



Women as agents of change: Female income and mobility in India

Nancy Luke^a, Kaivan Munshi^{a,b,*}

^a Brown University, United States

^b NBER, United States

ARTICLE INFO

Article history:

Received 11 October 2007

Received in revised form 6 May 2009

Accepted 8 January 2010

JEL classification:

D13

J12

J24

O12

Keywords:

Globalization

Mobility

Female income

Household decisions

Education

Marriage

Marital violence

Networks

Caste

Gender

ABSTRACT

Economic globalization will give many women in developing countries access to steady and relatively remunerative employment for the first time, potentially shifting bargaining power within their households and changing the choices that are made for their children. This paper exploits a unique setting – a group of tea plantations in South India where women are employed in permanent wage labor and where incomes do not vary by caste – to anticipate the impact of globalization on mobility across social groups in the future. The main result of the paper is that a relative increase in female income weakens the family's ties to the ancestral community and the traditional economy, but these mobility enhancing effects are obtained for certain historically disadvantaged castes alone. Although the paper provides a context-specific explanation for why the women from these castes emerge as agents of change, the first general implication of the analysis is that the incentive and the ability of women to use their earnings to influence household decisions depends importantly on their social background. The second implication is that historically disadvantaged groups may, in fact, be especially responsive to new opportunities precisely because they have fewer ties to the traditional economy to hold them back.

© 2010 Elsevier B.V. All rights reserved.

1. Introduction

Economic globalization will restructure labor markets throughout the developing world in the future. The demand for low-skill organized wage labor will increase, and although female labor force participation remains low in traditional societies, women will inevitably enter the workforce in large numbers. In many countries, women will have an unprecedented opportunity to gain access to steady and relatively remunerative employment.

Economic and social mobility remains low in the developing world and a natural question to ask is whether this reorganization of the labor force will increase mobility in future generations by changing the choices that parents make for their children. There is a common perception that money in the hands of women is put to different use than money in the hands of men. Consistent with this view, it is often observed that a relative increase in female income within the household leads to greater expenditures on children's nutrition and education. However, these

results are often obtained in environments where women do not work regularly over their lifetimes and where their incomes are a small fraction of the household budget. Moreover, we do not know whether or how changes in contemporaneous expenditures on children affect major outcomes such as educational attainment, marriage choice, and residential location that are closely linked to their future mobility.

The international migration literature provides us with descriptive evidence that is relevant to this question. Migrants who arrive in the United States and other advanced economies gain access to jobs that are typically far more remunerative than what they were accustomed to in their origin countries. Although these opportunities are available to men and women, female migrants often enter the market for low-skilled labor more readily and become the main breadwinners in their families. The early migration literature viewed this outcome as an emancipating experience for women, increasing their control over decision-making within the household (Boserup, 1970; Grasmuck and Pessar, 1991). At the same time, research across a variety of other contexts has found that migrant women often continue to conform to traditional patterns of behavior and defer to their husbands even when they contribute substantially to household incomes (see, for example, Zhou's, 1992 study of Chinese immigrants in New York city, Menjivar's, 1999 study of

* Corresponding author. Brown University, United States.

E-mail address: Kaivan_Munshi@brown.edu (K. Munshi).

Central American immigrants in California, or Kibria's, 1993 study of Vietnamese immigrants in Philadelphia; see also Parrado and Flippen, 2005). Underlying this alternative line of research is the idea that migrants continue to benefit from family and home-community networks and that altering traditional patterns of behavior can result in the loss of these services. Whether women assert themselves or not depends on the benefit that is derived from these social arrangements and the strength of the traditional norms. We expect to encounter similar variation in the relationship between female income and household decisions in economies that are globalizing, and the primary focus of this paper will be to empirically document such cross-community variation.

Globalization is a relatively recent phenomenon, whereas what we require to study the effect of female income on long-term outcomes for their children is an economic environment in which women have been engaged in permanent wage labor for at least a generation. This paper exploits a unique setting — a group of tea plantations in the South Indian High Range — to anticipate the impact of globalization on mobility in the future.

The High Range, a mountainous area straddling the modern Indian states of Kerala and Tamil Nadu, was virgin forest until it was acquired by British planters and converted into tea plantations in the last quarter of the nineteenth century. Since the plantation land was previously uninhabited, workers were brought to the High Range from the plains in Tamil Nadu. Today, the workers on the tea plantations — or “estates” — are the third-generation descendants of those migrants, whose population is supplemented by a fresh influx of new workers from the “low country” in each subsequent generation through marriage. Women work primarily as tea-leaf pluckers on the estates, whereas the men are employed in supporting tasks such as weeding, spraying, and pruning, as well as in the estate tea factories. The women have permanent full-time jobs over their working lives, just as they would in the modern factory system, and they actually earn more than men on average.

This research setting is well suited to study the relationship between female income and mobility across communities or castes, one of the most important and enduring social affiliations in India. Hindu society has been stratified along caste lines for centuries. Networks serving different functions have been historically organized at the level of the endogamous sub-caste or *jati*, and norms prescribing appropriate patterns of behavior continue to vary by caste. Although disparities in income and education persist across castes, both in rural and in urban India, a special feature of the organization of the tea estates is that workers have the same jobs (and income) and access to the same residential, educational, and medical facilities, irrespective of their caste affiliation. We are consequently in a position to test whether differences in social institutions and social norms across castes continue to shape the relationship between female income and household decisions, holding economic resources and opportunities constant across social groups.

The workers in the High Range continue to be tied to their ancestral communities in rural Tamil Nadu, despite having lived in the tea estates for many generations. Loans and transfers flow back and forth between the tea estates and the origin communities, the children of the workers are often sent home to study, and many workers will buy land, build a house, and return to their ancestral homes when they retire. Perhaps the most distinctive feature of South Indian kinship structure is marriage among close relatives. Reinforcing existing network ties, many workers continue to marry their children to relatives from the ancestral location in the traditional fashion. The key parental decision is the extent to which children will be tied to their ancestral communities and the traditional economy. This decision will, in turn, determine the probability that children will marry among their relatives as well as their (optimal) educational attainment. Our objective is to predict and document differences in these choices across castes in the tea estates, with a special emphasis on the role played by the (earning) mothers in shaping these choices.

While the inequities of the caste system are well known, an especially egregious feature of this system particular to South India was the institution of *agrestic* slavery, which committed the members of certain agricultural sub-castes to a lifetime of servitude. The slaves went by different names in different parts of South India; in the Tamil-speaking areas there were two slave sub-castes, known as the Pallars and the Paraiyars, who together accounted for somewhere between 10 and 20% of the total population in the nineteenth century (Kumar, 1965).¹ The emancipation of slavery by the British colonial administration coincided with the opening up of the plantations in the High Range, and not surprisingly a large proportion of the labor force was recruited from the (former) slave castes, who were looking to improve their economic opportunities. Today, the slave castes account for two thirds of the workers on the tea estates, with the remaining workers drawn from across the caste hierarchy.

Munshi and Rosenzweig (2009) have recently argued that the efficiency of rural caste-based insurance arrangements in India is a consequence of the frequent and important social interactions within endogamous sub-castes. Exclusion from these interactions serves as a powerful punishment device, allowing high levels of cooperation to be sustained. The slave castes would have been a notable exception to this general rule, with their members spread over a wide area and with extremely limited interactions between them.² We consequently expect mutual insurance networks among the slave castes to have been exceptionally weak historically, and to remain weak today, which implies that the workers from those castes should be less tied to their ancestral communities.

Most of the data used in the analysis are obtained from a survey of 3700 female workers conducted by the authors in 2003. These workers are employed by a single firm, the largest tea manufacturing company in the world, that operates 23 estates in the High Range. Each estate employs approximately one thousand workers and the sampled women were drawn randomly from all 23 estates. Annual incomes for all workers were also obtained over the 1997–2001 period from the company's computerized records to supplement the survey data. As predicted, preliminary empirical results indicate that among the adult workers in the tea estates, the former slaves are less attached to their ancestral communities and have significantly higher levels of education than the non-slave castes. It is interesting to note that these statistics are very similar across the non-slave castes, despite the fact that they are drawn from very different positions in the social hierarchy.

To further explore the observed differences between slave and non-slave castes in the tea estates, we proceed to estimate the effect of an increase in female income, net of total household income, on important decisions and outcomes for the children. Using a variety of independent estimation strategies, we find that a relative increase in female income weakens the family's ties to the ancestral community as the woman gains bargaining power within the household. The children are less likely to marry a relative, to be schooled in the ancestral location, and to ultimately settle there. At the same time, an exogenous increase in relative female income increases the educational attainment of the children. Most importantly, significant female income effects are obtained for the former slave castes alone, accounting for part of the caste differences in schooling and marriage choice observed in both the parental and the current generation.

Female income effects will only be observed if male and female preferences differ and women are able to act on these preferences. Extending Munshi and Rosenzweig's analysis by explicitly accounting for the costs and benefits of social interactions within the sub-caste, we will later argue that interactions with the ancestral community and the

¹ Pallar is derived from *pallam*, the Tamil word for lowness and Paraiyar means outcaste (hence the English “pariah”).

² Since the slaves were paid a customary subsistence wage, the potential to pool income and smooth consumption within these sub-castes would also have been extremely limited.

prospect of permanently settling there after retirement are especially burdensome for women belonging to the former slave castes. Thus, while both parents might benefit from mutual insurance, old-age support, and other forms of assistance organized around their ancestral communities, the cost of maintaining the social ties that are necessary to obtain this social support may be substantially larger for the women than the men in those castes.

The wider gender preference-gap among the former slave castes is likely reinforced by the greater ability among the women in those castes to act on their preferences. Lower caste women historically worked outside the home, and although they were typically employed in low-paying menial occupations, it has been argued that the income and the independence that this work provided gave rise to a culture in which these women were relatively assertive within their households (Geetha, 2002; Kapadia, 1995; Chakravarti, 1993). Given that culturally determined beliefs and practices are often slow to change, we expect these caste differences to persist in the High Range even though all women work in the tea estates, irrespective of their caste affiliation.³ It is consequently not at all surprising that female income effects, on net, are stronger for the former slave castes in the tea estates.

The apparent willingness of the Pallar and Paraiyar women to act on their preferences does not, however, come without a cost. Previous evaluations of female income-generation programs in developing countries have documented a male backlash, as measured by the increased incidence of marital violence, when recently empowered women shift household decisions away from their husbands' preferences (Schuler et al., 1996). Similar patterns of marital violence have been documented in the international migration literature as well (Min, 2001). We provide evidence that a relative increase in female income among the former slave castes also leads to an increase in marital violence. In contrast, female income has no effect on household decisions and outcomes among the other castes in the tea estates and has no effect on marital violence as well. Apart from providing independent support for the cross-caste results described above, this result also demonstrates that underlying social institutions can shape the incidence of marital violence, net of individual characteristics, providing new insight into this important topic.

The Indian economy has been growing rapidly since the early 1990s, and India is now poised to become a major economic power. This is a particularly interesting setting in which to study the tension between economic change and social inertia. When new opportunities presented themselves under British colonial rule, the upper castes were quick to gain access to western education and with it coveted administrative and professional jobs. The concern is that the higher castes might once again seize the new opportunities that are made available by globalization, widening the existing caste-gap even further. In the setting that we have chosen, however, women belonging to castes that have historically occupied a position at the very bottom of the social hierarchy use their earnings to emerge as independent agents of change. These results reinforce recent research from urban India (Munshi and Rosenzweig, 2006), which suggests that historically disadvantaged social groups and, in particular, disadvantaged individuals within those groups, may in fact be especially responsive to new economic opportunities precisely because they have fewer ties to the traditional economy to hold them back. This general observation may well apply to the development experience in other countries in the future, with the important caveat that globalization will only be equalizing if new opportunities are made available across all social groups.

2. The institutional setting

The South Indian High Range was historically part of the state of Travancore; today it is situated in the modern Indian state of Kerala

(on the border with Tamil Nadu). Travancore was nominally under the control of a native ruler, but under pressure from the local British Resident, the government of Travancore began to grant "concession" land in perpetuity for the cultivation of tea to British planters from the 1860s onward. Since the concession land was previously uninhabited, labor had to be imported from elsewhere. For reasons that are unclear to historians, it proved difficult to recruit labor from Travancore itself (Kumar, 1965; Baak, 1997). Instead, the planters brought up workers from the plains in the Madras Presidency (the modern Indian state of Tamil Nadu).

