

Gender differences in assets

Prepared by the SOFA Team

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Abstract: Agriculture can be an important engine of growth and poverty reduction. But the sector is underperforming in many countries in part because women, who are often a crucial resource in agriculture and the rural economy, face constraints that reduce their productivity. In this paper we document the gender gap in access to and ownership of most inputs, asset and services important for agricultural activities. We focus in particular on education, land, livestock, financial services, modern inputs, information and extension and labour. Across assets and inputs women are disadvantaged. The gap in education has narrowed over the last decades but substantial gaps remain in sub-Saharan Africa and South Asia. For land, the key farm household asset, there are significant gender differences in access to land across regions. Moreover female-headed households also typically operate smaller land holdings than male-headed households, across regions. There are also significant and systematic gender differences with regard to livestock, financial services, modern inputs, information and extension and labour. Gender differences in assets are generally interlinked, for example when female farmers have lower levels of technology this is due to their having less access to land, less access to labour and less access to extension services, not their sex. This also helps explain why women farmers do not necessarily benefit from access to extension services, as some studies have found. The implication of this is that selective interventions are unlikely to be effective.

Key words: Women, gender, agriculture, human capital, land, modern farm inputs, labour, livestock, financial services.

JEL: J24, Q10, Q14, Q15, Q16, Q19

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¹ This paper is based on background research in support of the preparation of FAO's *The State of Food and Agriculture 2010-11: Women in agriculture: Closing the gender gap for development*. The forthcoming report aims to increase understanding of the diversity of women's roles in agriculture, the constraints women face as farmers and rural labourers, the costs of these constraints in terms of agricultural productivity and broader measures of social welfare, and the effectiveness of innovative policies and interventions aimed at promoting the productivity of women in agricultural and rural activities. The report is to be released on March 7 2011 and will be available at <http://www.fao.org/publications/sofa/en/>.

² The Sofa team was lead by Terri Raney and included Gustavo Anríquez, Andre Croppenstedt, Stefano Gerosa, Sarah Lowder, Ira Matuschke and Jakob Skoet. Contact e-mail: andre.croppenstedt@fao.org.

Introduction

The agricultural sector in many developing countries is underperforming, in part because women lack the assets and opportunities they need to achieve their potential. Women represent a crucial resource in agriculture and the rural economy through their roles as farmers, labourers and traders, yet they face constraints – because of their gender – that reduce their productivity and retard progress on broader economic and social development goals.

In this paper we focus on gender differences in assets: land, technology, financial, education, labour, nutrition and information and extension services. We show that female smallholders are consistently asset-constrained relative to their male counterparts. In Box 1 we clarify the meaning of gender.

Box 1 Sex and Gender

The concepts of “sex” and “gender” can be confusing, not least because even the experts sometimes use them incorrectly. Sex is a biological concept while gender is a social concept. Sex describes the innate biological condition of being male or female. Gender refers to the social roles and identities associated with being a man or a woman and deals with relationships between men and women. Every society is marked by gender differences, but these vary widely by culture and can change dramatically over time. Sex is biology. Gender is sociology. Sex is fixed. Gender can change. Agnes Quisumbing explained the difference this -way:

Sex differences are due to innate biological differences between men and women. Gender differences, on the other hand, arise from the socially constructed relationship between men and women (Oakley, 1972). These differences affect the distribution of resources and responsibilities between men and women, and are shaped by ideological, religious, ethnic, economic, and cultural determinants (Moser, 1989). Being socially determined, this distribution can thus be changed through conscious social action including public policy (Quisumbing, 1996).

The asset gap in agriculture and rural areas

There is significant heterogeneity across regions, countries, locations and context in the role of rural women and their participation in agricultural and other economic activities (SOFA

Team and Cheryl Doss, 2011), with, for example, the female share of agricultural labour ranging from 20 to 50 percent. In spite of this heterogeneity, women across regions and contexts face a surprisingly similar set of constraints which limit their access to productive assets and inputs as well as employment opportunities. While the exact degree of gender inequality in access differs by assets and location, the underlying causes are repeated across contexts: social norms, household/reproductive duties that create time constraints, and asset complementarities (for example having access to land helps with access to credit which helps with access to purchased inputs). These gender inequalities negatively affect the productivity of women and thus involve costs in terms of lost output, income and ultimately welfare of households, communities and nations.

In the evidence presented in this paper, the unit of observation may differ from case to case. Sometimes, the reference is to inequalities between males and females, other times to differences between male-headed and female-headed households, or even to plots or farms managed by females and males³. The diversity in unit of observation may have different reasons. In some cases, it is determined by the nature of the indicator. Certain indicators, such as poverty and some nutritional measures are usually measured at the level of the household or the farm. Others, such as wages and labour force participation are measured at the individual level. In other instances the unit of observation is determined by data availability. For example, data on the use of modern seed varieties are sometimes derived from household surveys, in which the household is the unit of observation, in other cases from agricultural censuses, in which the farm (or more explicitly the agricultural holding) is the unit of observation; in other instances they may be derived from ad hoc surveys where agricultural plots may be distinguished according to the gender of the manager (Box 2).

Box 2 Female farmers, household heads and data limitations

Data on female farmers are limited. Most women engaged in farming do so within a household production unit, and their activities often are not separable from those of the household as a whole. Most of the data available on female farmers derives from household surveys and pertains to the activities of female-headed households, who comprise a minority of female farmers in most countries. Some data are available for female-operated plots within male-headed households, primarily in Africa where men

³ The latter differentiation between male and female managed plots is usually applied in studies in sub-Saharan Africa where the practice of female and males within the same household controlling separate agricultural plots is common.

and women often operate separate plots. The unit of observation used in this study (individuals, households, farms, or plots) varies depending on the resource being discussed and the availability of data.

The prevalence of female-headed households is generally higher in sub-Saharan Africa than in other regions (see Annex Table 5 in FAO (2010-11)), but this hides considerable variation within the region. In fact, the countries having the highest (Swaziland) and the lowest (Burkina Faso) prevalence of female-headed households in developing regions are both found in sub-Saharan Africa.

A distinction should be made between two types of female-headed households: (i) *de facto*, i.e. those in which an adult male partner is working away from the household but remains involved through remittances and other economic and social ties and (ii) *de jure*, i.e. those which have no male partner, such as women who are widowed, divorced or never married. Comprehensive data are not usually available to distinguish between these types of households, but for the few cases for which we have data most FHHs are *de jure*. In Malawi, Uganda and Panama about 70, 63 and 83 percent of all FHHs are *de jure* (Chipande, 1987; Appleton, 1996; and Fuwa (2000). Also in Cambodia and Laos most FHHs are *de jure* (FAO/GSO/MoP, 2010 and FAO/MAF, 2010). Studies which are able to disaggregate by type of FHH mostly find that *de jure* FHHs are more likely to suffer from a range of economic and social disadvantages (Seebens, 2010).

We attempt to always maintain clarity as to what is the unit of observation and comparison for the different pieces of evidence (individuals, households, farms, or plots). However, whatever the unit of observation, the differences described are all manifestations of gender inequality. For example, if plots managed by women benefit from fewer hours of draft animal services per unit of land the unit of observation is the plot, but the disparity in access to this productive input is the result of gender inequality. The underlying reason may be that women have less income to buy or rent the services of draft animals, they may have inferior access to financial services, have less available time to bargain for the services, and/or by reigning social norms have to wait for men to finish using the animals before being entitled to their services.

Gender differences in human capital endowment

Education

Education plays a major role not only for individual's opportunities in society, but also for the productive capacity and wellbeing of a household. Almost universally, studies that analyze income, agricultural production, and other measures of welfare find that education, - human capital available in the household (usually measured as the education of the head of household, or the average education of working age adults) - is strongly correlated with these

welfare measures. Cross-country studies have come to show that gender inequality in educational levels is important (World Bank, 1999) for a wide range of outcomes, including malnutrition, health, employment opportunities, and technology adoption, all of which ultimately affect household incomes and economic growth at the national level.⁴

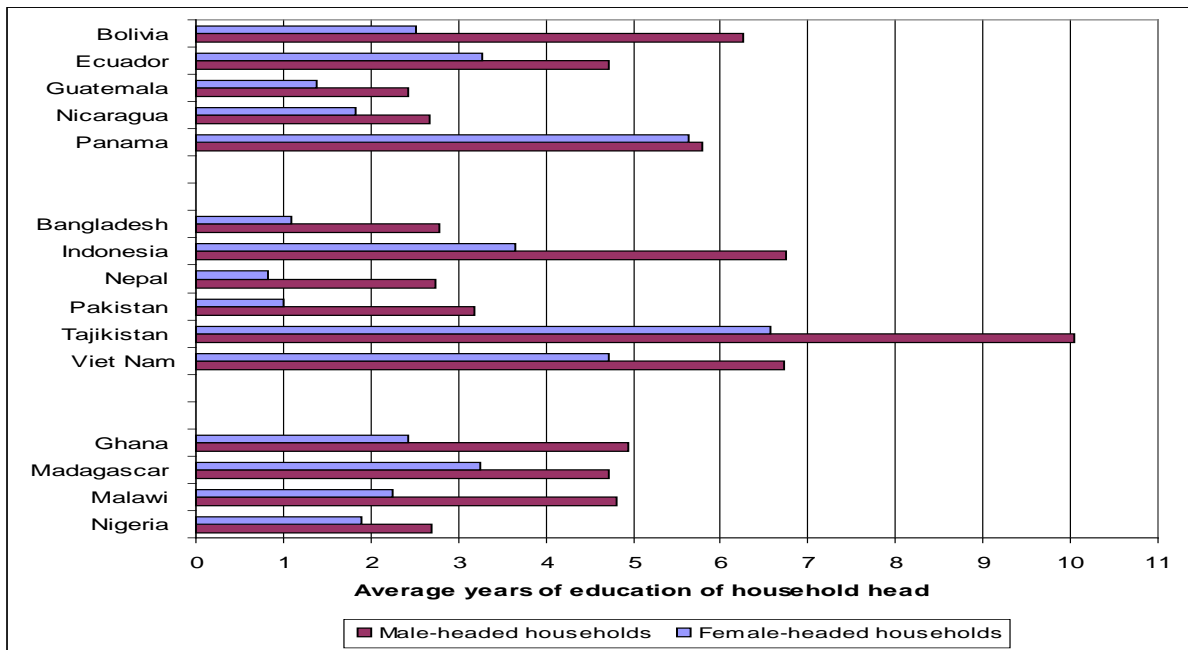
Gender differences in education are illustrated by Figure 1, which presents RIGA⁵ data showing the number of years of formal education of male and female heads of household respectively. In all countries, female heads have less education than their male counterparts, with the exception of Panama, where the difference is not statistically significant. The data suggests that, across developing regions and income levels, rural female household heads are in a disadvantaged position with respect to human capital accumulation. This evidence unveils an unambiguous bias across rural landscapes in the investment in education of girls and boys in the past.

