The Effects of Female Land Inheritance on Economic Productivity in Ghana

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Abstract

How does female land inheritance affect economic productivity in an economy with growing non-farm economic opportunities? I study this question in Ghana, by examining variation in inheritance customs across ethnic groups. In patrilineal groups, land passes from fathers to sons. In contrast, inheritance rules are more flexible in matrilineal groups; land can pass to both men and women. This flexibility improves productivity by allowing men and women to better optimize their labor allocation, taking into account gender differences in the outside options available. In matrilineal groups, women are more likely to inherit land, which leads to them managing farms and supplying labor to their own plots. Their inheritance induces men to exit agriculture and work for a wage. This improves male labor productivity and produces higher per capita consumption. In contrast, because women face additional barriers to participating in the labor market, male inheritance under patrilineal inheritance is associated with women supplying labor to male-owned plots, and supplying less labor in total. Two mechanisms explain the positive effects of female inheritance on male labor productivity: (1) men who exit farming capture the returns to their skill, because the wage labor market rewards cognitive skill, while farming does not, and (2) the wage labor market offers an earnings premium over agriculture. This gain does not come at the expense of reduced farm productivity, which does not differ across the two inheritance regimes. Male-only inheritance customs thus not only foster gender inequality, but can also facilitate labor misallocation, thereby lowering overall productivity.

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1 Introduction

A long literature in economics has posited that exiting agriculture is central to the process of economic development (Rosenstein-Rodan 1943, Lewis 1954). Consistent with this, there exists a strong negative correlation between the share of individuals employed in agriculture and GDP per capita (Hamory et al. 2021), and in low-income countries there are large productivity gaps between the farm and non-farm sectors (Gollin, Lagakos and Waugh 2014). Given these large productivity gaps, it is economically important to understand who chooses to enter or remain in agriculture, and to more thoroughly understand the economic consequences of these decisions.

Simultaneously, a large and growing literature has documented important interactions between cultural institutions and economic behavior. The rules that dictate who inherits land (Fernando 2020), what occupations an individual of a given ethnicity or caste can readily access (Munshi and Rosenzweig 2006), and what happens to an individual and their family at the time of marriage (Ashraf et al. 2020, Rosenzweig and Stark 1989) have been shown to meaningfully affect a wide margin of economic decisions, such as occupational choice, schooling decisions, and migration patterns. Moreover, as the economic environment changes, the returns to adhering to different cultural institutions might plausibly change as well. Who stands to benefit under a regime in which the majority of jobs are in agriculture might plausibly differ from who benefits under the regime in which the best jobs are outside of farming.

This paper studies one such interplay in Ghana: the relationship between inheritance customs that allow women to inherit land, and occupational choice. In Ghana, 52% of the population practices patrilineal inheritance, in which land passes from fathers to sons, and in which women are unlikely to inherit or manage land. In contrast, the system of matrilineal inheritance (practiced by the other 48%) is more flexible, and allows for both men and women to inherit. I show that these inheritance customs matter in determining land ownership today, and that in turn inheritance shapes who manages and applies their labor to this land. I show that these differences across gender and inheritance system are also associated with human capital investments, and the degree of selection into different occupations.

The core finding of this paper is that female land inheritance increases economic productivity, operating primarily through the channel of improved *male* productivity. This result is the product of asymmetric economic opportunities available to men and women in the non-farm sector, and thus asymmetric impacts associated with male and female inheritance. In matrilineal inheritance, in which women inherit land, men respond by exiting agriculture, and working in wage-based jobs. In anticipation of this exit, matrilineal parents respond by investing more in their sons' schooling. In contrast, when men inherit land under patriliny, women do not similarly move into wage labor, because of additional barriers to participating in the labor market. Instead, they respond by supplying labor to their husband's plots, and supplying less labor in total. I find that the net effect of the more flexible labor allocation is higher economic productivity, concentrated in gains to male, non-farm income. Matrilineal men benefit both by the returns to the schooling they capture, and through a non-agricultural premium.

I provide evidence for my hypothesis that female inheritance improves economic productivity in Ghana in four steps.

First, I detail the basis for gender differences in inheritance across the two inheritance systems, drawing on evidence from anthropology, and validating these differences in nationally representative micro-data. A core difference between the two inheritance systems is the extent to which colonialism and Abrahamic religions fostered ambiguity in who can inherit, and thus allowed for the possibility of female inheritance. Under patriliny, the custom of father-son inheritance is not in tension with these imported institutions, but under matriliny, colonialism and Abrahamic religions have facilitated a more ambiguous set of rules regarding exclusion and inclusion, which anthropologists have argued has expanded the scope for female inheritance. Consistent with this, in the Ghana Socioeconomic Panel Survey, I find that men are more likely to inherit land than women in both matriliny and patriliny, and in turn are more likely to be managing farms. However, this male-female gap is meaningfully smaller in matriliny: the female-male farm management gap is 34 percent in matriliny, as compared to 54 percent in patriliny. Moreover, I find that these inheritance differences are also associated with a positive $female \times matrilineal$ on who manages and supplies their labor to farms, suggesting a tight link between inheritance and occupational choice.

Second, I develop a framework that I argue can best explain the patterns I observe. This framework is motivated by three facts: (1) that there is a positive $female \times matrilineal$ interaction on land inheritance and on agricultural labor, (2) that matrilineal *sons* receive higher investments in schooling, and (3) that matrilineal households have higher per capita consumption, beyond direct effects driven by human capital differences. I propose that these behaviors can be explained by caring parents who can invest in their children by offering them land or investing in their schooling (and thus strengthening their cognitive skill). Matriliny relaxes a constraint that only men can inherit. This framework, when combined with relevant features of the economic environment, will have implications about the behavior of individuals if my hypothesis has bite.

This framework fundamentally depends on characterizing the economic environment, since the nature of occupational choice and selection will depend on the returns to different sectors for individuals with heterogeneous ability and schooling. In particular, the consequences of inheritance differences by gender and ethnic group will depend on the occupations individuals sort into, the returns to education and cognition in farming and in wage labor, the availability of work for men and women, and other gender differences shaping farm and non-farm productivity. As a core part of this paper, I evaluate these relationships empirically, and estimate (1) farmer total factor productivity (TFP) with endogenous input use, which I estimate using production function techniques, and (2) the returns to cognitive skill in wage labor and in farming, correcting for endogenous selection into sectors.

Finally, with these relevant attributes characterized, I assess the extent to which differences in behavior by gender and inheritance regime are consistent with my framework (and consistent with playing a causal role in productivity). Empirically, I find evidence that gender and inheritance shape the nature of sorting into sectors, consistent with the interplay between (i) differences in the returns to skill by sector, and (ii) differences in the constraint of who can inherit. I estimate a completely flat relationship between cognitive ability and farm productivity, but find that cognitive skill is rewarded in the labor market, and that at all levels of cognitive skill, women are less likely to be working. I find that matriliny lowers the threshold at which men choose to exit agriculture, allowing those who exit to better capture the return to their cognitive skills. Moreover, on top of this, I find evidence that even at low levels of cognition, there are non-agricultural earnings premia, suggesting benefits to exiting farming for most individuals.

Key to this set of results is the very tight link between inheritance and farm management, and the well-documented need in West Africa to continue to manage land to preserve rights over it (Goldstein and Udry 2008); leaving land fallow (or for others to manage) risks the possibility of appropriation. This work hints at the possibility that improving tenure (and in particular, making it possible to uncouple land ownership from use) might foster more exit on the part of men. It also suggests that women (and parents who care about women) are operating in the world of second-best. While women working for a wage might offer the highest possibility of earnings, other barriers to female employment mean that female inheritance plausibly offers an improvement for women; since it shifts them from working on their husbands' farms and working less, to working on an asset that they themselves are managing.

This work suggests that male-only inheritance regimes, in addition to contributing to gender inequality in asset wealth, can also dampen economic productivity. Land inheritance plays a strong role in shaping occupational choice and labor supply decisions in West Africa, and plausibly in other contexts where continued land ownership depends on continued land management. Male-only land inheritance can inefficiently keep men tied to farming, but this pattern does not hold for women, who are likely to be working for a wage regardless of their inheritance, suggesting benefits to a more flexible inheritance system. It also suggests that the specific nature of cultural institutions shapes occupations and thus earnings in important ways. An analysis that simply characterized both matrilineal and patrilineal households as practicing "traditional land tenure arrangements" would fail to observe an important source of heterogeneity when analyzing economic behavior.

1.1 Related Literature

This paper contributes to three literatures. In particular, this paper lies at the intersection of research on (a) the ways in which cultural institutions shape the economic choice sets of individuals, (b) the barriers to and the consequences of structural transformation, and (c) the nature of gender inequality in rural areas, and mechanisms through which this inequality can be attenuated,.

This paper contributes to our understanding of the ways in which specific cultural institutions shape the incentives and constraints that individuals face, and how this interacts with an economy undergoing structural transformation. This literature has shown that culture can shape a wide range of behavior, including schooling decisions (Ashraf et al. 2020, Munshi and Rosenzweig 2006), marriage (Rosenzweig and Stark

1989, Luke and Munshi 2006, Corno, Hildebrandt and Voena 2020), migration (Munshi and Rosenzweig 2016), exit from agriculture (Fernando 2020), transfer behavior (Hoff and Sen 2011, Jakiela and Ozier 2016) and intra-household cooperation (Lowes 2017). Differences in inheritance systems (and related institutions) in Ghana have been shown to shape transfer behavior (La Ferrara 2003, La Ferrara 2007) and human capital investment (La Ferrara and Milazzo 2017, Bau 2021). My work suggests that female land inheritance is another such institution that meaningfully guides economic behavior. More broadly, a key takeaway of this paper is that "customary land tenure" is not a monolith; papers considering the impacts of land reform in Sub-Saharan Africa and elsewhere and its relation to customary tenure should carefully evaluate this heterogeneity, and how reforms will affect differing existent institutions in different ways.

Secondly, a macroeconomic literature has discussed the nature of the agricultural wage gap (Gollin, Lagakos and Waugh 2014), and the reasons that individuals engaged in agriculture on average earn less than individuals outside of agriculture (Young 2013, Herrendorf and Schoellman 2018, Pulido and Swiecki 2018, Hamory et al. 2021). This work has considered the forces, including macroeconomic conditions, that might induce individuals to remain in or exit agriculture (Lagakos and Waugh 2013, Buera and Kaboski 2009, Restuccia, Yang and Zhu 2008). This paper complements this macroeconomic literature, by considering a specific set of frictions (gender-based inheritance rules, coupled with thin land markets) that can contribute to agricultural wage gaps. Moreover, my results show that studies that do not explicitly consider gender are plausibly neglecting an important dimension of heterogeneity, given the prevalence of and heterogeneity in female constraints present in developing nations.

Finally, given the multifaceted nature of gender inequality in the labor market, a large literature has considered the various ways in which women face additional barriers to work. In particular, this paper contributes to research on sources of inequality faced by women in rural areas. Existing work has explored factors shaping female agricultural productivity, (Kilic, Palacios-Lopez and Goldstein 2015, Goldstein and Udry 2008), how female asset ownership affects their labor productivity (Doss 2006, Bandiera et al. 2017, Banerjee et al. 2015), and how perceptions about the suitability of women's work further shapes behavior (Field et al. 2021, Bernhardt et al. 2018). Previous work has studied female inheritance, albeit in a context in India where women are unlikely to work as farm laborers (Heath and Tan 2020, Deininger, Goyal and Nagarajan 2013). A key contribution of this study is that it shows that factors shaping female labor allocations should not be considered solely in their effects on female and male labor productivity. Instead, both men and women are likely to respond to variation in gender inequality in important ways.

2 Gender and Inheritance in Ghana

Ethnic groups in Ghana practice unilineal descent, in which kinship, relations and inheritance are determined through a single parent only. The Akan, a meta-ethnicity comprising 47.5% of the population in Ghana in the 2010 Census,[1] practice matrilineal descent; the remaining ethnic groups practice patrilineal descent (Awusabo-Asare 1990). These customs have long historical origins—there is evidence of the Akan practicing matriliny at least as early as the 15th century (Wilks 1989).[2]

In patrilineal descent, kinship and inheritance are traced through male relatives. Sons and daughters belong to their father's lineage. Patrilineal descent strongly favors inheritance to males as a consequence of this structure. A son's children remain part of the same lineage as their father, while a daughter's children do not—instead they belong to the daughter's *husband's* lineage. Thus, among patrilineal ethnic groups in Ghana, inheritance and inter-vivos transfers of land to women have historically been limited. One explicit argument made by patrilineal individuals is that transferring land to a woman will cause the land to be lost to another lineage (discussed in e.g. Duncan 2010 and Bukh 1979).[3]

Matrilineal descent is not symmetric to patrilineal descent: land has historically still passed to men, and matrilineal tribes are not matriarchal; lineage heads, chiefs and other customary leaders are still traditionally male (Fortes 1956). Traditionally, Akan land has passed from a man to his *sister's* sons. Previous work has provided evidence that this uncle-nephew relation indeed shapes transfer and investment behavior (La Ferrara 2003, La Ferrara 2007, La Ferrara and Milazzo 2017).

A key difference between the two systems of descent is the degree to which their institutional rules inherently conflict with, and have thus evolved in response to more recent institutions in Ghana, most notably, British colonial rule (and thus law) and Western Religions (Danquah 1928). Both British colonial rule and the religions of Christianity and Islam have emphasized the preeminence of the nuclear family for economic matters. This emphasis does not necessarily conflict with patrilineal descent, in which inheritance was already transmitted through the nuclear family (from fathers to sons). In contrast, this focus on the nuclear family creates a tension with the matrilineal system, with competing claims between a man's own children, and those of his sister's (Okali 1983). As described by the anthropologist Meyer Fortes in the 1950s, regarding the largest Akan ethnic group, the Asante, "on the one side are the overwhelming bonds of matrilineal kinship...on the other, the ties of marriage and paternity. [Asante] are much preoccupied with this problem and constantly discuss it," (Fortes 1956).