Slavery in India differed from slavery in other parts of the world in two important respects. First, slaves in India could only be drawn from specific castes. And, second, these slaves belonged to the same race and culture as their masters and enjoyed certain rights, such as a customary wage (Kumar, 1965; Alexander, 1989). Nevertheless, the slave castes remained the most wretched and downtrodden groups in South India. Samuel Mateer, a Christian missionary writing in 1884 (cited in Kooiman 1989:18) describes how the slaves were "bought and sold like cattle, flogged like buffaloes, made to work all day for a little rice, and kept at a distance as polluted." The British noted the existence of slavery as soon as they arrived in South India at the beginning of the nineteenth century, but they did little to change the system initially except to protect the slaves from its worst abuses (Kumar, 1965). The anti-slavery movement in Britain ultimately pressured the Government of India to pass the Slavery Abolition Law, Act V, in 1843. This simply meant that the administration would no longer apprehend and bring back runaway slaves to their masters and that no claims to the services of slaves could be upheld in British courts. It was only with the passing of the Penal Code in 1861 that a man could actually face legal prosecution if found in the possession of a slave, finally freeing the slave castes (Hjeje, 1967).

As noted, the emancipation of the slaves coincided with the opening up of the plantations in the High Range, and so a large fraction of the labor force was historically recruited and continues to be recruited from the former slave castes. At the same time, other castes are well represented in the tea estates. Using census data, Kumar (1965) documents that the population of the Madras Presidency, the major source region for labor in the tea estates, rose by 300% between 1802 and 1901. This population increase, together with the structural change in the economy brought about by colonialism, displaced many individuals from their traditional caste occupations, inducing them to migrate to the tea estates as agricultural labor.

The demand for labor fluctuated with the tea crop in the early years, and so workers were recruited on fixed term contracts usually running for nine months (Baak, 1997). The problem with the short-term contracts was that workers would often return to the plains without advanced notice or be easily induced to switch companies at a slightly higher wage. The Criminal Breach of Contract Act, introduced in 1865 by the Travancore government, helped reduced this problem for a while. But the planters were forced to shift to a permanent workforce with the abolition of the Act in the 1930s. The permanent workers and their families have been provided free housing in "labor lines" located on each estate ever since.

The size of the workforce has remained fairly stable since the 1930s. To ensure that at least some of the children of the workers would have access to these relatively well paying jobs, strictly enforced company rules prevented workers from shifting across estates, or new workers from entering the estates, except through marriage. James Finlay and Company, which had acquired a large share of the High Range concession in 1890, gradually sold all its properties to a wholly Indian-owned company, Tata Tea, over the course of the 1970s and 1980s, and the divestment process was completed in 1986. Tata Tea has continued to enforce the rules restricting worker mobility.

Although the survey did not collect complete employment histories for the workers, this information was collected in supplementary semi-structured interviews conducted with 44 female workers and 46 male

³ Fernandez and Fogli (2007) document a similar cultural persistence among U.S. migrants over multiple generations.

workers. Among the 90 workers, just five cases of non-standard entry were reported. In two cases, the father of the worker was employed on the tea estate but not by the company, as a washerman (*dhobi*) and as a construction worker, respectively. This close proximity allowed the respondents to make connections with the company staff and to ultimately enter the workforce. In three other cases, the parents of the workers arrived in the tea estates before they were born, using close relatives (siblings and cousins) who were already employed there to secure entry into the company. Not a single worker, among the 90 interviewed, reported shifting from one estate to the other except through marriage (the woman invariably moved if both spouses were working prior to marriage). It consequently seems reasonable to assume that the workers on each tea estate today are the third-generation descendants of the workers who were hired permanently in the 1930s, supplemented by the influx of fresh migrants in each generation that followed through marriage.

3. Household decisions in the tea estates

The starting point for our analysis of household decisions in the tea estates is Munshi and Rosenzweig's (2009) observation that social interactions within sub-castes give rise to efficient mutual insurance networks in rural India, where the tea workers originally came from. The basic rule in Hindu society is that individuals must marry within their sub-caste or *jati*. This rule, together with restrictions on social interactions across sub-castes, resulted in close ties within sub-castes over the course of many generations. Exclusion from these interactions serves as a powerful punishment device and, not surprisingly, mutual insurance arrangements in rural India have historically been organized and continue to be organized around the sub-caste.

Intra-caste interactions will be less frequent and less important for households whose members have married outside their sub-caste or migrated. Without the threat of collective punishment, these households cannot credibly commit *ex ante* to cooperative behavior *ex post* and so will be denied access to the insurance network. It follows that households in rural India will be faced with two choices: (i) participate in the network but then forego the additional utility that comes with mobility, or (ii) out-marry and out-migrate at the cost of losing the services of the network. Munshi and Rosenzweig argue that without access to alternative consumption-smoothing arrangements of comparable quality, most households appear to have chosen the first option, providing one explanation for the exceptionally low social and spatial mobility that is observed in India.

The prospects for *ex post* commitment and, hence, migration improve when groups of households drawn from the same sub-caste move together. Indeed, rural–urban migration in India has historically been organized around the sub-caste, with migrants receiving support from members of their caste at the destination as well as their insurance networks at the origin (Munshi and Rosenzweig, 2006). Migration to the tea estates followed the same pattern, with workers traveling to the High Range in gangs drawn from the same sub-caste (Kumar, 1965). The descendants of those workers are now well established on the tea estates but continue to be tied to their ancestral communities. Loans and reciprocal transfers flow back and forth between the tea estates and these communities and many workers will buy land, build a house, and return to their ancestral homes when they retire. Marriage in South India traditionally occurred among relatives, with overlapping extended-family networks linking the entire sub-caste (Karve, 1953; Trautmann, 1981). Households in the tea estates can thus compensate for the spatial distance between the High Range and their origin communities by marrying their children to relatives in the traditional fashion, sending them home to study, and visiting their ancestral communities as frequently as possible.

As in rural India, each household in the tea estates is faced with two choices: (i) it can maintain close ties with the ancestral community, benefitting from caste-based mutual insurance and old-age support, or

(ii) it can move into the modern economy where the returns to individual ability are higher but a social safety-net is unavailable. Children in households that choose the first option are more likely to be married to a relative, to be sent to school in the rural ancestral location, and to ultimately settle there. The returns to education will thus be relatively low for them, which results in lower levels of schooling in equilibrium. If the distribution of intrinsic ability and the returns to education in the modern (urban) economy do not vary systematically (to a first-order approximation) by caste, then variation in household decisions across sub-castes in the tea estates will be determined by variation in the returns to investment in the traditional networks.

Recent evidence from rural and urban India indicates that marital endogamy is closely followed in sub-castes across the social hierarchy (Munshi and Rosenzweig, 2006, 2009). This implies that network efficiency will be uncorrelated with a caste's economic or social status. The slave castes, however, are a notable exception to this rule for two reasons: First, the Pallars and Paraiyars were concentrated in areas where labor-intensive rice cultivation was practiced. Since rice is cultivated on irrigated land and tanks were the only source of irrigation in the nineteenth century, they were clustered in small settlements spread over the entire Madras Presidency (Alexander, 1989). This spatial dispersion would have resulted in less frequent social interactions. Restrictions on travel, placed on the slaves by their masters, would have only exacerbated this problem. Second, since the slaves were paid a subsistence wage, typically in kind, the potential to pool resources and smooth consumption within these sub-castes would have been extremely limited. Once an equilibrium with low levels of cooperation was established in the Pallar and Paraiyar networks, it could have persisted over multiple generations in which case households belonging to those sub-castes in the tea estates would display the greatest propensity to weaken ties to their ancestral communities today.

The preceding discussion tells us that Pallar and Paraiyar households in the tea estates will benefit less by investing in their traditional networks and, therefore, will display a greater propensity to move their children into the modern economy. Our analysis is also concerned with gender differences in these preferences within households and across castes. Both men and women will benefit from the services that the traditional networks provide. However, the maintenance of the social interactions that are necessary to obtain these services will be especially burdensome for Pallar and Paraiyar women. The slave castes have historically been the most downtrodden group in South Indian society and poverty is often associated with maladaptive behaviors, such as male alcohol abuse and domestic violence, that must be borne disproportionately by women (Kooiman, 1989). Kapadia's (1995: 56) ethnography of a Tamil village, for example, notes that "Pallar women often spoke of the problems caused by excessive male drinking... violence against women was a visible phenomenon on the Pallar street."

Moreover, while caste status is acquired at birth and is immutable, education and the acquisition of wealth do permit class mobility, especially in urban areas (Rubinoff, 1999). Pallar and Paraiyar women earn relatively high wages in the tea estates compared to their ancestral communities and are treated with respect by the company's management, staff, and workers. They thus have little reason to return to the lower caste status and the poverty of their ancestral neighborhoods in rural Tamil Nadu, preferring to remain in the High Range or to move to the relative anonymity of the city when they retire.⁴ Pallar and Paraiyar women in the tea estates will thus have a disproportionately strong incentive to ensure that their children do not settle in the ancestral location to avoid having to ultimately settle there themselves. In addition, mothers are more likely than fathers to internalize the cost to the children from marrying into the network and subsequently living

⁴ Pallars and Paraiyars continue to live in "colonies" that are spatially distinct from the "main village" in rural Tamil Nadu and Kapadia describes how "the Pallars, Christian Paraiyars, and Wottans (Hindu Paraiyars) in Aruloor all continue to be regarded as 'untouchables,' as they have been for centuries" (p. 9).

and working in the ancestral location. Pallar and Paraiyar children (especially the girls) must bear substantial costs associated with poverty in the community, as described above, when they end up in the ancestral location, and so mothers from the former slave castes will have a greater incentive than their husbands to shift household investments away from the network.⁵

Upper caste women traditionally did not enter the labor force and therefore were accorded greater status in the household and the community. In contrast, women from all castes work in the tea estates. Moreover, families live side-by-side irrespective of their caste status, in contrast once again with the spatial segregation along caste lines that is characteristic of the South Indian village. One way in which upper caste women can distinguish themselves from Pallar and Paraiyar women in the tea estates and preserve their traditionally higher social status is consequently to maintain ties with their ancestral communities and define their identity as members of those communities. In this case, higher caste women will prefer to have their children attend school, marry, and settle in the origin, as their husbands do.⁶ The cost of maintaining these ties, in terms of the domestic violence and alcohol abuse described above, will also be less severe for the upper caste women, given the relatively favorable conditions in their home communities. Therefore, for all the reasons described above, we expect the gender preference-gap to be wider among the Pallars and Paraiyars than among the upper castes.

This gap will only translate into a change in household decisions if women are able to act on their preferences. Given that Pallar and Paraiyar women traditionally worked outside the home in the fields, this work gave them some degree of influence within their households, and a pattern emerged whereby women in lower caste groups tended to be more assertive with their husbands (Agarwal, 1997; Malhotra and Mather, 1997). These cross-caste cultural differences, if they persist in the tea estates where all women work, would only reinforce the wider gender preference-gap that we anticipate among the Pallars and Paraiyars, and, in turn, reinforce household-level differences in the propensity to invest in the traditional networks across castes.

4. Empirical analysis

4.1. The data

This paper uses data collected by the authors in two phases in 2002–2003. Annual incomes for all workers over the 1997–2001 period were obtained from the company's computerized records on an initial trip to the tea estates in February–March 2002. Historical climate data from 1965 to 2001 and the elevation of each estate were also collected on this visit. Subsequently, we conducted a survey of 4000 female workers on a second visit, from December 2002 to March 2003.

Each estate office maintains a “family card” listing the individuals residing in each unit in the labor lines and their relationship to the (typically male) household head. The information on the family cards was collected and digitized on our first visit to the tea estates in 2002, and the sampling frame for the subsequent survey in 2002–2003 was

restricted to wives of (male) household heads. The sampling frame ultimately comprised 11,700 women from which 4600 were drawn randomly and interviewed at their homes.

Since the list of workers was one year old at the time of the survey, some of the workers in the sample had left employment by February 2003. The 4600 selected workers reside in 86 divisions in the 23 estates spread all over the area (some of the estates are as far as 25 km from Munnar, the only town in the area, where the survey team was based). Female workers are employed full time so they could only be interviewed in the late evenings and on weekends. Despite these logistical difficulties, 3994 schedules were ultimately completed, leaving us with an overall response rate of 89.1%.

Each worker is assigned a permanent identity number by the company, which we used to merge the survey data with the individual income data collected earlier from the company's records. Discarding mismatches between the identity numbers recorded in the survey and the administrative records, as well as mismatches between the identity numbers in the survey and the family card, we were left with 3700 couples in which the woman was the wife of a household head and for whom we had income information for both spouses. The survey instrument collected detailed information on the background of the respondent, her husband, and their parents. We also collected information on the respondent's children and their spouses (where relevant), paying particular attention to the marriage and schooling choices that were made by the workers for their children.

