates fertilizer, which can increase the land's productivity. Therefore, the presence of cattle will be associated with very strong norms towards patrilocal residence. To further demonstrate this point, I include a regressor which is whether the group's subsistence does not involve cattle. As predicted, after controlling for total reliance on animal husbandry, groups which do not use bovine animals in their subsistence are significantly less likely to be patrilocal. This finding is further reinforced by Figure VIII, which reports land inheritance norms among groups in the Ethnographic Atlas stratified by whether they are patrilocal. The results indicate that male-dominated land

inheritance customs are intimately linked with patrilocality: *every* society which participates in primogeniture or other “male only” inheritance systems are patrilocal. Furthermore, patrilocal societies are more likely to exhibit male preference in land inheritance, whereas non-patrilocal societies are more balanced. This is consistent with a thesis that the customs of coresidence norms for sons is related to inheritance norms, rather than a bias against girls of a more general variety.

C. Connecting the Past to the Present: Patrilocality and Modern Sex Ratios

In the previous section, I have laid out a set of stylized facts regarding which cultures adopted norms requiring strict patrilocality. In this section, I examine whether these customs are in fact responsible for the ‘missing girls.’ I examine this using two very different data sources. The first is provided by Putterman (2008), who catalogues the timing of each country’s neolithic transition, which demonstrates that certain parts of the globe adopted agriculture first, presumably because the land was amenable to this type of subsistence. Second, I exploit variation in India in terms of the land’s conduciveness for wheat farming. This represents a useful case study to evaluate whether the logical chain presented in this paper is valid. If the paper’s main argument is correct, areas of India that are more amenable to intensive agriculture should have higher coresidence rates and high sex ratios at birth.

In Table VIII, I present cross-country regressions analyzing the relationship between coresidence with sons and the sex ratio of children. We are restricted to the countries which are available in Putterman (2008), which generates a sample of 107 countries and 103 for which we can observe the reduced form. As shown in Figure IX, coresidence rates and sex ratios are higher among countries with long traditions of agriculture. The countries singled out as having high sex ratios – India, China, Armenia, Azerbaijan – all had Neolithic transitions over 9,000 years ago.

Presumably, an earlier Neolithic transition resulted from having land that was more conducive to agriculture, and made a further advance to intensive agriculture more likely. The pattern in the figure is consistent with an interpretation that intensive agriculture leads to stronger patrilocal norms, and that the strength of these customs is related to the suitability of land for this form of subsistence. While myriad other factors are not accounted for in these regressions, the fact that the countries in the Caucuses share a similar agricultural history and similar demographic experience with China and India is compelling evidence in favor of this interpretation.

As shown in Table VIII, I find using OLS that increasing the fraction of elderly who live with a son by 10 percentage points is associated with an increase the sex ratio at birth by 1.24 boys per 100 girls. However, once I instrument for today's coresidence rate with the years since the Neolithic revolution, we observe that a similar increase in coresidence rates would increase the sex ratio at birth by 3.77 boys. It is worth noting that this instrument is unlikely to pass the exclusion restriction, since the timing of the Neolithic revolution reflected a region's integration with its neighbors and other factors that could have affected the path of history (Diamond 1997). However, the results are consistent with the body of evidence that the adoption of agriculture was intimately related to the norm of living with sons, and the timing of adoption is correlated today with both coresidence rates and the 'missing women' phenomenon.

In light of the strong relationship between patrilocal norms and the value of land in our sample of ethnic groups and across countries, it is worth examining directly the relationship between regional variation in land quality, coresidence, and sex ratios within a country. A natural candidate for this analysis is India. Unlike China, India has historically exhibited dramatic variation in cultures across regions, and the kinship norms in Southern India have traditionally been bilateral (Das Gupta et al. 2013). We examine this in Table IX, where I exploit the strong

regional variation across India in norms of coresidence. Since India exhibits such marked patterns of heterogeneity regionally, it provides an opportunity to directly examine whether this variation lines up with the land's quality. A casual investigation suggests that land quality may be partly responsible for regional variation, as traditionally strong son preference in Northern India lines up with extremely rich agricultural regions, such as Punjab or Haryana. As shown in Table IX, GIS measures of a region's suitability for wheat are positively correlated with the coresidence rate. Annual rainfall is negatively correlated with the coresidence rate, which is logical since tropical climates are less favorable towards intensive agriculture. The 2SLS results indicate that increasing the ratio of living with sons to daughters by 1 is associated with a 0.92 increase in the sex ratio of children, significant at the 5% level. This further supports the hypothesis that intensive agriculture is at the root of kinship norms favoring coresidence with sons, and that these continue to have relevance today.

V. A Case Study of Pension Expansion in South Korea

A natural concern regarding this paper's central argument is that son preference is not the result of parents living with sons, but rather parents choose to live with sons because they prefer sons. In this line of thinking, coresidence patterns are the byproduct of preferences rather than the main driver. In order to examine this hypothesis, I present evidence from South Korea. South Korea is a country with historically strong son preference that engaged in a massive expansion in pension coverage in 1995. The expansion applied to self-employed workers and required every citizen to contribute 9.5% of income to the pension program, representing a landmark shift in how the country provided for its elderly population. This also obviated the need for elderly to live with sons, since it provided a guaranteed stream of wealth during retirement for all citizens.

As shown in Figure X, coresidence rates have begun to decline in South Korea. Insofar as this paper's main hypothesis regarding the motivation for having sons is related to coresidence, sub-populations which will have larger declines in anticipated coresidence rates should have larger decreases in the sex ratio at birth.

