



Gender inequalities in the Colombian cattle sector: an econometric analysis

Ana Milagros Pirela Rios, Manuel Francisco Díaz Baca, Karen Johanna Enciso Valencia, Natalia Triana Ángel & Stefan Burkart

To cite this article: Ana Milagros Pirela Rios, Manuel Francisco Díaz Baca, Karen Johanna Enciso Valencia, Natalia Triana Ángel & Stefan Burkart (2022): Gender inequalities in the Colombian cattle sector: an econometric analysis, *Development in Practice*, DOI: [10.1080/09614524.2022.2098256](https://doi.org/10.1080/09614524.2022.2098256)

To link to this article: <https://doi.org/10.1080/09614524.2022.2098256>



© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 23 Jul 2022.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

Gender inequalities in the Colombian cattle sector: an econometric analysis

Ana Milagros Pirela Rios, Manuel Francisco Díaz Baca , Karen Johanna Enciso Valencia , Natalia Triana Ángel  and Stefan Burkart 

ABSTRACT

Differences in access to productive resources, education, and credit can affect the productive capacity of cattle producers, especially women. This document analyses gender inequalities in the Colombian cattle sector using census information on the cattle activity, disaggregated at the territorial level. The econometric analysis evidences a negative relationship between the participation of women producers and cattle production at the municipal level. Our findings underscore the importance of improving access to quality education, credit, and technical assistance for rural women, which can benefit agricultural production and national economic growth at large.

ARTICLE HISTORY

Received 15 February 2022
Accepted 1 July 2022

KEYWORDS


Participation; gender and diversity; labour and livelihoods; diversity and inclusion; gender and intersectionality; rural livelihoods; social protection; region: Latin America and the Caribbean

Introduction

Cattle are the main anthropogenic form of land use in the world (FAOSTAT 2020). In addition to being a source of income, cattle are among the most valuable assets for rural households, which can be used as a source of wealth accumulation and as insurance against income shocks or insecurity (FAO 2010). For cattle farming, access to land is essential, as the animals live and feed in grazing areas (Ciparisse 2003). Land tenure allows households to face unexpected situations and makes it easier to access credit by serving as collateral (FAO 2004; Kaur and Kapuria 2020; Lawry et al. 2017). Land provides the necessary security to make long-term investment decisions, adopt new practices and technologies, and participate in decision-making (Lawry et al. 2017).

Women in particular face more complex barriers to accessing productive resources and participating in decision-making processes than men (FAO 2017). The disparities range from farm size and land tenure rights to natural resource availability (FAO 2002, 2004). Women cattle producers have less access to land, and when they do, it tends to be smaller and of poorer quality (Croppenstedt, Goldstein, and Rosas 2013; FAO 2010). Despite participating in most productive activities, their work is often invisible, particularly in the case of milk processing and animal care (Bhanotra et al. 2015; Gumucio et al. 2016; Najjar, Baruah, and Al-Jawhari 2019; Rivas Herrera, Ramírez, and Chacón Cascante 2017), harming their participation in decision-making at home and in their communities (FAO 2009). While limitations to access to quality education and formal credit affect rural households in general (FAO 2017; Kaur and Kapuria 2020), the obstacles are more severe for women. In fact, rural women have lower schooling rates, which limits their access to credit and leads to lower production levels (Croppenstedt, Goldstein, and Rosas 2013; de Castro and Teixeira 2012; Narayanan 2016; Silong and Gadanakis 2020).

The Colombian cattle sector is not exempt from gender disparities. Overall, rural women have lower labour participation and incomes (Ramírez et al. 2015). Cattle household activities are

CONTACT Stefan Burkart  s.burkart@cgiar.org  km 17 recta Cali-Palmira, Cali, Colombia

© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

marked by gender roles, with men focusing on highly profitable activities, such as marketing, and women on unpaid work, such as caring for and cleaning cattle (Gumucio et al. 2016). Gender roles also contribute to the unequal distribution of the domestic burden: rural women spend up to 18% of their daily time in unpaid care activities (Gumucio et al. 2016; Ramírez et al. 2015). At the same time, these social constructions limit the spaces for women's participation by reducing their negotiating power in decision-making in their homes and communities (Cable 1992; Eccles 1986; Haller and Hoellinger 1994), and restrict their time available for joining cooperatives and attending extension activities (Gumucio et al. 2016; Ramírez et al. 2015). Their financial inclusion is also lower, partly due to difficulties in accessing land or having formal rights over it (Gumucio et al. 2016).