4.2. Caste comparisons in the tea estates

The discussion in the previous section emphasizes the distinctiveness of the former slave castes. We consequently begin by comparing schooling and marriage choices for the adult workers in the sample across the major sub-castes in the tea estates. Among the 32 sub-castes with five or more respondents, four sub-castes – Pallars (40%), Paraiyars (28%), Sakliyars (7%), and Thevars (12%) – account for 87% of the sample. We construct dummy variables for each of these major sub-castes and begin in Table 1 by regressing schooling and marriage on these dummies (without a constant term). The coefficient on these dummies represents the corresponding sub-caste mean. As predicted

Table 1
Sub-caste comparisons among adult workers.

Dependent variable	Husband's schooling	Wife's schooling	Married relative	Husband first-generation	Wife first-generation
	(1)	(2)	(3)	(4)	(5)
Pallar	5.94 (0.08)	3.85 (0.09)	0.57 (0.01)	0.10 (0.01)	0.16 (0.01)
Paraiyar	6.00 (0.10)	3.82 (0.10)	0.49 (0.02)	0.06 (0.01)	0.11 (0.01)
Sakliyar	5.27 (0.19)	2.84 (0.20)	0.68 (0.03)	0.14 (0.02)	0.23 (0.02)
Thevar	5.36 (0.15)	3.33 (0.16)	0.69 (0.02)	0.15 (0.01)	0.23 (0.02)
Sakliyar = Thevar (F statistic)	0.12	3.74	0.23	0.26	0.00
p-value	0.73	0.05	0.63	0.61	0.96
Paraiyar = Sakliyar (F statistic)	11.37	19.13	31.20	16.94	25.87
p-value	0.00	0.00	0.00	0.00	0.00
Pallar = Paraiyar (F statistic)	0.19	0.07	15.45	9.99	15.26
p-value	0.66	0.79	0.00	0.00	0.00
No. of observations	3219	3219	3219	3219	3219

Note: standard errors in parentheses.

Sample restricted to four largest sub-castes.

Schooling is measured in years.

First-generation workers are those that grew up outside the tea estates.

⁵ Women tend to be socialized to favor collective interests (especially children's welfare) rather than personal consumption in traditional economies (Agarwal, 1997). Cox (2003) offers an alternative explanation from evolutionary biology, based on paternity uncertainty, as to why mothers might care more about their children's welfare than fathers.

⁶ A recent examination of Tamil caste identity in the psychology literature indicates that high caste women identify more strongly with their caste group than high caste men on average (Mahalingam, 2007). Among the three upper caste groups that were studied – Brahmin, Thevars, and Gounders – the Thevars were found to have the strongest sense of caste identity. It is worth noting that the Thevars are the dominant sub-caste among the high caste workers in the tea estates.

by the theory, we see in Table 1 that Pallars and Paraiyars have greater educational attainment, are less likely to marry a relative in the traditional fashion, and are less likely to be first-generation arrivals in the tea estates than the Sakliyars and Thevars.⁷

The Sakliyars are a Scheduled Caste and although they were never slaves, they occupy a position at the very bottom of the social hierarchy. The Thevars, in contrast, are an upper caste who do not qualify for any of the quotas currently offered by the state for historically disadvantaged groups. It is consequently quite striking that we cannot reject the hypothesis that schooling and marriage choices are the same for Sakliyars and Thevars in the tea estates. In contrast, we easily reject the hypothesis that these choices are the same for Paraiyars and Sakliyars, and while marriage patterns do differ for the Pallars and Paraiyars, it is evident from Table 1 that the choices made by the former slave castes are distinct from the choices made by the other sub-castes, irrespective of their position in the caste hierarchy. We are ultimately interested in the role played by the women in moving their families away from the traditional economy in the current generation and for that analysis we will need to estimate separate regressions in broad caste groups, treating schooling and marriage among the parents as predetermined. Given the theoretical motivation and the results in Table 1, a natural partition of the data includes the Pallars and Paraiyars in one group and all the other sub-castes (the remainder of the sample) in the other.⁸ All the analyses that follow will be based on this caste classification.

Table 2 compares characteristics of the workers, including the schooling and marriage choices described above, by caste category. The age of both male and female workers does not vary by caste in Table 2, Panel A. We also see that access to the same jobs translates into the same income for both men and women by caste. In contrast, the former slave castes have significantly higher schooling, for both men and women, matching the patterns reported separately by sub-caste in Table 1.

Table 2, Panel B compares marriage practices and retirement patterns by caste category. The workers in the tea estates, irrespective of their caste affiliation, continue to adhere to the fundamental social rule of marriage within the sub-caste as elsewhere in the country. The Pallars and Paraiyars actually have slightly lower levels of out-marriage, perhaps due to the continuing stigma associated with marriage into the former slave castes. Matching the patterns in Table 1, we see that the former slave castes are nevertheless significantly less likely to marry a relative and, therefore, less likely to be first-generation arrivals in the tea estates. Households that distance themselves from the home community invest less in the traditional network over their working lives and, not surprisingly, the parents of the Pallar and Paraiyar workers are much less likely to have retired in the ancestral location.⁹ The differences in the quality of the traditional network that we believe are responsible for the caste-gap reported in Table 2 have been present for many generations and continue to persist. To separately identify a role for the Pallar and Paraiyar women in contributing to these differences we next turn to the choices made for the children in the current generation.

Table 3 compares schooling, marriage choices, and residential locations by caste for the children of the workers. We are interested in the educational attainment and the residential location of children who have completed their schooling and are now living independently.

⁷ The term “cross-cousin marriage” is sometimes used to describe marriage patterns in the South Indian kinship system. This is somewhat of a misnomer since traditionally the most preferred match for a woman was her mother’s brother, followed by the mother’s brother’s son and the father’s sister’s son (Kapadia, 1995). Among our female respondents who married a relative, 12.5% married the mother’s brother, 25.4% married the mother’s brother’s son, and 22.3% married the father’s sister’s son. The remaining 39.8% married some other relative.

⁸ Among the remaining 13% of the households in the sample, who do not belong to one of the four large sub-castes, 62% are classified as Scheduled Castes, while the rest are drawn from across the caste hierarchy.

⁹ The reported retirement statistics exclude first-generation workers whose parents would have mechanically retired in the ancestral location.

Table 2
Caste comparisons among adult workers.

Gender	Men		Women	
	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes
Caste	(1)	(2)	(3)	(4)
<i>Panel A: individual characteristics</i>				
Age	41.90 (0.17)	41.92 (0.26)	38.46 (0.16)	38.34 (0.24)
Income	18.58 (0.19)	19.02 (0.28)	21.46 (0.09)	21.43 (0.13)
Years of schooling	5.97 (0.06)	5.56* (0.09)	3.84 (0.07)	3.34* (0.09)
<i>Panel B: marriage and retirement</i>				
Married within sub-caste	–	–	0.98 (0.003)	0.95* (0.01)
Married relative	–	–	0.54 (0.01)	0.64* (0.01)
First-generation worker	0.08 (0.01)	0.15* (0.01)	0.14 (0.01)	0.26* (0.01)
Parents retired in ancestral location	0.27 (0.01)	0.36* (0.02)	0.30 (0.01)	0.37* (0.02)
No. of observations	2515	1181	2515	1181

Note: standard errors in parentheses. * denotes rejection of the equality of means at the 5% significance level.

Women refers to the respondents and men to their husbands.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Income is measured in thousands of Rupees per year.

First-generation workers are those that grew up outside the tea estates.

Parents retired in ancestral location if they settled either in the father’s or the mother’s ancestral location in Tamil Nadu.

Retirement statistics exclude first-generation workers whose parents would have certainly retired in the ancestral location.

Although the minimum age of legal employment in India is 14, a fairly large fraction of children in the tea estates complete secondary school (around age 15). We consequently restrict the sample in the analysis that follows to children aged 16–45, recognizing that educational attainment will be truncated for some of the youngest children. None of

Table 3
Caste comparisons among children.

Child's gender	Boy		Girl	
	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes
Caste	(1)	(2)	(3)	(4)
<i>Panel A: marriage</i>				
Married within sub-caste	0.87 (0.02)	0.86 (0.02)	0.93 (0.01)	0.89* (0.01)
Married relative	0.40 (0.02)	0.56* (0.03)	0.48 (0.02)	0.57* (0.02)
Spouse grew up in ancestral location	0.20 (0.02)	0.33* (0.03)	0.26 (0.01)	0.33* (0.02)
<i>Panel B: schooling</i>				
Attended secondary school in ancestral location	0.26 (0.01)	0.33* (0.02)	0.22 (0.01)	0.23 (0.02)
Years of schooling	9.47 (0.06)	9.32 (0.09)	9.36 (0.07)	8.82* (0.09)
<i>Panel C: residence</i>				
Child lives in ancestral location	0.28 (0.02)	0.36* (0.03)	0.28 (0.01)	0.39* (0.02)

Note: standard errors are in parentheses. * denotes rejection of the equality of means at the 5% significance level.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Statistics computed for children aged 16–45, who are married in Panel A and no longer residing with their parents in Panel C.

the results that we report below are qualitatively affected when the sample is further restricted to the 18–45 age range.

Table 3, Panel A, describes marriage choices.¹⁰ Most of the children continue to marry within their sub-caste, although a comparison with the parents in Table 2 indicates that the prevalence of out-marriage has increased over the past two generations. Cross-cousin marriage (or marriage to a relative) has declined all over South India in recent decades with relatively wealthy and educated individuals matching on the “open” marriage market (Kapadia, 1995; Rahman and Rao, 2004). Although such marriages have also declined in the tea estates across generations, they continue to be quite prevalent among the workers’ children. As with the previous generation, boys and girls belonging to the former slave castes are much less likely to marry a relative and, by extension, someone who grew up in the ancestral location. The Pallars and Paraiyars are less likely to marry outside their sub-caste, so their lower propensity to marry a relative cannot be attributed to increased out-marriage.

The Plantations Labor Act of 1951 stipulates that the owners of all plantations in the country must provide drinking water, sanitation, medical facilities and primary education to the workers and their families. Although primary education is available free of cost in the estate school, the parents must pay for secondary school from the fifth grade (age 10) onward. A number of educational options are available to the parents. They could send the child to one of the secondary schools in the tea estates or Munnar, the main town, but these local schools are perceived to be of relatively poor quality. Alternatively, they could send their child to a school in rural Tamil Nadu and bear the additional monetary cost of food and accommodation. An intermediate solution is to send the child to school in the parents’ ancestral location. Although the child may stay with relatives, reducing the current pecuniary cost to the parents, this strategy will increase future social obligations.

Sending the child to study in the ancestral location strengthens both the family’s ties and the child’s ties to the home community, which is presumably what Pallar and Paraiyar parents, particularly the mothers, want to avoid. As an additional measure of the family’s investment in the network, we construct a binary location variable that indicates whether the child was sent to secondary school in the ancestral location or elsewhere. Children belonging to the slave castes are less likely to attend secondary school in the ancestral location in Table 3, Panel B, as expected, although significant differences are only obtained for the boys.

The descriptive statistics in Table 2, Panel A and Table 3, Panel B indicate that educational attainment has increased substantially over the last two generations for both boys and girls. While educational attainment is statistically indistinguishable across castes for the boys, the caste-gap that we observed for the female workers in Table 2 persists for the daughters in Table 3. Moreover, both secondary school location and educational attainment vary significantly by caste (at the 5% level) when we pool boys and girls (not reported).

The schooling and marriage choices that parents make for their children will determine where they eventually settle. Children from the former slave castes have higher schooling and are less likely to marry a relative than children belonging to the other sub-castes. Restricting the sample to children aged 16–45 who have left their parents’ home, we see in Table 3, Panel C that Pallar and Paraiyar children are less likely to reside in the ancestral location as well.¹¹

¹⁰ 89.5% of the respondents in the survey reported that their marriage was “arranged” by their parents. These numbers have remained very stable over time; 88.7% of their children’s marriages were also arranged.

¹¹ Although we restricted parental choices in Section 3 to investing in the traditional network or the market economy, children can also remain on the tea estates. The workforce has remained stable since the 1930s and once we allow for the arrival of marital partners from rural Tamil Nadu only a limited number of children per family can be “registered” for employment in the tea estates. For example, just 25% of the children in our sample aged 16–45 who have left the parental home remain on the estates. The estate job appears as an unanticipated opportunity for a restricted set of children long after the parents have made choices for the children and so could be reasonably ignored when characterizing decision-making within the household in Section 3.