In Table X, I examine the impact of South Korea's pension expansion in a differences-in-differences setup. While wage and salary workers were covered by other pension schemes, the addition of self-employed workers to the mandatory pension program was a significant change in policy.²² Roughly a quarter of workers in South Korea are self-employed, making this an ideal opportunity to consider whether changing the probability of needing to rely on sons changes the sex ratio of children. As shown in Table X, while 54.8% of births were male prior to the expansion, only 52.9% were male after 1995. This can be compared to a relatively stable ratio of male births among salaried workers who had been covered, which increased slightly from 53.5% to 53.8%. I estimate that the introduction of mandatory social security was associated with a 2.21 percentage point decline in the male fraction of births $[(54.8-52.9)-(53.5-53.8)]$, and this point estimate is statistically significant at the 5% level.

While the data available in the South Korean census are not sufficiently rich to conduct a more complete analysis of trends in births prior to the change, the evidence presented here is strongly suggestive evidence that parents in Korea were responsive to the policy change.²³ In fact, the rapid normalization of the sex ratio suggests that the 'missing girls' phenomenon can be properly framed as a problem of missing social insurance, consistent with evidence presented

²² The pension scheme in Korea was initially introduced for public officials and military personnel in the early 1960s. The National Pension Program, as a compulsory scheme for private firms with ten or more employees, was introduced in 1988. In 1992, the compulsory coverage was expanded to cover workplaces with five or more. In July 1995, the compulsory coverage was extended further to cover the self-employed living in rural areas, including farmers and fishermen. I exploit the last phase of the rollout.

²³ I also have little information regarding people's expectations of the policy change. Expectations of an expansion would presumably attenuate the estimated effect of the policy, suggesting that the policy's estimated impact on the sex ratio would be even larger if parents had children in the early 90s expecting the policy change.

from China that parents without sons are deeply concerned about the prospect of retirement with no son to provide care (Ebenstein and Leung 2010). While other scholars have focused on the decline in the intensity of son preference in Korean fertility surveys in terms of the proportion of participants who report that they “must have a son,” it may be that the underlying *reason* parents feel less obliged to have a son is related to concerns over financial support when they are elderly (Chung and Das Gupta 2007).

VI. Conclusion

This paper examines the relationship between ‘missing girls’ and cultural norms favoring coresidence with sons during old age. I present evidence that sex ratios and coresidence rates are positively correlated when looking across countries, within countries across districts, and within districts across ethnic groups. Standard measures of gender inequality, such as relative education or employment rates, are only weakly correlated with sex ratios, suggesting that attributing the phenomenon to “son preference” is insufficient. In light of the relationship between patrilocal norms and the phenomenon of “missing girls,” I examine the roots of this custom. I find that ethnic groups practicing intensive agriculture were more likely develop norms dictating that sons inherit land, and this is linked to the modern expectation that sons will care for elderly parents. Further evidence supporting this hypothesis is found in analysis of land quality in India, where areas conducive to intensive agriculture continue to have higher rates of coresidence with sons, and higher sex ratios of children. I then turn to an analysis of South Korea’s pension expansion, which indicates that the male fraction of births dropped significantly among those added to the program, consistent with the paper’s main argument.

The findings of this paper lend further support to the belief that the “missing girls” phenomenon is related less to religion or culture and more to the role played by sons in caring for

their elderly parents. While initiatives aimed at improving female status are noble, expanding social insurance is likely to be more effective at normalizing the sex ratio. The recent experience from South Korea suggests that social change can occur quite rapidly when effective public policy reduces the economic need for sons.

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Table I

Sex Ratios of Children, Coresidence Patterns, and the Status of Women in IPUMS Countries

Country	Sex Ratio Under 5	<u>Coresidence Differences</u>			<u>Schooling Differences</u>			<u>Employment Differences</u>		
		Son	Daughter	Diff	Men	Women	Diff	Men	Women	Diff
<i>Panel A: Select Countries with High Rates of Coresidence with Sons</i>										
Armenia	113	0.49	0.10	0.39	12.99	13.34	-0.3	0.63	0.46	0.16
China	110	0.48	0.09	0.39	7.79	5.97	1.81	0.98	0.90	0.09
India	109	0.56	0.06	0.50	5.81	3.60	2.20	0.95	0.44	0.51
Vietnam	108	0.41	0.11	0.30	7.58	7.36	0.22	0.95	0.86	0.09
<i>Panel B: Select Countries with Gender Inequality</i>										
Iran	105	0.23	0.14	0.09	8.21	6.51	1.69	0.87	0.14	0.73
Morocco	105	0.22	0.14	0.09	3.97	2.55	1.42	0.84	0.22	0.62
Turkey	106	0.28	0.10	0.18	8.21	6.01	2.20	0.85	0.40	0.44
Pakistan	105	0.35	0.05	0.30	4.30	2.02	2.28			
<i>Panel C: OECD Countries</i>										
Israel	106	0.12	0.09	0.03	11.08	11.42	-0.3	0.80	0.61	0.19
Italy	105	0.19	0.12	0.07	10.58	10.74	-0.1	0.83	0.56	0.26
United States	104	0.07	0.06	0.02	9.23	9.02	0.21	0.86	0.69	0.16

Notes : The statistics are reported for the most recent IPUMS sample for each country. The fraction living with a son or daughter is defined as the share of men age 60+ who coreside with adult sons or daughters (age \geq 25). Those residing with both sons and daughters are defined as not coresiding for this calculation. Schooling and employment are reported for men and women ages 25-45. All differences for schooling and employment are statistically significant at the 1% level.