Studies that document the gender differences between cattle producers in Colombia are scarce. Although there exists research with both qualitative (Gumucio et al. 2016; Triana Ángel and Burkart 2019) and mixed approaches (Ramírez et al. 2015), to date, there is no quantitative evidence that allows measuring the effect of gender gaps on cattle production. Likewise, there are no studies that analyse the differences with a spatial disaggregation that allows identifying regions with stark gender disparities.

This research seeks to explore how gender inequalities in Colombia's cattle sector affect household production, applying a quantitative and spatial approach based on a database that combines information on cattle production, household characteristics, and multidimensional deprivation (Multidimensional Poverty Index, MPI) at the departmental level.

Literature review

Characteristics of gender inequality in the cattle sector

Access to land is especially relevant for land-intensive activities such as cattle production (Ciparisse 2003; FAO 2004). In the short and medium-term, owning land provides security for households to make productive investments, allowing them to increase their productivity and income, and in the long term, helps them extend their assets beyond land and workforce (FAO 2004; Lawry et al. 2017; Smith 2004). Households with land tenure rights also have access to more affordable formal credit compared to households with no formal rights over land (Feder et al. 1988; Feder, Onchan, and Chalamwong 1988). When there is limited access to land, households are more susceptible to food insecurity and falling into poverty, since they have less capacity to respond to fluctuations (FAO 2002).

Although there are differences in access to opportunities and resources in agriculture at large, women face additional, pervasive difficulties. It is difficult for women to own land, and once they do, it tends to be smaller and of poorer quality (Croppenstedt, Goldstein, and Rosas 2013; FAO 2010). For example, in Colombia seven out of ten productive agricultural units are led by men, of which more than half are larger than three hectares (54.1%). However, only four out of ten of the farms led by women exceed three hectares (39.9%) (DANE and Ministry of Agriculture and Rural Development 2021). While men tend to obtain land through transactions, women tend to depend on inheritance (Croppenstedt, Goldstein, and Rosas 2013). Gender stereotypes reduce women's possibilities to inherit the land, as they tend to be seen as unfit leaders, incapable of handling production challenges (Triana Ángel and Burkart 2019). Agricultural generational transfer in both family businesses and land tenure focuses on first-born sons, excluding daughters (Cavicchioli, Bertoni, and Pretolani 2018; Grubbström and Sooväli-Sepping 2012). Additionally, there are differences in the type of farm animals, with men handling larger and women smaller livestock (FAO 2010), meaning that the value of household livestock assets is different (and unequal) according to the sex of the head of the household (Ramírez et al. 2015).

Rural women have lower schooling levels than men, and the time they spend on household chores reduces their participation in extension activities (FAO 2009, 2010). Their work in productive activities is less recognised, as it is seen as an extension of domestic work and not as an essential task

for economic survival (Triana Ángel and Burkart 2019). The invisibility of their work and the time restrictions it implies translate into lower adoption of new practices and technologies, but also less participation in (productive) decision-making (FAO 2009), even though women are primarily responsible for milk processing and cattle care (Bhanotra et al. 2015; Najjar, Baruah, and Al-Jawhari 2019; Rivas Herrera, Ramírez, and Chacón Cascante 2017). In mixed crop-livestock systems, the economic benefits tend to be concentrated in men, who are responsible for milk marketing and own the cattle (Najjar, Baruah, and Al-Jawhari 2019).

There exist gaps in access to credit and the sources from which it comes, with women being more likely to face constraints. A field study in Nicaragua indicates that 23% of rural women but only 17% of their husbands have restrictions in accessing credit (Fletschner 2009). The use of informal credit predominates (USAID, UT Econometría, and Marulanda Consultores 2014), particularly to finance small-scale agricultural activities (Trivelli and Venero 2007). When it comes to formal credit, there are more male beneficiaries, as women resort to informal credit, with lower amounts and more restrictive interest rates (Silong and Gadanakis 2020; USAID, UT Econometría, and Marulanda Consultores 2014). These gaps remain as such for institutional credit sources. Even when women obtain financing, the rate of return on credit is higher for men, contributing to widening the gender gap in income (Sam 2021). These differences not only affect women individually but the entire rural household. Household efficiency can drop by up to 11% when women encounter obstacles in meeting their capital needs (Fletschner 2008).