Nevertheless, human capital accumulation is the one asset where over the last decades there is a clearly documented narrowing of the gender gap, although progress has been uneven across regions. The World Bank (1999) finds that, with few exceptions, female primary education levels improved over time although important gaps persist. Over the period 1975-1999 significant gains in reducing the gender gap in primary school enrolment rates for girls have been made. Currently the gender gap in education, for both levels of enrolment and attainment, is largest in sub-Saharan Africa and South Asia. In these two regions, despite the gains, a substantial gap remains. In Latin America, on the other hand, Katz (2003) argues that one of the most significant advances in gender equality has been in the area of women's education, where female primary enrolment ratios are about 94 percent of those of males while women outnumber men in secondary education.

Figure 1 Education of rural household heads, by male and female-headed households.

⁴ With regard to gender inequality in education and economic growth see also: Blackden et al (2006), Knowles, Lorgelly and Owen (2002), World Bank (2001), Lagerlöf (2003), Galor and Weil (1996), Abu-Ghaida and Klasen (2004), Dollar and Gatti (1999), Esteve-Volart (2004), and Morrison, Raju and Sinha (2007).

⁵ Rural Income Generating Activities (RIGA) is a FAO project that has created an internationally comparable database of rural household income sources from existing household living standards surveys for more than 27 countries. Most of the surveys used by the RIGA project were developed by national statistical offices in conjunction the World Bank as part of its Living Standards Measurement Study (LSMS). For more information see [HTTP://WWW.FAO.ORG/ES/ESA/RIGA/ENGLISH/INDEX_EN.HTM](http://www.fao.org/es/esa/riga/english/index_en.htm).

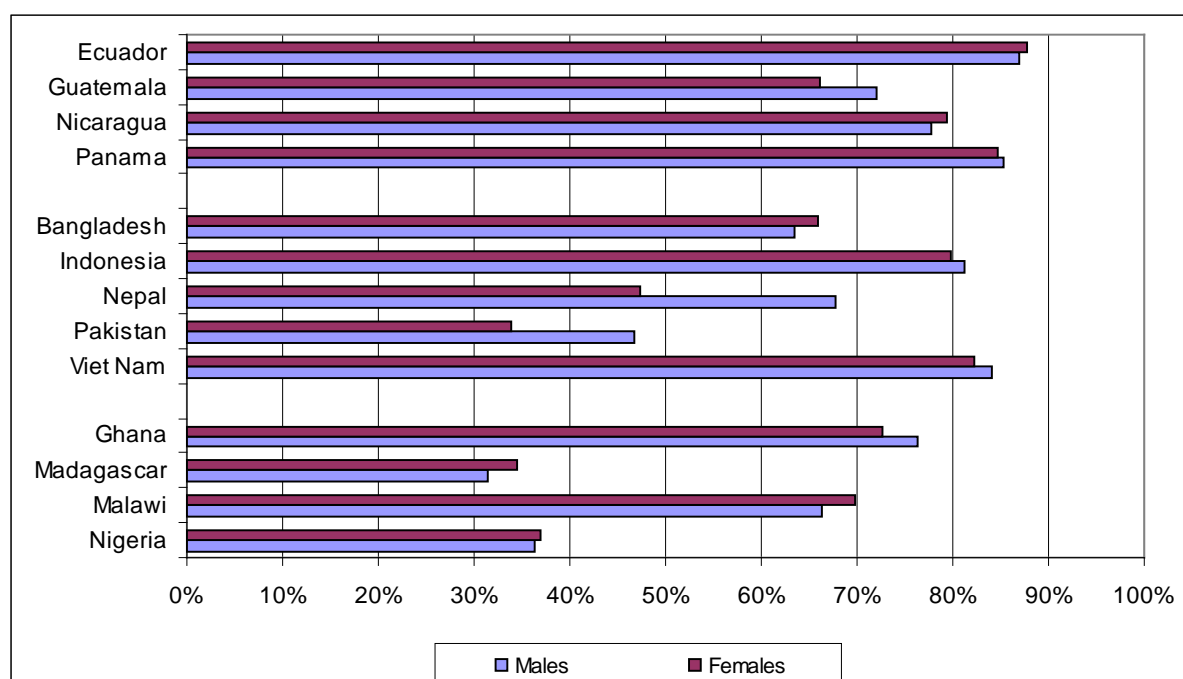


Source: FAO, RIGA-team and Anríquez (2010). Calculations based on nationally representative household surveys. Differences statistically significant at the 95 percent confidence level for all countries except for Panama.

Future prospects for reducing and eliminating the educational gender gap, as measured in terms of educational attainment, appear promising, as highlighted by the gender gap in rural primary education attendance (Figure 2). In terms of primary school attendance, most of the countries covered in Figure 2 now display gender parity (defined as the difference between male and female attendance rates), the exceptions being Ghana, Guatemala, Pakistan and Nepal. Gender attendance disparity is particularly acute in the latter two South Asian countries⁶.

⁶ For Ghana also Doss and Morris (2001) find that female farmers have less schooling, on average, than male farmers. However, they also report female farmers in FHHs have even less education than female farmers in MHHs.

Figure 2 Gender differences in rural primary education attendance rates



Source: FAO, Riga team. Note: Attendance rates are defined as the number of children in primary school age who attend primary school, expressed as a percentage of the total number of children in official primary school age. Only Ghana, Guatemala, Nepal and Pakistan are statistically significantly different from 0 at the 95 percent level.

These data are consistent with evidence reported by the World Bank (2007b), according to which, by 2005, 83 out of 106 developing countries had met Millennium Development Goal 3 regarding gender parity in access to education. Most of the countries that have yet to meet this standard are found in sub-Saharan Africa. The experience from Latin America may be illuminating in this respect. Using household surveys that are representative of 90 percent of the Latin America and Caribbean region and a cohort analysis, Duryea et al. (2007) show that around 1970 the education enrolment and attendance gap closed in Latin America. Today women are, on average, more educated than males. Countries in the region that have yet to close the gender gap -- Bolivia, Guatemala (in the RIGA sample), Mexico, and Peru -- have relatively large indigenous populations; a detailed analysis by the authors reveals that it is precisely among these groups that the educational gender gap persists.

Gender differences in access to productive resources

Land

In rural areas, where agriculture is still the main source of income, land remains the key household asset. Access to land is a basic requirement for farming and control over land is synonymous with wealth, status and power in many areas. Strengthening women's access to and control over land is an important means of raising their status and influence within households and communities. Improving women's access to land and security of tenure has direct impacts on farm productivity, but can have far reaching implications for improving household welfare as well. Strengthening land ownership by women in Nepal, for example, is linked with better health outcomes for children (Allendorf, 2007).

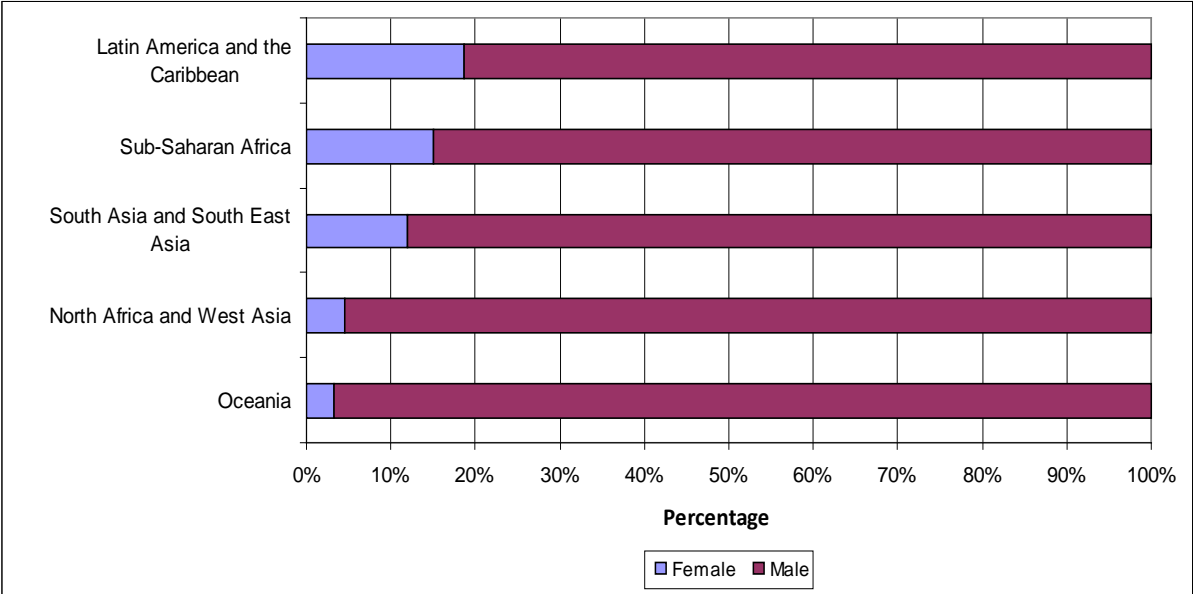
The evidence illustrating gender inequalities in access to land is overwhelming. Across regions women are consistently less likely to be owners (or operators) of agricultural land, and when they own or operate agricultural land, they usually have smaller plots. Furthermore, land holdings of women also tend to be of lower soil quality than those of men (Barnes, 1983; Jackson 1985; Keller, Chola and Milimo, 1990; and Alwang and Siegel, 1994). The evidence illustrating the inequalities in access to land is overwhelming and straddles continents and cultural contexts. In regions, such as Latin America, where private property systems are the norm, inheritance is the most frequent source of transfer of ownership of land. As a result of customs, women are much less likely to inherit. In addition, there is usually male privilege in marriage, and state programs of land redistribution (land reform) have tended to be biased towards men (Deere and León, 2003). In sub-Saharan Africa, where communal property regimes are more common, community heads tend to assign land to males, not females, and where private property prevails cultural norms generally dictate that men are the owners of land while women gain access to land through their relationship with a male relative: father, husband, brother or other (Lastarria-Cornhiel, 1997).