Table II**Cross-Country Relationship Between Share of Elderly Living with Sons and the Sex Ratio of Children**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	<i>Dependent Variable: Sex Ratio of Children (ages 0-5)</i>										
Mean of Dep. Var.	103.80	105.20	105.20	104.30	105.20	105.20	103.40	104.20	103.60	105.30	105.30
Share of Elderly Living With Son	12.88*** (3.19)	12.47** (5.13)	10.38** (5.23)	11.30*** (3.83)	12.39** (5.29)	10.48* (5.62)	15.13*** (2.99)	15.13*** (2.99)	15.22*** (3.36)	17.49*** (5.72)	11.29* (6.17)
Weights	No	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
Continent Fixed Effects	No	No	Yes	No	No	Yes	No	No	No	No	Yes
Sample Selection	Full	Full	Full	IPUMS	IPUMS	IPUMS	DHS	DHS	No OECD	No OECD	No OECD
Observations	140	140	140	69	69	69	71	71	122	122	122
R Squared	0.15	0.26	0.41	0.16	0.26	0.41	0.23	0.23	0.21	0.34	0.39

Notes: Sample is composed all IPUMS and DHS samples for the most recent year available. The share of elderly living with a son is defined as the ratio of men age 60+ who coreside with adult sons (age \geq 25). Standard errors are reported in parentheses below the coefficients and are heteroskedastic-consistent. Weighted regressions are weighted by the number of observations in the survey. * significant at 10% ** significant at 5%. *** significant at 1%.

Table III

Cross-Country Relationship Between Share of Elderly Living with Sons and the
Sex Ratio of Children Controlling for Measures of Gender Equity

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Dependent Variable: Sex Ratio of Children (ages 0-5)</i>					
Mean of Dep. Var.	105.20	105.20	105.20	105.30	107.20	103.60
Share of Elderly Living With Son	10.38** (5.23)	17.73*** (5.18)	19.74*** (4.64)	24.36*** (5.23)	24.52*** (7.83)	20.65*** (6.94)
Education Ratio (male yrs / female yrs)		-2.90** (1.18)	-2.39* (1.31)	-6.90** (2.68)	-6.73 (7.27)	-3.88 (3.07)
Working Ratio (male emp / female emp)			-0.44*** (0.14)	-0.47*** (0.11)	-0.56*** (0.09)	0.27 (0.17)
Literacy Ratio (male rate / female rate)				5.05*** (1.78)	2.40 (10.44)	3.06 (2.40)
Sample Selection	Full	Full	Full	Full	Asia	Non-Asia
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Continent Fixed Effects	Yes	Yes	Yes	Yes	No	No
Observations	140	138	126	102	24	78
R Squared	0.41	0.51	0.62	0.68	0.76	0.33

Notes: Sample is composed all IPUMS and DHS samples for the most recent year available. In row 1, the fraction living with son is defined as the ratio of men age 60+ who coreside with adult sons (age \geq 25). In row 2, the education ratio is the ratio of average years of education of men to women. In row 3, the employment ratio is the ratio of the employment rate of any type among men to the rate among women. In row 4, the literacy ratio is the ratio of the literacy rate among men to the literacy rate among women. In column 6, the sample is restricted to countries in Asia. In column 7, the sample is restricted to countries not in Asia. Standard errors are reported in parentheses below the coefficients and are heteroskedastic-consistent. All regressions are weighted by the number of observations in the survey used. * significant at 10% ** significant at 5%. *** significant at 1%.

Table IV

Relationship between Elderly Coresidence and Sex Ratios Within Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Dependent Variable: Sex Ratio of Children (ages 0-5)</i>							
	China		India		Sudan		South Sudan	
Mean of Dep. Variable	110.1		108.4		107.7		105.6	
Mean of Indep. Variable	8.542		16.87		1.998		1.463	
Ratio of Elderly Living with Sons to Daughters	0.18** (0.080)	0.17* (0.090)	0.12* (0.060)	0.19** (0.080)	5.22*** (0.790)	4.95*** (1.070)	5.62*** (1.650)	4.46*** (1.580)
Gender Equity Controls	No	Yes	No	Yes	No	Yes	No	Yes
Type of District	Prefecture	Prefecture	Region	Region	County	County	County	County
Observations	347	347	79	79	129	129	67	67
R Squared	0.01	0.04	0.04	0.09	0.42	0.43	0.27	0.41

Notes: Each column represents a separate regression. The samples are China (1990 census), India (1983-2008 National Sample Surveys), Sudan (2008 census), and South Sudan (2008 census). All are taken from IPUMS. The unit of observation is a district. The independent variable in each regression is calculated by taking the ratio of men ages 60 and older who are living with a son to those living with a daughter. Standard errors are reported in parentheses below the coefficients, are heteroskedastic-consistent, and clustered at the district level. Regressions are weighted by sample weight when available. * significant at 10% ** significant at 5%. *** significant at 1%.

Table V**Relationship between Elderly Coresidence and Sex Ratios Within Countries and Within Regions**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Dependent Variable: Male (1=yes)</i>							
	China		India		Sudan		South Sudan	
Mean of Dep. Var.	52.39%		52.06%		52.22%		51.35%	
Ratio of Elderly Living with Sons to Daughters	0.0381** (0.018)	-0.0337 (0.038)	0.0328** (0.013)	0.0880** (0.031)	1.519*** (0.338)	0.701*** (0.206)	3.138** (1.104)	0.448* (0.226)
Coresidence Defined by:	Prefecture	Ethnicity	Region	Religion	State	County	State	County
Fixed Effects at:	None	Prefecture	None	Region	None	State	None	State
Coresidence Groups	347	57	79	9	15	129	10	66
Observations	429,561	429,561	64,985	64,984	1,418,185	1,417,126	940,736	940,736

Notes: Each column represents a separate regression. The samples are the same as in Table IV. The unit of observation is an individual child age 0-5. The independent variable in each regression is calculated by taking the ratio of men ages 60 and older who are living with a son to those living with a daughter. Standard errors are reported in parentheses below the coefficients, are heteroskedastic-consistent, and clustered at the district level. Regressions are weighted by sample weight when available. The samples are all taken from IPUMS.* significant at 10% ** significant at 5%. *** significant at 1%.