Altogether, limited access to production factors and credit, restrictions on decision-making, lower schooling rates, and time restrictions become obstacles for women producers to match male production levels, thus reducing their income (FAO 2010). Even though women represent about half of the agricultural labour force in developing countries (43%), the division of labour assigns them the care of livestock or the processing of milk and concentrates ownership and marketing of animals in men, which prevents women from receiving the economic benefits of their work (Croppenstedt, Goldstein, and Rosas 2013; Najjar, Baruah, and Al-Jawhari 2019). This division, marked by gender roles and cultural aspects, reduces the bargaining power of women producers (Najjar, Baruah, and Al-Jawhari 2019). The limited empowerment of women in cattle farming is a critical factor, both because of its economic implications and its relationship with the nutritional status of households (Price et al. 2018; Smith et al. 2003). Gender gaps not only restrict women's contribution to family well-being, but also harm agricultural production, economic growth, and the reduction of inequality (FAO 2010; Triana Ángel and Burkart 2019).

The Colombian cattle sector and gender gaps

Cattle are the most important agricultural activity in Colombia, representing around 30.6% of the national agricultural GDP, 19% of the agricultural, and 6% of the national employment (DANE 2019). It surpasses the values of coffee and palm oil production by three and eight times, respectively (Fedegán 2021). In economic and social terms, the Colombian rural sector has stark gender differences. Rural women have lower participation in the labour market, with an employment rate of 28.3% compared to 72.2% for men. Labour income also differs, with an average monthly salary of \$294,127 Colombian Pesos for women and \$580,000 for men, as of 2013 (Ramírez et al. 2015). Within cattle-producing families, roles and tasks are heavily gendered. While men focus on commercialisation, women spend part of their time on unpaid activities, such as cleaning and caring for cattle (Gumucio et al. 2016). Combined with divergent domestic roles and activities, women have less time available to work in production and commercialisation, participate in cooperatives and associations, and attend extension activities (Gumucio et al. 2016; Ramírez et al. 2015).

Despite the growing empirical evidence supporting that female participation in credit programmes leads to lower levels of investment portfolio risk (e.g. in terms of lower write-offs and

lower provisions) (D'Espallier, Guérin, and Mersland 2011), the participation of women in microcredit programmes remains low. In addition to informality in land ownership, which restrict women's ability to access formal credit, invest, and participate in decision-making (Gumucio et al. 2016), some studies have revealed other limitations inherent to a dispersed rural context and failures in microcredit governance systems that prevent institutions from reaching a larger fraction of women and support large producers with lower transaction costs for obtaining information, which in some way excludes the poorest households and those with less knowledge of complex financial products (Afriyie et al. 2020; Sarangi 2007; Sharma 2008). Indeed, financial literacy has been identified as a strong predictor of demand for financial services (Afriyie et al. 2020; Brown 2001; Cole, Sampson, and Zia 2009).

Afriyie et al. (2020) explore other contextual factors that explain the low request for microcredit by women, among which the influence of conjugal partners in the investment of the borrowed funds stands out (in the initial decision-making or to decide whether to take a microcredit). On some occasions, women do not exercise full control over both the initial capital of the loan and the financed business, which can discourage their participation in applying for microcredits.

The cultural context and the characteristics of the Colombian economy also determine gender gaps in cattle farming. Lack of empowerment, social relationships, and patriarchal authority are among the key barriers (Ramírez et al. 2015). This shows that in addition to barriers affecting men and women simultaneously, cultural factors also hold a relevant role in the origins of gender gaps in the Colombian cattle sector (Gumucio et al. 2016; Ramírez et al. 2015; Triana Ángel and Burkart 2019).

Material and methods

Data

Different sources of information on cattle production, sociodemographic contexts, agricultural credit, and poverty were gathered to develop the descriptive analysis and the estimation of the econometric model. Table 1 presents the generalities of the consulted databases. Although these sources provide information for the agricultural sector in general, our descriptive and econometric analyses focus on the agricultural production units (UPA¹) and cattle farmers.