The caste differences in schooling, marriage, and residential location in Table 3 can be explained by the disproportionately strong incentive of the Pallar and Paraiyar mothers to distance their families from their ancestral communities. However, other explanations for these differences are also available. For example, we noted in Section 3 that Pallar and Paraiyar households, as a whole, might have less incentive to invest in the traditional network. The reservation policies currently in place guaranteeing a fixed proportion of seats in institutes of higher education and the central government for the Scheduled Castes, which include the former slave castes, would only reinforce this shift toward the market economy. If workers systematically selected into the tea estates, and these historical selection pressures varied by caste, then workers could differ on dimensions such as intrinsic ability that independently determine educational outcomes and marriage choices. Pallars and Paraiyars are disproportionately represented on the tea estates. Since the rule of endogamous marriage continues to be followed almost without exception, individuals from those sub-castes will have more eligible partners to choose from within the tea estates. Differences in the local marriage market might then explain differences in marriage patterns and, by extension, schooling choice across castes. The analysis that follows will use the income data we have collected to identify an independent role for the women from the former slave castes in shaping important household decisions in the tea estates.

4.3. Female income and household decisions

When male and female incentives, or preferences, differ within the household, models of collective decision-making predict that a relative increase in the female’s options outside marriage will shift household choices along the Pareto frontier to a point that she prefers. This result is obtained regardless of whether additional restrictions are placed on the cooperative equilibrium as in Manser and Brown (1980), McElroy and Horney (1981), and Lundberg and Pollak (1993), or whether only Pareto optimality is assumed as in Chiappori (1992) and Browning et al. (1994). Because female participation in the formal labor market is limited in developing countries, it has been customary to use unearned income, measured by the woman’s dowry or inheritance, to reflect her outside options in the event of marital dissolution. However, all women work full time and have permanent employment (independently of their husbands) in the empirical setting we have chosen. Our objective in the analysis that follows will thus be to estimate the effect of earned female income on important household decisions.¹²

In a dynamic environment with forward-looking agents, Pareto optimality requires that each parent’s bargaining position within the household should be invariant over time. Suppose, for example, that the husband and the wife have the same lifetime incomes and, hence, equal bargaining positions. In the canonical case with full spousal commitment, a transitory positive shock to the wife’s income in a given period will have no effect on her bargaining position because she expects her husband to reciprocate likewise in the future when the pattern of shocks is reversed. Given the finite horizon over which important household decisions are made and the infeasibility of implementing legally binding contracts within the household, it is difficult to imagine that full commitment of this sort could be sustained in practice. In the alternative canonical case without spousal commitment, bargaining positions will be determined by contemporaneous incomes alone. Ligon (2002) proposes a more realistic intermediate model with limited spousal commitment in which bargaining positions remain constant over multiple periods but can evolve over time with changes in parental incomes. This implies that bargaining positions will depend on average

¹² The survey collected information on the dowry paid by the woman’s family to her husband. The amount of the dowry turns out to be relatively small, perhaps because women work full time and actually earn more than their husbands on average in the tea estates.

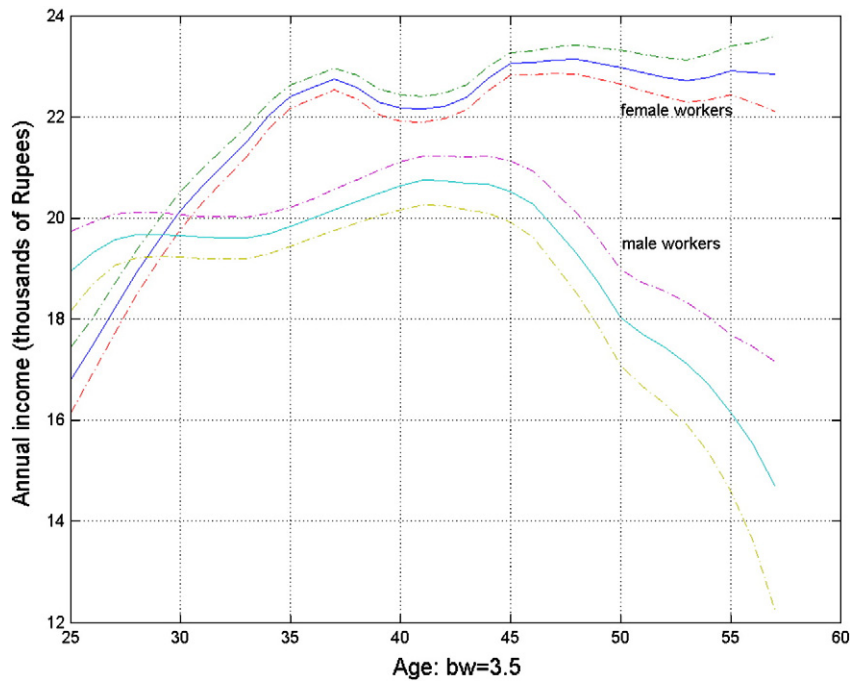


Fig. 1. Income and age.

incomes over multiple periods around the time that a particular choice is made by the household. We assume that household behavior can be characterized by the limited commitment model in the empirical analysis. For the discussion on identification that follows, however, it will be convenient to assume that choices made for the children are determined by contemporaneous incomes. We thus estimate regressions of the form

$$y_i^\tau = \gamma FI_i^\tau + \lambda I_i^\tau + \epsilon_i^\tau, \quad (1)$$

separately by caste category. y_i^τ is a choice that was made for a child in household i in period τ , FI_i^τ is female income in that household in that period, I_i^τ is the corresponding total (male plus female) household income, and ϵ_i^τ collects all the unobserved determinants of y_i^τ .

We could, in principle, include any measure of the income distribution or the income of any individual to test the hypothesis that income is pooled within the household. The specification that we have chosen allows us to easily determine the direction in which the woman shifts household decisions.¹³ Following the discussion in Section 3 we expect male and female incentives to diverge substantially among the former slave castes. Conditional on total income, an increase in female income in those sub-castes should thus significantly increase children's schooling and lower the probability that they will marry a relative, be schooled in the ancestral location, or ultimately settle there. We do not expect the gender gap in the incentive to invest in the market economy to be as wide among the other sub-castes and so the female income effect (γ) in that caste category should be smaller than it is for the former slave castes.

We expect important choices for the children to be determined by parental incomes at critical points in their lives. One virtue of the data we have collected is that extremely accurate computerized income information is available for each worker over a five-year period or as long as they have been working for the youngest workers. These are current incomes, however, and so the first estimation strategy that we

propose will impute historical incomes around the time when decisions were made for the children.

Fig. 1 presents nonparametric estimates of the relationship between male and female income and the worker's age.¹⁴ All the analyses in the paper, including Fig. 1, restrict the sample to households in which the female worker's husband either works on the estate or is unemployed (male income set to zero), since accurate income statistics for those husbands who work outside the estates are unavailable. Further, although incomes are available over five years, Fig. 1 and the regressions that follow use average annual incomes over the shorter 1999–2001 period. This smooths out short-term fluctuations in productivity while at the same time preserves the relationship between age and income that allows us to impute historical incomes. We see in Fig. 1 that female incomes increase steeply with age until the mid-thirties, after which they continue to grow but at a slower rate. The income–age relationship for the men is very different from what we see for the women.

Men and women have historically been assigned different tasks on the tea estates. Women work primarily as pluckers and are paid a piece rate set by the Kerala government based on the weight in leaves that they pluck. While women work fixed hours, 8 AM to 5 PM on weekdays and 8 AM to 1 PM on Saturdays, the amount that they pluck will depend on their ability and the tea yield on their estate. One explanation for the female income–age relationship in Fig. 1 is based on the idea that plucking ability improves with age, which has also been observed in other economic environments that involve repetitive tasks (Rubin and Perloff, 1993; Shearer, 1996; Hellerstein and Neumark, 1995; Ilmakunnas et al., 1999). In contrast, men are engaged for the most part in maintenance activities such as weeding, spraying, and pruning, as well as in the estate tea processing factory.¹⁵ These male tasks are generally less sensitive to yield and depend more on leaf quality, and none of these tasks involves the high degree of repetitiveness that characterizes tea plucking. The decline in male income after age 45 in the figure is due to

¹⁴ The Epanechnikov kernel function is used to smooth the data in all the nonparametric regressions reported in this paper. Point-wise 95% confidence intervals are computed using a method suggested by Härdle (1990).

¹⁵ The company's income records provide the number of days worked and the number of days spent plucking for each worker in each year from 1997 to 2001. Consistent with the gender division of labor that we have described, female workers pluck for 95% of the time, while male workers pluck just 25% of the time.

¹³ Lower caste income would be substantially lower than higher caste income in most settings, in which case it would be appropriate to include higher-order income terms when comparing marginal income effects across castes. Total household income and female income do not vary by caste, however, in the special setting we have chosen.

exit from the workforce; the male unemployment rate in our sample of households increases very steeply after age 50.

The workers, particularly the women, are engaged in the same task over their entire working life. Given the strong statistical relationship between income and age in Fig. 1, it is consequently possible to impute parents' historical incomes. We will estimate income regressions with age, age-squared, and individual characteristics as regressors, then use the estimated age coefficients to adjust each parent's income back to the time when a particular decision was made for the child.

If the returns to ability are different in the traditional economy and the modern economy then the choices that the parents make for their children will depend on their ability. Household income and female income will be positively correlated with the child's unobserved ability, which is included in the ϵ_i^t term in Eq. (1), to the extent that ability is correlated across generations and the income of the parents is determined by their ability. As Behrman (1997) notes, studies that use unearned income to measure the woman's options outside marriage face the same problem since we would expect her dowry or inheritance to be correlated with her ability in equilibrium. For the analysis in this paper, the additional statistical problem that arises is that we are using imputed historical incomes. To understand the implications of the income adjustment for consistent estimation, consider a simplified (linear) version of the income relationship

$$I_i^t = \chi AGE_i^t + \omega_i + u_i^t, \quad (2)$$

where I_i^t is current (period t) income for individual i , AGE_i^t is her current age, ω_i is her unobserved ability, and u_i^t is an unobserved productivity term.¹⁶ u_i^t consists of a permanent component that depends on fixed factors in the worker's estate that determine tea yields and leaf quality as well as a transitory component that varies with rainfall and other i.i.d. shocks to productivity. Assume that this is a single-parent household and that a particular choice must be made for one of the children in year τ . This choice y_i^τ is described by a simplified version of Eq. (1)

$$y_i^\tau = \lambda I_i^\tau + \epsilon_i^\tau, \quad (3)$$

where I_i^τ is household (the single parent's) income in period τ and ϵ_i^τ subsumes the child's ability as well as other period- τ determinants of that choice. Since I_i^τ is not observed, we use instead its imputed value $\tilde{I}_i^\tau = I_i^\tau - \hat{\chi}(AGE_i^\tau - AGE_i^t)$, with $\hat{\chi}$ estimated from Eq. (2). Eq. (3) can then be re-written as

$$y_i^\tau = \lambda \tilde{I}_i^\tau - \lambda(u_i^t - u_i^\tau) - \lambda(\chi - \hat{\chi})(AGE_i^t - AGE_i^\tau) + \epsilon_i^\tau, \quad (4)$$

which is the equation that will be estimated. The last three terms on the right hand side of Eq. (4) are unobserved by the econometrician. $\hat{\chi}$ converges asymptotically to χ and so one of these terms can be ignored if the income-age relationship is correctly specified by the econometrician and is stable over time. However, if ability is transmitted across generations, then ϵ_i^τ will be correlated with ω_i . From the expression for I_i^t in Eq. (2) it is evident that I_i^t , and hence \tilde{I}_i^τ , will also be correlated with ω_i . OLS estimation of both Eqs. (3) and (4) yields biased estimates of the income effect due to the ability term in the residual of those equations. In addition, the productivity shock in

Eq. (4), $u_i^t - u_i^\tau$, will bias the estimated income coefficient toward zero.

The standard solution to these sources of bias is to instrument for \tilde{I}_i^τ (see Strauss and Thomas, 1995 for an exhaustive review of the literature on intra-household bargaining). Valid instruments in this setting satisfy three conditions: First, they must determine historical incomes. Once we return to the complete specification in Eq. (1) at least two instruments are required and to separately identify a total (male plus female) income and a female income effect at least one of the instruments must also have a differential effect on male and female income. Second, the instruments must be uncorrelated with the productivity shock $u_i^t - u_i^\tau$. Third, the instruments must be uncorrelated with unobserved ability subsumed in ϵ_i^τ .

The first instrument that we propose takes advantage of the mountainous terrain and the considerable variation in elevation – ranging from 1300 m to 1900 m – in the tea estates. Nonparametric regressions reported in Luke and Munshi (2004) indicate that male income increases with estate elevation initially, then flattens out before rising steeply once again at higher elevations. Leaf quality improves at higher elevations, particularly above 5000 ft (1600 m), and higher quality teas require greater care and maintenance, which is the responsibility of the male workers. In contrast, female income depends on the quantity of tea leaves plucked, rather than the quality, which explains why the relationship between female income and elevation is not as strong as it is for the men; male income varies by Rs. 4000 over the entire range of estate elevations as compared with a corresponding variation of less than Rs. 2000 for the women.