One consequence of this tension between obligations is that it has fostered an "open texture" of potential claimants to land under matriliny (Douglas 1969), and that the "vague rules of inclusion and exclusion" offer increased flexibility in determining who gains access to land (Amanor 2001, Hill 1997). One manifestation of this increased

[1] I calculate this number using the Integrated Public Use Microdata Series

[2] Appendix Table A1 shows the prevalence of different inheritance regimes, under both customary rule and legal system. It shows that matriliny is less common than patriliny but is not an extreme occurrence; roughly 14% of ethnicities in the Ethnographic Atlas (Murdock 1967) practice matriliny of some form.

[3] For example, Bukh 1979 discusses that patrilineal women's own families restrict their use of lands, out of concern her children will claim access to her land and trees, thus transferring land from their lineage to her husband's.

flexibility, which forms the basis of this paper, is the increased possibility of female inheritance. Some evidence of matrilineal female land inheritance has been documented at least as early as 1928 (Danquah 1928). More recent work has attributed increased female inheritance to women using the flexibility of inheritance rules and "matrifocal alliances" (ie female-centered networks) to assert their rights to land (which is also differentially feasible under matriliny, because of the female nature of kinship) and ensure inheritance and transfers also pass to women (Amanor 2001). Okali 1983 and Quisumbing et al. 2001 also provide evidence of females gaining access to land via their matrilineal kin and spouses, which again, relative to a patrilineal system, they differentially are able to pass onto their female relatives.

Thus, while the long-run customs of both patriliny and matriliny led to inheritance passing to men, changes in the centrality of the nuclear family, coupled with differences in the structure of kinship have differentially expanded the choice set of potential claimants to land. As a result of this interaction, matrilineal women have the possibility of gaining access to land to an extent not true for patrilineal women. This difference forms the basis of my study, offering a chance to examine the margins that adjust as a result of these differences in inheritance, and their broader consequences.

3 Data and Variables

This primary data used in this study comes from the Ghana Socioeconomic Panel Survey (GSPS). The GSPS is a nationally representative survey, encompassing 6,337 households from 334 enumeration areas.[4] GSPS enumeration areas were randomly sampled from the list of enumeration areas in the 2000 Ghana Population and Housing Census. A re-census of these enumeration areas was conducted in 2009; households in the GSPS were randomly selected from this re-census of the chosen enumeration areas.

The panel spans three waves over nine years, with data collected in 2009/2010, 2013, and 2018. Waves 1 and 2 of the GSPS were collected through collaboration between the Institute of Statistical, Social and and Economic Research (ISSER) at the University of Ghana, Legon and the Economic Growth Center at Yale University; Wave 3 was collected through ISSER and the Global Poverty Research Lab at Northwestern University. Across the three waves, the GSPS includes a total of 6,337 households (an initial 5,009 households, and an additional 1,328 "split-off" households) and 15,452 household-wave observations; it includes 27,259 individuals (18,889 from the first wave, plus additional individuals born or joining the original households and their split-offs in the second and third waves) and 54,263 individual-wave observations. Given my focus on labor supply and land inheritance, I restrict my sample to prime-aged adults (i.e. those aged 25-54), born in a non-urban district. This sample restriction leaves me with 6,615 individuals and 12,981 individual-wave observations across 4,135 households and 8,910 household-wave observations.

[4] Enumeration areas generally correspond to communities in rural area and neighborhoods in urban areas.

The GSPS data includes detailed information on several domains relevant to the study of labor supply, earnings and productivity in Ghana. In the domain of agricultural production, survey data contains detailed, agricultural plot-level information, including the person responsible for each plot, agricultural "consumable" inputs (e.g. seeds, fertilizers) used in production, reported in both quantities and (when relevant) prices paid, land characteristics and the shared of owned land that was cultivated in a given year, labor supplied at each agricultural stage (disaggregated by male and female household labor, and by communal and paid labor), crop choices, and the harvest quantities and prices received.

I also observe detailed information on non-agricultural productive activities. The GSPS includes detailed information at the enterprise-level for household owned-or-operated businesses, including the identify in the household of the owner(s), the sector of the business, firm inventory, revenues, expenses, and detailed labor supply for the four most important employees, including their person-identifier within the household where relevant (97.5% of businesses have four or fewer employees, suggesting censoring is minimal). Information is also collected for all members who worked outside of the household for a wage in the last year, including the sector of employment, wage rates (and benefits, where relevant), and the days worked in the last year. It also contains a detailed consumption module.

The GSPS also includes detailed information on all members of the household, including their ethnicity (which, using the Ghana Census ethnicity categorization, I use to classify whether an individual is Akan and therefore of matrilineal descent), region and district of birth, age, educational attainment and (in Wave 3) a measure of their cognitive skill, as measured by their performance on a (a) Raven's Progressive Matrices test (Raven 1941) and (b) on digit span forwards and backwards tests (Wechsler 1955).

The GSPS also includes household-level global positioning system (GPS) coordinates, which I use to classify the urban-rural nature of an individual's current residence (for price adjustments), and which I merge with data on land quality from the Food and Agricultural Organization (FAO)'s Global Agro-Ecological Zones (GAEZ) v3.0 dataset. The FAO-GAEZ dataset includes gridded data on the dominant soil, agricultural zone, and other soil characteristics (e.g. rooting conditions, oxygen availability) at the $0.083° \times 0.083°$ level, which corresponds to roughly 9 km $\times$ 9 km in Ghana.

4 Analytic Framework

In this section, I provide a framework for analyzing the relevant margins affected by differences in inheritance customs for matrilineal and patrilineal men and women. I begin by documenting three relevant facts: (1) the prevalence of female inheritance is greater among matrilineal ethnic groups, and subsequently, agricultural plot management and agricultural labor is greater for matrilineal women; (2) gender and descent also jointly predict human capital investment; and (3) that there exist differences in per capita consumption between matrilineal and patrilineal households, not fully explained by differences in human capital or district of birth.

I then propose that these differences can be understood through the framework of parents who care about the future welfare of their children. Two margins through which to support children are by investing in their human capital and by providing them with land. Women face barriers to participating in the labor market, which negatively affects the returns to investment in women's human capital. Matriliny relaxes a constraint present in patriliny that only men inherit land. After characterizing the relevant features of the environment, I then consider implications of this framework.

4.1 Motivating Differences

The anthropological literature provides a rationale for why we might expect to see differences in inheritance for men and women across descent systems. While the strong norm of male inheritance persists under patriliny, the "open texture" of claimants fostered by the interplay between matriliny and more recent institutions has increased the possibility of female inheritance. Here, I test this relationship empirically. In Table 1, I estimate the relationship between gender, descent and inheritance among prime age adults born in rural districts, using the three waves of the GSPS, with the equation:

$$y_{idt} = \alpha + \beta female_i + \gamma matrilineal_i + \delta female_i \times matrilineal_i + \nu_t + \eta_d + \epsilon_{idt}$$

where y_{idt} is the outcome of interest for an individual i born in district d at time t, $female_i$ is an indicator variable for whether the individual is female, $matri_i$ an indicator for belonging to an ethnic group that practices matrilineal descent, ν_t is a wave fixed effect, η_d a district of birth fixed effect, and ϵ_{idt} an error term. Standard errors are clustered at the person-level.

In Column (1) I report whether or not an individual has received any land via inheritance,[5] and in Column (2), whether they were "allocated" any land. Allocation refers to a form of inter-vivos transfer, where an individual is either transferred ownership over land, or given usufruct rights over it (ie, given the right to manage but not to sell).[6] These results are consistent with the anthropological literature emphasizing the possibility of female inheritance under matriliny. While men are more likely than women

[5] This does not appear to correspond to individuals gaining access to land after their parent dies necessarily. The median age at which a plot owner received land is 35; individuals still report "inheriting" land in cases where both parents are still alive.

[6] Amanor 2001 describes allocation among the Akan in the following way:

> *In place of giving land as a gift to a family member land may be allocated to a relative or close friend to "eat from" or to cultivate freely. Men may give land to children or sisters' children and wives on this basis. Women may give land to their children and grandchildren on this arrangement. [...] Gaining user rights in land is often the first stage which children pass through before they are given a gift of the plot. If children cannot afford to make the aseda ["thank you payment"] to seal the granting of land as a gift, they will hold land on a user right basis. Frequently children start off working with their father or mother on their farms, and then are given a plot of their own on which to make a farm, before this plot is later formally presented to them as a gift.*

to inherit or be allocated land under both inheritance regimes, the gap is meaningfully smaller under matriliny. In a difference-in-difference, matrilineal women are 11 percentage points more likely to have inherited any land (relative to a sample mean of 20%), and are 8 percentage points more likely to have been allocated land (relative to a sample mean of 11%). The same pattern also holds in acreage, reported in Columns (3) and (4): men inherit more than women; this gap is meaningfully smaller under matriliny than under patriliny.

This effect is not simply driven by matrilineal households having more land (and thus being able to better transfer land to both sons and daughters). In Appendix Table A2, I compare inherited land between matrilineal and patrilineal households, again controlling for wave and district of birth fixed effects. I cannot reject that matrilineal and patrilineal adults are equally likely to have any inherited land, or that they have equal amounts of inherited land.

These differences in inheritance in turn translate to differences in the gendered composition of farm management and farm labor. In Table 2, I report equivalent estimates for whether or not an individual managed an agricultural plot in the most recent growing season. I again find a large and positive $female_i \times matrilineal_i$ effect—relative to a sample mean of 37%, matrilineal women are 20 percentage points more likely to have land under their management in a difference-in-difference estimate; they cultivated 1.35 more acres (sample mean of 1.75 acres).

Moreover, farm management strongly predicts the gender composition of labor supplied on a given agricultural plot. In Table 3, I show summary statistics of male and female labor on male- and female-managed plots.[7] For patrilineal and matrilineal plots managed by men, 70 and 75% of the labor is supplied by men, respectively; for patrilineal and matrilineal female-managed plots, 71 and 79% of the labor is supplied by women. For all gender-descent pairs, the gender of the plot manager strongly predicts the labor supplied on the plot.[8] In my setting, the more flexible inheritance rules under matrilineal are associated with greater female inheritance, more frequent female plot management, and a greater share of agricultural labor supplied by women.

A second way in which parents might aim to improve the welfare of their children is through investing in their human capital; depending on the extent to which skill is or is not rewarded in farming, transfers of land and human capital investment might plausibly be substitutes (La Ferrara and Milazzo 2017, Deininger, Goyal and Nagarajan 2013). Thus, differences in land inheritance could plausibly affect the human capital investments by gender and descent in Ghana. I test this relationship in Table 4, where I compare education by gender and descent. Here, I treat each individual ever in my sample as a

[7] I formally test this relationship in Appendix Tables A3 and A4, by reshaping data to be at the "manager - gendered labor" level (ie male labor under person 1's managed plot and female labor under person 1's managed plot are treated as two separate observations). I find an extremely strong relationship between gender of the manager and gender of the plot owner, for both matrilineal and patrilineal individuals.

[8] In waves two and three, I also see the labor supplied by the plot manager themselves. On average, the farm manager is responsible for 39% of the labor on plots under their control.

single observation.[9] Here I find three effects: (1) women receive less schooling than men, (2) matrilineal individuals receive greater schooling than patrilineal individuals, and (3) the gap in schooling between men and women is greater in matriliny—that is, there is a negative coefficient on the $female_i \times matrilineal_i$ interaction. In an environment where the difference in descent systems simply reflected a generalized female empowerment, we might expect that the coefficient on δ, the interaction between female and matriliny would be positive. The negative coefficient in contrast is consistent with a context in which parents are substituting land transfers and human capital investment.

In Table 5, I consider differences in the permanent income of matrilineal and patrilineal households, as measured by their per capita adult equivalent consumption (following the argument in eg Deaton and Zaidi 2002 that consumption is likely a better measure of permanent income in developing countries). I control for the number of men and women in the household, and the head's district of birth.[10] I report results in Column (1) without further adjustments, and then add controls for male and female (i) adult years of education and (ii) cognition (described in Section 6) in Column (2). Column (1) thus measures a total effect of differences across inheritance systems; Column (2) explores the possibility of an effect beyond direct human capital effects, consistent with (albeit not dispositive of) differences driven by differences in selection into occupation across sectors. I observe that matrilineal households on average have higher per capita consumption, and that this effect is attenuated but not eliminated when controlling for education and cognition. In Column (2), matrilineal per capita consumption is 9 log points higher than patrilineal per capita consumption.

These differences, namely that (1) matrilineal women are more likely to inherit land and engage in farming, (2) matrilineal men receive more schooling, and (3) that matrilineal households have higher consumption beyond what can be directly explained by human capital differences, provide the basis of my proposed analytical framework. In this set-up gender, descent and human capital jointly determine the allocation of male and female labor, which in turn shapes individual-level productivity.

4.2 Framework and Environment

I hypothesize that parents care about the welfare of their children, which they can facilitate by investing in their human capital and (depending on the gender and descent of the child) providing them with land. An individual's human capital and land endowment will in turn shape their occupation, productivity, and control over income. The key difference between the two groups, which in turn shapes several additional margins, is that the male-only inheritance constraint is relaxed under matriliny.

Investment decisions (and subsequent sorting into occupations) depend on the following features of the Ghanaian economy:

[9] As would be expected, the auto-correlation of individuals is quite high. I use the average reported value across waves in cases where an individual's schooling is reported differently across waves.

[10] I restrict my sample here to households with at least one female and one male aged 18 or older, thus shutting down differences in marriage patterns. Results are similar when I do not implement this restriction.