Table VI

Ancestors of the "Missing Girls" and their Characteristics

	(1)	(2)	(3)
	High Sex Ratio Groups	All Other Groups	Difference
Patrilocality	1.00	0.62	0.38***
<i>Forms of Subsistence</i>			
Agriculture	63.35	41.10	22.25***
Animal Husbandry	27.65	16.74	10.91*
Gathering	3.65	12.85	-9.20***
Hunting	3.64	17.24	-13.60***
Fishing	8.78	18.31	-9.53***
<i>Political & Social Characteristics</i>			
Frequently Attacked (1=yes)	0.72	0.35	0.37**
Size of Community	6.71	3.57	3.14***
Fixity of Residence	5.00	3.72	1.28***
Class or Caste System (1=yes)	1.00	0.35	0.65***
<i>Main Crop Type</i>			
Cereals (1=yes)	1.00	0.47	0.53***
Roots (1=yes)	0.00	0.21	-0.21***
<i>Female Contribution to Subsistence</i>			
Murdock Measure	28.75	34.82	-6.07
Number of Cultures	7	179	

Notes: The data are taken from the Standard Cross-Cultural Sample (Murdock and White 1969). The seven cultures in the column of those with high sex ratios are the Chinese, Lolos, Vietnamese, Koreans, Abkhaz, Armenians, and Punjabis. The size of communities is classified by categories ranging from 1 (fewer than 50) to 8 (cities of greater than 50,000). Fixity of settlement ranges from 1-5, with 1 representing fully nomadic tribes and 5 representing groups with fixed settlement.

Table VII

Relationship between Subsistence Methods and Patrilocality

	(1)	(2)	(3)
	<i>Dependent Variable: Patrilocality (1=yes)</i>		
	Pooled OLS	Continent Fixed Effects	Country Fixed Effects
<i>Panel A: Intensive Agriculture and Patrilocality</i>			
Intensity of Agriculture (index 0-3)	0.163*** (0.01)	0.0796*** (0.01)	0.0387** (0.02)
Observations	1,065	1,065	1,065
R Squared	0.13	0.30	0.50
<i>Panel B: Hunting, Gathering, Fishing and Patrilocality</i>			
Percent Reliance on Hunting, Gathering, Fishing (0-100%)	-0.700*** (0.03)	-0.473*** (0.05)	-0.227*** (0.06)
Observations	1,266	1,266	1,266
R Squared	0.21	0.29	0.47
<i>Panel C: Animal Husbandry and Patrilocality</i>			
Percent Reliance on Animal Husbandry (0-100%)	0.835*** (0.08)	0.602*** (0.08)	0.416*** (0.10)
Absence of Bovine Animals (1=yes)	-0.222*** (0.03)	-0.150*** (0.03)	-0.0830** (0.04)
Observations	1,158	1,158	1,158
R Squared	0.20	0.31	0.49

Notes : Sample is composed of 1,267 ethnic groups contained in the Ethnographic Atlas (Murdock 1965). The dependent variable in all regressions is a dummy variable for the ethnic group practicing patrilocality. The independent variables are listed in the left-most column. Intensity of agriculture is defined as [0=none, 1=casual, 2=extensive, 3=intensive]. The other measures of subsistence vary between 0 and 1. An indicator is coded for the absence of bovine animals using V40 of the Ethnographic Atlas. Standard errors are reported in parentheses below the coefficients and are heteroskedastic-consistent. * significant at 10% ** significant at 5%. *** significant at 1%.

Table VIII

Cross-Country Relationship between Coresidence Rates the Sex Ratios of Children Using Time Since the Neolithic Transition as an Instrument

	(1)	(2)	(3)	(4)
	Dependent Variable: Sex Ratio of Children		Dep Var: Coresidence Rate	Dep Var: Sex Ratio of Children
	OLS	Reduced Form	First Stage	2SLS
Share of Elderly Living With Son	12.4*** (4.16)			37.7*** (9.31)
Log of Years since Neolithic Transition		2.87*** (0.61)	0.080*** (0.02)	
Observations	107	103	98	98
R Squared	0.131	0.245	0.202	

Notes : Each column represents a separate regression. The sex ratio of children and the coresidence rates are calculated from the most recent IPUMS/DHS survey for each country as described in Table 1. The instrument for the coresidence rate is the log years since the neolithic transition. Standard errors are reported in parentheses below the coefficients and are heteroskedastic-consistent. Data on the timing of the neolithic by country are taken from Putterman (2008). * significant at 10% ** significant at 5%. *** significant at 1%.

Table IX

Relationship Across Indian States between Coresidence Rates the Sex Ratios of Children Using Suitability for Intensive Agriculture as an Instrument

	(1)	(2)	(3)
	Dep Var: Sex Ratio of Children	Dep Var: Sex Ratio of Children	Dep Var: Coresidence Ratio
	OLS	Reduced Form	First Stage
			2SLS
Ratio of Elderly Living with Sons to Daughters	0.298* (0.16)		0.92** (0.35)
Suitability for Wheat Cultivation (000s)		1.762** (0.83)	2.19*** (0.66)
Annual Rainfall (000s)		-44.62** (19.63)	-40.53** (17.98)
Observations	34	34	34
Gender Equity Controls	Yes	Yes	Yes
Type of District	State	State	State
First Stage F-Statistic			23.49

Notes : Each column represents a separate regression. The sample is the India National Sample Survey (1983-2008), provided by IPUMS. Suitability for wheat cultivation is provided by FAO through the GAEZ website. Rainfall is taken from a global raster on precipitation in milimeters per year. States are assigned the average value using ArcGIS zonal package. The 34 states in the NSS that successfully match to the GIS shapefile are included in the analysis. Standard errors are reported in parentheses below the coefficients and are heteroskedastic-consistent. Data on the timing of the neolithic transition by country are taken from Putterman (2008). * significant at 10% ** significant at 5%. *** significant at 1%.