The second instrument that we propose is motivated by the strong gender-specific link between current income I_i^t and current age AGE_i^t in Fig. 1 and the method that we use to impute the historical income at the time when choices were made for the child \tilde{I}_i^τ . It follows immediately that the adjusted age AGE_i^τ will determine \tilde{I}_i^τ and that both male and female ages will have a differential effect on female and total income. Apart from the three conditions necessary for the instruments to be valid, the assumption that $\hat{\chi}$ converges to χ assumes particular importance once AGE_i^τ is chosen as an instrument. $(\chi - \hat{\chi})(AGE_i^t - AGE_i^\tau)$ remains in the error term of Eq. (4) if the income-age relationship is misspecified, in which case AGE_i^τ will no longer be a valid instrument. By assigning zero income to unemployed men, and using the estimated age coefficients to project back into the past, we are clearly underestimating incomes when those men were employed. All the women in our sample have been working as tea-leaf pluckers throughout their working lives, and so this measurement issue should not apply to them. As expected, we will later fail the test of the overidentifying restrictions when male adjusted age is included as an instrument, and so the robust regressions that we report will restrict the set of instruments to estate elevation and female adjusted age.

Using the instruments described above, significant female income effects will be obtained for the former slave castes but not the other sub-castes. To provide additional independent support for these results, our second estimation strategy investigates the reduced form relationship between historical rainfall shocks and household decisions. To compare the instrumental variable estimates with the reduced form estimates it will be necessary to estimate the pooled regression corresponding to Eq. (1)

$$y_i^\tau = \gamma_1 F_i^\tau + \lambda_1 I_i^\tau + \gamma_2 F_i^\tau \cdot C_i + \lambda_2 I_i^\tau \cdot C_i + \psi C_i + \xi_i^\tau, \quad (5)$$

with C_i equal to one for the former slave castes and zero for the other sub-castes. The γ_2 coefficient will be significantly different from zero if the gender gap varies by caste, as described in Section 3. We expect γ_2 to be positive and significant with educational attainment as the dependent variable. The sign on this coefficient should reverse when the dependent variable is specified to be the probability that the child marries a relative, is schooled in the ancestral location, or ultimately resides there.

¹⁶ Notice that worker effort does not appear as a determinant of income in Eq. (2). While the amount of time worked in the tea estates may be fixed, the worker could in principle adjust the amount of labor supplied by varying effort per unit of time. Indeed, Chiappori (1992) has proposed using observed labor supply to back out the sharing rules underlying the allocation decisions made by the household. The fact that female incomes do not vary by caste in the tea estates, despite the considerably stronger female income effect among the former slave castes that we will document later, provides some support for the view that effort is supplied inelastically in this environment. Additional checks are discussed in a previous version of the paper (Luke and Munshi, 2004).

While income data are only available over five years, 1997–2001, annual estate rainfall is available over the much longer 1965–2001 period for the reduced form analysis. We begin by establishing the relationship between income and rainfall during the 1997–2001 period,

$$FI_i^t = \beta_1 RAIN_i^t + f_{1i} + \delta_{1t} + \chi_{1i}^t$$

$$I_i^t = \beta_2 RAIN_i^t + f_{2i} + \delta_{2t} + \chi_{2i}^t$$

where $RAIN_i^t$ measures rainfall in household i 's estate in period t . f_{1i} , f_{2i} are household fixed effects, δ_{1t} , δ_{2t} are year dummies, and χ_{1i}^t , χ_{2i}^t are mean-zero disturbance terms. As with age and elevation, the relationship between income and rainfall is specified to be independent of caste and we later verify that this is indeed the case.

Assuming that the income–rainfall relationship has remained stable over time, the expressions for FI_i^t , I_i^t above can be substituted in Eq. (5) to obtain the reduced form regression specification

$$y_i^t = (\gamma_1 \beta_1 + \lambda_1 \beta_2) RAIN_i^t + (\gamma_2 \beta_1 + \lambda_2 \beta_2) RAIN_i^t \cdot C_i + g_i + \eta_i^t, \quad (6)$$

where g_i is a household fixed effect and η_i^t is a mean-zero disturbance term. We are interested in the coefficient on the rainfall–caste interaction term. If this coefficient is significantly different from zero then income effects must differ by caste; either γ_2 , λ_2 , or both γ_2 and λ_2 must be non-zero. Although the theory provides no guidance about how λ_2 might vary by caste, results based on the first (instrumental variable) estimation strategy indicate that this parameter is the same across caste categories. If we impose the additional restriction that the total income coefficient does not vary by caste, $\lambda_2 = 0$, then a significant coefficient on the rainfall–caste interaction term implies that the female income effect must vary by caste.

By including household fixed effects in the reduced form regression we are effectively estimating the effect of transitory income shocks, measured by the difference between historical rainfall and mean estate rainfall, on contemporaneous household decisions. The instrumental variable estimates, in contrast, measure the effect of the predictable component of income on household decisions; estate elevation in particular is invariant over the individual's working life. For the canonical case without spousal commitment each parent's bargaining position within the household will be determined entirely by current income, which implies that transitory income and permanent income have the same effect on household decisions. This was the implicit assumption when deriving Eq. (6) above. In practice, we would expect some level of commitment to be sustained in the marriage, preventing us from comparing the magnitude of the coefficients in Eqs. (5) and (6) directly. However, the income effects will work in the same direction and it is still possible to verify the consistency of our results by comparing the sign of the coefficients obtained with these independent estimation strategies: The rainfall–caste interaction coefficient in the reduced form regression should have the same (opposite) sign as the female income–caste coefficient in the pooled regression if the rainfall coefficient in the female income regression β_1 is positive (negative).¹⁷

4.4. Estimated income effects

Apart from female income and total income, all the instrumental variable regressions that we estimate include the child's gender and cohort, the schooling of each parent, and whether the parent is a first-

generation arrival in the tea estates as regressors. Gender is commonly believed to influence the resources that the child receives in India (Behrman, 1997) and the child's cohort controls for secular changes in economic opportunities, which would have affected schooling and marriage choices at the time they were made. The parental characteristics control for their preferences for schooling and ties to the ancestral community, which would directly determine the choices they make for their children. Since many of the workers' families have been on the same estate for multiple generations, differences in household decisions across estates could reflect the cumulative effect of differences in income over many generations. By including parents' schooling and marriage characteristics, we isolate the effect of current generation income on the choices that are made for the children. We noted earlier that average ability and marriage patterns could vary across sub-castes in the tea estates. A full set of sub-caste dummies is consequently included in all the regressions that we estimate, although their omission does not affect the instrumental variable results that we report.

We begin the description of the regression results by presenting the first-stage regressions in Table 4. Based on the discussion in the previous section, the husband's adjusted age will be dropped as an instrument for most of the second-stage regressions. The specifications in Table 4 consequently report the effect of elevation and wife's age on current female income and total income, measured as the average over the 1999–2001 period, separately by caste. The linear, quadratic, and cubic elevation coefficients are positive, negative, and then positive again, matching the description of the income–elevation relationship in the previous section. The linear and quadratic age terms are positive and negative matching the patterns for the women in Fig. 1. All of the coefficients are very precisely estimated, and the pattern of coefficients is qualitatively similar for the two caste groups. The regressors also have a differential effect on female income and total income, which we noted earlier is necessary to separately identify the income effects. Although not reported, the parental characteristics that we include as controls generally play an insignificant role in the income regressions. Finally, the F -statistic testing the joint significance of the excluded instruments is extremely large across all columns (the p -values are less than 0.0001

Table 4
First-stage regressions.

Caste	Former slave castes		Non-slave castes	
	Female income	Total income	Female income	Total income
Dependent variable	(1)	(2)	(3)	(4)
Elevation	39.593 (18.086)	124.162 (36.823)	33.897 (15.724)	104.128 (40.136)
Elevation-squared	−2.548 (1.162)	−7.845 (2.339)	−2.334 (0.994)	−6.921 (2.542)
Elevation-cubed	0.054 (0.025)	0.164 (0.049)	0.053 (0.021)	0.152 (0.053)
Woman's age	1.434 (0.103)	2.855 (0.219)	1.570 (0.125)	3.589 (0.222)
Woman's age-squared	−0.016 (0.001)	−0.037 (0.003)	−0.018 (0.002)	−0.046 (0.003)
R^2	0.295	0.119	0.320	0.159
F	52.12	68.80	79.95	108.90
Number of observations	2240	2240	1049	1049

Note: Standard errors in parentheses. Standard errors are robust to heteroscedasticity and clustered residuals within each estate.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Elevation is measured in hundreds of meters.

Income is measured in thousands of Rupees per year.

Regressions include sub-caste dummies, the man's and woman's years of schooling, and whether they are first-generation workers.

First-generation workers are those who grew up outside the estates.

F statistic measures the joint significance of the excluded instruments.

¹⁷ Note that the rainfall shocks cannot be used as instruments because they will be uncorrelated with \tilde{FI}_i^t , \tilde{I}_i^t by construction. However, average rainfall also determines (permanent) income in the estates, together with estate elevation. Elevation and rainfall are strongly correlated and so including average rainfall as an instrument adds little power to the first-stage regression and similarly has little effect on the second-stage instrumental variable estimates.

Table 5
Marriage, schooling and residential location.

Dependent variable	Child married relative		Secondary school in origin		Years of schooling		Child resides in origin	
	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes
Caste	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A: OLS</i>								
Female income	−0.002 (0.005)	0.002 (0.008)	0.003 (0.005)	0.0004 (0.005)	0.085 (0.019)	0.035 (0.024)	0.008 (0.004)	−0.007 (0.007)
Total income	0.001 (0.001)	−0.001 (0.002)	0.002 (0.001)	0.004 (0.002)	0.036 (0.007)	0.045 (0.008)	−0.001 (0.001)	0.005 (0.002)
<i>Panel B: first set of instruments</i>								
Female income	−0.063 (0.025)	−0.013 (0.016)	−0.021 (0.012)	−0.023 (0.022)	0.174 (0.087)	0.085 (0.075)	−0.052 (0.018)	−0.031 (0.014)
Total income	0.021 (0.009)	0.007 (0.005)	0.004 (0.006)	0.030 (0.011)	0.009 (0.032)	−0.058 (0.042)	0.010 (0.008)	0.013 (0.007)
Overid test (<i>F</i> statistic)	0.52	0.62	5.36	3.29	3.83	1.86	1.01	0.36
Overid test (<i>p</i> -value)	0.82	0.74	0.00	0.00	0.00	0.07	0.42	0.93
<i>Panel C: second set of instruments</i>								
Female income	−0.057 (0.027)	−0.014 (0.018)	−0.107 (0.048)	−0.057 (0.038)	0.376 (0.170)	0.183 (0.114)	−0.079 (0.036)	−0.036 (0.020)
Total income	0.015 (0.013)	0.010 (0.011)	0.052 (0.027)	0.060 (0.016)	−0.127 (0.082)	−0.155 (0.088)	0.026 (0.019)	0.016 (0.013)
Overid test (<i>F</i> statistic)	0.56	0.35	0.82	0.64	2.69	0.65	0.40	0.26
Overid test (<i>p</i> -value)	0.73	0.88	0.54	0.67	0.02	0.66	0.85	0.94
Number of observations	1227	648	3101	1473	3281	1578	1696	815

Note: Standard errors in parentheses. Standard errors are robust to heteroscedasticity and clustered residuals within each estate.

Sample restricted to children aged 16–45, who are married in Columns 1–2 and who have left the parental home in Columns 7–8.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Regressions include child's cohort and sex, a full set of sub-caste dummies, the parents' years of schooling and whether they are first-generation workers.

Income is measured in thousands of Rupees per year. Cohort is computed as 46 minus current age.

Incomes and ages are adjusted to the year in which the child was 17 in Columns 1–2, 10 in Columns 3–4, 14 in Columns 5–6, and 16 in Columns 7–8.

First set of instruments includes elevation (linear, quadratic, and cubic terms) and man's and woman's adjusted age (linear and quadratic terms).

Second set of instruments includes elevation (linear, quadratic, and cubic terms) and woman's adjusted age (linear and quadratic terms).

without exception), indicating that there is sufficient power in the instruments we have chosen.¹⁸

Table 5 reports the second-stage schooling, marriage, and residence regressions. The set of dependent variables includes a binary variable indicating whether the child married a relative, a binary variable indicating whether the child was sent to school in the ancestral location, the child's educational attainment, and a binary variable indicating whether the child resides in the ancestral location (conditional on having left home).¹⁹ At this point in the analysis we must decide on the age of the child when these choices are made, which will in turn determine how far back in time incomes must be imputed. Children start secondary school at age 10 (grade 5) so it seems natural to adjust incomes to the time when the child was 10 years old in the school location regression. The income

¹⁸ Since the dependent variables in the second stage are decisions and outcomes for the children, we also reported estimates with the child as the unit of observation in a previous version of the paper (Luke and Munshi, 2004). The child's cohort (46 minus current age) and sex were included in these regressions to match the second-stage specification and income and the wife's age were adjusted to the year in which the child was born. With multiple children per woman, the regression coefficients continued to be precisely estimated, matching the pattern in Table 4. The *F* statistics remained extremely large and the results are robust to alternative age adjustments as well as to a reduced sample of children aged 16–45.