Feature 1: Land passes to men in patriliny; this constraint is relaxed under matriliny.

Discussed in Sections 2 and 4.1.

Feature 2a: Land markets are thin, limiting the scope of land sales and rentals.

One mechanism through which individuals might exit agriculture is by selling off or renting out inherited land. In an environment with perfect land markets, inheritance will affect wealth of an individual, but not the efficient allocation of labor—a high cognition individual who inherits land might not choose to remain in farming, but could either sell or rent out their land to capture an income. In Ghana however, land markets are thin, likely reflecting that land use has traditionally been managed via customary tenure (Goldstein and Udry 2008). Only 4% of individuals managing agricultural plots in the sample obtained their land via purchase. Survey respondents are also asked if any members outside of the household are managing plots under which they have ownership rights or control over, and if so, whether they are receiving rent payment or sharecropping in these cases. In total, 5% of plots are not being managed by a household member; 4% of individuals are receiving sharecropping as a form of rental income, 0.3% are receiving cash for renting out their plots.[11]

Feature 2b: Cultivating one's own land ensures tenure security.

In an environment with formal, secure property rights, we might plausibly expect to see a relatively frequent dissociation between the inheritor of a plot, and the individual managing the plot and/or supplying labor to it, given that the individual with the comparative advantage in farming might plausibly differ from the individual inheriting the land. Such a dissociation is relatively uncommon in this context—just 4% of plot managers are managing a plot obtained by another household member, and 93% of plot managers supplied labor to their own plots. This tight link between inheritance, management, and labor reflects the nature of customary tenure principles, in which tenure security is ensured by individuals actively cultivating a plot they own. Previous work in West Africa has shown that individuals not cultivating their own farmland face concerns of land reallocation/appropriation (Austin 2005, Berry 1993, Goldstein and Udry 2008, Pande and Udry 2005); having a spouse or non-lineage member manage a farm plausibly weakens an individual's claim to the land they have inherited or been allocated relative to the individual themselves managing it.[12]

[11] The remaining plots not under the household's management are being borrowed free of charge.

[12] The behavior of individuals is consistent with this pattern. Note however that I only observe the reported tenure security of individuals managing land; the survey does not ask people to imagine hypothetical tenure security if a non-lineage member counterfactually managed the plot. In qualitative exploratory interviews I have conducted however, this exact concern has been raised by rural-born individuals in Ghana.

Feature 3: Women face additional barriers to participation in the labor market.

Another key attribute of the economic environment is that women are disproportionately likely to face barriers to entering the labor market. Among prime-age rural-born men, 22% worked for a wage at any point in the past year, while just 7% of women did.[13] Unpacking the specific source(s) of these barriers is beyond the scope of the paper, though one plausible source of variation is that childcare constraints affect the feasibility of participating in short-term employment arrangements.

Feature 4: Cognitive skill is rewarded in the labor market, but not in farming.

I provide evidence for this feature in section 6.2, in which I model endogenous entry into occupations, and estimate the selection-adjusted returns to cognition and years of education. I find a positive return (both annually, and per day) to cognition and years of education among those earning a wage. In contrast, for individuals who select into farming, I estimate a completely flat (selection-corrected) relationship between cognition/education and (a) farmer total factor productivity, and (b) farmer profits.

Feature 5: Women have lower farmer total factor productivity than men.

I provide evidence for this feature of the economic environment in Section 6.5, in which I estimate farmer total factor productivity (TFP) with endogenous input use. I find that women on average have land-adjusted farmer TFP 0.29 standard deviations lower than that of men. In section 6.5 I consider candidate explanations for this gap.

4.3 Implications

These features of the economic environment have the following implications with respect to sorting, occupation schooling, productivity, and control over income:

Wage Labor: because cognitive skill is rewarded in the labor market (but not in farming), participation in the labor market will be increasing in ability for all individuals. Additionally, because women face additional barriers, wage labor participation will be higher for men than for women. Finally, the existence of women inheriting land under matriliny implies that more matrilineal men will be without land, thus inducing them to differentially enter the labor market and work for a wage.

Human Capital: human capital will endogenously differ by gender and descent. The additional barriers women face relative to men encourages greater human capital investment in men. Moreover, because matrilineal men are more likely to be in the labor

[13]These differences are also not solely a function of differences in human capital, but rather hold at both (a) when controlling for human capital, and (b) when conditioning on a subset with a given education level.

market (as a result of not having land), and cognitive skill is rewarded in the labor market but not in farming, there are differential incentives to invest in matrilineal education among men. The results presented in Table 4 are consistent with this implication: men have more education than women; the gender gap is larger under matriliny.

Land Inheritance: Given the lack of returns to cognitive skill in farming, and the thin nature of land markets, individuals inheriting land (and thus farming) will be negatively selected in human capital and cognition, given that they will earn less in the labor market, but face no such penalty in farming. The increased flexibility in inheritance under matriliny will increase the share of farm managers who are women. Where exactly in the skill distribution this "matriliny treatment effect" on female inheritance will occur is ex ante ambiguous.

Female income: Matrilineal women will be more likely than patrilineal women to have any income under their control, given that (i) matrilineal women can inherit land, and (ii) women face additional barriers to participating in the labor market. (Were it not for this second feature, we might expect male plot ownership under patriliny to be associated with relatively high rates of patrilineal women in the labor market).

Permanent Income: Given that matrilineal households have an inheritance constraint relaxed, we should weakly expect matrilineal households to have higher per capita consumption, consistent with Table 5. The magnitude of the expected matriliny-patriliny income gap is contingent on each of: (a) agriculture/non-agriculture premium, (b) the magnitude of the returns to skill in non-agriculture, and (c) the extent to which matrilineal households are less productive in agriculture as a result of more women being farmers, given that females in this context on average have lower farmer TFP.

To test these implications (and provide the basis for my assumptions), I next estimate two empirical objects: (1) farmer total factor productivity, with endogenous input use, and (2) the returns to skill by sector. Estimating farmer TFP allows me to compare farm productivity across the two inheritance systems, and is an outcome variable I use to examine the relationship between cognitive skill and farmer productivity. Estimating the returns to skill allows me to examine the relationship between gender, inheritance custom, and selection into a given occupation.

5 Farmer Total Factor Productivity

To examine how agricultural productivity varies by the gender and descent of the farm manager, I estimate a model of farmer total factor productivity (TFP), in which farmers' input allocations are endogenous.

I assume that farm output for a given farmer is determined by the function:

$$Y_{it} = e^{\beta_0 + \omega_{it} + \epsilon_{it}} L_{it}^{\beta_1} N_{it}^{\beta_2} M_{it}^{\beta_3}$$

or in logs:

$$y_{it} = \beta_0 + \omega_{it} + \beta_1 l_{it} + \beta_2 n_{it} + \beta_3 m_{it} + \epsilon_{it}$$

Where Y_{it} is farmer output, L_{it} is the land cultivated by a farm manager, N_{it} the effective labor supplied on the farm manager's plots, and M_{it} the agricultural inputs (seeds, fertilizer, herbicides and plowing services) used by the farmer.[14] I assume, given the term $e^{\beta_0+\omega_{it}+\epsilon_{it}}$, that unobserved productivity can be decomposed to a ω_{it} term, at least partially known or predictable to the farmer, and an ϵ_{it} term, unobservable to both the econometrician and the farmer.

5.1 Inversion Techniques

In estimating total factor productivity, I face the classic issue of endogenous input selection (Marschak and Andrews 1944). Since ω_{it} affects a farmer's marginal return to a given input, unobservably more productive farmers will optimally use more inputs. To correct for this issue, I employ "inversion techniques" from the industrial organization literature. In particular, I estimate ω_{it} using the procedure proposed by Levinsohn and Petrin (2003) ("LP").[15]

The core insight of LP is that intermediate inputs, such as electricity, or materials used in production, are likely to be freely variable in every time period (and non-zero), and monotonic in ω_{it}. With these assumptions, ω_{it} can be inverted, and estimated as a function of the intermediate inputs and the dynamic asset (in my case, land). I assume that agricultural inputs (seeds, fertilizers, herbicides and tractor plowing services, henceforth "consumable inputs") fulfill the basic "intermediate input" properties: in every period, farmers can freely adjust these inputs, they only affect profitability in the given growing season, and an operating farmer is unlikely to use zero inputs.[16]

Under this framework, a farmer's demand function for consumable inputs can be expressed as a function of their known TFP, ω_{it}, and their land, l_{it}:

$$m_{it} = m_{it}(\omega_{it}, l_{it})$$

which, when inverted, can be re-written as:

$$y_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 n_{it} + \beta_3 m_{it} + f_{it}^{-1}(m_{it}, l_{it}) + \epsilon_{it}$$

This procedure involves two-stage estimation: in a first stage, I estimate β_2 (the factor share of labor) and a composite inverse function of land and consumable inputs,

[14] I use the terms "farm manager" and "farmer" synonymously here; a constant distinct from from labor (though highly related, given that 30% of farm labor on a plot is the manager themself in my sample).

[15] I estimate factor shares and ω_{it} in Stata using the user-written command levpet, introduced by Petrin, Poi and Levinsohn (2004)

[16] In my sample, just under 2% of farmers used no consumable inputs in a given period. In my base results, I exclude these observations from the sample. Results are extremely similar when I bottom-code input use at the 2nd percentile.

$\phi_{it}(l_{it}, m_{it}) = \beta_0 + \beta_1 l_{it} + \beta_3 m_{it} + \omega_{it}(l_{it}, m_{it})$ (non-parametrically using a polynomial expansion). These estimates are then used in second-stage moment conditions to estimate the factor shares of each input.[17]

Note that this empirical strategy implies further assumptions about the timing of input choices and shocks (as discussed in Ackerberg, Caves and Frazer (2015)). In particular, the necessary conditions needed for identification that are most plausibly satisfied in my context are that: (1) households make their decision about input use prior to determining their labor supply (satisfied if agricultural inputs are chosen at the beginning of the growing season, and some quantity of labor is determined later into the season), and (2) there are additional shocks to the price (or more plausibly in my context, the shadow price) of labor, realized after households make their consumable input choice. The sequential nature of agriculture thus makes it an industry that is relatively likely to satisfy these data generating process assumptions. Individuals need to make planting decisions at the start of the growing season; variations in the shadow price of labor throughout the multiple agricultural stages are unlikely to be fully foreseeable in advance.

5.2 Valuing Labor

The decision of how to value labor in particular merits some discussion (I additionally detail the construction of the other variables in Appendix A). Given that certain stages of the agricultural production process (such as land preparation) are brawn-based, there is reason to think that for these parts of the agricultural production process, men possess a comparative advantage (Pitt, Rosenzweig and Hassan 2012). I aim to separate differences in farmer managerial productivity (e.g. what variety of seeds to use, whether to row plant, the day at which fertilizer should be applied) from differences in the efficiency of labor. In terms of my production function, I aim to estimate gender differences in ω_{it} from gender differences in the effective contribution of an average day's labor.

To do this, I use differences in wage rates paid to men and women in agriculture to calculate an "effective unit of labor." In Waves 2 and 3 of the GSPS, the ratios of the median wages of women to men are 78% and 80%, respectively.[18] I therefore calculate an effective unit of female labor as 80% of that of male labor. I additionally explore the sensitivity of my results to valuing a day of female labor as equal to 100%, 60% and 0% of male labor, reported in Appendix Table A5. While these changes lead to modest differences in the estimated factor shares of outputs, my estimated farmer productivity estimates are extremely similar, regardless of the share used.

[17] The second-stage moment conditions are that $E[(\xi_{it} + \epsilon_{it})l_{it}] = E[\xi_{it} l_{it}] = 0$ and $E[(\xi_{it} + \epsilon_{it})m_{it-1}] = E[\xi_{it} m_{it-1}] = 0$, where ξ_{it} is the innovation in productivity relative to last period's expectations. The first condition implies that land cultivation does not respond to the innovation in productivity ξ_{it} (that is, that land cultivation is determined prior to the full realization of a farmer's productivity in a given year), and the second, that last period's consumable input choice is uncorrelated with this period's innovation in productivity.

[18] Wave 1 does not have information on agricultural wage rates.

5.3 Factor Shares

I report estimated agricultural production function factor shares in Table 6. To provide information about the magnitude of the endogeneity issue, I also present factor share estimation when using (1) ordinary least squares (OLS), and (2) ordinary least squares with farm manager fixed effects (OLS-FE). These results suggest some degree of endogenous input selection; the estimated factor share of land in particular declines when controlling for endogenous input choice. However, estimated farmer productivity is not sensitive to the estimated factor shares used. The correlation in estimated TFP between (a) OLS and OLS-FE, (b) OLS and LP, and (c) OLS-FE and LP are 0.99, 0.98 and 0.99, respectively.[19] The extremely similar TFP estimates regardless of the method used are consistent with Syverson (2011), who suggests that in general, productivity measures are quite robust to the specific measurement procedures, and that "high-productivity producers will tend to look efficient regardless of the specific way that their productivity is measured."