Table X

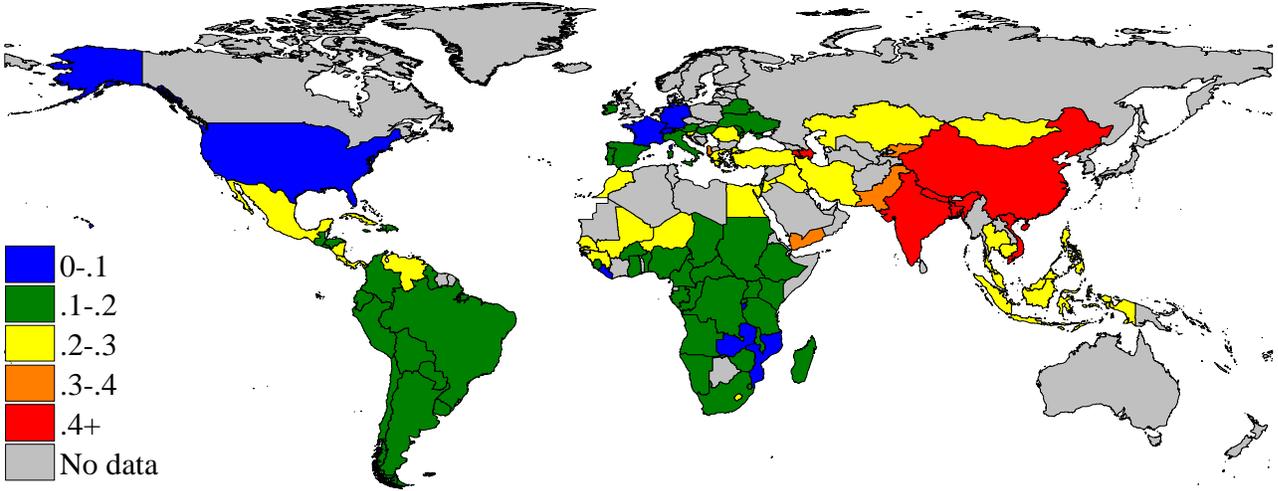
Differences in Differences Estimates of the Effect of Pension Expansion
on the Male Fraction of Births in Korea

	Self-Employed (added to pension)	Salaried Workers (existing pension)	Difference
	(1)	(2)	(3)
1. Children Born Before Pension Expansion (1990-1994)	0.548 (0.005)	0.535 (0.003)	0.0133** (0.005)
2. Children Born After Pension Expansion (1995-2000)	0.529 (0.006)	0.538 (0.004)	-0.009 (0.007)
3. Change in Male Fraction of Births After Reform	-0.0191** (0.008)	0.003 (0.005)	-0.0221** (0.009)

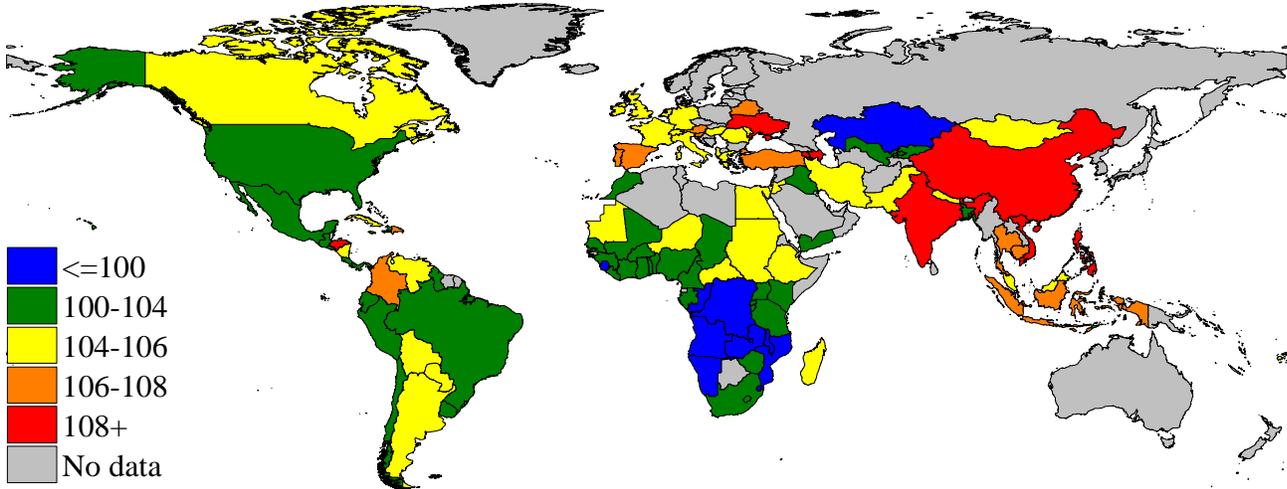
Notes : Data are taken 68,282 births observed between 1990 and 2000 observed in the Korean 2000 census. Sample is restricted to parents where the father and mother are at least 35 and 30 years old respectively. * significant at 10% ** significant at 5%. *** significant at 1%.

Figure II

Panel A: Coresidence Rates by Country



Panel B: Sex Ratios by Country

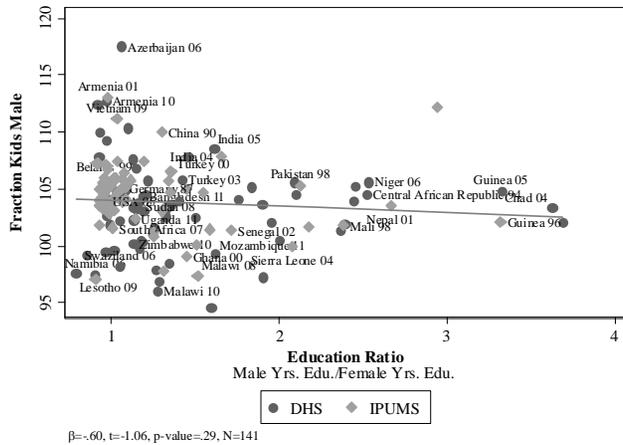


Notes : Data for 103 countries using IPUMS and DHS data with the most recent available survey.