¹⁹ The marriage and residence regressions are estimated with a selected sample and it is easy to verify that the instruments will no longer be valid if they determine the probability that the child is married or is no longer residing with the parents. Conditional on the child's age and sex, and the parental controls, the instruments have no effect on these probabilities. The analysis also omits those households in which the husband works outside the tea estates. Distance to Munnar, the main town, is a significant determinant of the husband's work location but does not directly influence the long-term choices that are made for the children. We verified that the second-stage estimates were unchanged when this variable was used to control for the potentially selective omission of households from the sample.

adjustment is not as obvious with educational attainment as the dependent variable. There is a growing literature documenting the relationship between nutrition and other inputs in early childhood and outcomes later in life. The health care system in the tea estates, which places strong emphasis on maternal and child health care, including prenatal care and child immunization and nutrition programs, is available free of cost to all workers and their children.²⁰ Early childhood inputs are thus effectively standardized across households and tea estates. From our conversations with the workers, what matters most for educational attainment is the willingness of the parents to incur the considerable expenses that accompany higher education.

Among children aged 16–45, most (94%) received some secondary schooling. 24% completed tenth grade, the final year of school, and a further 24% studied beyond tenth grade. However, a substantial number of the children dropped out in secondary school; 9% report 7 years of schooling, 12% report 8 years of schooling, and 17% report 9 years of schooling. The period between grade 7 and grade 9 (age 12 to 14) is critical in determining whether the child will complete secondary school and possibly continue for further education. The educational attainment regressions will consequently project incomes to the year when the child was aged 14.

For marriage choices we note that less than 5% of the 16–45 year olds married before age 17. None of the current 16 year olds are married and so we take 17 as the age at which children enter the marriage market and, hence, the age to which incomes are adjusted in the marriage regressions. Finally, residential location is determined by

²⁰ These efforts are reflected in positive child health outcomes. For example, the infant mortality rate in the tea estates was 19 in 1999–2000 (Tata Tea, 2000), versus 48 in Tamil Nadu and 68 for the entire country in 1998–1999 (IIPS and ORC Macro, 2000).

Table 6
Marriage, schooling and residential location (pooled regressions).

Dependent variable Specification	Child married relative		Secondary school in origin		Years of schooling		Child resides in origin	
	Unrestricted	Restricted	Unrestricted	Restricted	Unrestricted	Restricted	Unrestricted	Restricted
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female income	−0.010 (0.018)	−0.006 (0.020)	−0.056 (0.036)	−0.052 (0.032)	0.189 (0.110)	0.181 (0.099)	−0.026 (0.019)	−0.032 (0.017)
Female income – former slave castes	−0.052 (0.037)	−0.055 (0.024)	−0.054 (0.063)	−0.071 (0.034)	0.176 (0.192)	0.212 (0.164)	−0.059 (0.046)	−0.039 (0.022)
Total income	0.011 (0.010)	0.012 (0.009)	0.063 (0.014)	0.058 (0.016)	−0.156 (0.084)	−0.146 (0.066)	0.012 (0.013)	0.018 (0.011)
Total income – former slave castes	0.004 (0.019)	–	−0.011 (0.027)	–	0.028 (0.101)	–	0.014 (0.024)	–
Overid test (<i>F</i> statistic)	0.25	0.21	0.63	0.61	1.59	1.56	0.30	0.39
Overid test (<i>p</i> -value)	0.99	0.99	0.79	0.81	0.10	0.11	0.98	0.95
Number of observations	1875	1875	4574	4574	4859	4859	2511	2511

Note: Standard errors in parentheses. Standard errors are robust to heteroscedasticity and clustered residuals within each estate.

Sample restricted to children aged 16–45, who are married in Columns 1–2 and who have left the parental home in Columns 7–8.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Regressions include child's cohort and gender, a full set of sub-caste dummies, the parents' years of schooling and whether they are first-generation workers.

Income is measured in thousands of Rupees per year. Cohort is computed as 46 minus current age.

Incomes and ages are adjusted to the year in which the child was 17 in Columns 1–2, 10 in Columns 3–4, 14 in Columns 5–6, and 16 in Columns 7–8.

Instruments include elevation (linear, quadratic, and cubic terms) and woman's adjusted age (linear and quadratic terms), interacted and uninteracted with former slave caste dummy.

Restricted specification sets the total income – former slave caste coefficient to zero.

schooling and marriage choices made earlier in the child's life and so it is difficult to identify a single age that is critical to this outcome. We adjust incomes to the time when the child was 16, between the critical age for educational attainment and marriage, for this outcome. Given the ambiguity in some of these choices, we will discuss the robustness of the results to alternative income adjustments below.

Once a critical age has been determined, we impute incomes back to the time when the child was that age, and one year before and after that age, to compute the three-year average income. This smoothing is consistent with the structure of the limited commitment model in which decisions are determined by incomes over multiple periods around the time a choice is made and we will later discuss the robustness of the results to alternative construction of the average income.²¹ The second-stage regression was specified in Eq. (1) and includes as regressors (age-adjusted) female and total income, the child's cohort (46 minus current age), a boy child dummy, parents' schooling, and whether the parents are first-generation arrivals in the tea estates. In addition, all regressions include a full set of sub-caste dummies. These controls are not reported in Table 5 to preserve space but it is worth mentioning that schooling has increased rapidly over time and that parents' schooling has a large and statistically significant effect on children's schooling, consistent with the results from previous studies.

The second-stage regressions are reported in three steps. We begin in Table 5, Panel A with OLS regressions, followed by instrumental variable regressions with the full set of instruments – estate elevation, husband's adjusted age, and wife's adjusted age, together with the higher-order terms for each variable associated with the nonlinearity in the income–elevation and income–age relationships – in Panel B. We have already noted that the husband's adjusted age is unlikely to satisfy the exclusion restriction and, not surprisingly, while the marriage and residential location regressions pass the test of the overidentifying restrictions comfortably in Panel B, the schooling regressions do not (the *p*-values are less than 0.01). The set of instruments in Panel C is consequently restricted to estate elevation and the wife's adjusted age, together with the higher-order terms associated with those variables.

²¹ The regression that we use to adjust male and female current income has the same specification as the first-stage regression in Table 4 except that elevation is replaced by a full set of estate dummies and husband's age and age-squared are included as regressors to increase the precision of the estimates.

The overidentification tests reported in Panel C, which is our preferred specification, perform better and only one specification (educational attainment for the former slave castes in Column 5) fails the test.²²

Inspection of the estimated coefficients in Table 5 indicates that the OLS coefficients are generally much smaller in magnitude than the instrumental variable estimates. Most of the female income coefficients are imprecisely estimated and there is no particular pattern to the estimates across outcomes. There are many potential sources of bias in the OLS regressions and these coefficients are consequently difficult to interpret. Once we instrument for female and total income, however, the expected pattern of coefficients starts to emerge. Consistent with the discussion in Section 3, a relative increase in female income among the former slave castes lowers the probability that the children will marry a relative or be schooled in the ancestral location, increases children's schooling, and consequently lowers the probability that the children will settle in the ancestral location. While the female income effects go in the same direction for both caste groups, they are statistically significant for the former slave castes alone (with the exception of residing in the origin among the non-slave castes in Column 8). We can clearly reject the income pooling hypothesis for one caste group but not the other. These differences across castes arise because the female income coefficient is substantially larger – more than twice as large in

²² The superior performance on the test in Panel C does not follow mechanically because the number of instruments has been reduced. If we replaced the wife's adjusted age with the husband's adjusted age as the instrument we would continue to perform as poorly on the test in Columns 3–6 as in Panel B. The most likely explanation for the continuing failure of the exclusion restriction in Panel C, Column 5 is that the women's adjusted age AGE_i^w is correlated with ε_i^w in Eq. (1). Because we assume that each choice is associated with a critical age that does not vary across households, the woman's age when a particular choice is made for a particular child will depend on her age at childbirth. That age will, in turn, depend on her age at marriage, the number of children and birth spacing in her household, and the birth order of the child. The standard two-sided matching model predicts that the age at marriage depends on the woman's ability, which will be correlated with ε_i^w to the extent that ability is transmitted across generations. Fertility choices could be correlated with parental preferences for schooling and marriage that are also included in ε_i^w . To address these possibilities, we constructed robust instruments that purged AGE_i^w of the sources of variation that are potentially correlated with terms in ε_i^w . The point estimates with these robust regressions, reported in Luke and Munshi (2004), are very similar to the corresponding coefficients in Table 5, Panel C. These robust regressions also comfortably pass the tests of the overidentifying restrictions.

Table 7
Household decisions and historical rainfall.

Dependent variable	Female income	Total income	Child married relative	Secondary school in origin	Years of schooling	Child resides in origin
	(1)	(2)	(3)	(4)	(5)	(6)
Log rainfall	−1.428 (0.410)	−2.517 (0.607)	−0.341 (0.272)	−0.239 (0.102)	1.075 (0.812)	−0.403 (0.213)
Log rainfall – former slave castes	0.534 (0.465)	1.185 (0.689)	0.614 (0.339)	0.305 (0.126)	−2.100 (1.001)	0.419 (0.264)
Number of observations	15,642	15,642	2112	5181	5500	2636

Note: All regressions include household fixed effects. Standard errors in parentheses.

The household is the unit of observation in Columns 1–2 and the child is the unit of observation in Columns 3–6.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Columns 1–2 estimated with annual estate rainfall over the 1997–2001 period and a full set of year dummies.

Columns 3–6 estimated with estate rainfall at the time a particular decision was made and child's cohort (46 minus age) and sex.

Rainfall computed as a three-year average around the time that the child was 17 in Column 3, 10 in Column 4, 14 in Column 5, and 16 in Column 6.

Rainfall – former slave castes interacts rainfall with former slave caste dummy.

Sample restricted to children aged 16–45 in Columns 3–6, who are married in Column 3 and who have left the parental home in Column 6.

most specifications – among the former slave castes. The standard errors, in contrast, are comparable across caste groups.²³

The results in Table 5 indicate that the incentives to distance the family from the ancestral community differ by the gender of the parent among the former slave castes but not the other sub-castes. To compare the gender gap in parental incentives across castes directly, we pool both caste groups in the regressions reported in Table 6, allowing for the interaction between income and a former slave caste dummy. The estimates in Table 5, Panels B and C, reveal no relationship between the total income coefficient and caste.²⁴ The unrestricted regressions in Table 6 thus include the interaction of both total income and female income with the caste dummy, whereas the restricted regressions omit the total income interaction term, increasing precision without affecting the other point estimates.

As expected, the female income–caste coefficient has the same sign as the female income coefficients in Table 5 and is precisely estimated with the restricted specification (with the exception of educational attainment as the dependent variable). To get a sense of the substantial magnitude of the female income effects, households in the tea estates earn Rs. 40,000 per year on average, with a Rs. 3000 gap between the women and the men. Based on the female income–caste coefficient in Table 6 this implies that the entire caste-gap in schooling and half of the caste-gap in the marriage choice (pooling boys and girls) would be closed if male–female incomes were equalized within these households. As an alternative measure of the magnitude of the female income effect, a one standard deviation (Rs. 4300) increase in female income among the former slave castes would increase schooling by as much as 1.6 years

²³ In the previous version of the paper (Luke and Munshi, 2004) we estimated the income effects separately by caste and gender of the child using the same specification as in Table 5, Panel C. The key result was that the female income effect for the former slave castes was much larger for girls than for boys with educational attainment and residential location as the dependent variables. The disproportionate effect of female income on daughter's schooling has been noted in previous studies (Thomas, 1990; Duflo, 2003), but the result that we obtain depends importantly on the social group that the household belongs to. This result also helps explain the striking observation that boys and girls from the former slave castes have comparable levels of schooling Table 3.