5.4 Additional Corrections

The ω_{it} term represents variation in farmer productivity at least partially known to the farmer at the time of making input allocation decisions; this is likely to include both information they have about their own ability, and information they have about the quality of their land. Given that a subset of the information known to the farmer is also observable in the GSPS survey and FAO-GAEZ data, I control for these characteristics, to control in part for land quality. In particular, I assume that for a farmer i at time t in FAO-GAEZ agro-ecological zone z (of which there are 11 in my sample),[20] that ω can be parameterized as:

$$\omega_{izt} = exp(\nu_t + \eta_z + X'_{izt}\beta + \theta_{izt})$$

where ν_t is a survey wave fixed effect, η_z is an agro-ecological zone fixed effect, X_{izt} are observable land characteristics (e.g. the color of the soil, the time it takes for the soil to drain) and θ_{izt} are determinants of farmer productivity not explained by time or observed land characteristics. I estimate

$$\widehat{\theta}_{izt} = ln(\omega_{izt}) - \widehat{\nu}_t - \widehat{\eta}_z + X'_{izt}\widehat{\beta}$$

[19] I also estimate TFP using the methods described by Ackerberg, Caves and Frazer (2015). Their assumptions involve additional moment conditions, that appear to have sufficiently stringent data conditions such that my results are extremely imprecise when I estimate factor shares using their method. For example, with the Levinsohn-Petrin technique, my 95% confidence interval for the factor share of consumable inputs is [0.22, 0.37], while for ACF, it is [-0.93, 1.05]. Despite this imprecision, I none-the-less find similar log TFP estimates when using their procedure, the correlation of my ACF log TFP estimates with those of OLS, OLS-FE and LP are 0.95, 0.97 and 0.97, respectively.

[20] (i) Hydromorphic soils, (ii)-(x) $\{moist, sub\text{-}humid, humid\} \times \{good, moderate, poor\}$ soils, (xi) adjacent to water

using cross-validated least absolute shrinkage and selection operator (LASSO) estimation, to control for overfitting.[21] This $\widehat{\theta}_{izt}$ is my preferred estimate of farmer productivity, which I use as a dependent variable in analyzing the returns to human capital by sector in Table 8, and in examining other differences in TFP in table 9.

6 Selection into Sectors and the Returns to Skill

I show in Section 4.1 that matriliny and patriliny differ in the rates at which women inherit land, and that these differences affect agricultural plot management and agricultural labor. To understand the productivity consequences of these allocations, and the mechanisms driving any such difference, I estimate the returns to skill across sectors, using profits and wage earnings for those working for a business or a wage respectively, and using my estimated land-adjusted TFP term for those managing a farm. With these estimates, I then examine how differences in gender and descent interact with the returns to skill across sectors to shape sorting.

The differences in the probability of land inheritance for men and women across the two descent systems (coupled with thin land markets) generate shifts in the probability an individual will be employed in a given occupation. I use this feature of the economic environment to endogenize entry into a given occupation for men and women (controlling for the direct effect of education, cognition and place of birth). In particular, a man born into a matrilineal ethnic group is less likely to be managing a farm, and more likely to be working for a wage, while a matrilineal woman is more likely to be managing a farm, and less likely to be earning no individual income. Using these features of the data, I estimate selection into occupation for men and women separately, calculate an Inverse Mills' Ratio capturing selection into a given occupation, and estimate the returns to cognitive skill by sector, correcting for endogenous entry. I then use these estimates to further test implications of my framework, and consider the implications of increased inheritance flexibility by gender.

6.1 Variable Construction: Cognition and Occupation

This procedure relies on use of two variables, (i) cognition, and (ii) occupation, where the construction method merits some discussion, described here:

To measure cognition, I rely on a battery of tests administered in the third wave of the Ghana Panel. In particular, all individuals aged 5 or older, present at the time of the survey, were administered a series of tests, including Raven's Progressive Matrices (Raven 1941), forward digit span, and backward digit span (Wechsler 1955). Raven's Progressive Matrices (a pattern recognition task) is a measure of inductive reasoning, and the digit span tests of working memory, attention, encoding and auditory processing. Each test has found to be highly correlated with the largest factor load on intelligence quotient (IQ) tests (Hunt 2010).

[21] I implement this using the user-written Stata command cvlasso, presented in Ahrens, Hansen and Schaffer 2020.

Following the procedure laid out by Cunha, Heckman and Schennach (2010) and Cunha and Heckman (2008), I assume there exists an underlying latent measure of cognitive ability, and that each of these three test scores constitute a noisy measure of this underlying measure. I estimate this latent measure using factor analysis. The data are consistent with the assumption of a single latent factor (Kaiser 1960). I find a large eigenvalue on the first component, (>2), and no other eigenvalues larger than 1; each individual test score has a strong positive correlation with the first component. I then standardize this cognition measure such that it has mean 0 and standard deviation 1.

I classify an individual as belonging to one of four sectors: farming, working on a non-farm family enterprise, working for a wage, or not engaged in an occupation that provides an individual with their own income (i.e. providing labor to another household member's farm or business, or not working at all). Among individuals who are engaged in multiple occupations (e.g. managing a farm and working for a wage), I classify an individual's occupation as the activity that occupied the greatest share of their time in the last year.[22] [23]

6.2 Selection into Sector and the Returns to Cognitive Ability

I estimate the returns to skill with a two-step procedure. In the first stage, for $occupation_{irt} \in \{farming,\ business,\ wage\ income,\ no\ individual\ income\}$ I estimate participation in a given occupation separately for men and women at time t, born in region r, using the multinomial logistic regression:

$$Pr(occupation_{irt} = s) = \frac{e^{\beta^s \cdot X_{irt}}}{\sum_{m=1}^{M} e^{\beta^m \cdot X_{irt}}}$$

where the variables X_{irt} consist of: (i) an individual's cognition index, (ii) their years of education, (iii) their region of birth,[24] (iv) a survey wave indicator, and (v) an indicator for whether or not they are matrilineal. I report average marginal effects for men and women in Table 8; estimates are relative to being a farm manager.

The matrilineal indicator variable reflects the fact that the inheritance rules shape an individual's occupation, beyond their region of birth, years of education, and cognition. Among women, matrilineal women are more likely to be farm managers because of the more flexible rules of inheritance. In contrast, patrilineal women are more likely

[22] I also test the sensitivity of this procedure to other methods of classifying an individual's occupation, discussed in Appendix A. Results are qualitatively unchanged.

[23] This procedure requires some further assumptions about an individual working on a farm, in which I observe "own" labor for plot managers in Waves 2 and 3, but not Wave 1. I also detail the procedure I use to address this in Appendix A.

[24] I use region of birth rather than district of birth, as in previous specifications, because I do not achieve convergence for female occupation when including district of birth, given the limited variation in occupations in some rural areas in particular. For men, I have extremely similar estimates when using district of birth fixed effects, region of birth fixed effects, or an indicator for whether an individual was born in the south, reported in Appendix Table A7.

to not be earning any individual income (ie either working on the asset of another family member, or not working). These results are thus consistent with the idea that female inheritance, coupled with additional barriers to female labor market participation, increase the probability matrilineal women have any income under their control. In turn, the increase in female inheritance corresponds to fewer matrilineal men working as farm managers, and instead in the labor market (again, a predicted consequence of the increased inheritance flexibility under matriliny).

These differences allow me to explicitly model the process of selection into or out of farming, and account for this endogeneity in the error term of my estimates of the returns to cognitive skill across sectors. These estimates therefore correct for an issue present in many estimates of the returns to human capital across sectors in developing countries, that do not explicitly consider the endogenous nature of selection into a given occupation.

I use my first stage multinomial logit estimates to calculate the Inverse Mills' Ratio for each sector s, λ^s_{irt}, following the procedure described by Dubin and McFadden 1984. I then estimate the returns to cognition and education in a second stage-equation in agriculture and non-agriculture, including the Inverse Mills' Ratio to account for endogenous selection:

$$y^s_{irt} = \beta_0 + \beta_1 \cdot cognition_{ir} + \beta_2 \cdot educ_{irt} + \nu_r + \eta_t + \lambda^s_{irt} + \epsilon^s_{irt}$$

where the y^s_{irt} is the income measure for an individual i, born in region r, at time t for a given income measure in sector s; $cognition_{ir}$ their cognition index, $educ_{irt}$ their years of education,[25] ν_r a region of birth fixed effect, η_t a wave indicator, and λ^s_{irt} the Inverse Mills' Ratio for selection into the given sector. Results are reported in Table 8, for men in Panel A and women in Panel B.

I estimate the returns to skill in the two sectors in multiple ways. For labor market earnings, I estimate the returns to skill both in annual wages, reflecting the idea that for an individual selecting into wage labor, a consequence might be that employment is more irregular (Pulido and Swiecki 2018, Lagakos et al. 2020) as well as in daily wage rates.[26] For agricultural earnings, I rely on three estimates: (1) land-quality adjusted log TFP (i.e. the estimates derived in section 5), (2) log profits per acre,[27] and (3) real profits per acre, trimmed at the top 1%.

Regardless of the measure used, these estimates yield similar conclusions: cognitive skill is rewarded in the labor market, but not in farming. I find large and statistically significant estimates of the relationship between labor market earnings and (i) years of education, and (ii) performance on the cognitive tests. For example, for men, I estimate a one-year increase in education is associated with a 0.20 log increase in wages, and a one standard deviation increase in cognition with a further 0.22 log increase. In contrast, I am

[25]The t subscript for education, but not for cognition, reflects that I only observe cognition for an individual in wave 3, but individuals are asked about their education in every wave.

[26]I calculate this value in cases where individuals are paid in weekly, monthly or quarterly intervals, based on their reported days worked (per week and where relevant, per month).

[27]I find that approximately 20% of farm profits are negative in a given year; this estimate therefore excludes these observations.

unable to detect any relationship between cognitive skill and agricultural productivity, regardless of the measure used.

6.3 Selection into Inheritance and Wage Labor

These differences in the returns to cognitive skill across sectors affect the optimal strategy for parents aiming to provide for their children (and in turn for children, considering whether to leave their household in search of non-farm work, or to remain in household farming with the hope of future inheritance). In particular, these differences suggest that in an efficient allocation, individuals with higher cognitive ability will benefit to a greater extent from being in the labor market, by capturing the returns to their cognitive skill. In contrast, individuals with lower cognitive skills will be more likely to be in farming in an efficient allocation, given that their lower cognition does not negatively affect their farm TFP.

I test this hypothesized relationship, and how it interacts with gender and descent, in Figures 1 and 2. In particular, I plot the non-parametric relationship between an individuals' cognition index and whether or not they inherited or were allocated land in Figure 1, and whether or not they worked for a wage in Figure 2, in each case separately by gender and descent.[28]

Figure 1 shows three main effects, consistent with the hypothesized framework of (a) parents transmitting land or human capital to their children, (b) differences in the returns to skill by sector, and (c) an additional inheritance constraint present under patriliny. I find that for each of patrilineal men, matrilineal men, and matrilineal women, individuals who inherit land, and who thus in general remain in farming, given the limited presence of land markets, are negatively selected on cognitive ability.[29] Figure 1 shows very low rates of inheritance (and a diminished importance of descent) at very high levels of cognition, consistent with a framework in which at sufficiently high levels of cognition, the returns to being in the labor market are sufficiently high that very few individuals choose to remain in farming. The matrilineal female inheritance "treatment" is visible in the distribution, concentrated among individuals in the left-to-middle of the skill distribution.

One aspect to note is that this matrilineal allocation does not appear to be fully consistent with a productivity-maximizing allocation. Given the limited opportunities for women in the labor market, holding the share of matrilineal land assigned to men and women fixed, an efficient allocation would instead involve matrilineal and patrilineal men of especially low cognition equally likely to remain in farming, with a steeper slope for matrilineal men. That is, holding the land to matrilineal men fixed, in an efficient allocation, a greater share of medium-cognition men would be in the labor market, with

[28]Results are qualitatively similar by education, albeit with more noise and thus imprecision on the relatively uncommon education intervals (e.g. 2 years of education); cognition is a smoother measure for the non-parametric estimation.

[29]In contrast, I see no relationship between cognition and land inheritance for patrilineal women, perhaps reflecting the rather unusual circumstance of patrilineal female inheritance and thus perhaps some external factor driving such behavior.

the land reallocated to low ability men.

This departure suggests that while efficiency seems to guide a good deal of the behaviors observed in this context; it does not explain all patterns. This relationship could, for example, reflect a desire on the part of some matrilineal households to ensure a minimum level of consumption for their low-cognition daughters, given their limited opportunities on the marriage market. This same phenomena does not occur for patrilineal women, perhaps again due to the male-only inheritance constraint. While the way the marriage market interacts with this inheritance is potentially a promising avenue to explore, it is beyond the scope of this paper.

Figure 2 plots the non-parametric relationship between an individual's cognition index and whether or not they worked for a wage in the last year. The relationships here suggest three mechanisms at play, consistent with the framework outlined in Section 3. First, selection into the labor market is increasing in cognitive ability for all groups, consistent with the idea that skill is rewarded in the labor market but not in farming (and thus high-cognition individuals optimally select into wage labor). Second, at all levels of cognition, women are less likely than men to be in the labor market—some women are working for a wage at all levels of cognition, a large male-female gap persists at all levels. Finally, at all levels of cognition (and especially to the left and middle of the cognition distribution), matrilineal men are disproportionately likely to be earning a wage—there is a positive $male_i \times matrilineal_i$ effect.

The results in Figures 1 and 2 jointly suggest that female inheritance under matriliny is associated with a male exit out of agriculture and into wage labor. Low- and medium-cognition women are more likely to inherit land under matriliny; low- and medium-cognition matrilineal men are more likely to be in the labor market. In contrast, the greater share of male plot owners is not associated with an increase in females in the labor market under patriliny, consistent with the idea of women facing labor market barriers.

These differences can also rationalize the differences in human capital I observe across groups. Women across both descent systems receive less education than men, consistent with their being less likely to be in the labor market at a given human capital level (and thus there being lower returns to investing in their human capital, under the current economic conditions). Moreover, this male-female education gap is larger for matrilineal men, consistent with the fact that relative to patrilineal men, matrilineal men are disproportionately likely to be in the labor market, and thus more prone to be engaged in work where cognitive skill (and thus education) is rewarded.