The most comprehensive data on women's access to land comes from the FAO Gender and Land Rights Database, which were collected from different data sources, including household surveys, agricultural censuses and academic literature. The database provides information on the shares of "agricultural holders" who are male and female. An agricultural holder is defined as the person or group of persons who exercise management control over an agricultural holding. The holding may be owned, rented or allocated from common property resources and may be operated on a share-cropped basis.

Stark gender disparities in land holdings are apparent in all regions Figure 3. Women represent less than 5 percent of all agricultural holders in the countries in North Africa and

West Asia for which data are available. The sub-Saharan Africa average of 15 percent masks wide variations, from less than 5 percent in Mali to over 30 percent in several countries such as Botswana, Cape Verde and Malawi. Latin America has the highest regional average share of female agricultural holders, which exceeds 25 percent in Chile, Ecuador and Panama.

Figure 3 Share of male and female landowners in main developing regions



Source: Elaboration based on data from the FAO Gender and Land Rights Database (WWW.FAO.ORG/GENDER/LANDRIGHTS)

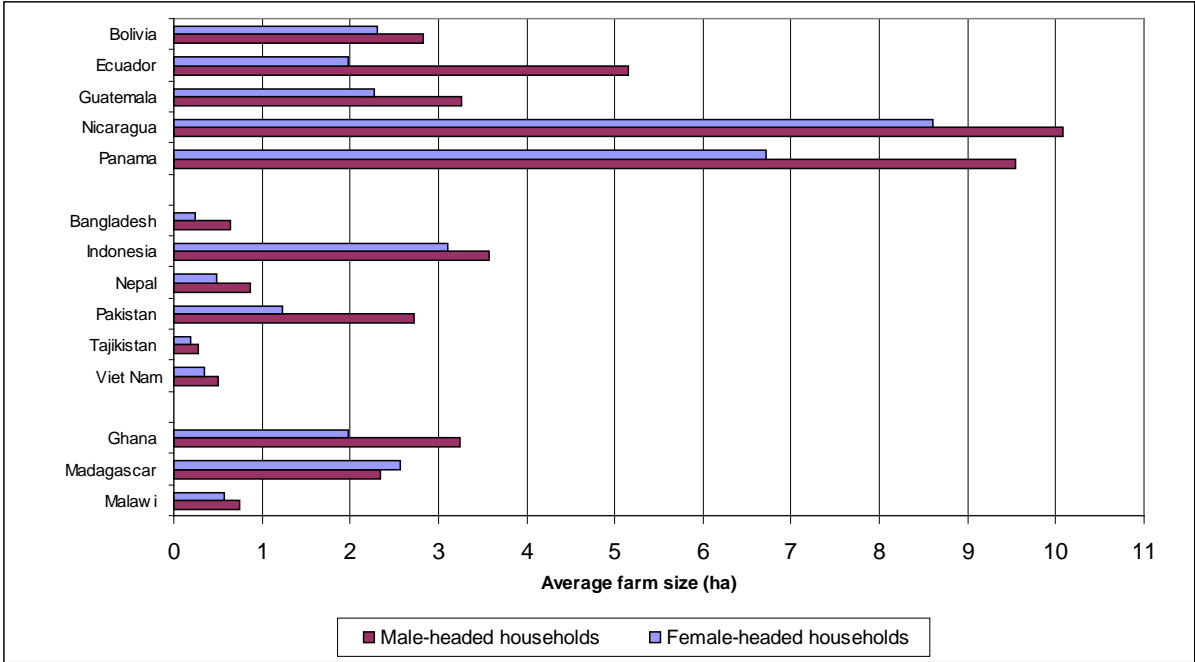
Note: regional aggregates do not include all countries due to lack of data. Country-level data are provided in the Annex Table 5 of FAO (2010-11).

Household surveys often permit to obtain a more nuanced picture of the differences in access to land and other assets. Representative and comparable data for 14 countries across different regions from the RIGA database show that in all cases male-headed households (MHHs) on average operate larger agricultural land holdings than female-headed households (FHHs) (Figure 4). The inequality in access to land is particularly acute in Bangladesh, Ecuador, and Pakistan, where the land holdings of MHHs are, on average, more than twice the size of those of female-headed households. Deere and Leon (2003), using *ad-hoc* farm surveys from nine Latin American countries, likewise found that male headed landholders always tend to own more land on average than do female landowners.⁷ Similarly, FAO (1997), as cited by Deere

⁷ Only for Chile and Paraguay, the differences were statistically significant at the 95 and 90 percent levels, respectively.

and Doss (2006), report that male land holdings are larger than female holdings in Benin, Morocco, and Zimbabwe, although without indicating whether the differences are statistically significant.

Figure 4 Rural household assets: access to land



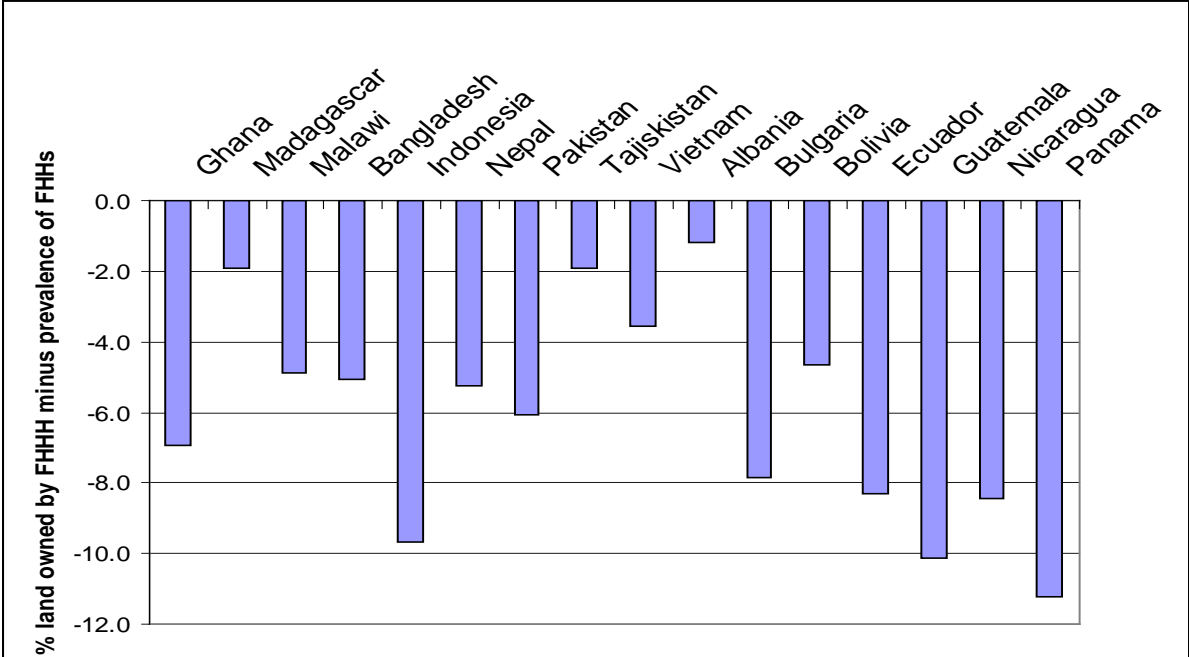
Source: FAO, RIGA-team and Anríquez (2010). Calculations based on nationally representative household surveys. Differences between male and female-headed households are statistically significant at the at the 95% confidence level for all countries except for Madagascar, Indonesia, Tajikistan, Bolivia and Nicaragua.

If the average land holdings of FHHs are smaller than those of MHHs, this implies that the share of land held by FHHs is lower than the prevalence of FHHs. This gap is illustrated in Figure 5a. In all of the countries considered, the share of land held by FHHs is less than their prevalence, with the difference being statistically significant in all cases. Similarly there is a gap between the share of FHHs among the land-owning households and among all rural households. Figure 5b shows that, with the exception of Malawi and Vietnam, the share of FHHs among the land-owning households is smaller than their share among all households⁸. In other words, FHHs are less likely to own land than MHHs. Conversely, a larger percentage of female headed households than male-headed households are landless. In most cases, FHHs are also largely under-represented among households that rent land or access land through

⁸ This approach controls for the fact that the prevalence of FHHs is usually much lower than MHHs. So even if FHHs were relatively more likely to be landowners than MHHs, they can represent a much lower share of the landowners.