²⁴ The total income coefficients in Table 5 indicate that an increase in household income, conditional on female income, increases the probability that children will marry a relative, be schooled in the ancestral location, and ultimately reside there. An increase in household income also lowers educational attainment (in Panel C). The unconditional effect of an increase in household income should be to increase educational attainment. Recent evidence from rural India also indicates that relatively wealthy households within their sub-castes have a greater propensity to exit the caste-based mutual insurance arrangement (Munshi and Rosenzweig, 2009). Households in the tea estates earn relatively high incomes and so should distance themselves from their ancestral communities by this argument. At the same time, an increase in household income conditional on female income implies that the man has more bargaining power and his incentive (relative to his spouse) will be to move the household closer to the ancestral community. The different effects we have described work in opposite directions and the conditional effect of household income on decisions for the children is consequently theoretically ambiguous.

and reduce the probability of the child marrying a relative by 0.26, based on the estimates in Table 5, Panel C.

We complete the analysis of the income effects by reporting reduced form regressions in Table 7. The reduced form estimates are more precisely estimated when log-rainfall is included as a regressor, although the pattern of coefficients in levels is qualitatively the same. Columns 1–2 consequently regress income on log-rainfall over the 1997–2001 period, including household fixed effects to control for characteristics that could be correlated with average rainfall in the tea estates as well as year dummies to allow for secular changes in productivity and the wage structure over time.²⁵ Once household fixed effects are included, we are effectively studying the effect of rainfall shocks on income. These shocks have a negative and significant effect on total and female income, but do not vary significantly across castes. Excessively low or high rainfall is harmful to the crop and while low rainfall can be augmented with irrigation, high rainfall cannot be as easily corrected. High rainfall also lowers worker productivity. Estate tea yields are available over the 1965–2001 period and we verified that rainfall shocks are negatively correlated with yields as well, matching the patterns in Columns 1–2.

Having established that rainfall determines income, it follows immediately that historical rainfall should determine household choices if these choices were determined, in turn, by incomes around the time that they were made. Looking back at Eq. (6) we cannot sign the reduced form coefficient on uninteracted rainfall because the female income and total income coefficients for the other sub-castes, γ_1 and λ_1 respectively, take opposite signs across all outcomes in Table 5, Panels B and C. However, if we impose the restriction that the total income effect is the same across caste groups ($\lambda_2 = 0$), as supported by the estimates in Table 5, then we can compare the sign of the rainfall–caste interaction coefficient ($\gamma_2\beta_1 + \lambda_2\beta_2$) in Table 7 with the female income–caste interaction coefficient γ_2 in Table 6. Because the rainfall coefficient β_1 in the female income regression in Table 7, Column 1 is negative, it follows that the interaction coefficients in Tables 6 and 7 must take opposite signs if the alternative estimation strategies generate consistent results.

The regressions in Table 7, Columns 3–6, include log-rainfall around the time choices were made for each child, household fixed effects that subsume parental characteristics, and the child's cohort and gender. The rainfall statistic in Columns 3–6 is computed as the three-year average around the same age for each choice as in Tables 5 and 6. The rainfall–low caste coefficient in Table 7 takes the opposite sign to the female income–low caste coefficient in Table 6 with each outcome and is fairly precisely estimated.

²⁵ Once household fixed effects and year dummies are included, it is well known that a linear age effect cannot be separately identified. We verified that the inclusion of the woman's age-squared as an additional regressor had no effect on the estimated rainfall coefficients in Columns 1–2.

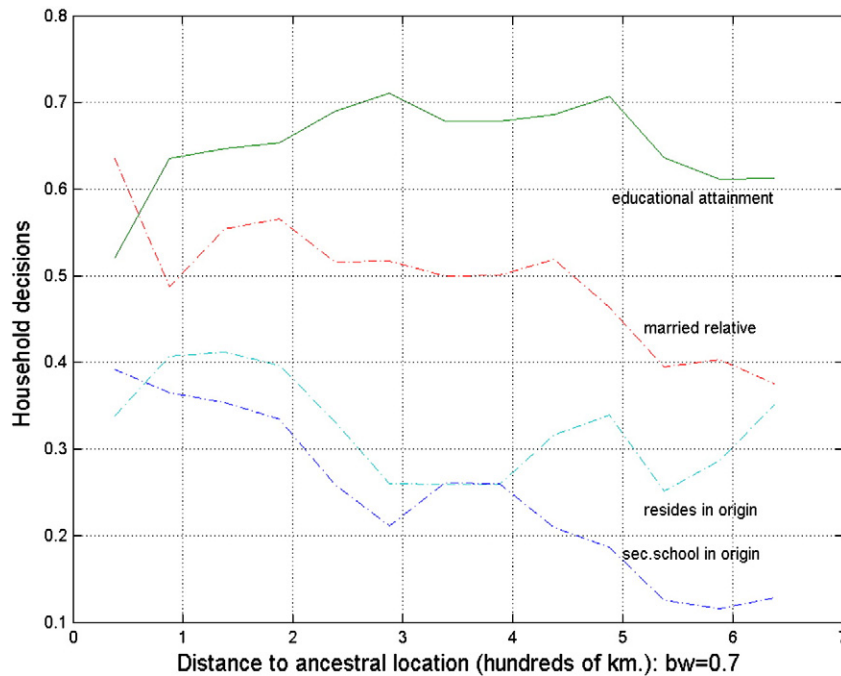


Fig. 2. Household decisions and distance to ancestral location.

It is quite striking that the alternative estimation strategies, which utilize independent sources of income variation, generate entirely consistent results across all the outcomes of interest. To verify the robustness of these results we experimented with different adjustment ages and with a five-year rather than the three-year average of income (or rainfall) around that age. Given that the instrumental variable regressions exploit fixed variation across estates and the woman's age at childbirth (plus a fixed term for each outcome) to estimate the income effects, it is not surprising that the estimates in Table 6 are stable across these alternative specifications. In contrast, the reduced form estimates in Table 7 weaken substantially when the five-year average is used to compute historical rainfall, possibly because the longer average smooths out variation over time in the rainfall shocks. The reduced form estimates are also sensitive to the adjustment age, consistent with the idea that the distribution of parental incomes is most relevant at critical periods in the child's life.

4.5. Distance to the ancestral location and household choices

Pallar and Paraiyar parents, especially the mothers, are assumed to benefit less from their ancestral communities and so have a greater propensity to distance their families from these communities. This shift away from the traditional economy is reflected in the schooling and marriage choices that they make for their children. However, female income effects could vary by caste for other reasons as well. To provide independent support for the view that connections to the ancestral community drive choices in the tea estates we consequently proceed to show that households tied less closely to their ancestral community for exogenous reasons independent of caste also invest more in their children's schooling and in general make choices that move the children away from the extended-family network.

Distance from the tea estates to the household's ancestral location will mechanically determine the frequency of social interactions and, hence, the strength of its ties to the ancestral community. Although households from distant communities might put more effort into maintaining ties with their networks, we expect the direct effect to dominate, with the strength of social ties being negatively correlated with physical distance. Fig. 2 nonparametrically tests this hypothesis by regressing the four outcomes — marriage, school location, educational attainment, and resi-

dential location — on the distance to the ancestral location.²⁶ As expected, an increase in distance lowers the probability that the child will be married to a relative, sent to school in the ancestral location, or ultimately settle there, presumably because network ties are less strong. In contrast, educational attainment is steadily increasing with distance, except for a downward dip beyond 500 km, consistent with the view that community-based networks far away are influencing important household decisions in the tea estates. These patterns also allow us to verify that investments in the traditional network and children's schooling are substitutes as implicitly assumed in the theoretical framework.

To test the statistical significance of the distance effects just described, we estimated parametric regressions with the same outcomes and distance, distance squared, a full set of estate and sub-caste dummies, and the usual child and parental characteristics as regressors. Although not reported, all the distance coefficients have the expected sign and are jointly significant at the 5% level for each outcome, verifying the importance of the distance effect and, by extension, the role of the ancestral community in shaping household decisions in the tea estates.²⁷

5. Female income and marital violence

The standard assumption in models of collective decision-making is that a change in bargaining power within the household shifts resource allocation smoothly along the Pareto frontier. In a society in which men

²⁶ Detailed maps of Kerala and Tamil Nadu were scanned and geocoded to compute the distance by road (adjusting for the hilly terrain) from Munnar, the main town in the tea estates, to each location in rural Tamil Nadu.

²⁷ Estate elevation determines household income, which in turn determines exit from the tea estates through marriage. If individuals who exit are selected by ability and the selection pressures vary with the level of exit, then the ability distribution of those individuals that remain on the estate will be correlated with its elevation, even if the ability distribution across estates was the same to begin with, violating the exclusion restriction for that instrument. One simple test to rule out this possibility is to establish that distance from the ancestral location (which is correlated with the level of exit) is uncorrelated with income (which measures ability). Reassuringly, we find no relationship between distance and income for both male and female workers, providing further support for the validity of the elevation instrument. In a related test we verified that including distance to the ancestral location as an additional regressor has no effect on the estimates reported in Table 5.

Table 8
Female income and marital violence.

Dependent variable	Hit in the last year		Hit repeatedly in the last year			
	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes	Former slave castes	Non-slave castes
Caste	(1)	(2)	(3)	(4)	(5)	(6)
Female income	0.072 (0.037)	0.009 (0.053)	0.066 (0.030)	−0.0002 (0.044)	0.059 (0.037)	−0.017 (0.038)
Total income	−0.035 (0.017)	−0.002 (0.024)	−0.033 (0.013)	0.003 (0.020)	−0.031 (0.017)	0.010 (0.016)
Husband drinks regularly	–	–	–	–	0.228 (0.044)	0.290 (0.038)
Overid test (<i>F</i> statistic)	0.21	0.72	0.07	0.87	0.23	0.50
Overid test (<i>p</i> -value)	0.96	0.61	0.99	0.50	0.95	0.78
Number of observations	2242	1050	2242	1050	2242	1050

Note: Standard errors in parentheses. Standard errors are robust to heteroscedasticity and clustered residuals within each estate. Hit repeatedly if beaten two times or more in the last year.

Former slave castes include Pallars and Paraiyars. Non-slave castes include all other sub-castes.

Income is measured in thousands of Rupees per year.

Regressions include a full set of sub-caste dummies and husband's age, schooling and whether he is a first-generation worker.

Instruments include elevation (linear, quadratic, and cubic terms), and woman's age (linear and quadratic terms).

have traditionally made all the important decisions it is difficult to imagine that such shifts toward female preferences will take place without conflict. We argue that incentives differ by gender among the former slave castes and thus we expect the shift in resources that follows to be accompanied by conflict, possibly escalating to marital violence, if the traditional norm of male decision-making persists in the tea estates. If the absence of a female income effect on household decisions among the other sub-castes arises because incentives are more closely aligned within these households or because upper caste women are less assertive, then a relative increase in female income should have no effect on marital violence.

The respondents in the survey were asked whether they had been beaten by their husbands in the last year. Marital violence is widespread in the tea estates: 35% of the former slave caste women versus 31% of the non-slave caste women reported that they had been beaten in the last year (the difference between castes is significant at the 5% level). Studies of marital violence typically include male characteristics, such as age, education, employment status, and alcohol consumption, together with household characteristics, particularly income or wealth, as regressors (e.g., Martin et al., 1999; Hoffman et al., 1994). Those studies that are interested in disagreements over resource allocation include female income, or other measures of female resources, as well (Luke et al., 2007; Rao, 1997). The basic specification of the marital violence regression that we estimate consequently includes the husband's age, education, and whether he is a first-generation arrival in the tea estates as regressors. Since there can be a social aspect to marital violence, a full set of sub-caste dummies is also included in these regressions. Finally, current total income and current female income are included as regressors, which we instrument for with elevation (linear, quadratic, and cubic terms) and the woman's current age (linear and quadratic terms). We make the assumption as elsewhere in the paper that current conflict will depend disproportionately on current incomes. This implies that we no longer need to impute historical incomes and adjust the age instruments as we did previously.

The assumptions that we must make to support the validity of the elevation instruments are unchanged in the violence regressions. However, the woman's age is no longer adjusted and so the identifying assumption will change; conditional on the man's age, which is included as a regressor, the woman's age must not directly determine marital violence. This equivalently implies that the age difference between the husband and the wife must not determine marital violence. This condition will be satisfied under the standard assumption that it is the resources that the husband and the wife bring to the bargaining table, rather than their underlying characteristics, that determine the allocation of resources within the household and hence the potential for conflict. However, we might imagine that the woman's ability to avoid potentially violent

situations will improve with age and experience. The age difference between the husband and the wife might also determine the respect that he is accorded within the household, with implications for the incidence of marital violence. Rejection of the exclusion restriction for the age instruments will, however, lead to the failure of the overidentifying restrictions, which we proceed to test below.

Table 8, Columns 1–2 report regression estimates with marital violence in the last year (measured as a binary variable) as the dependent variable. An increase in total household income reduces the probability of marital violence among the former slave castes, perhaps because disagreements over resource allocation are less likely to escalate into violence when overall economic conditions are favorable. Conditional on total household income, an increase in female income increases the probability of marital violence, which is precisely what we would expect when there are disagreements over resource allocation within the household. In contrast with the strong effects that we obtain for the former slave castes in Column 1, we see in Column 2 that total income and female income have no effect on marital violence among the other sub-castes.