6.4 Non-Agricultural Premium

The returns to cognitive skill in the labor market but not in farming suggest that, for a plausible parameter region of the relative returns to farming and skill, individuals will benefit from exiting farming and seeking work in the non-agricultural sector. The male labor productivity consequences of the matriliny-induced exit from agriculture also depend on whether there exist level effect differences: for example, for an individual with low observed cognitive skill, how do the returns to wage labor compare to expected agricultural profits at various levels of land ownership?

My results on selection into the labor market suggest that simply comparing the distribution of labor market earnings to the distribution of agricultural profits does not offer a complete picture of the relative returns to the two sectors, because the corrected return to skill is steeper when incorporating endogenous selection than when simply estimating the relationship with OLS. However, given the lack of statistical significance on the Inverse Mills' Ratio for entry into farming and reasonably small point estimates, suggesting that endogenous entry into farming does not meaningfully affect my estimates of the returns to skill, one informative test is simply comparing the wage distribution of low skill individuals in the labor market to the distribution of agricultural profits at various levels of land ownership.

I implement this comparison in Figure 3. In particular, using the coefficients on the returns to skill in the labor market, I use an individual's cognition index and years of education to estimate a predicted cognitive skill value. I then partition these individuals into four bins, and compare the distribution of log wages for individuals in the bottom cognitive skill quartile (i.e. the individuals with the lowest expected wages) to the distribution of log profits at various bins of land ownership. My estimates suggest that an individual at the bottom quartile of wages has earnings slightly higher than the 3rd quartile of earning, suggesting that even very low levels of wages seem to on average be higher than most levels of land ownership that I observe. Thus, beyond the benefits of skill being rewarded in the labor market (and thus the greater investment in matrilineal men's human capital, potentially in anticipation of their entry into wage work), there appears to be a positive level effect associated with an exit from agriculture and into the labor market.

6.5 Other differences in agricultural productivity

While I estimate a flat relationship between cognitive skill and farm TFP, it is also possible that the inheritance regimes differ in their farm productivity as the result of some other difference. I thus examine differences in farmer TFP by gender and descent in Table 9. In Columns (1) and (2), I compare differences with no adjustments for land quality, In Columns (3) and (4), I compare estimates of land-quality adjusted log TFP, $\widehat{\theta}_{izt}$. Finally, Column (5) considers differences in land-quality adjusted TFP at the descent level, rather than by gender and descent. In all cases, I control for district of birth and wave fixed effects, and cluster at the person level.

The first takeaway of Table 9 is that women have estimated farmer productivity meaningfully lower than that of men. I find that on average, female TFP is 0.27 standard deviations lower when using the unadjusted measure of TFP, and 0.28 when I control for land quality. Thus, two effects negatively shaping matrilineal farmer TFP are that (1) a greater share of matrilineal farmers are female, and (2) women on average have lower TFP than men. However, on net, I find that matrilineal and patrilineal farmers have very similar TFP; I cannot reject that TFP is equal across the two inheritance regimes. This is due to a third pattern in the data, that the male-female gap in farm manager TFP is smaller in matriliny than in patriliny.

Given my finding that human capital is not rewarded in farming, differences between male and female TFP do not appear attributable to men having more schooling than women. Nor do these differences appear to be due to unobserved differences in labor supply (for example, because the measure of labor supply at the day-level fails to capture women working fewer hours in a day, because they also are responsible for household chores or childcare). In my base case, I treat one day of female labor as equivalent to 0.8 days of male labor, but females continue to have meaningfully lower TFP when I code female labor as equal to 0.5 days of male labor, or even 0.0 days (shown in Appendix Table A5). In the latter case, I am effectively treating the only relevant inputs into production as land, consumable inputs and male labor, yet I still find that female farmers have lower TFP.

Another candidate explanation that cannot explain these differences is differences in crop choice (which might offer different returns). Doss (2002) and Duflo and Udry (2004) both document that certain types of crops are considered "male" and "female" crops in West Africa. One hypothesis might be that male crops happen to be ones that are more productive (say due to female crops being more likely to be subsistence crops). However, I find that when I include crop fixed effects for the 10 most common crops (equal to 97% of all crops grown) in Appendix Table A6, the male-female TFP gap remains more-or-less unchanged (0.28 SDs with no controls, 0.29 SDs with crop controls).

Two potential explanations (albeit ones I do not observe direct evidence for) is that women either have worse inputs on some unobserved dimensions or worse access to information about the best farm management practices on their specific fields (or both). While my estimating procedure incorporates the value of consumable inputs, it is very likely that there is unobserved heterogeneity in input quality not captured by my estimation, that could plausibly differ by gender. As an example, an important mechanism through which farmers in Ghana gain access to seeds is by informal trading (Etwire et al. 2013). A common practice for farmers is to keep seeds from the crops that grew best on their field, save them for the next growing season, and share some with others in their social network. If females have less expansive social networks in a community, or are less easily able to move about a community, they might not benefit to the same extent from seed-sharing, and have worse inputs (that my estimation procedure would attribute to them having lower TFP).

Similarly, BenYishay et al. (2020) finds that women are less likely to attend agricultural extension meetings in Malawi, one mechanism through which individuals learn about appropriate inputs and best farming practices. If again, women face further constraints that affect their participation in institutions (formal or informal) that facilitate information transmission, this could negatively affect productivity. Suppose for example, that some farmers (accurately) learn that one product of fertilizer is especially well-suited for the community's soil, and that this information spreads (imperfectly) through social networks, and men have a more expansive network. If a male farmer uses the appropriate fertilizer, and a female farmer uses an equivalent amount of a less appropriate fertilizer, this difference would enter into my equation as lower ω_{izt} for the second farmer, given that both are using the same quantity of materials, but the former is achieving a greater output.

Female-based input or information-sharing networks would also rationalize the positive $female \times matrilineal$ effect, given the greater share of female farm managers in primarily-matrilineal communities. If women benefit from the presence of other female farm managers, network effects could attenuate the male-female gap. Another candidate explanation for the $female \times matrilineal$ interaction is that simply because female inheritance is more likely, matrilineal women are more likely to have developed farming-specific skills in recognition of the increased possibility they will be responsible for a farm.

Collectively, the key takeaway of Table 9 is that farm productivity does not differ across the two inheritance regimes. The gains to male earnings through matriliny exit out of farming is not offset by a reduction in farm productivity. While female farm managers have lower TFP than do male farm managers, and matrilineal women are more likely to be farm managers, the reduced male-female TFP gap in matriliny is sufficiently large to lead to the two regimes having similar TFP.

7 Discussion

7.1 Why do these differences persist?

I find that matriliny, in which both men and women can inherit land, is associated with higher earnings, facilitated by increased matrilineal male earnings outside of agriculture. These results thus motivate a follow-up question: why don't patrilineal men simply mimic the behavior of matrilineal men, cede property to their sisters or wives, and enter the labor market?[30] While in the extreme, all individuals exiting agriculture would likely bid down the wages to the current labor market, the different rates in labor market participation across the two regimes, coupled with the earnings gap I observe, raises something of a puzzle.

While answering this question is beyond the scope of this paper, I consider some possible explanations here:

First, this paper speaks to the question of the relative productivity and permanent income of male and female labor under the two systems of descent and inheritance. They suggest earnings would improve were more inheritance systems to allow for female inheritance, and thus male exit from agriculture. These differences are not sufficient however to determine how expected utility would be affected (Rosenzweig and Binswanger 1993). It could be that the certainty of some amount of farm income in each period sufficiently justifies not earning higher average income if there is uncertainty associated with finding wage labor in any given period. Perhaps matrilineal men who lack the certainty of land (because of the contested nature of inheritance) go on to earn more in the labor market, but if given the choice, they would (at the very least, ex ante) prefer an arrangement where they have a secure source of income in farming. This hypothesis would be consis-

[30]In an environment with perfect markets, one might instead imagine the individuals selling the land, making an exit from agriculture even more appealing. That however does not seem to be an especially frequent or viable occurrence; only 4.5% of plot owners in the sample acquired their land via purchase.

tent with a Harris-Todaro framework, in which greater unemployment or uncertainty of employment allows this earnings gap to persist (Harris and Todaro 1970).

In my data, I do not see a higher probability of matrilineal men not being engaged in any occupation, nor do I see an increase in the prevalence of very low levels of consumption, which might be expected were it the case that non-agricultural work yields higher wages but greater uncertainty of employment. However, with only three periods (and thus three realizations of the world), I am only observing a finite set of possible realizations—it is possible that my conclusions would differ under a different set of rainfall realizations, or different macroeconomic conditions shaping the returns to non-agricultural income Rosenzweig and Udry 2020).

It is also possible that the primary deterrent to exiting agriculture is not due to short-term fluctuations in income, but rather risk associated with long-run changes to the availability of and returns to wage labor. An individual might be concerned that just because wage offers are on average higher than the returns to agriculture from 2009-2018, does not mean that they will continue to be higher over the course of their lifetime. For example, a negative macroeconomic shock might meaningfully decrease the viability of wage labor. If exiting agriculture causes individuals to forfeit their subsequent access to land (for example, because a relative or chief might reallocate the land to another individual (Goldstein and Udry 2008)), an individual might optimally be extremely cautious about choosing to exit agriculture. Even if agricultural income is less than labor income continuously in most states of the world, individuals might see agriculture as insurance against a worst-case outcome. Thus, while matriliny seems to foster an increase in productivity, it also potentially exposes these individuals to greater extreme left tail risk.

The patterns I observe are also consistent with a hypothesis that I am simply observing differences in transition dynamics. Work in other contexts has shown that differences in cultural institutions can affect the rate at which households embrace new technologies, such as English schooling instruction (Munshi and Rosenzweig 2006) or girls' education (Ashraf et al. 2020). It is therefore possible that matriliny's flexibility simply accelerated the process through which men in particular transition out of agriculture. Moreover, this gap might partially be a product of the time lag between investments in a child's human capital, and their adult earnings. Parents making human capital investment and land transfer decisions have to forecast an uncertain trajectory of returns in both the agriculture and non-agriculture sectors, which may or may not correspond to the true relative returns a given adult faces in their lifetime.

7.2 Conclusion

I show that differences in inheritance rules in Ghana are associated with differences in how female and male labor is allocated, and in turn, with differences in productivity. While patrilineal ethnic groups continue to disproportionately pass land to their sons, the possibility of inheritance exists for both men and women under matriliny, which leads to adjustments on multiple margins. Women are more likely to be managing an agricultural plot, and are thus more likely to have income under their control. While I find that women on average have lower farmer TFP, and matriliny induces more women to be farmers, the male-female TFP gap is sufficiently smaller under matriliny that I cannot reject that the two regimes lead to equal farmer TFPs.

Instead, I find productivity benefits as a result of female inheritance, via the channel of men exiting agriculture. These men experience a non-agriculture earnings premium, and are in a sector that better enables them to capture the returns to their skill, which in turn incentives greater ex ante investment in male human capital. Additional barriers to female labor market participation create an asymmetry: female inheritance does not dampen their participation in the labor market, because they were unlikely to be employed there regardless.

These results suggest benefits to institutions that enable female inheritance in contexts where there exist viable non-farm opportunities, and where women face additional constraints. Given the high rates of urbanization and growing declines in agricultural shares in many countries, as well as the multitude of research showing that women face barriers, Ghana is highly unlikely to be unique in this regard. Thus, while policymakers continue to push for more female inheritance on equity grounds, this study suggests that male-only inheritance regimes are also dampening economic productivity.

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8 Tables

Table 1. Land Inheritance, by Gender and Descent

	(1)	(2)	(3)	(4)
	Inherited any Land	Allocated any land	Acres inherited	Acres allocated
Female	-0.305***	-0.173***	-1.885***	-1.043***
	(0.0114)	(0.0085)	(0.0892)	(0.0596)
Matrilineal Tribe	-0.0281	-0.0367**	-0.300**	-0.451***
	(0.0199)	(0.0148)	(0.1520)	(0.0806)
Female * Matrilineal	0.109***	0.0816***	0.658***	0.717***
	(0.0181)	(0.0129)	(0.1400)	(0.0765)
Sample Mean	0.203	0.114	0.928	0.440
Patrilineal Male Mean	0.373	0.216	2.054	1.134
Observations	12,172	12,172	12,172	12,172
F-Test: Female * Matri=0	36.52	39.93	22.08	88.04
p-value	0.000	0.000	0.000	0.000
F-Test: Matri + Fem*Matri=0	28.50	15.78	13.42	19.37
p-value	0.000	0.000	0.000	0.000
F-Test: Female + Fem*Matri=0	192.80	88.33	130.90	47.76
p-value	0.000	0.000	0.000	0.000

This table compares land inheritance by gender and descent, using the three waves of the Ghana Socioeconomic Panel Survey, among individuals aged 25-54 born in rural districts. Regressions include district of birth and survey round fixed effects. Standard errors are clustered at the person level.

Table 2: Plot Management, by Gender and Descent

	(1)	(2)
	Manages agricultural Plot	Acres cultivated
Female	-0.540***	-3.618***
	(0.0125)	(0.1220)
Matrilineal Tribe	-0.153***	-1.213***
	(0.0232)	(0.2090)
Female * Matrilineal	0.203***	1.345***
	(0.0207)	(0.1840)
Sample Mean	0.367	1.750
Patrilineal Male Mean	0.677	3.965
Observations	12,175	12,175
F-Test: Female * Matri=0	96.33	53.40
p-value	0.000	0.000
F-Test: Matri + Fem*Matri=0	6.74	0.90
p-value	0.009	0.344
F-Test: Female + Fem*Matri=0	413.40	272.60
p-value	0.000	0.000

This table compares agricultural plot management by gender and descent, using the three waves of the Ghana Socioeconomic Panel Survey, among individuals aged 25-54 born in rural districts. Regressions include district of birth and survey round fixed effects. Standard errors are clustered at the person level.