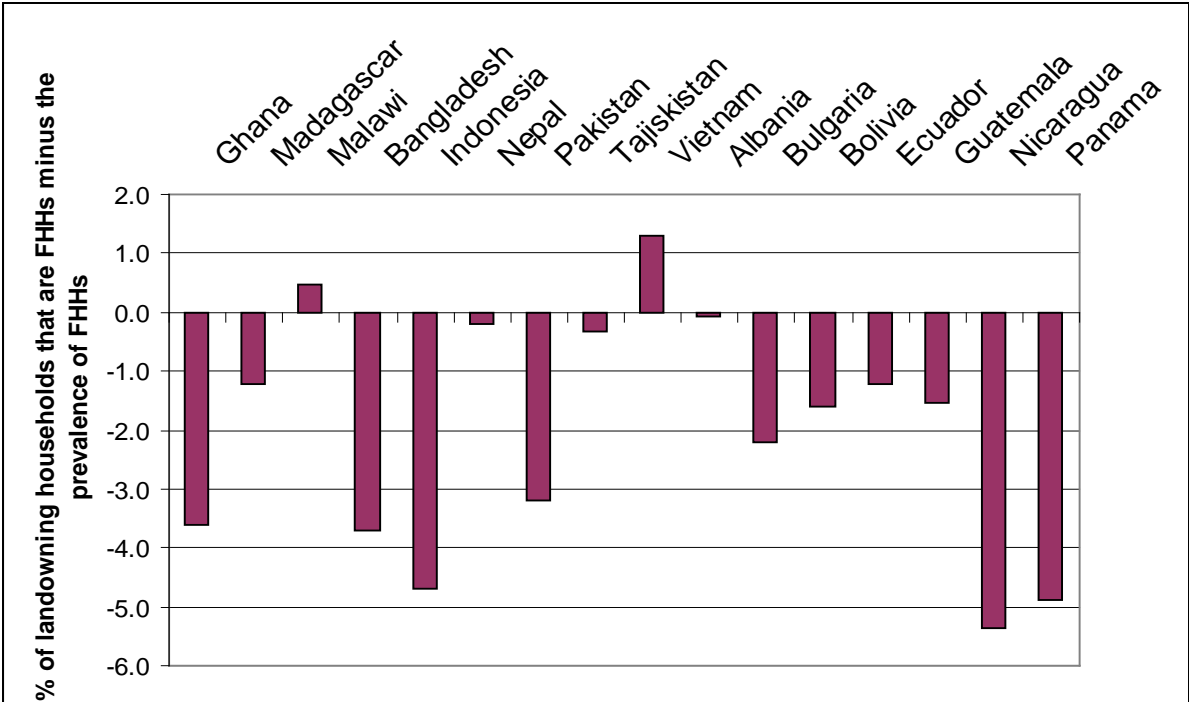
sharecropping, particularly relevant in South Asia. Figure 5c shows the gap between the share of FHHs renting land (including sharecropping) and the share of FHHs among all households.

Figure 5a Percent of land owned by FHHs minus the prevalence of FHHs



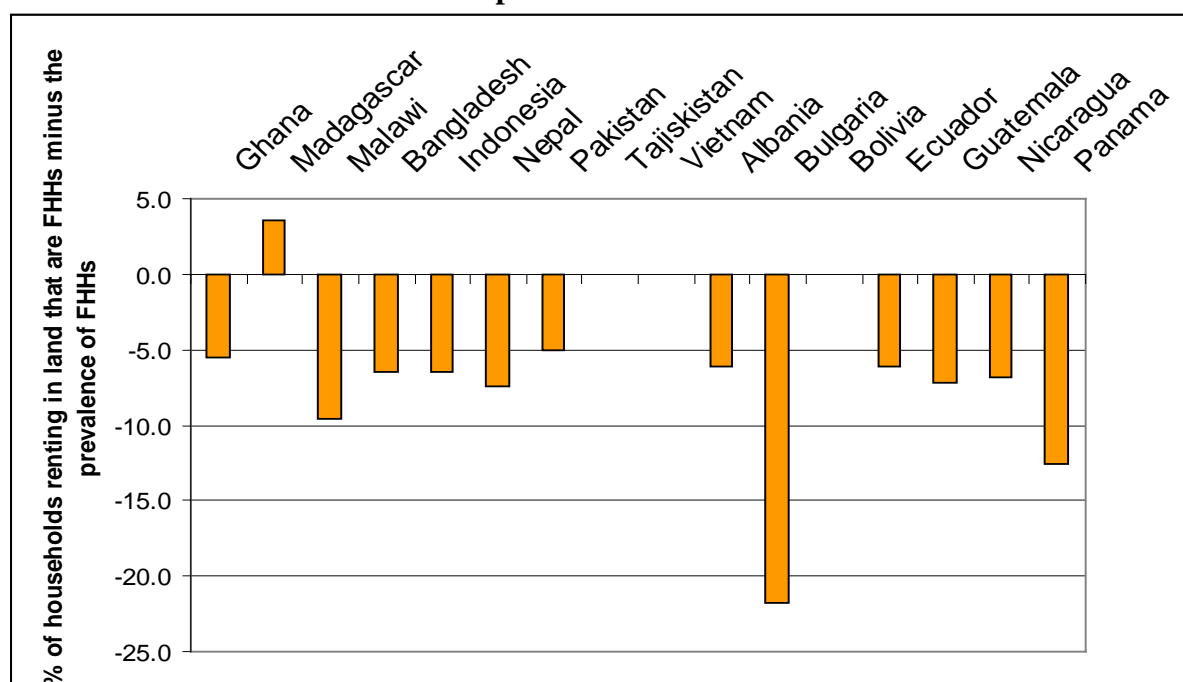
Source: FAO, RIGA-team and Anríquez (2010).

Figure 5b Percent of landowning households that are FHHs minus the prevalence of FHHs



Source: FAO, RIGA-team and Anríquez (2010).

Figure 5c Percent of households renting in-land that are FHHs minus the prevalence of FHHs



Source: FAO, RIGA-team and Anríquez (2010).

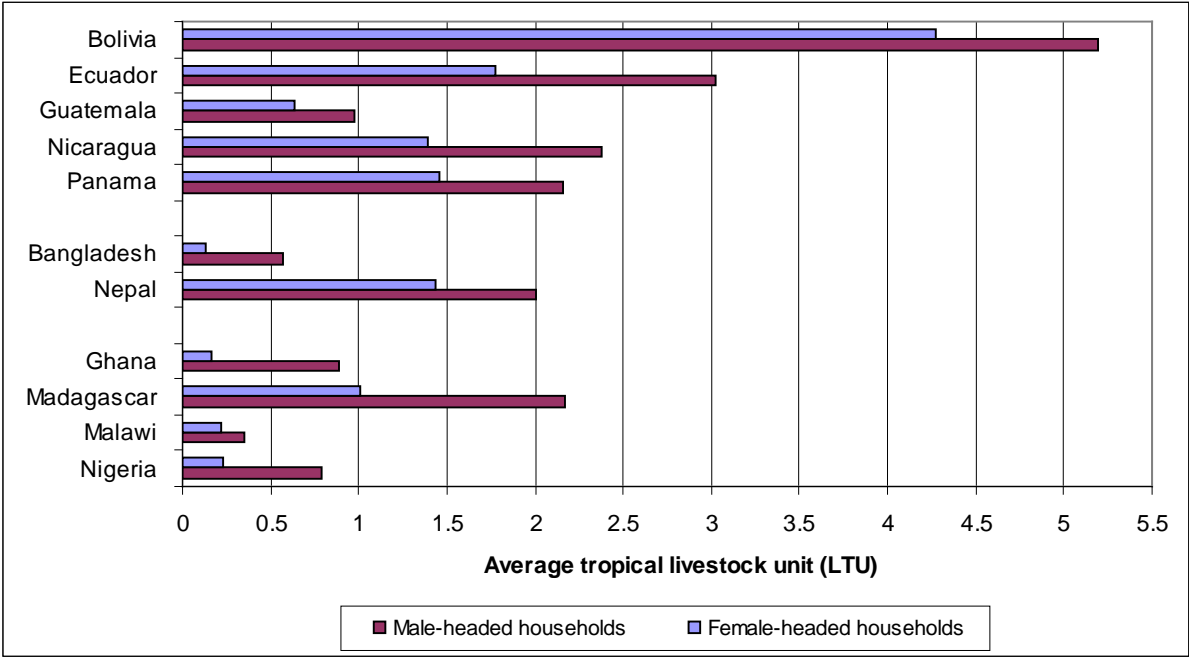
Livestock

Livestock as an asset plays a fundamental role in rural areas as it is often the most valuable agricultural asset and represents an important source of income through direct sale or through the sale of livestock products. For instance, Larson et al. (2000) estimate that the value of livestock is twice the value of fixed agricultural capital in El Salvador, three times in Indonesia, and even higher in Madagascar. Although in most countries the value of fixed agricultural capital exceeds the value of livestock holdings, these estimates nevertheless highlight the fact that livestock in many countries tends to be the main source of agricultural wealth. Furthermore, in many developing economies draft animal power is the main source of power for plowing, land clearing, and transportation. For example, Whitehead (2006) demonstrates that in Ghana, farmers with a greater initial stock of land, livestock, and male labour are able to take advantage of new, higher-value crops and improved plowing technology.

As was the case for access to land, the evidence for livestock holdings points to systematic gender inequalities. In all the cross-country data from the FAO RIGA database presented in Figure 6, MHHs have on average larger livestock holdings (measured in tropical livestock units) than FHHs. Similar results were found in Indonesia and Pakistan (although based on a

slightly different indicator) with gross livestock incomes (value of livestock consumed and sold) and net livestock incomes (net of variable inputs cost) being significantly higher in male-headed than in female-headed households. Inequality in livestock holdings appears to be particularly acute in Ghana, Bangladesh and Nigeria, where holdings of MHHs are more than 3 times as large as those of FHHs.