Econometric model

This section presents the specifications of the linear regression models that relate gender with cattle production at the municipal level. The estimates use information from cattle producers obtained

Table 1. Sources of information on cattle production and socio-economic conditions of cattle producers.

Database	Source	Disaggregation level	Period	Variables
National Agricultural Survey (ENA)	DANE (2014b, 2015b, 2016, 2017)	Departmental, gender	2014–2017	Productivity of the UPA, characteristics of the producer (gender, age, educational level), producer type and land use, access to credit
National Agricultural Census	DANE (2014a)	Departmental	2014	Characteristics of the UPA (size, workforce, productivity, number of animals) and producers (education, access to credit, technical assistance)
Multidimensional Poverty Index (MPI) adjusted for rural areas	DANE (2015a)	Departmental	2014	Percentage of people living in multidimensional poverty
Agricultural credit	FINAGRO (2017)	Departmental	2017	Number of cattle loans granted and total value for each level of disaggregation

from the 2014 National Agricultural Census. The equations are as follows:

$$\begin{aligned} prod_i = & \beta_0 + \beta_1 part_women_i + \beta_2 area_cattle_i + \beta_3 cred_cattle_i \\ & + \beta_4 labor_cattle_i + \beta_5 technical_assistance_i + \varepsilon_i \end{aligned} \quad (1)$$

$$\begin{aligned} part_prod_i = & \beta_0 + \beta_1 part_women_i + \beta_2 area_cattle_i + \beta_3 cred_cattle_i \\ & + \beta_4 labor_cattle_i + \beta_5 technical_assistance_i + \varepsilon_i \end{aligned} \quad (2)$$

Where $prod_i$ represents the cattle inventory (heads) or the milk production (litres) of a given r i. $part_prod_i$ indicates the share of the cattle inventory or milk production in a municipality of the national production. $part_women_i$ is the percentage that women represent of the total number of cattle producers. $area_cattle_i$ is the average size of cattle UPAs (hectares), and $labor_cattle_i$ is the average number of workers in an UPA. $cred_cattle_i$ indicates the percentage of credits granted to cattle producers in a municipality concerning the total cattle credits granted in the country, and $technical_assistance_i$ is the percentage of cattle UPAs that received technical assistance in good cattle practices. ε_i is the stochastic error that captures unobservable effects.

Limitations

Among the limitations of this research is the data scarcity on the agricultural sector disaggregated by gender and at the territorial level. Although the consulted census data allows analysis by gender, its cross-sectoral nature prevents observing changes in cattle production over time, which could provide more information on the dynamics within UPAs. Likewise, it does not provide variables associated with beef production. A possible alternative would be to use the ENA, which is available for 2014–2017, but is only disaggregated at the departmental level for 2017 and does not have information on the size of the UPAs or the labour employed. This makes the census source preferable, both for its completeness and representativeness at the municipal level.

We counteracted the potential problem of omitted variables in the linear regression model by including information on the productive activity of the UPAs. Specifically, the model includes variables on the size of the UPA, access to credit, labour, and technical assistance, which help control for differences between cattle producers. Additional characteristics that could be included in future research are the educational level of producers (municipality level), poverty, access to roads and markets, and the physical capital existing in UPAs. Likewise, climatic and geographical variables could be incorporated, such as rainfall, temperatures, or altitudes since they can affect production.

The applied methodology prevents us from establishing causal relationships between gender and cattle production. Linear regression does, however, allow statistically significant correlations to be established that help us understand the direction of the relationship. Finally, the quantitative nature of this study does not allow the construction of qualitative results that analyse the social and cultural contexts in which cattle producers operate.

Results

Descriptive analysis

Figure 1 shows that most cattle producers in Colombia are men, with participation between 74.8% and 77.6% of the total number of producers, while women only represent between 22.3% and 25.2%. Although the participation of women has increased slightly between 2014 and 2017, most of the UPAs are still headed by men. Data shows that about half of the women producers are the main caregivers of their families, with an average participation of 42.2% for 2014–2017. Figure 2 shows a dispersion in the distribution of women-led UPAs at the departmental level, where some regions of the