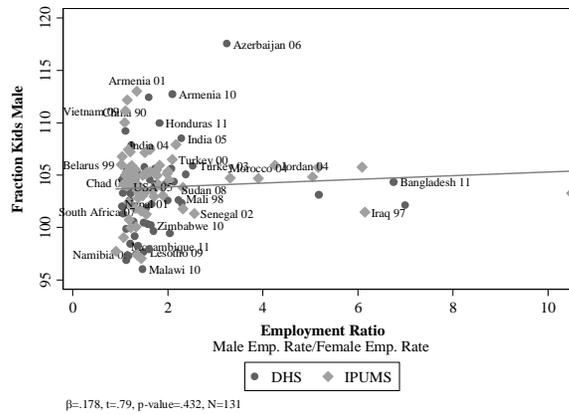
Figure III

Male Fraction of Births and Relationship with Other Measures of Gender Equity

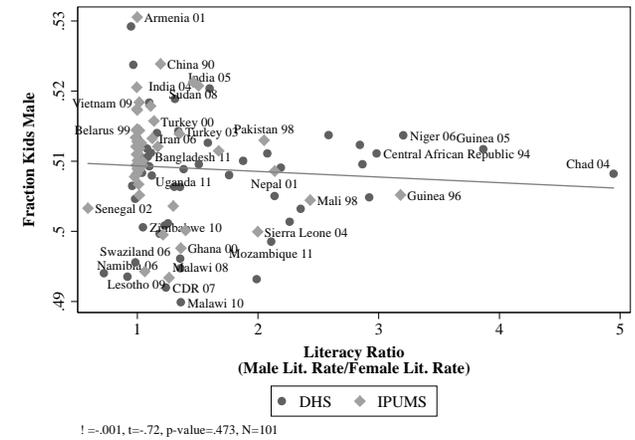
Panel A: Education Ratio



Panel B: Employment Ratio



Panel C: Literacy Ratio

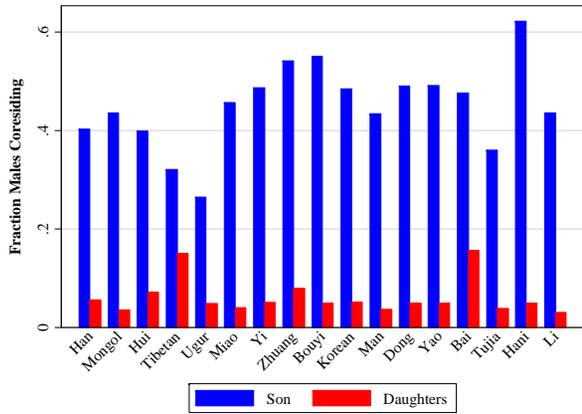


Notes : The ratios are defined as (a) male to female education in years (b) male to female labor force participation and (c) male to female literacy rates. These are calculated among individuals ages 25-45.

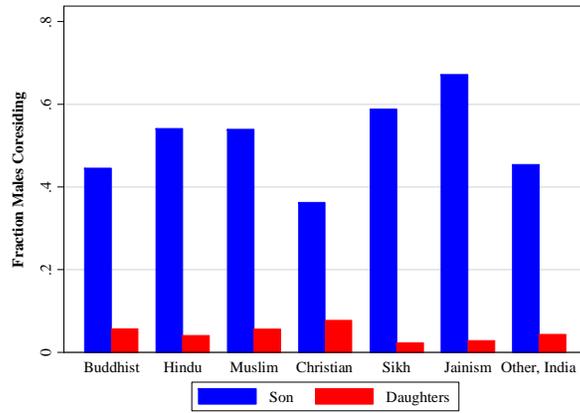
Figure IV

Elderly Coresidence Rates with Sons and Daughters in China, India, and the United States