Figure 6 Household livestock assets



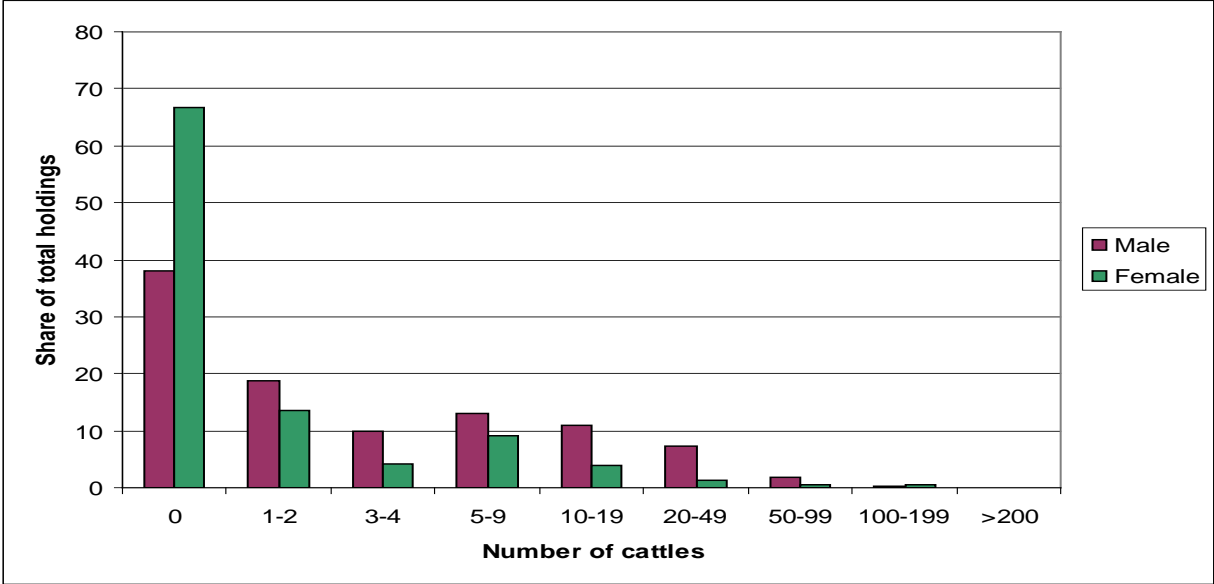
Source: FAO, RIGA-team. Calculations using nationally representative household surveys. The number of livestock is computed in the tropical livestock unit (LTU), which is equivalent to a 250 kg animal. The scale varies by region. For example in Latin America, the scale is: 1 bovine=0.7 LTU, 1 pig = 0.2 LTU, 1 sheep = 0.1 and 1 chicken = 0.1 LTU. Differences between male and female-headed households are statistically significant at the 95% confidence level for all countries, except for Guatemala.

Data on cattle holdings for Mali shown in Figure 7 provide a more detailed illustration of the inequalities of livestock ownership by gender of the head of the agricultural holding. Not only do about 68 percent of female headed agricultural holdings own no cattle, as compared to 39 percent of male headed holdings; along the whole distribution of cattle ownership female-headed agricultural holdings are under-represented. Across the border in Niger, according to official government data⁹, the distribution of cattle stocks between male and female headed agricultural holdings appears much more even. In fact, female-headed agricultural holdings

⁹ Niger, Ministère du Développement Agricole (2008).

with cattle own on average 1 additional unit, but if the livestock ownership is disaggregated by the sex of the owner, men own more than twice as many cattle as women.

Figure 7 Size distribution of cattle stocks by sex of head of holding for Mali (2004/05)



Source: Mali, Agricultural Census 2004/05.

The control that women exercise over household livestock holdings varies by culture and context; generally, however, while men are responsible for the keeping and marketing of large animals, such as cows, horses, and camels, women tend to claim control over smaller animals such as goats, sheep, pigs, and specially poultry (FAO, 2009). This pattern is confirmed in a number of studies: for example in Nicaragua women own about 10 percent of work animals and cattle but between 55-65 percent of pigs and poultry (Deere, Alvarado and Twyman, 2009). The overall value of male owned livestock was found to be 6 ½ times that owned by females. A similar situation is observed in Kenya by Kossoudji and Mueller (1983), who find that in value terms MHHs own three times as much cattle as FHHs, while the comparable ratio for small animals is lower. And for data from Northern Nigeria, Dillon and Quiñones (2009) estimated the value of men’s livestock holdings to be about 2 times that of women’s in 2008. Furthermore, even when women enjoy joint ownership of large animals, this does not necessarily imply that they have access to them, as was found for Indian women and the use of oxen (Chen, 2000; Sharma, 1980).

Financial services

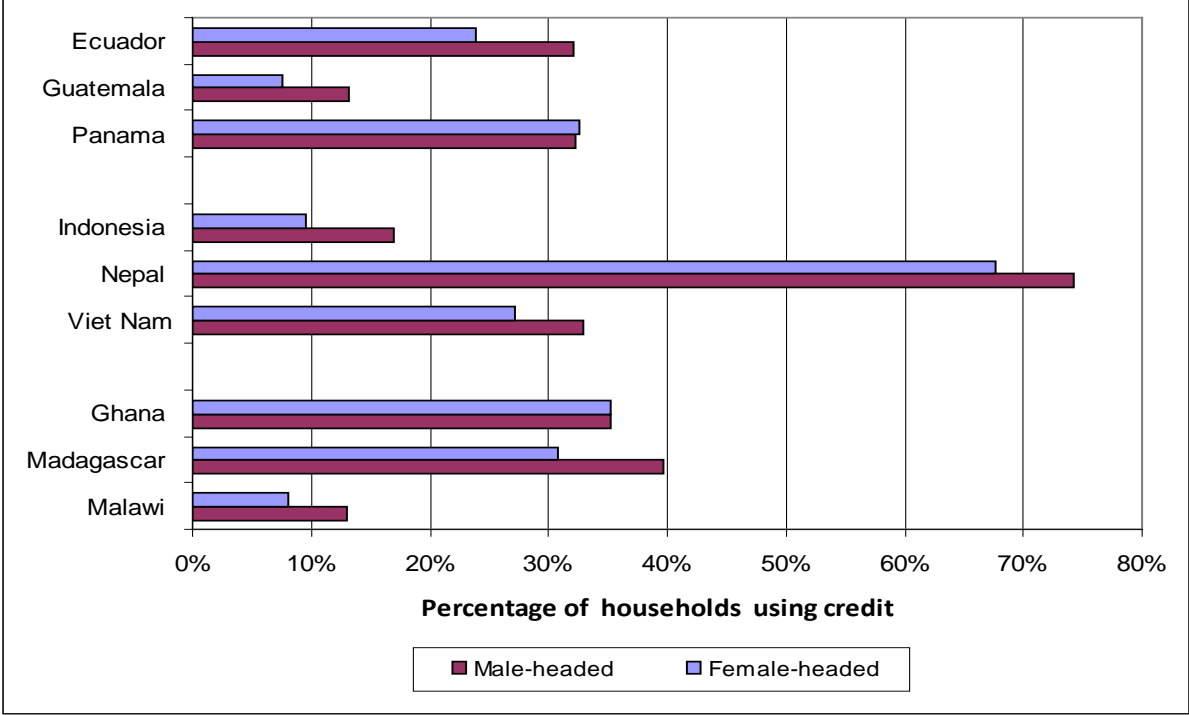
Producers who are unable to cover their short term expenses, or want to access more productive, but more expensive technologies must rely on either credit markets or informal credit sources. Without access to credit producers may fail to make the necessary upfront investments to boost their productivity or be unable to bear additional risks that may enhance their income and improve their wellbeing (Besley, 1995; Boucher, Carter and Guirkinger, 2008; World Bank, 2007a). In the aggregate, broader access to financial services provides opportunities for improving agricultural output, food security and economic vitality of entire communities and nations.

The evidence shows that credit markets are by no means gender neutral. A number of factors may limit the access of women to credit. Often they do not have the same rights or control over the types of fixed assets that are usually necessary as collateral to access credit markets. Cultural and societal norms and family obligations limit the economic activities in which women can engage. Furthermore, the latest experimental studies show that women are more risk averse than men (Fletschner, Anderson and Cullen, 2010; Croson and Gneezy, 2009; Browne, 2006). To this can be added frequent institutional discrimination, that is, biased practices by private and public lending institutions, which either ration women out of the market or grant women loans that are smaller than those granted to men for similar activities (Fletschner, 2008a; World Bank, 2009; Ospina, 1998; Baydas, Meyer and Alfred, 1994). These constraints on female-headed households' access to capital are important and have a measurable negative impact on their production capabilities (Snapp et al., 2002 and Fletschner, 2008b). For example, Fletschner, (2008b) found that in Eastern Paraguay in 1999 17 percent of men and 23 percent of women of a sample of 210 rural households faced credit constraints to both farm and non-farm incomes. Households where men had inadequate access to credit were 25 percent less economically efficient than those that were able to meet their needs for capital. In households of married couples, a wife's inability to meet her need for capital resulted in an additional 11% drop in efficiency.

Gender differences in credit use are illustrated by Figure 8, based on the RIGA data set, which shows the difference between the percentage of FHHs and MHHs which use credit. In seven out of nine countries, female-headed households are under-represented among credit users. The case of Ghana is noteworthy: although it is one of the countries where assets are most unequally distributed among genders, there seems to be no such pattern for credit, which is indeed accessed by about 1 out of 3 rural households, whether they are male- or female-

headed. For most of the countries, the unequal distribution of assets is observed in parallel with unequal access to credit sources.