Table 3: Gender Composition of Male and Female-Managed Land

	(1)	(2)	(3)
	Share of Family Labor on Plots Female	Any Male Family Labor on Plots	Any Female Family Labor on Plots
Patrilineal Male	0.30	0.95	0.80
Patrilineal Female	0.71	0.67	0.94
Matrilineal Male	0.25	0.91	0.64
Matrilineal Female	0.79	0.52	0.91

This table reports the gendered composition of agricultural labor, for land managed by patrilineal and matrilineal men and women. Column (1) reports the share of labor that is female; Columns (2) and (3) report the presence of any male and female labor. A more detailed breakdown (and regression tests of equality) are reported in Appendix Tables 3 and 4.

Table 4: Human Capital, by Gender, Descent

	(1)
	Years, Education
Female	-2.108***
	(0.1530)
Matrilineal Tribe	1.911***
	(0.2470)
Female * Matrilineal	-0.378*
	(0.2190)
Sample Mean	5.796
Patrilineal Male Mean	5.863
Observations	6,137
F-Test: Female * Matri=0	2.96
p-value	0.085
F-Test: Matri + Fem*Matri=0	41.70
p-value	0.000
F-Test: Female + Fem*Matri=0	247.80
p-value	0.000

This table compares years of education by gender and descent, among individuals who ever appear as a prime-age adult (aged 25-54), born in a rural districts, in the three waves of the panel. Regressions include district of birth fixed effects (and take the mean in cases where an individual's education is reported differently across waves)

Table 5: Household-Level Per Capita Log Consumption

	(1)	(2)
	Log Consumption per Capita, Adult Equivalent	Log Consumption per Capita, Adult Equivalent
Matrilineal Tribe	0.216***	0.0994**
	(0.0445)	(0.0394)
Average Male Years of Education		0.0225***
		(0.0026)
Average Female Years of Education		0.0261***
		(0.0031)
Mean Male Cognition		0.0208
		(0.0157)
Mean Female Cognition		0.0572***
		(0.0157)
Observations	4,290	4,290

This table reports log per capita consumption (in rural 2018 prices) among households in which the either the head or spouse was born in a rural district, and at least one female and one male are present. Both regressions include head district of birth, wave fixed effects, and controls for the number of male and female adults in the household. Column (2) additionally includes controls for average male and female adult years of education and average male and female adult cognition. In cases where education or cognition is missing, the value is recoded as zero, and an indicator is included for "missing education/cognition."

Table 6: Farm Factor Share Production Estimation

	(1)	(2)	(3)
	Levinsohn Petrin ("LP")	OLS	OLS-FE
Labor	0.085***	0.097***	0.178***
	(0.014)	(0.018)	(0.025)
Land	0.320***	0.409***	0.359***
	(0.044)	(0.018)	(0.028)
Agricultural Inputs	0.290***	0.351***	0.263***
	(0.040)	(0.013)	(0.018)

Panel B: Estimated log TFP Correlation by Estimation Technique

	LP	OLS	OLS-FE
LP	1.000		
OLS	0.989	1.000	
OLS-FE	0.996	0.993	1.000

This table reports estimates of factor shares in an agricultural production function, in which log output is a function of labor, land, and agricultural inputs (seeds, fertilizers, herbicides, plowing). Variable construction is detailed in Appendix 2. Column (1) of Panel Areports estimates using the "Levinsohn-Petrin (2003)" inversion technique; as a comparison Columns (2) and (3) report estimates simply using OLS, and OLS with farmer-level fixed effects. Panel B reports the correlation of log TFP across the three methods.

Table 7: Sector of Labor - Average Marginal Treatment Effects

	(1)	(2)	(3)	(4)
	Males		*Females*	
	Among Sample engaged in any occupation	All Prime-Age Men	Among Sample engaged in any occupation	All Prime-Age Men
Manages Business				
Matrilineal	-0.0225	-0.0184	-0.0921***	-0.0108
	(0.0215)	(0.0187)	(0.0331)	(0.0228)
Years Education	-0.0010	-0.0009	0.0033	0.0089***
	(0.0017)	(0.0015)	(0.0027)	(0.0018)
Cognition	0.0115	0.0056	-0.0074	0.0046
	(0.0102)	(0.0090)	(0.0137)	(0.0096)
Employed in Wage Labor				
Matrilineal	0.0570**	0.0471**	-0.0202	-0.0066
	(0.0255)	(0.0228)	(0.0208)	(0.0109)
Years Education	0.0297***	0.0265***	0.0170***	0.0102***
	(0.0021)	(0.0020)	(0.0018)	(0.0011)
Cognition	0.0426***	0.0315***	0.0382***	0.0207***
	(0.0106)	(0.0094)	(0.0087)	(0.0045)
Not Earning Individual Income				
Matrilineal		0.0020		-0.0643***
		(0.0205)		(0.0238)
Years Education		0.0012		-0.0108***
		(0.0013)		(0.0018)
Cognition		0.0229***		-0.0125
		(0.0080)		(0.0096)
Omitted Group: Managing Agricultural Plot				
Observations	3,550	4,063	2,921	5,731

This table shows average marginal effects of male and female participation in a given occupation (managing a farm, managing a business, working for a wage, not earning an income under the individuals' control) from a multinomial logistic regression; variable construction is detailed in Appendix A. The sample includes men (columns 1 and 2) and women (columns 3 and 4) aged 25-54 born in a rural-district. Logistic regressions include region of birth and wave fixed effects; standard errors are clustered at the person-level.

Table 8: Returns to Skill with Matriliny-Induced Selection

	(1)	(2)	(3)	(4)	(5)
	ln(Total Annual Wage Income)	ln(Wages per Day)	ln(TFP), land quality adjusted	ln(Agricultural Profits per Acre)	Agricultural profits per Acre (levels)
Panel A: Men					
Years Education	0.204***	0.215***	-0.0051	-0.0030	-20.5800
	(0.0526)	(0.0447)	(0.0188)	(0.0254)	(24.5900)
Cognition Index	0.222**	0.249***	-0.0475	-0.0356	7.4840
	(0.1040)	(0.0840)	(0.0449)	(0.0609)	(46.4900)
Inverse Mills - Selection into Wage Labor	-0.203**	-0.244***			
	(0.0791)	(0.0690)			
Inverse Mills - Selection into Agriculture			-0.048	-0.063	-61.380
			(0.066)	(0.083)	(78.790)
Sample Mean	8.58	3.32	0.12	6.33	616.10
Observations	772	771	2,249	1,767	2,480
Panel B: Women					
Years Education	0.528***	0.507***	-0.0052	0.0277	0.7560
	(0.1570)	(0.1400)	(0.0216)	(0.0373)	(49.9000)
Cognition Index	0.935***	0.698***	0.0816	0.0538	-4.9110
	(0.2580)	(0.2260)	(0.0641)	(0.1020)	(145.8000)
Inverse Mills - Selection into Wage Labor	-0.515***	-0.474***			
	(0.1790)	(0.1580)			
Inverse Mills - Selection into Agriculture			0.039	0.106	70.740
			(0.055)	(0.091)	(143.400)
Sample Mean	8.28	3.11	-0.21	6.37	447.30
Observations	326	326	800	618	933

This table presents second-stage estimates of the returns to cognition and education for wage labor and agriculture, estimated separately for men and women. The Inverse Mills' Ratio is estimated from the multinomial logistic regressions reported in Table 7, and calculated using the procedure discussed in Dubin and McFadden (1984). Regressions include district of birth and wave fixed effects; standard errors are clustered at the person level. The procedure for calculating log TFP in column (3) is discussed in Section 5 of the main text; the construction of the other variables is discussed in Appendix A.

Table 9: Farmer Total Factor Productivity by Descent

	(1)	(2)	(3)	(4)	(5)
	Log TFP, Unadjusted	Log TFP, Unadjusted	Log TFP, with Land Quality Adjustments	Log TFP, with Land Quality Adjustments	Log TFP, with Land Quality Adjustments
Female	-0.268***	-0.336***	-0.280***	-0.337***	
	(0.0326)	(0.0459)	(0.0348)	(0.0493)	
Matrilineal Tribe		0.0954		0.0264	0.0282
		(0.0583)		(0.0609)	(0.0591)
Female * Matrilineal		0.154**		0.144**	
		(0.0663)		(0.0708)	
Omitted Group Mean	0.050	-0.124	0.076	0.060	-0.010
Observations	3,742	3,488	3,742	3,489	3,489
F-Test: Female * Matri=0		5.38		4.14	
p-value		0.021		0.042	
F-Test: Matri + Fem*Matri=0		11.12		4.69	
p-value		0.001		0.030	
F-Test: Female + Fem*Matri=0		14.10		13.99	
p-value		0.000		0.000	

This table compares estimates of farmer total factor productivity using the Levinsohn-Petrin (2003) method by gender and descent. Columns (1) and (2) show comparisons of the raw estimates, Columns (3) to (5) estimates with additional controls for household-reported and satellite measures of land quality (using LASSO with cross-validation to avoid overfitting). Observations for TFP are trimmed at the top and bottom 1%

9 Figures

Figure 1: Cognition and Land Inheritance, by Descent, Gender

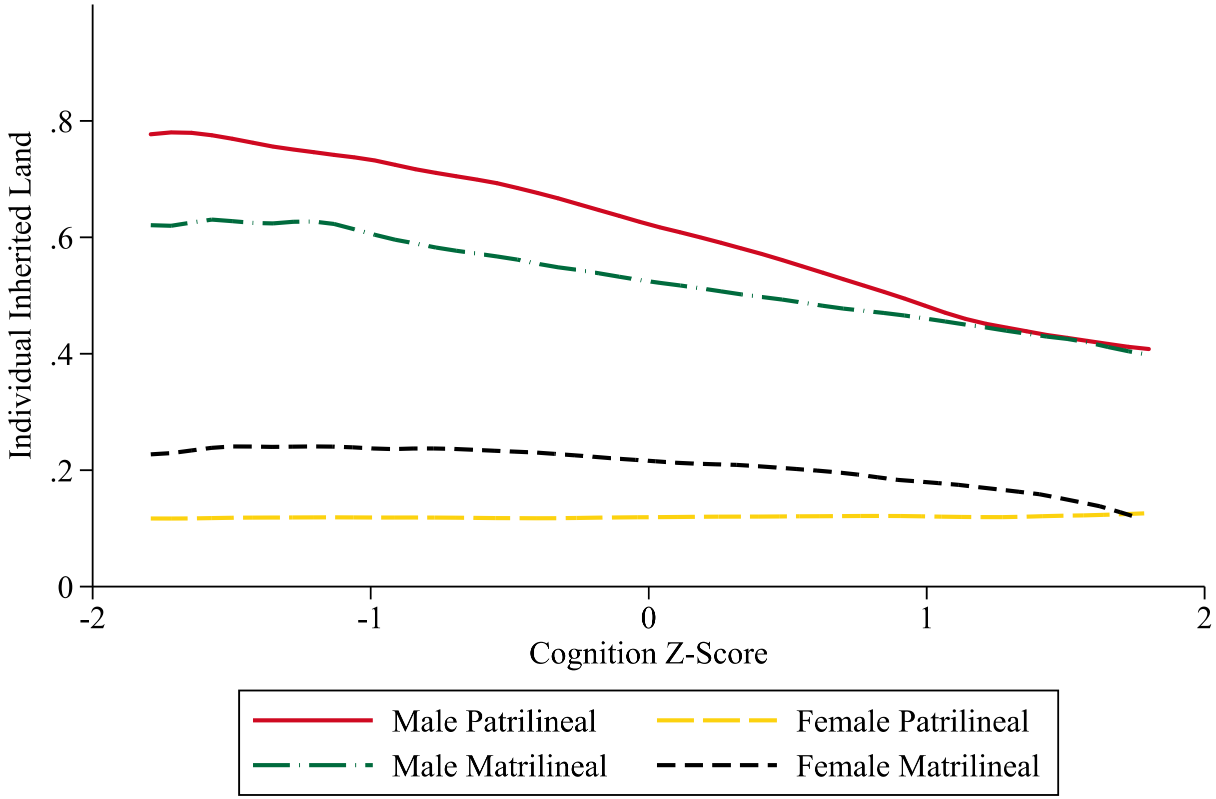
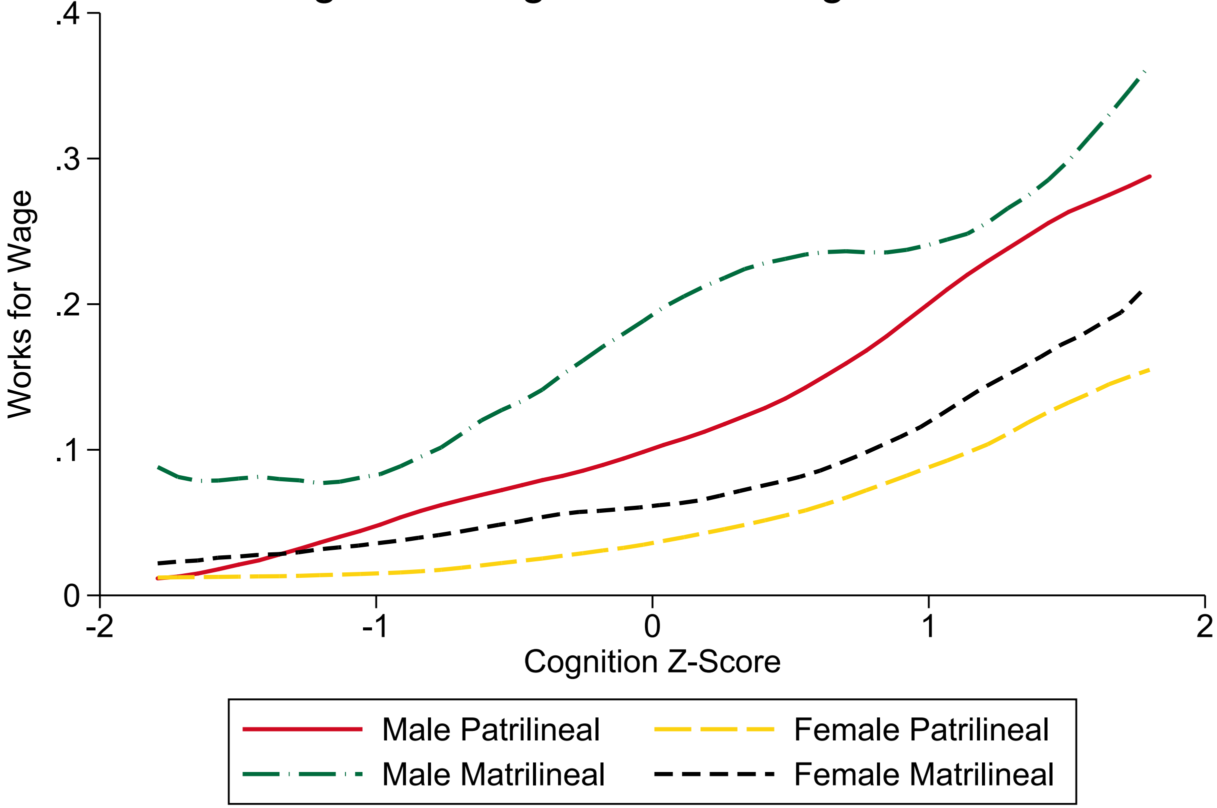