The results in Columns 1–2 are consistent with the results in Tables 5–7. The instruments that we use also comfortably pass the tests of the overidentifying restrictions. Nevertheless, there remains the possibility that insignificant coefficients for the other sub-castes in Column 2 are obtained simply because the self-reported incidence of marital violence by the survey respondents is a noisy measure of the true incidence. The survey collected information not only on the incidence of marital violence but also on the frequency of violence in the past year. Table 8, Columns 3–4 use repeated marital violence (two or more times) in the past year, which is probably more precisely measured as the binary dependent variable, to obtain essentially the same results.²⁸ As a final check we include a binary variable indicating whether the husband drinks regularly as an additional regressor in Table 8, Columns 5–6. The idea here is to see whether the association between violence and alcohol consumption, which has been found in many previous studies (e.g., Rao, 1997), is similar for the two caste groups. While the coefficient on the alcohol variable, which is clearly endogenous, is difficult to interpret, it is very precisely estimated and close in magnitude for both caste groups. The income coefficients in Columns 5–6 remain very similar to what we obtained in Columns 1–4; only the income effects, which are associated with conflict over resource allocation within the household, vary substantially by caste.

²⁸ The incidence of marital violence drops substantially with this measure to 20% for the former slave castes versus 17% for the other sub-castes. The difference between caste groups is close to significant at conventional levels ($p = 0.07$).

6. Conclusion

Economic globalization will give many women in developing countries access to steady and relatively remunerative employment for the first time. The question that we ask in this paper is whether these new opportunities will increase mobility in future generations by changing the choices that parents make for their children. This paper exploits a unique setting – a group of tea plantations in South India where women have been employed in permanent wage labor for multiple generations – to anticipate the impact of globalization on mobility in the future.

The key decisions that parents in the tea estates must make for their children are how much to invest in their education and whether to marry them to a relative. These decisions, in turn, determine the extent to which the children will remain tied to their ancestral communities and the traditional economy. The main result of the paper is that a relative increase in female income weakens the family's ties to the ancestral community as women gain bargaining power within the household. The success of the women in asserting their preferences comes at the cost of greater marital violence, however, presumably because their efforts challenge the norm of male decision-making. Most importantly, female income effects (on household decisions and marital violence) are obtained for certain sub-castes alone. Although we provide a context-specific explanation for why the women from the former slave castes emerge as agents of change, the first general implication from the analysis is that the incentives and the ability of women to use their earned incomes to influence household decisions in the future will depend importantly on their social background.

One explanation for the persistence of poverty is that historically disadvantaged groups are deprived of new opportunities. An alternative explanation is based on the idea that social institutions or the culture in these groups, determined perhaps by historical circumstances, prevent them from responding to opportunities as they become available. The second implication of our analysis is that historically disadvantaged groups might, in fact, be especially responsive to new opportunities precisely because they have fewer ties to the traditional economy to hold them back. Under these circumstances, the exogenous distribution of new opportunities rather than the endogenous response to these opportunities may be the main constraint on convergence across social groups in the future.

Acknowledgments

This project could not have been completed without the encouragement and support that we received from Homi Khusrookhan. We thank the management, staff, and workers of Tata Tea, Munnar, for their assistance and gracious hospitality during our extended stays in the tea estates. Binitha Thampi supervised the data collection and, together with Leena Abraham, assisted us in the design of the survey. We are grateful to Anna Aizer, Oriana Bandiera, Tim Besley, Suma Chitnis, Raquel Fernandez, Jonathan Gruber, Glenn Loury, Ignacio Palacios-Huerta, Imran Rasul, Duncan Thomas, Padma Velaskar and especially Andrew Foster for helpful comments. Chun-Fang Chiang, Alaka Holla, and Jonathan Stricks provided excellent research assistance. Sarah Williams and Naresh Kumar assisted us with the geo-mapping. Seminar participants at Berkeley, Brown, LSE-UCL, Maryland, NYU, the University of Washington, and Washington University in St. Louis provided useful comments. Research support from the Mellon Foundation at the University of Pennsylvania, the Harry Frank Guggenheim Foundation, and NICHD grant R01-HD046940 is gratefully acknowledged. We are responsible for any errors that may remain.

References

Agarwal, Bina, 1997. "Bargaining" and gender relations: within and beyond the household. *Feminist Economics* 3 (1), 1–51.

- Alexander, K.C., 1989. Caste mobilization and class consciousness: the emergence of agrarian movements in Kerala and Tamil Nadu. In: Frankel, F.R., Rao, M.S.A. (Eds.), *Dominance and State Power in Modern India; Decline of a Social Order*, vol. 1. Oxford University Press, Delhi, pp. 362–413.
- Baak, Paul Erik, 1997. *Plantation, Production and Political Power: Plantation Development in South West India 1743–1963*. Oxford University Press, Delhi.
- Behrman, Jere R., 1997. Intra-household distribution and the family. In: Rosenzweig, Mark R., Stark, Oded (Eds.), *Handbook of Population and Family Economics*. Elsevier, Amsterdam, pp. 125–187.
- Boserup, Ester, 1970. *Women's Role in Economic Development*. George Allen and Unwin, London.
- Browning, Martin, Bourguignon, François, Chiappori, Pierre-André, Lechene, Valérie, 1994. Income and outcomes: a structural model of intrahousehold allocation. *Journal of Political Economy* 102 (6), 1067–1096.
- Chakravarti, Uma, 1993. Conceptualizing Brahmanical Patriarchy in Early India: Gender, Caste, Class and State, *Economic and Political Weekly*, 3 April.
- Chiappori, Pierre-André, 1992. Collective labor supply and welfare. *Journal of Political Economy* 100 (31), 437–467.
- Cox, Donald, 2003. Private transfers within the family: mothers, fathers, sons and daughters. In: Munnell, Alicia H., Sundén, Annika (Eds.), *Death and Dollars: The Role of Gifts and Bequests in America*. The Brookings Institution Press, Washington D.C. pp. 168–216.
- Duflo, Esther, 2003. Grandmothers and granddaughters: old age pension and intra-household allocation in South Africa. *World Bank Economic Review* 17 (1), 1–25.
- Fernandez, Raquel and Alessandra Fogli, 2007. Culture: an empirical investigation of beliefs, work, and fertility. New York University Department of Economics mimeograph.
- Geetha, V., 2002. *Gender*. Stree Publishers, Calcutta.
- Grasmuck, S., Pessar, P., 1991. *Between Two Islands: Dominican International Migration*. University of California Press, Berkeley and Los Angeles.
- Härdle, Wolfgang, 1990. *Applied Nonparametric Regression*, *Econometric Society Monographs* No.11. Cambridge University Press, Cambridge.
- Hellerstein, Judith K., Neumark, David, 1995. Are earnings profiles steeper than productivity profiles? Evidence from Israeli firm-level data. *The Journal of Human Resources* 30 (1), 89–112.
- Hjejle, Benedicte, 1967. Slavery and agricultural bondage in South India in the nineteenth century. *The Scandinavian Economic History Review* XV (1,2), 71–126.
- Hoffman, K.L., Demo, D.H., Edwards, J.N., 1994. Physical wife abuse in a non-western society: an integrated theoretical approach. *Journal of Marriage and the Family* 56 (1), 131–146.
- Ilmakunnas, Pekka, Maliranta, Mika, Vainiomaki, Jari, 1999. The Roles of Employer and Employee Characteristics for Plant Productivity, Helsinki School of Economics and Business Administration Working Paper W-223.
- International Institute for Population Sciences (IIPS) and ORC Macro, 2000. *National Family Health Survey (NFHS-2)*, 1998–99: India. IIPS, Mumbai.
- Kapadia, Karin, 1995. *Siva and Her Sisters: Gender, Caste, and Class in Rural South India*. Westview Press, Boulder.
- Karve, Irawati, 1953. *Kinship Organization in India*. Asia Publishing House, New York.
- Kibria, Nazli, 1993. *Family Tightrope: The Changing Lives of Vietnamese Americans*. Princeton University Press, Princeton.
- Kooiman, Dick, 1989. *Conversion and Social Equality in India; the London Missionary Society in South-Travancore in the 19th Century*. Manohar Press, Delhi.
- Kumar, Dharm, 1965. *Land and Caste in South India: Agricultural Labour in the Madras Presidency during the Nineteenth Century*. Cambridge University Press, Cambridge.
- Ligon, Ethan, 2002. Dynamic bargaining in households (with application to Bangladesh). CUDARE Working Paper No. 972.
- Luke, Nancy, Munshi, Kaivan, 2004. Women as Agents of Change: Female Incomes and Household Decisions in South India, BREAD Working Paper No. 087.
- Luke, Nancy, Schuler, Sidney Ruth, Bui Thi Thanh Mai, Pham Vu Thien, Tran Hung Minh, 2007. Exploring couple attributes and attitudes and marital violence in Vietnam. *Violence Against Women* 13 (1), 5–27.
- Lundberg, Shelly, Pollak, Robert A., 1993. Separate spheres bargaining and the marriage market. *Journal of Political Economy* 101 (6), 988–1009.
- Mahalingam, Ramaswami, 2007. Beliefs about chastity. *Machismo, and Caste Identity: A Cultural Psychology of Gender*, *Sex Roles* 56, 239–249.
- Malhotra, Anju, Mather, Mark, 1997. Do schooling and work empower women in developing countries? Gender and domestic decisions in Sri Lanka. *Sociological Forum* 12 (4), 599–630.
- Manser, Marilyn, Brown, Murray, 1980. Marriage and household decision making: a bargaining analysis. *International Economic Review* 21 (1), 31–44.
- Martin, S., Tsui, A., Maitra, K., Marinshaw, R., 1999. Domestic violence in Northern India. *American Journal of Epidemiology* 150, 417–426.
- McElroy, Marjorie B., Horney, Mary Jean, 1981. Nash bargained household decisions. *International Economic Review* 22 (2), 333–350.
- Menjivar, Cecilia, 1999. The intersection of work and gender: Central American immigrant women and employment in California. *American Behavioral Scientist* 42 (4), 601–627.
- Min, Pyong Gap, 2001. Changes in Korean immigrants' gender role and social status, and their marital conflicts. *Sociological Forum* 16 (2), 301–320.
- Munshi, Kaivan, Rosenzweig, Mark, 2006. Traditional institutions meet the modern world: Caste, gender, and schooling choice in a globalizing economy. *American Economic Review* 96 (4), 1225–1252.
- Munshi, Kaivan, Rosenzweig, Mark, 2009. Why is mobility in India so low? Social Insurance, Inequality and Growth, NBER Working Paper No. 14850.
- Parrado, Emilio A., Flippen, Chenoa A., 2005. Migration and gender among Mexican women. *American Sociological Review* 70, 606–632.
- Rao, Vijayendra, 1997. Wife-beating in rural South India: A qualitative and econometric analysis. *Social Science and Medicine* 44 (8), 1169–1180.

- Rahman, Lupin, Rao, Vijayendra, 2004. The determinants of gender equity in India: examining Dyson and Moore's thesis with new data. *Population and Development Review* 30 (2), 239–268.
- Rubin, D. Kate, Perloff, Jeffrey M., 1993. Who works for piece rates and why. *American Journal of Agricultural Economics* 75, 1036–1043.
- Rubinoff, Janet Ahner, 1999. Fishing for status: impact of development on Goa's fisherwomen. *Women's Studies International Forum* 22 (6), 631–644.
- Schuler, Sidney Ruth, Hashemi, Syed M., Riley, Ann P., Akhter, Shireen, 1996. Credit programs, patriarchy and men's violence against women in rural Bangladesh. *Social Science and Medicine* 43 (12), 1729–1742.
- Shearer, Bruce, 1996. Piece-rates, principal-agent models, and productivity profiles: parametric and semi-parametric evidence from payroll records. *The Journal of Human Resources* 31 (2), 275–303.
- Strauss, J., Thomas, D., 1995. Human resources: empirical modeling of household and family decisions. In: Behrman, J., Srinivasan, T.N. (Eds.), *Handbook of Development Economics*. North Holland, Amsterdam.
- Tata Tea, 2000. Welfare Audit 1999–2000. South India Division.
- Thomas, Duncan, 1990. Intra-household resource allocation: an inferential approach. *The Journal of Human Resources* 25 (4), 635–664.
- Trautmann, T.R., 1981. *Dravidian kinship*. Cambridge University Press, Cambridge.
- Zhou, Min, 1992. *Chinatown*. Temple University Press, Philadelphia.