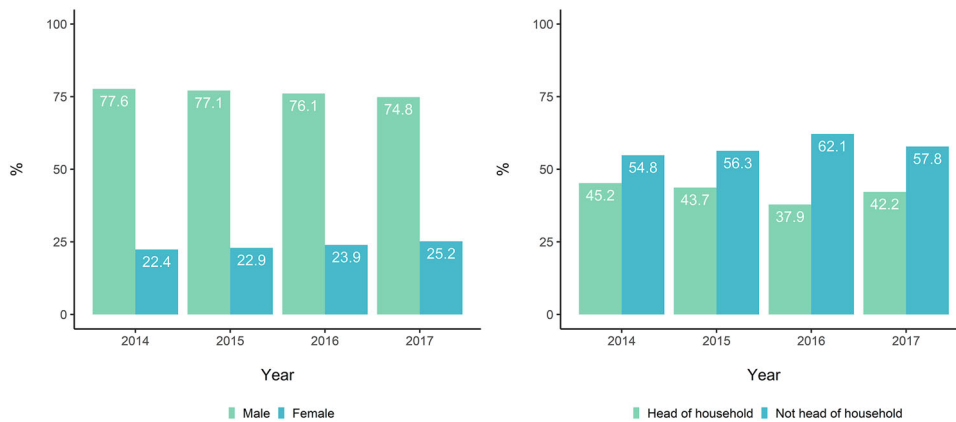


Figure 1. Gender distribution among Colombian cattle farmers (left) and share of female producers that are also heads of household (right).

country, such as the Caribbean, have low percentages (between 9.6% and 19.2%), while others, such as the Andes, concentrate a greater number (between 24.8% and 38.5%).

Another dimension is the participation of women in decision-making within the UPAs.² We found that in cattle UPAs, women make 21.7% of the production decisions, while men occupy 78.3%. Female participation in the cattle sector is, therefore, not only low in terms of leadership but also has a lower weight in production decision-making.

Regarding farm size, in 2014, 56% of the UPAs led by men and 69% of the ones led by women ranged between 0 and 100, respectively 76% and 84% between 0 and 300 hectares. In 2017, the share of smaller UPAs was even higher with 84.1% of the UPAs led by men and 91% of the ones led by women ranging between 0 and 100, respectively 85.5% and 92.6% between 0 and 300 hectares. Gender differences are also observed in the largest UPAs (1,000–2,000 hectares) which made up 6.3% of the UPAs led by men and only 2.8% of the ones led by women. This indicates that women, on average, operate on smaller farms.

In [Figure 3](#) (left side), we can observe a concentration of granted cattle credits in the departments of Antioquia, Santander, Boyacá, Cundinamarca, Cauca, Nariño, and Caquetá, which each represent between 4.1% and 19% of the granted cattle credits at the national level. The departments with the highest levels of poverty ([Figure 4](#)) are also those with the lowest participation in cattle credits: La Guajira, Chocó, Vichada, Guainía, and Vaupés each receiving less than 0.5% of the granted credits at the national level. When analysing access to credit by gender, it is found that women requested fewer credits in 2017 than men (13.6% versus 8.9%). There exist, however, no gender differences in the percentage of granted credits (~93% each).

When it comes to the spatial distribution of credits granted to female producers ([Figure 3](#), right side), it is found that most are concentrated in the departments of Boyacá (14.5%), Huila (13%), Cundinamarca (12.6%), Tolima (10.9%), and Nariño (10.6%). In turn, the departments with the lowest participation are Chocó (0.04%) and Magdalena (0.09%), which might be associated with the high incidence of multidimensional poverty in 2017 ([Figure 4](#)).

Gender gaps are also manifested in the educational level of cattle producers. [Figure 5](#) shows that most producers only have elementary education (61.2% of men and 66.8% of women in 2016). Although the participation of other educational levels is low, in 2016 and 2017, there were more men with high school (18.7%) and university (10.3%) degrees than women (17% and 6.6%).



% of the productive units with female producers



Figure 2. Share of UPAs with female producers at the departmental level.

Econometric analysis

Table 2 shows the relationship between cattle inventory and milk production as dependent variables and gender. In all model specifications, there is a negative and significant relationship visible, indicating that an increase in women's participation could decrease both the municipal cattle inventory and milk production, both in absolute and relative terms. On average, an increase of 1 percentage point (pp) in women's participation would lead to a decrease of 330 cattle heads and 240 litres of milk, while an increase of 10% would lead to a decrease of 0.02% in the municipality's share of the national cattle inventory and milk production.