Figure 2: Cognition and Wage Income



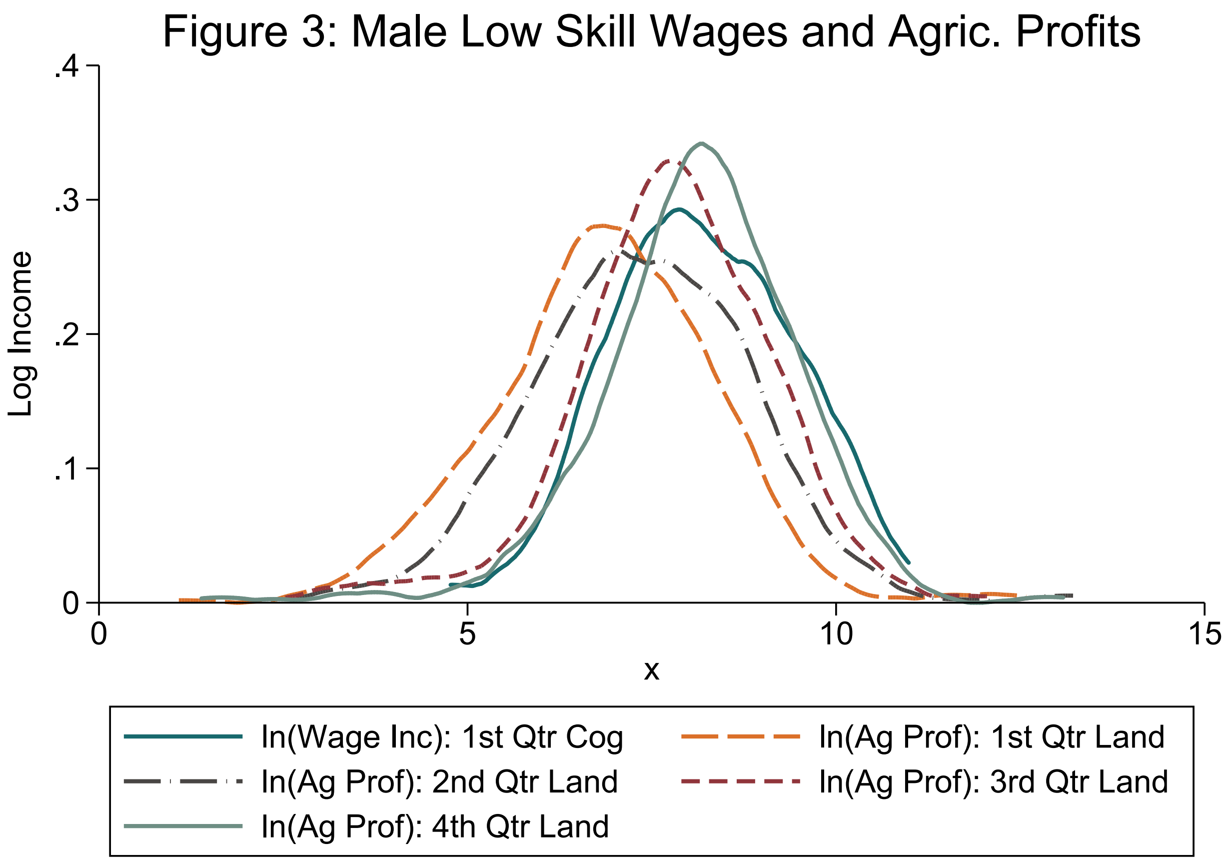


Figure 3: Male Low Skill Wages and Agric. Profits
Log Income
.4
.3
.2
.1
0
0
5
10
15
x
ln(Wage Inc): 1st Qtr Cog
ln(Ag Prof): 1st Qtr Land
ln(Ag Prof): 2nd Qtr Land
ln(Ag Prof): 3rd Qtr Land
ln(Ag Prof): 4th Qtr Land

A Variable Construction Details

This section describes the construction of variables used in the analysis of this paper.

A.1 Agricultural Production

My estimate of farmer total factor productivity depends on: (1) land cultivated (2) agricultural labor, (3) consumable inputs (itself a composite of seeds, chemicals and plowing services), and (4) agricultural output. Each of these components requires some degree of construction and assumptions made, outlined here. Construction is the same across waves, except where explicitly specified (due to modest changes to the survey instruments in some sections across waves).

Land cultivated: Individuals report the size of each plot, and the share left fallow in the last year. I convert all land from local units to acres using median size estimates from the community survey, and adjust for the share of land left fallow.

Agricultural labor: Individuals report the number of days worked at each agricultural stage by type of worker: (1) members of the household, (2) communal/casual labor, and (3) hired/permanent labor. Household labor is reported by gender in wave 1, and in wave 2 by (a) the plot manager, (b) other male household members, and (c) other female household members. To harmonize these measures, I create a single "male household" and "female household" labor variable (as well as non-household and household labor). To implement this, in waves 2 and 3, I add the "days supplied by self" to male labor if the plot manager is male and to female labor if the plot manager is female. At each stage, I top-code days of labor at the 99th percentile per acre within each wave. As discussed in Section 5.2, in my main analysis I code 1 day of female labor as equal to 0.8 days of male labor, and test the sensitivity of this estimate in Appendix Table A5.

Chemicals: Individuals report the amount and type of chemical used on each plot, and in Waves 1 and 2, the price the individual paid for the chemical. In Wave 3, I observe the quantities only (although I observe prices in the community survey). I classify chemicals into one of four categories: $\{fertilizer, herbicide\} \times \{liquid, solid\}$.[31] I take the category-level median price (using household-level data in Waves 1 and 2, and community-level data in Wave 3), to calculate the value of each category of chemical use, and sum to the farmer level.

Seeds, Wave 1: Individuals report the way in which they received their seeds, and the total estimated value of the seeds (including in cases where it was not received via a market transaction). Unlike the subsequent waves, I am therefore unable to convert seeds to a common unit to estimate median prices. My estimate of the value of the seeds is simply what the individuals directly report.

Seeds, Waves 2 and 3: Individuals report the quantity of seed for each type they used, and in cases where purchased, what they paid for the seeds. Where known, individuals report the seed variety, but the names are detailed enough that seed quality-adjustments are infeasible. Given the lack of prices for non-purchased seeds, I assume

[31] Relevant herbicides in Ghana include weedicides, pesticides and fungicides.

that the value of the seeds is determined solely by their quantity.[32] I calculate the seed crop-unit median in all cases with sales data, as well as the seed unit median (e.g. the median of all seed purchases across all crops reported in bowls). For crop-seed unit pairs with at least 5 observations, I take the crop-seed unit median to calculate values, in cases with fewer I use the seed unit median.

Agricultural Output: On each plot, individuals report the full set of crops they have harvest or expect to harvest, in quantities and units (generally local units, e.g. "bowls" or "maxi bags"), and in cases where the farmers have sold the crops, each type of buyer (e.g. locally in community, in a neighboring community, to aggregators, etc), the prices received, and quantity and unit sold. I reshape all sales to the transaction level, and find the median crop-unit sale price for every crop-unit pair.[33] I then multiply the total amount (a) harvested already, and (b) expected to be harvested in the short-term by the median crop-unit sale price.

A.2 Occupation and Earnings

Primary occupation: in Section 6, I model selection into a given occupation, which I classify as one of four types: (1) managing a farm, (2) managing a family non-farm enterprise, (3) working for a wage, (4) no individual income. I achieve this classification in two steps. First, I evaluate each on the extensive margin: someone is managing a farm if for any agricultural plot under the control of the household, they are reported as the manager. An individual is coded as an enterprise manager if they are coded as an owner of a business (up to 2 are allowed), and (3) a wage earner if they earned any income in the past year for a wage, and in turn (4), if none of the first three are true.

One context in which this procedure is slightly more complicated is when an individual managed a plot and worked in another sector in Wave 1. In Waves 2 and 3, I directly observe the days provided on the farm by the individual themselves, but in Wave 1, I only see this classification for male and female household labor. I assume in these cases that the individual worked the mean share of total days for men and women in subsequent waves (65% for men, 70% for women). To give a specific example, if a female-managed plot in Wave 1 included 100 total days of female labor, I code the female plot manager as having worked 70 days (and use this to compare to other occupations in determining their primary classification).

Agricultural Profits: In addition to estimating farmer total factor productivity, I also calculate farm profits, not incorporating the opportunity cost of household labor. For this measure, I calculate revenue as equal to the full value of agricultural output

[32] I find when comparing the estimated log value of seeds just based on their quantity, as described below, to the log actual reported payment, among those that bought any seeds, that the correlation is 0.65, suggesting I am losing some information, but a good deal of information is contained just by quantity.

[33] I calculate medians at the crop-unit level rather than crop level, because (1) the relative weight between units is likely to differ at the crop level (e.g. a bag of onions has a different weight in kilograms than a bag of groundnuts), and (2) I lack the ability of convert all crops into a common unit (for example, there are no instances of mangoes and cocoa being reported in the same harvest or sale unit).

(detailed above). For expenses, I consider: (a) the cost of all seeds, when paid, (b) the cost of all purchased inputs, and (c) the price paid for all hired labor.

Wage income: Individuals report the time worked in the past year, the pay frequency, the amount paid at a time, and any other benefits (most often, food). My two measures of wage income are (a) total value of income paid in the past year, and (b) daily wage, equal to total value paid, divided by the number of days worked for a wage.

A.3 Administrative Characteristics

District and Region Definitions: In the time horizon from the first wave of the Ghana Socioeconomic Panel Survey (GSPS) in 2009/10 to the third wave in 2018, several new districts and regions have been created, all by splitting existing districts and regions. When controlling for district, district-of-birth, region or region-of-birth effects, I hold the initial classification fixed. Thus, references to administrative fixed effects, or characteristics at a given administrative level should be considered "2009 Administrative Unit."

A.4 Individual Characteristics

Matrilineal: I classify individuals as matrilineal based on whether their ethnicity is classified as "Akan" under the Ghana Census definition. Ethnicities that the census classifies as Akan are the: Agona, Ahafo, Ahanta, Akuapem, Akwamu, Akyem, Aowin, Asante, Assin, Boron, Chokosi, Denkyira, Evalue, Fante, Kwahu, Nzema, Sefwi and Wasa (and "Akan: unclassified"). For individuals whose ethnicity is not in the census list ("Other tribe originating from Ghana" and "Other tribe originating from Africa") I do not assign a descent (i.e. they are not included in analysis in which descent is an independent variable).

Born Rural District: Land inheritance customs are most relevant in the context of rural Ghana. Given the fact that urban-migration is likely to reflect an endogenous choice, I classify an individual as part of my rural sample if they are born in a rural district, rather than based on their location at the time of being surveyed. Individuals in the survey are asked for their district of birth. I classify districts as urban (and thus exclude them from my analysis) if they encompass a city with a population estimate of greater than or equal to 75,000 as of a 2007 population estimate. This list includes: Accra (and adjacent administrative units part of the metropolitan area, i.e. Ashaiman, Teshie, Tema, Madina, Nungua, and Tema New Town), Kumasi, Tamale, Sekondi-Takoradi, Sunyani, Cape Coast, Obuasi, Koforidua, Wa, and Techiman. This classification therefore includes individuals born in small towns in districts that are primarily rural (given my inability from their district of birth to infer whether or not they were born in the town part or the fully rural part of the district).

Cognition components: In section 6.1, I describe the procedure through which I estimate an individual's cognition. They depend on three measures whose construction is briefly summarized here.

Raven's Progressive Matrices: Individuals attempt to identify which of six figures completes a pattern. My variable here is simply the percent of answers the individual recorded correctly.

Digit Span: I follow the standard digit span scoring procedure (Wechsler 1955). For an ascending number of digits, individuals attempt to repeat back (either forwards or backwards) digits read aloud to them; they have two attempts at each number of digits. If they get either correct, they proceed to the next number of digits; if they get both wrong, the test ends. Their score is equal to the maximum number of digits correctly repeated.