Figure 8 Gender gap in access to financial institutions



Source: FAO, Riga-team and Anríquez (2010). Note: Calculations based on nationally representative household surveys. Share of households using formal credit.

The gender gap in access to credit is confirmed also by other evidence. For example, Ellis, Manuel and Blackden (2006) document how women entrepreneurs in Uganda - who receive just 1 percent of available credit in rural areas - face a clear gender bias in their access to credit. In Nigeria, Saito, Mekonnen and Spurling (1994) find that 14 percent of males and 5 percent of females obtain formal credit, while for Kenya the percentages are 14 and 4 for males and females, respectively. And in Uganda, Dolan (2004) finds that one of the most prominent barriers was a lack of financial services. Nearly all FHHs reported a desire to expand agricultural activities but lacked the money to purchase land, inputs such as seeds, fertilizer, and pesticides and/or to hire in labour.

Also in South Asia, similar patterns emerge. In Bangladesh, for example, women received about 5 percent of loans disbursed by financial institutions to rural areas in 1980, and only just over 5 percent in 1990 (Goetz and Gupta, 1996) despite the significant shift in gender orientation of special credit programs in Bangladesh since the 1980s. The evidence coming

from Bangladesh is revealing also in other ways, showing that even when programs improve the access of women to credit sources by targeting them, this does not necessarily mean that women retain control over the assets: White (1991) found that about 50 percent of loans taken by women were used for men's productive activities; Goetz and Gupta (1996) reported that on average women retained full or significant control over loan use in only 37 percent of all cases; while Chowdhury (2009) reports that credit to women from the Grameen Bank, is positively significantly correlated with male- but not female-managed micro enterprises.

In East Asia, the evidence on biases in credit access is mixed. In China, De Brauw et al. (2008) find that households in which women manage their own farms appear to have almost identical access to land and credit relative to households run by men. On the other hand, a joint study by the FAO and UNDP (FAO/UNDP, 2002) carried out in Vietnam indicates that female-headed households borrow less, have less access to formal credit, and pay higher interest on loans than dual-headed households.

Women's access to credit in Latin America differs from South Asia. Fletschner (2009) reports that in Paraguay women in farm households typically receive loans only from credit co-operatives as opposed to the state banks or wholesalers. Her findings show that women are more likely to be credit-constrained than men under equivalent socio-economic conditions and that women are not always able to rely on their husbands to help them overcome the obstacles that they face.

Modern inputs

Technology is as crucial in agriculture as for any other productive activity. Technology, as implied here, must be intended broadly and can range from machines and tools to advanced genetic resources, biocides and management techniques that help farmers make their work more productive and more efficient. A number of constraints lead to gender inequalities in access to and adoption of new technologies as well as usage of purchased inputs. First of all, the use of purchased inputs depends on the plots of land cultivated, which, as we have seen tend to be smaller for female-headed than for male-headed households. In an activity with long turnaround periods, such as agriculture, working capital is essential for the ability to access purchased inputs like fertilizers and biocides; however, as discussed earlier, women face additional constraints relative to men in their access to credit. Adoption of modern technologies and inputs may also be constrained by risk-taking behaviour, which tends to

differ between men and women. In general, women tend to be more risk-averse than men. In many instances the adoption of improved technologies is positively correlated with education but also depends on time constraints (Blackden et al, 2006), both of which are not equitably distributed between genders.

At different levels but consistently across continents and regions, the evidence points to remarkable gender differences in access to and adoption of modern technologies and use of purchased inputs. In Ghana, for example, Doss and Morris (2001) report that female farmers had a much lower adoption rate of modern crop varieties (59 versus 39 percent), while their analysis showed the differences to be explained by less access to land, lower availability of family labour, and less access to extension services. For Kenya, several studies show FHHs to have a much lower adoption rate of both improved seeds and fertilizers. These differences are explained by the reduced availability of land and labour to FHHs (Kumar, 1994); the lower education levels of FHHs, Saito, Mekonnen and Spurling (1994); and the more limited access to credit markets (Ouma, De Groote and Owuor 2006). Also, Minot, Kherallah and Berry (2000) highlight the role of credit markets in limiting the access of FHHs to fertilizers in Benin and Malawi. In addition, for Malawi, Uttaro (2002) finds access to fertilizers to be higher for married than for un-married women (62 percent compared to 45 percent). He finds the gap between male farmers and married female farmers to be smaller, with 67 percent of male farmers able to afford some fertilizer. Udry et al's (1995) well known study for Burkina Faso found that women receive less fertilizer than men, also when measured on a per-hectare basis.

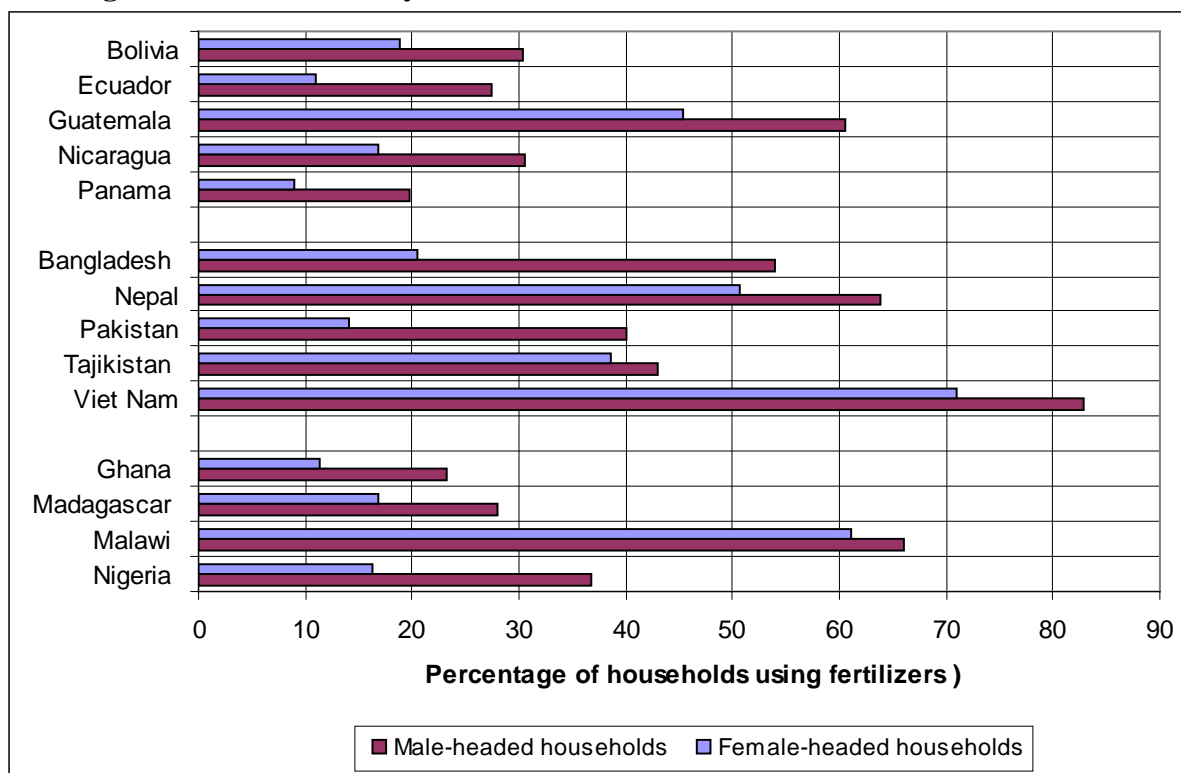
Further evidence of lower use of modern inputs by FHHs or on female-operated plots can be found in several of the studies cited in Peterman, Behrman and Quisumbing (2010). However, not all types of FHHs, are equally constrained. Indeed, Wanjiku et al. (2007) analyzed gender difference in the use of farm mechanization in small farms in Kenya and found that *de jure* FHHs, that is households headed by widows or single or divorced women, were the least likely to use animal traction. On the contrary, *de facto* FHHs, that is households where the husband lives away from the household, are more likely to use animal traction and hired labour, as they still benefit from their husband's name and social network and remittances often coming from their absent husbands.

Studies that focus on or include mechanization - tools and other farming equipment - disaggregated by gender are rare.¹⁰ This may be in part because modern farming equipment such as tractors and tillers are simply not commonly available to any farmer, especially in sub-Saharan Africa. However, some studies from the late 1980's and early 1990's point to gender differences in ownership of or access to tools. In a Gambian irrigated rice scheme, less than one percent of women owned a weeder, seeder or multipurpose cultivation implement, while respectively 12, 27 and 18 percent of men did (von Braun, Hotchkiss and Immink, 1989). Also, only men (eight percent of them) owned any type of plough. According to data from a household survey across three Kenyan districts, the value of farm tools owned by women amounted to only 18 percent of the tools and equipment owned by male farmers (Saito, Mekonnen and Spurling, 1994). In a more recent study of productivity differences by gender in a rice irrigation scheme in Central Benin, researchers noted that equipment such as motor-cultivators used for ploughing and transport are managed by groups. Women's groups were unable to start ploughing until the drivers for men's groups completed the work on the men's fields. As a consequence, women faced yield losses and could not participate in a second cropping season due to delays in ploughing and planting in the first season. (Kinkingninhou-Médagbé et al., 2008). Gender differences in utilization of farm equipment may have further implications. Indeed, Quisumbing (1995) concludes that farmers with more land and tools are likely to adopt other technologies, thus highlighting the complementarities and synergetic aspects of agricultural inputs.

The evidence summarized above is generally from sub-Saharan Africa, where most of the studies focusing on gender differences have been conducted. The FAO RIGA database offers a broader regional coverage. Data on differences in agricultural input use for male- and female-headed households from the RIGA database are presented in Figures 9 through 11. Male-headed households show much wider use of biocides, fertilizers, and mechanized power than their female counterparts in all countries covered. While the direction of the differences is unambiguous, the degree of inequality shows notable variations, appearing much more pronounced in Southern Asia (Pakistan and Bangladesh) and in Western Africa (Ghana and Nigeria).