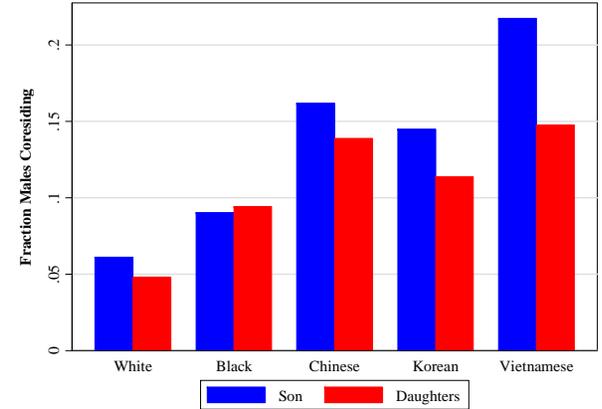
Panel A: China Ethnicities



Panel B: India Religions



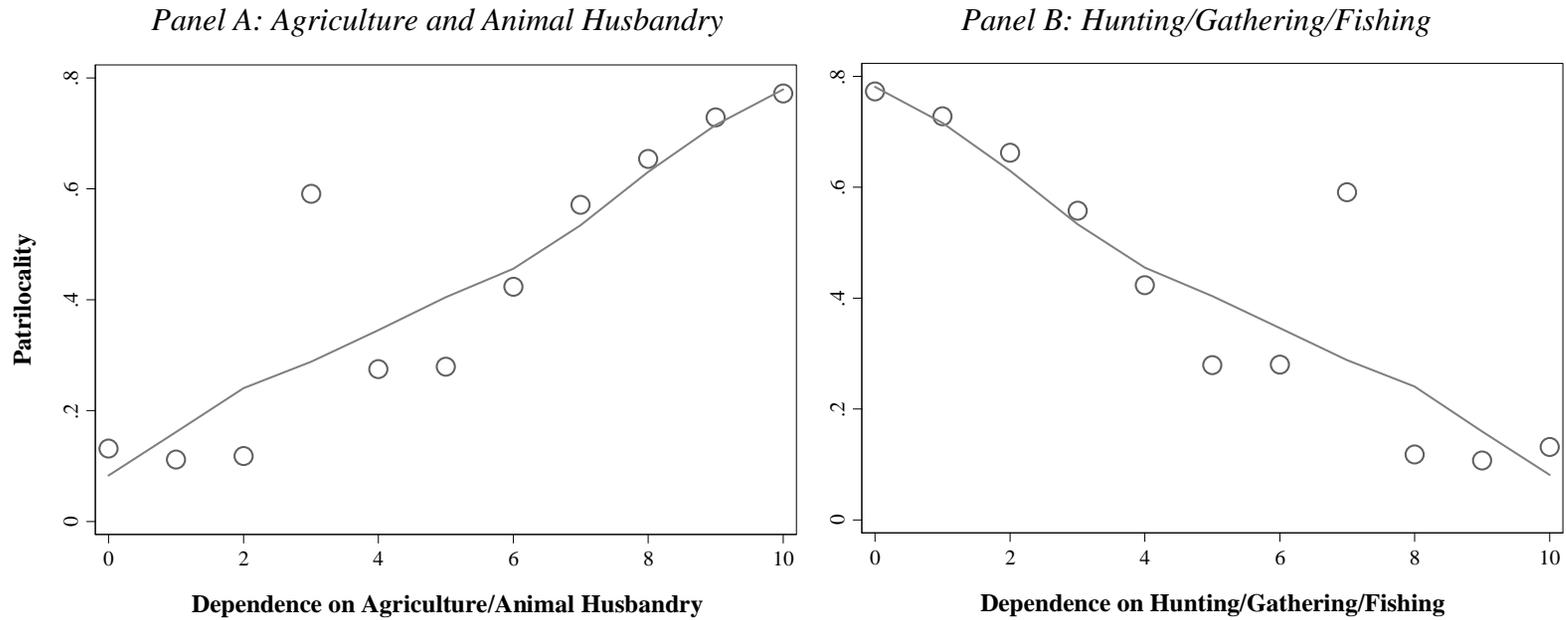
Panel C: United States Ethnicities



Notes: China 1990 IPUMS (10% sample), India 2005/6 DHS Sample, United States IPUMS 2010. See Figure 1 for details.

Figure VI

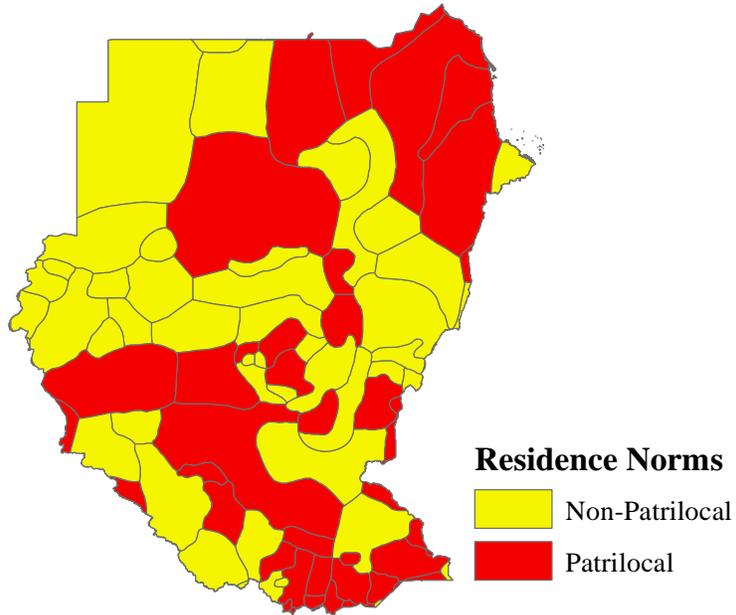
Coreidence Patterns and Subsistence Methods Across Societies



Notes : The figure plots the relationship between patrilocal norms and subsistence methods among 1,267 traditional societies recorded in the Ethnographic Atlas (Murdock 1965). The figure is created using the lowess smoother in STATA (bandwidth .80). The index of dependence ranges from 0-9, with zero indicating 0-5% dependence and 9 indicating 85-100% dependence.

Figure VII

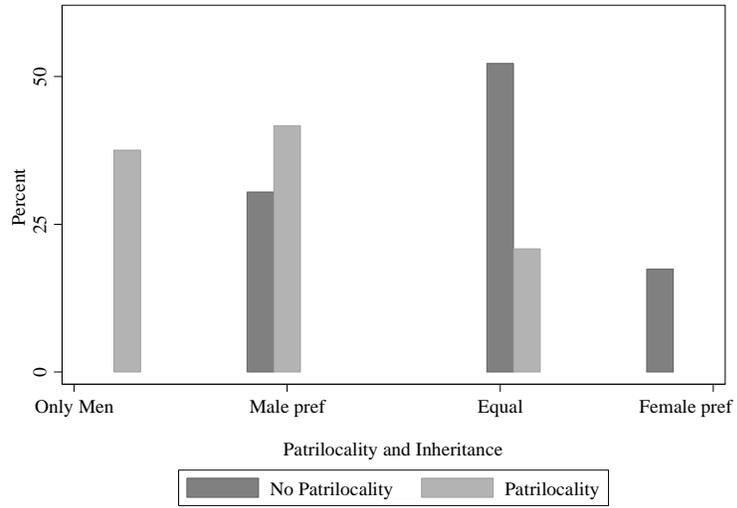
Residence Norms of Ethnic Groups in Sudan



Notes : Each polygon represents the ancestral homeland of an ethnic group in Sudan, and the color shades reflect their residence customs, taken from Murdock (1959).