A.5 Other Variables

Relative Prices: All prices used in the paper are adjusted for time and place—they are in "2018 Rural" prices, using the relative prices of food. My sample restriction is adults born in a rural district; this sample therefore includes individuals both currently living in rural and urban areas. To standardize these measures, I proceed in the following steps: first, I use the GPS coordinates of a household at a given point in time to classify them into one of three geographic groups: (1) major city (Accra or Kumasi), (2) smaller city (within one of the 40 largest in Ghana, which corresponds to a population of 40,000 or larger as of a 2013 estimate), or (3) rural. I use GPS coordinates to classify location because I do not have the census classification for movers; this allows me to build a consistent measure for movers and non-movers. I create a price basket for all food-unit pairs for which I have at least 7 observations in every geographic group-wave combination.

I calculate the median price (to limit the role of outliers), and estimate the item-unit "quantity" as the mean amount consumed of the item-unit pair for individuals in the sample (mean rather than median, because the median for most goods is zero). I use these estimated prices and quantities to calculate a Fisher price index (i.e. geometric mean of the Paasche and Laspeyres price indices).

Per capita consumption: This variable reflects an aggregate of several sub-components. The steps for aggregation include:

Food consumption: For a battery of food items, individuals are asked to estimate the value of their consumption that was: (a) purchased and consumed, (b) consumed from home production, and (c) received as a gift and consumed. I sum these three quantities. I recode outliers on an item-by-item following the best practices laid out by Deaton and Zaidi 2002.

Non-food consumption: Non-food consumption here includes components from several modules, including (a) fuel (e.g. firewood, electricity)), (b) various types non-food expenditure in the last 30 days and 12 months, (c) utilities, (d) home repairs, and (e) education expenditure. I use an individual's estimate for fuel consumption in the last year (ie rather than purchases, reflecting the prevalence of home production), and estimates for expenditure in the other sections.

Price standardization: Converted to 2018 rural prices, using the price index procedure outlined above

Per capita, adult equivalent: I use the adult equivalent formula of $1 + (.7 \times$ number of adults - 1) + ($.5 \times$ number of children), reflecting both economies of scale in production (and the feature that children on average consume less).

B Description of Supplemental Analysis

B.1 Gendered Composition of Agricultural Labor

In Table 3, I provide high-level evidence that farm management and agricultural labor are highly correlated—female plot management is associated with primarily female labor on plots, and vice versa for men. In Appendix Tables A3 and A4, I more formally test this relationship; I briefly outline the procedure for doing so here.

The formal hypothesis I seek to test is whether the gender of the plot manager affects the gender of the labor. To implement this test, I reshape data to be at the "gender of labor - plot - wave" level. That is, "female labor on plot managed by person 10100101-01 in Wave 1" and "male labor on plot managed by person 10100101-01 in Wave 1" are two separate observations. I create a variable "female labor" equal to 1 if in reference to female labor, and 0 if male labor. I then interact the gender of the labor with the gender of the manager. In Appendix Table A3, I report these interactions, with an omitted group of male labor on male-managed plots. The large negative coefficients on male labor $\times$ female plot manager and female labor $\times$ male plot manager (and a coefficient close to 0 for female labor $\times$ female plot manager) are consistent with the manager-laborer link.

In Appendix Table A4, I provide evidence that this effect isn't attenuated under matriliny (which could be the case if the greater prevalence of female inheritance under matriliny increases the likelihood of a manager-laborer dissociation). Here, I include triple interactions of descent $\times$ gender of manager $\times$ gender of labor. The results suggest that the manager-laborer link strongly holds under both descent regimes.

C Appendix Tables

Appendix Table A1: Inheritance Customs and Laws

Panel A: Ethnographic Atlas: Inheritance Rules for Land

	Share	
Custom	Gender-specified only	All
Matrilineal: Sister's Sons	0.066	0.050
Children, daughters receive less	0.092	0.070
Children, both sexes equally	**0.117**	**0.089**
Patrilineal: Sons	0.725	0.549
Other Matrilineal Heirs		**0.097**
Other Patrilineal Heirs		0.145
Upper Bound Female		**0.186**

Panel B: World Bank Law Database - Sons and Daughters Inherit Equally

	1971	*2020*
Lower and Lower Middle Income Countries, Weighted Equally	0.545	0.688
Lower and Lower Middle Income Countries, Weighted by Population	0.225	0.696

This table documents the prevalance of gender differences in land inheritance. Panel A shows differences in inheritance across societies in which individual land ownership exists. Panel B shows prevalances of laws that explicitly preference sons over daughters, in 1971 and 2020.

Appendix Table A2: Comparison of Inherited Land by Descent

	(1)	(2)
	Obtained land via inheritance or allocation	Acres Received via Allocation or Inheritance
Matrilineal Tribe	0.0018	-0.162
	(0.0192)	(0.123)
Patrilineal Mean	0.31	1.55
Observations	12,175	12,175

This table compares land receipt via inheritance or allocation by descent, on the extensive margin (Column 1), and in acreage (Column 2). The sample includes individuals born in rural districts, aged 25-54. Regressions included district of birth and wave fixed effects, standard errors are clustered at the person-level.

Appendix Table A3: Agricultural Labor Supply, Reported at Gendered Labor - Manager - Wave Level

	Household Labor		
	(1)	(2)	(3)
	Any Gendered Labor	Days Gendered Household Agricultural Labor	Days Gendered Household Agricultural Labor per Acre
Female Labor * Male Manager	-0.192***	-61.81***	-16.52***
	(0.0079)	(2.6390)	(0.6940)
Male Labor * Female Manager	-0.316***	-78.13***	-8.376***
	(0.0146)	(3.9920)	(2.7850)
Female Labor * Female Manager	-0.0161	-39.80***	25.39***
	(0.0106)	(4.7720)	(3.5230)
Omitted Group: Male Labor - Male Manager Mean	0.88	128.10	33.87
Observations	9,518	9,518	8,926
F-Test: Fem Labor*Male Mgr = Male Labor*Fem Mgr	62.9	21.4	8.8
p-value	0.000	0.000	0.003
F-Test: Fem Labor*Fem Mgr + Fem Labor*Male Mgr = 0	215.8	257.9	5.8
p-value	0.000	0.000	0.017
F-Test: Male Labor*Fem Mgr + Fem Labor*Fem Mgr = 0	245.6	218.4	11.8
p-value	0.000	0.000	0.001

Results are pooled from the three waves of the Ghana Panel data, with Wave and District of Birth fixed effects. Standard errors are clustered at the household level. A single observation here is gendered, manager level labor in a given wave (e.g. Female labor, on plot managed by person 101001001-01, in Wave 1.) The sample is restricted to individuals aged 25-54, born in a rural district, who managed a plot in the most recent agricultural season prior to the survey wave. Controls are included for (i) rainfall z-scores for the current and lagged growing season, (ii) degree days and harmful degree days for the current and lagged growing season, (iii) survey respondent measures of soil characteristics and land quality, and (iv) FAO-GAEZ measures of soil type, agricultural zone, and land quality.

Appendix Table A4: Labor-Manager-Descent Triple Difference, Agricultural Labor Supply

	(1)	(2)	(3)
	Any Gendered Labor	Days Gendered Household Agricultural Labor	Days Gendered Household Agricultural Labor per Acre
Female Labor * Male Manager	-0.151***	-66.11***	-15.72***
	(0.0091)	(3.5050)	(0.8370)
Male Labor * Female Manager	-0.241***	-79.51***	-2.5140
	(0.0202)	(5.9560)	(5.1160)
Female Labor * Female Manager	-0.0230	-53.15***	13.92***
	(0.0150)	(5.5170)	(3.2100)
Matri * Male Labor * Male Mgr	0.0248	-10.7700	5.008*
	(0.0198)	(7.5660)	(2.9420)
Matri * Female Labor * Male Manager	-0.0888***	5.7920	3.5510
	(0.0243)	(6.4950)	(2.7010)
Matri * Male Labor * Female Manager	-0.118***	-0.7380	-5.2230
	(0.0319)	(7.9310)	(6.0460)
Matri * Female Labor * Female Manager	0.0194	20.03**	26.66***
	(0.0251)	(8.6640)	(7.4330)
Omited group: Male Labor - Male Mgr - Patrilineal Mean	0.90	142.20	34.02
Observations	8,896	8,896	8,336
F-Test: Fem Labor*Fem Mgr*Matri =0	0.60	5.35	12.86
p-value	0.440	0.021	0.000

Results are pooled from the three waves of the Ghana Panel data, with Wave and District of Birth fixed effects. Standard errors are clustered at the household level. A single observation here is gendered, manager level labor in a given wave (e.g. Female labor, on plot managed by person 101001001-01, in Wave 1.) The sample is restricted to individuals aged 25-54, born in a rural district, who managed a plot in the most recent agricultural season prior to the survey wave. Controls are included for (i) rainfall z-scores for the current and lagged growing season, (ii) degree days and harmful degree days for the current and lagged growing season, (iii) survey respondent measures of soil characteristics and land quality, and (iv) FAO-GAEZ measures of soil type, agricultural zone, and land quality.

Appendix Table A5: Farmer TFP Sensitivity to Female Effective Labor Rate

	TFP Estimates, with Female Labor Valued at X% of Male Labor			
	(1)	(2)	(3)	(4)
	80% (Base Case)	100% (Male and female labor treated equally)	50%	0% (Only male labor enters labor aggregate)
Female	-0.280***	-0.289***	-0.271***	-0.216***
	(0.0348)	(0.0349)	(0.0349)	(0.0360)
Male Mean	0.076	0.077	0.073	0.054
Observations	3,742	3,742	3,743	3,647

This table shows the sensitivity of TFP comparisons to the valuation of female labor relative to male labor. In each case, one day of female labor is coded as X% of female labor, and TFP is re-estimated with Levinsohn-Petrin with the updated input, after controlling for land quality. Regressions include district of birth and wave fixed effects; standard errors are clustered at the person level.

Appendix Table A6: Female Sensitivity to Crop Indicator Variables

	(1)	(2)
	Base Case	With Crop Indicator Variables
Female	-0.280***	-0.289***
	(0.0348)	(0.0349)
Patrilineal Male Mean	0.076	0.076
Observations	3,742	3,742

This table shows the sensitivity of female TFP comparisons to crop dummies. Column (1) is the base comparison, Column (2) includes crop fixed effects for the 10 most common crops. Regressions include district of birth and wave fixed effects; standard errors are clustered at the person level.

Appendix Table A7 - Robustness: Male Sector of Labor - Average Marginal Treatment Effects - All Prime Age Men

	Born South Indicator Only		*Region of Birth FEs*		*District of Birth FEs*	
	(1)	(2)	(3)	(4)	(5)	(6)
	Logit	Probit	Logit (Base Case)	Probit	Logit	Probit
Manages Business						
Matrilineal	-0.0083	-0.0089	-0.0184	-0.0185	-0.0092	-0.0123
	(0.0147)	(0.0150)	(0.0187)	(0.0193)	(0.0212)	(0.0204)
Years Education	-0.0011	-0.0001	-0.0009	0.0000	-0.0008	-0.0002
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0016)	(0.0015)
Cognition	0.0045	0.0046	0.0056	0.0055	0.0070	0.0067
	(0.0084)	(0.0084)	(0.0090)	(0.0089)	(0.0086)	(0.0081)
Employed in Wage Labor						
Matrilineal	0.0537***	0.0554***	0.0471**	0.0448*	0.0567**	0.0602**
	(0.0166)	(0.0170)	(0.0228)	(0.0232)	(0.0253)	(0.0247)
Years Education	0.0264***	0.0241***	0.0265***	0.0243***	0.0237***	0.0223***
	(0.0020)	(0.0018)	(0.0020)	(0.0018)	(0.0019)	(0.0017)
Cognition	0.0359***	0.0367***	0.0315***	0.0328***	0.0281***	0.0287***
	(0.0092)	(0.0091)	(0.0094)	(0.0093)	(0.0095)	(0.0092)
Not Earning Individual Income						
Matrilineal	-0.0327**	-0.0323**	0.0020	0.0033	0.0019	0.0027
	(0.0141)	(0.0137)	(0.0205)	(0.0191)	(0.0216)	(0.0203)
Years Education	0.0009	0.0019	0.0012	0.0021	0.0018	0.0026*
	(0.0014)	(0.0014)	(0.0013)	(0.0014)	(0.0014)	(0.0014)
Cognition	0.0277***	0.0269***	0.0229***	0.0224***	0.0234***	0.0219***
	(0.0080)	(0.0078)	(0.0080)	(0.0078)	(0.0080)	(0.0075)
Omitted Group: Managing Agricultural Plot						
Observations	4,063	4,063	4,063	4,063	4,063	4,063

Appendix Table A8: Household-Gender Level Labor Supply

	(1)	(2)	(3)	(4)
	Days Agricultural Labor per Adult	Days in Wage Labor	Days in Non-Farm Enterprise	Total Days Labor
Female	-35.12***	-26.64***	28.30***	-31.98***
	(1.9040)	(2.1580)	(2.7500)	(3.0540)
Matrilineal Tribe	-18.42***	23.61***	-8.1420	-1.6990
	(3.6440)	(4.7680)	(5.1930)	(5.7160)
Female * Matrilineal	22.09***	-21.32***	17.41***	16.86***
	(2.7180)	(3.9360)	(4.7190)	(5.0290)
Patrilineal Male Mean	76.1	48.0	37.4	156.5
Observations	11,420	11,459	11,459	11,420
F-Test: Female * Matri=0	66.03	29.35	13.62	11.24
p-value	0.000	0.000	0.000	0.001
F-Test: Matri + Fem*Matri=0	1.40	0.43	3.02	7.87
p-value	0.237	0.515	0.082	0.005
F-Test: Female + Fem*Matri=0	47.65	213.20	143.30	14.49
p-value	0.000	0.000	0.000	0.000

This table shows differences in gendered labor at the household level. A single observation here is gender-household-wave, e.g. "Female labor in household 101001001 in Wave 1." Regressions include head district of birth and wave fixed effects; standard errors are clustered at the household level.