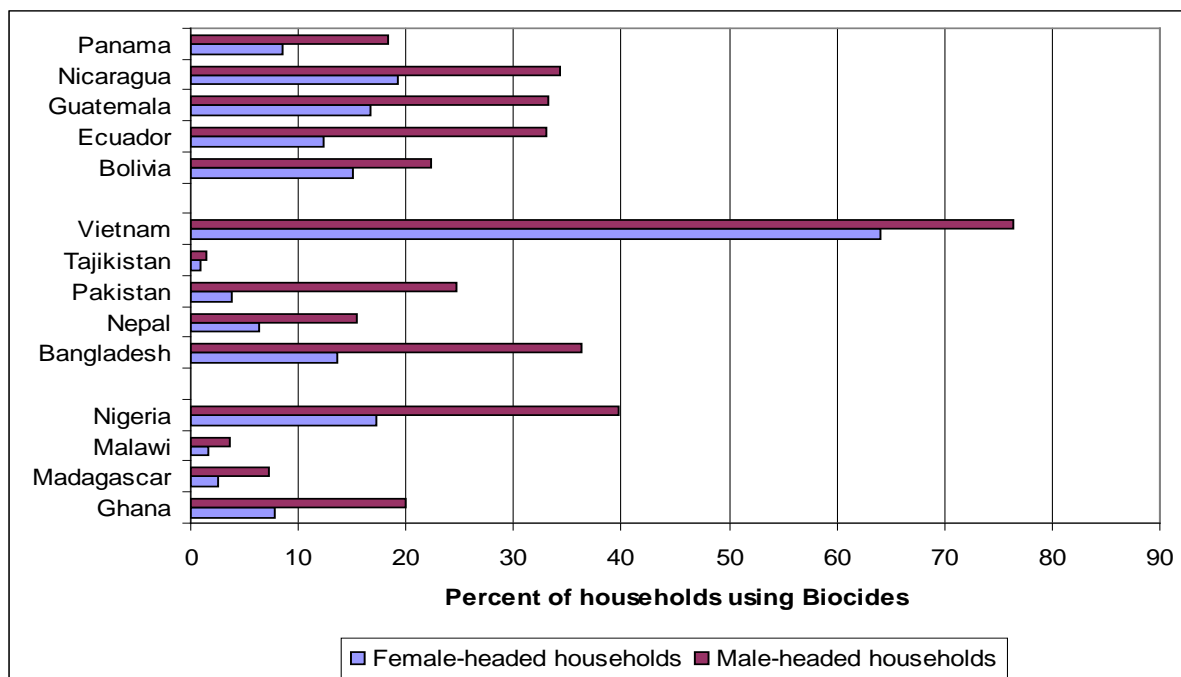
¹⁰ Additional research is available on mechanization and technology applied to post-harvest labor (see e.g. Mulokozi et al (2000), Paris, Feldstein and Duron (2001), and Singh, Singh and Kotwaliwale (1999)).

Figure 9 Fertilizer use by Female- and male-headed households in rural areas



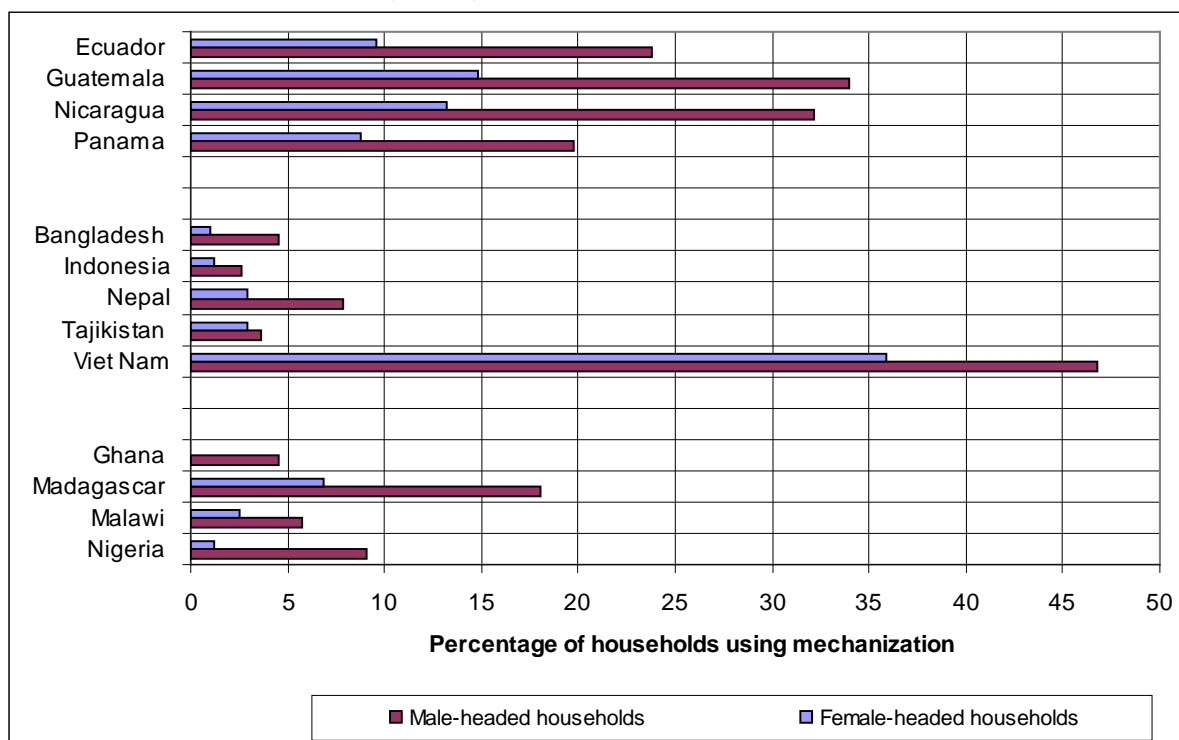
Source: FAO, RIGA-team and Anríquez (2010). Calculations using nationally representative household surveys. Differences between female and male-headed households are significant at the 95% confidence level for all countries.

Figure 10 Biocide use by female-headed (FHH) and male-headed households (MHH) in rural areas for selected countries.



Source: FAO, RIGA-team and Anríquez (2010). Calculations using nationally representative household surveys. Differences between female and male-headed households are significant at the 95% confidence level for all countries, except Tajikistan.

Figure 11 Mechanized equipment use by female-headed (FHH) and male-headed households (MHH) in rural areas for selected countries.



Source: FAO, RIGA-team and Anríquez (2010). Calculations using nationally representative household surveys. Differences between female and male-headed households are significant at the 95% confidence level for all countries.

Information and extension

Extension services encompass the wide range of services from communication to education activities provided by experts in the areas of agriculture, agribusiness, health and others and designed to improve productivity and overall wellbeing of rural populations. Agricultural extension services, can lead to significant yield increases (see for example Bindlish and Evenson, 1997); yet women are again found to be lagging behind in exploiting the benefits of extension services. Among other reasons, gender-specific time constraints may hinder their participation. However, frequently there is a gender bias on the part of the institutions providing extension - for example when there are no trained women to reach out to other women in social contexts where meetings between women and men from outside the family nucleus are not accepted. Also, to be fully beneficial for women farmers, extension services need to be tailored to their needs and specific constraints.

According to a 1988-89 FAO survey of extension organizations covering 97 countries only 5 percent of all extension resources were directed at women. Moreover only 15 percent of the extension personnel were female (FAO, 1993)¹¹. The access of female farmers to extension services and their preference for extension agents of a particular gender, differ by country. In Ghana, for example, the work of Doss and Morris's (2001) shows little difference in contact with extension agents between male and female farmers from MHHs, however female farmers in FHHs have much less contact. They also found that women farmers were willing to speak to agents of either gender. In Tanzania, on the other hand, the opposite is true: many female farmers prefer to talk to a female extension officer (Due, Magayane and Temu, 1997).¹² Safilio-Rothschild (1994) cites research showing that women do not necessarily prefer female extension officers and that female extension officers do not necessarily reach more women than male farmers. Okwu and Umoru (2009) find, for a sample of women farmers in Benue State, Nigeria, that the main source of advice was first their husbands, then women's groups and mass media and only finally extension agents.

However, even when women have access to extension services, the benefits may not be obvious. Moock (1976), for example, reported that women in Kenya do not benefit from their contact with extension agents in the same manner as men do, perhaps because of the strongly male-oriented nature of the services. Staudt (1978) found that women farmers did not benefit from extension services in western Kenya and relied more on informal women's groups. Also in Kenya Saito, Mekonnen and Spurling (1994) find that in extension contact contributes significantly and positively to output on male-managed plots, but not so on female-run land. Both for their Kenyan and Nigerian samples, they found that fewer female farm household heads had extension contact, but female household members who farm have more extension contact than do male household members. They argue that just having extension services will not automatically raise output, highlighting the need for extension services that are adapted to the need of female farmers.

Extension service agents tend to approach male farmers more often than female farmers because of the misperception that women do not farm and that extension advice will eventually "trickle down" from the male household head to all other household members. Moreover, extension services are often directed to farmers who are more likely to adopt

¹¹ A total of 115 countries were covered but only 97 collected gender disaggregated data for extension personnel.

¹² They found that in 1997 one-third of extension officers in Tanzania were women, up from almost zero 15 years prior.

modern innovations, i.e. farmers with sufficient resources in well-established areas. Women do not necessarily possess such resources and may therefore be bypassed by extension service providers (Meinzen-Dick et al, 2010).