Figure VIII

Patrilocality and Male Domination in Land Inheritance



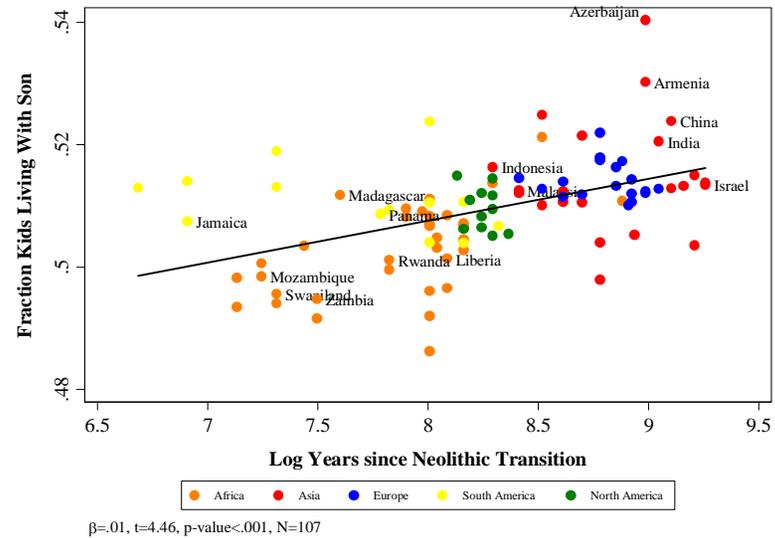
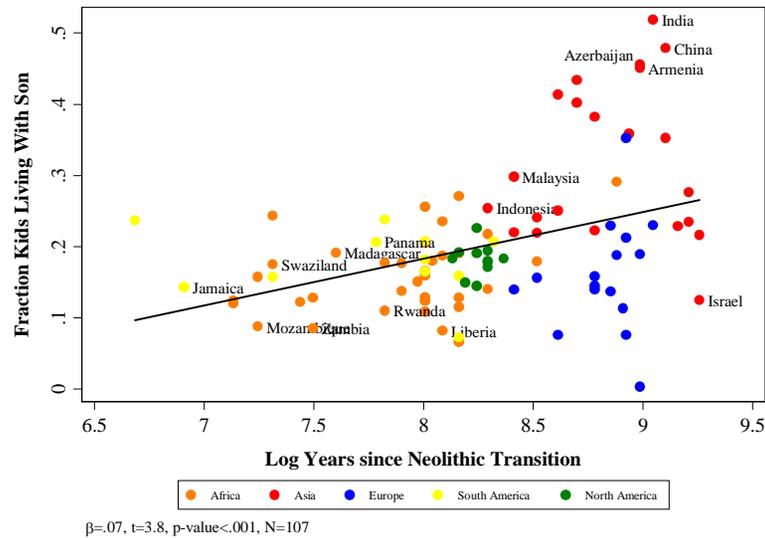
Notes: The figure plots a histogram of the frequency of inheritance practices by whether residence after marriage was patrilocal.

Figure IX

Coreidence Rates, the Male Fraction of Births, and Log Years since the Neolithic Transition across Countries

Panel A: Coreidence Rates and the Neolithic Transition

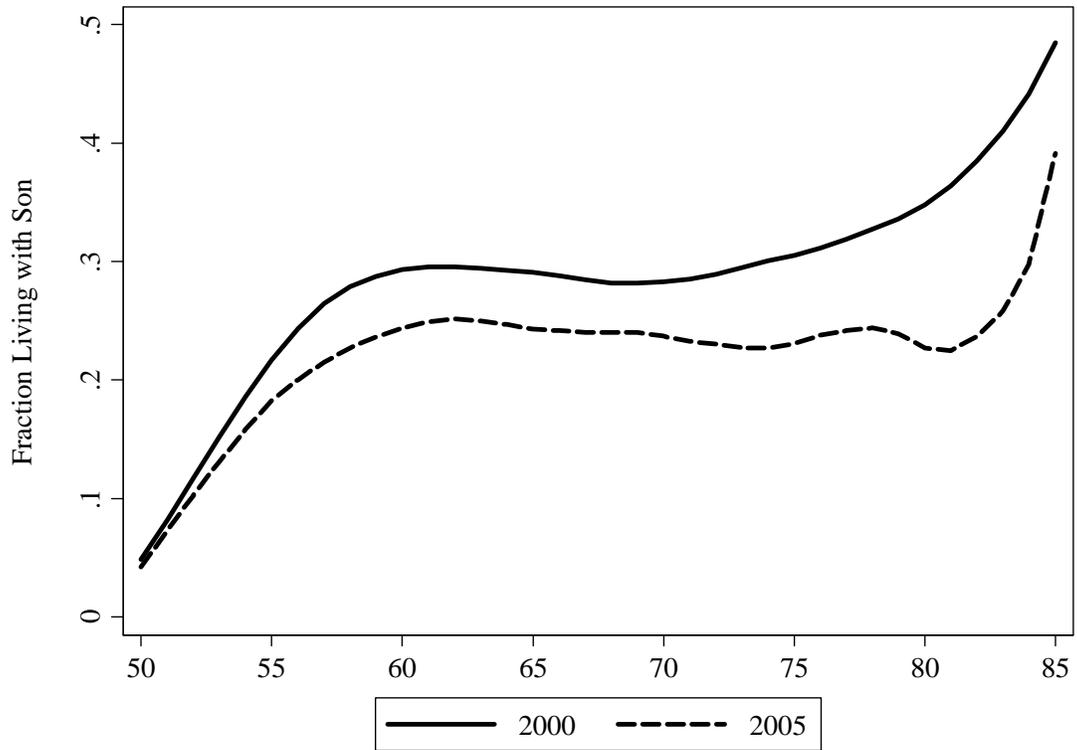
Panel B: Male Fraction of Births and the Neolithic Transition



Notes: Panel A plots the relationship between the fraction of elderly parents (ages 60+) living with their married adult son (ages 25+) and the log years since the neolithic transition. Panel B plots the relationship between the male fraction of children, ages 0 to 5, and the log years since the neolithic transition. The coreidence patterns and male fraction of children are taken from the most recent IPUMS and DHS data. Data on the timing of the neolithic by country are taken from Ashraf and Galor (2011).

Figure X

Age Profile of Elderly Coresidence with Sons in Korea



Notes : The figure plots the coresidence rate for adult males for the years 2000 and 2005. The figure is created using the lowess smoother in STATA (bandwidth .30).