A number of new and participatory extension approaches have been developed and tested in the past decade to move away from a top-down model of extension service provision to more farmer-driven services. In particular Farmer Field Schools have been shown to target women effectively and increase their uptake of innovations (Davis et al., 2009). Participatory approaches that encourage the communication between farmers and researchers can also lead to positive feedback loops that allow researchers to adjust innovations to local needs.

Modern information and communication technologies (ICTs) such as radio, mobile phones, computers and internet services can also play an important role in transferring information. ICTs offer opportunities for accessing and sharing information faster, networking, the mobilization of resources and educational purposes. Mobile phone subscriptions in developing countries doubled since 2005. To date 57 out of 100 inhabitants (up from 23 in 2005) in developing countries have a mobile phone subscription (International Telecommunication Union, 2010). These technologies may be beneficial for rural women who are restricted to travel to distant markets. Rural women may face barriers in accessing ICTs due to a lack of education and financial and time constraints. Locations that are convenient and appropriate for women to visit can also improve women's access (Best and Maier, 2007).

Farm labour

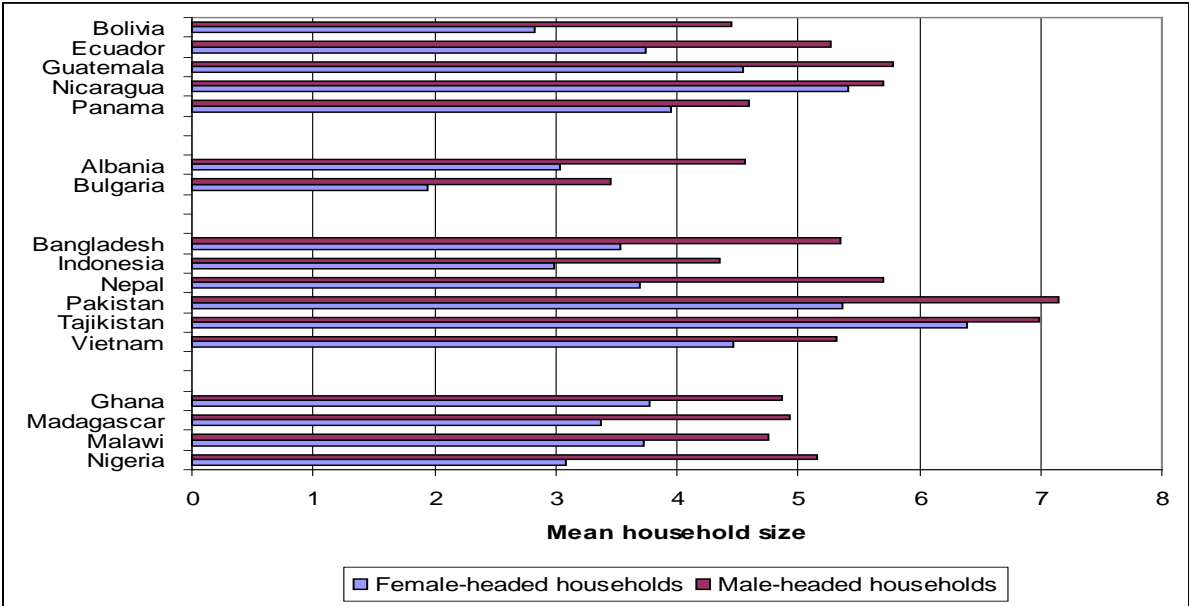
Labour availability depends on both the amount of family labour that a household can mobilize and the amount of labour that can be hired in local labour markets. Labour constraints can be more acute for both women and female-headed households than for men and male-headed households for a number of reasons. Women generally face gender-specific constraints as agricultural labourers and in hiring-in labour. Low levels of human capital, i.e. education, health and nutrition, are a constraint to women's labour productivity in agriculture and other sectors (Behrman, Alderman and Hoddinott, 2004) (Box 3). Some nutrition issues, such as iron deficiency which directly affects labour productivity and is widespread, are especially relevant to women (Quisumbing and Pandolfelli, 2010). Often there is a pronounced gender division of labour for particular agricultural tasks, meaning male and

female labour cannot be easily substituted. Moreover, women are time-constrained by domestic tasks such as care-giving and firewood and water collection (McGuire and Popkin, 1970; Quisumbing and Pandolfelli, 2010; Malmberg-Calvo, 1994; Ellis, Manuel and Blackden 2006; Kumar (1987)).

In addition, for demographic reasons female-headed households face more severe labour constraints than MHHs. Indeed, FHHs tend to be smaller – implying less availability of family labour - and usually display higher economic dependency ratios. Also, to the extent that FHHs may be financially constrained they have a limited ability to use the labour market to meet their demand for labour; however, the opposite may apply to *de facto* FFHs if recipient of remittances from absent male household members.

Figure 12 illustrates how the demographics of rural households put FHHs at a disadvantage in terms of own family labour. FHHs have on average fewer household members than MHHs.

Figure 12 Rural household demographics, by female-headed (FHH) and male-headed households (MHH) – Mean household size.



Source: FAO, RIGA-team. Calculations using nationally representative household surveys. Differences between male and female-headed households are statistically significant at the 95% confidence level for all countries

That women typically farm smaller plots does not mean that labour is not a constraint. For example, FHH smallholder maize farmers in Malawi put in about 10 percent less labour per

hectare than MHHs and that in particular the household head but also the offspring worked much more to make up most of the shortfall due to having less family labour (Takane, 2008).

Box 3 Nutrition and labour productivity

Adequate nutrition is an important factor in determining labour productivity. Nutrition is also linked to health because inadequate consumption of protein and energy as well as deficiencies in key micronutrients such as iodine, vitamin A and iron are key factors in the morbidity and mortality of children and adults.

Marcoux (2002) and others have noted that a widely held belief in an anti-female bias in nutrition has been formed. However, there does not appear to be clear and systematic evidence to support this hypothesis.

Women are generally considered vulnerable because of their energy and nutritional needs during pregnancy, lactation and menstruation as well as the impact of their nutritional status on their offspring. On the other hand, when they are not pregnant, lactating or menstruating their energy requirements are usually lower (typically 25 percent less) than those of men, although they require the same amount or even more of many nutrients than men require (FAO, 2000; Webb, Nishida and Darnton-Hill 2007).

For the Asia and Pacific region data is available for 15 countries and in most (eleven) of these, women show a higher incidence of CED than men.¹³ Also in Latin America and the Caribbean there appears to be a higher prevalence of CED among women. Data for male adults is mostly lacking for sub-Saharan Africa, preventing a gender comparison. Nevertheless, for the five countries for which data for both males and females is available, all show a higher incidence of CED among men than women. CED is likewise more prevalent among men than among women in North Africa and the Middle East. The reported data is consistent with data on underweight children (under 5 years of age): in Asia and the Pacific a larger share of girl children than boy children are underweight, whereas the converse is true in sub-Saharan Africa.

Consistent with these findings, Svedberg (1990) observed, in a study of more than 50 sub-Saharan African populations, that females (of any age) have at least as good health and nutrition status as males. The same was not the case for South Asia. He attributes this to female labour being a scarce factor in sub-Saharan Africa and, as such, considered of value, as opposed to many parts of South Asia. Webb, Nishida and Darnton-Hill (2007) survey 400 articles on vitamin A, iron, and iodine deficiency, 72 of which present information disaggregated according to gender and age. The study concludes that micro-nutrient deficiencies are context-specific and that generalizations about gender and age differences are difficult to make.

Overall, it appears impossible to draw the general conclusion that women are more malnourished than men. Although sex differences in nutritional status do exist, they are highly context specific.

More relevant are sex-specific nutritional requirements. For example women do face specific nutritional issues, such as iron deficiency anemia. Addressing these can make

¹³ Data is not shown here, but is available from the authors.

an important contribution to the quality of women's lives and their productivity (Behrman, Alderman and Hoddinott 2004).

The severity of a gender-specific labour constraint is confirmed by Dolan (2004), who identified labour as the most prevalent constraint facing women farmers, especially in FHHs. Having to balance their time between household and community responsibilities as well as their agricultural duties, women are disadvantaged in responding to price signals (Evers and Walters 2001). The differential access to labour can lead to reductions in both scale and efficiency of production. Udry (1996) found that lower productivity on female plots vis-à-vis male plots within households is attributable to labour and fertilizer (manure) tending to be more intensively applied on men's plots. Similarly, Holden, Shiferaw, and Pender (2001) found that female-headed households in Ethiopia display lower land productivity as a consequence of insufficient access to male labour and oxen and low degree of substitutability among factors of production. Similar results - that access to labour was part of the explanation for yield differences – were found by Gilbert, Sakala and Benson (2002) for Malawi. Tibaijuka (1994) finds that gender roles in agriculture, i.e. a lack of substitutability between men and women for certain tasks, lead to production losses in Tanzania. Finally, Dey Abbas (1997) finds that labour constraints are in part to blame for FHHs not adopting improved technology packages for fire-cured tobacco and improved maize, despite inducements of credit and extension.

Conclusions

In this paper we document that females, and female-headed households and farms lag their male counterpart in their access to and ownership of most inputs, assets and services that are relevant for productive activities in rural areas. Education has seen important improvements in gender parity, with women even exceeding male attainment levels in some regions, but in most regions even in this area females lag behind. This biased distribution of assets damages not only women: it is also a hindrance to increased social welfare. A better distribution of assets across genders would improve overall well-being. The main findings are:

Across regions and contexts women engaged in agriculture face gender-specific constraints that limit their access to productive inputs, assets, and services. This is observed for: land, livestock, purchased and modern inputs, financial services, extension services and labour.

Access to assets is often bundled: land ownership helps with securing credit while credit is necessary for investment and covering short-term expenses for inputs, in particular for cash crops. At the same time labour constraints in the family and the labour market make it more difficult for women to adopt more labour intensive technology, access land and take advantage of cash cropping possibilities.

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