A positive relationship is found between the size of the UPA and cattle production, indicating that municipalities with larger UPAs have higher cattle production. An increase of 0.02 hectares in the UPAs would lead to an increase of 20 cattle heads at the municipal level, which might be related to the higher purchasing power of larger producers, allowing them to invest in the productive

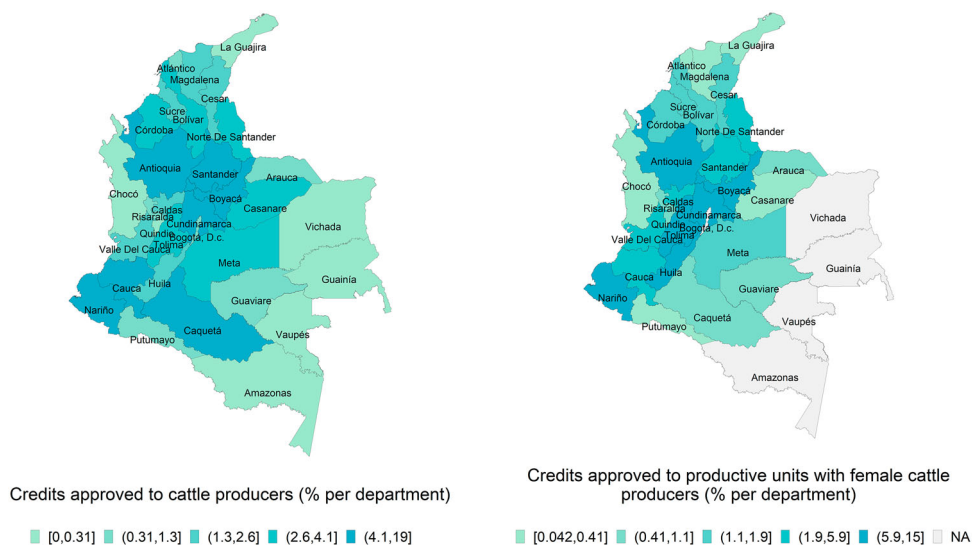


Figure 3. Departmental share of approved cattle credits (left side) and of cattle credits approved to UPAs with female producers (right side).

capacity (cattle inventory) of their farms. Similarly, given the extensive nature of Colombian cattle ranching, having larger farms also allows for more cattle, even though stocking rates might be low.

The strongest relationship, however, corresponds to access to credit. An increase of 1% in the percentage of granted cattle credits would lead to a growth of 0.19% of the cattle inventory and 0.28% of milk production at the municipal level. This positive relationship may be attributed to higher possibilities for investments in technology, the purchase and care of cattle, and the hiring of additional labour force, in addition to smoothing unexpected shocks – translating into higher production. The number of cattle workers in the UPAs is also related to an improvement in the cattle inventory. Keeping the other factors constant, if the average number of UPA workers in a municipality increases by 1 pp, the municipal inventory can grow by 2,720 cattle heads. Hiring more workers contributes to

Table 2. Gender inequalities in cattle farming. Relationship between the dependent variables cattle inventory and municipal milk production, and the number of female producers.

	Dependent variable			
	Cattle inventory (thousand heads) (1)	Cattle inventory (%) (2)	Milk production (thousand litres) (3)	Milk production (%) (4)
Female producers (%)	-0.33*** (0.09)	-0.002*** (0.001)	-0.24*** (0.06)	-0.002*** (0.0004)
Size of the UPA (ha)	0.02*** (0.01)	0.0001*** (0.0000)	0.01 (0.004)	0.0000 (0.0000)
Approved agricultural credits (%)	34.26*** (6.55)	0.19*** (0.04)	42.27*** (4.49)	0.28*** (0.03)
Agricultural workers (#/UPA)	2.72*** (1.04)	0.02*** (0.01)	0.46 (0.71)	0.003 (0.005)
Use of good practices (%)	-0.62*** (0.19)	-0.003*** (0.001)	-0.23* (0.13)	-0.002* (0.001)
Mean of the dependent variable	15.98	0.09	13.92	0.09
Mean female producers (%)	21.92	21.92	21.92	21.92
Year	2014	2014	2014	2014
Observations (N)	1,102	1,102	1,102	1,102

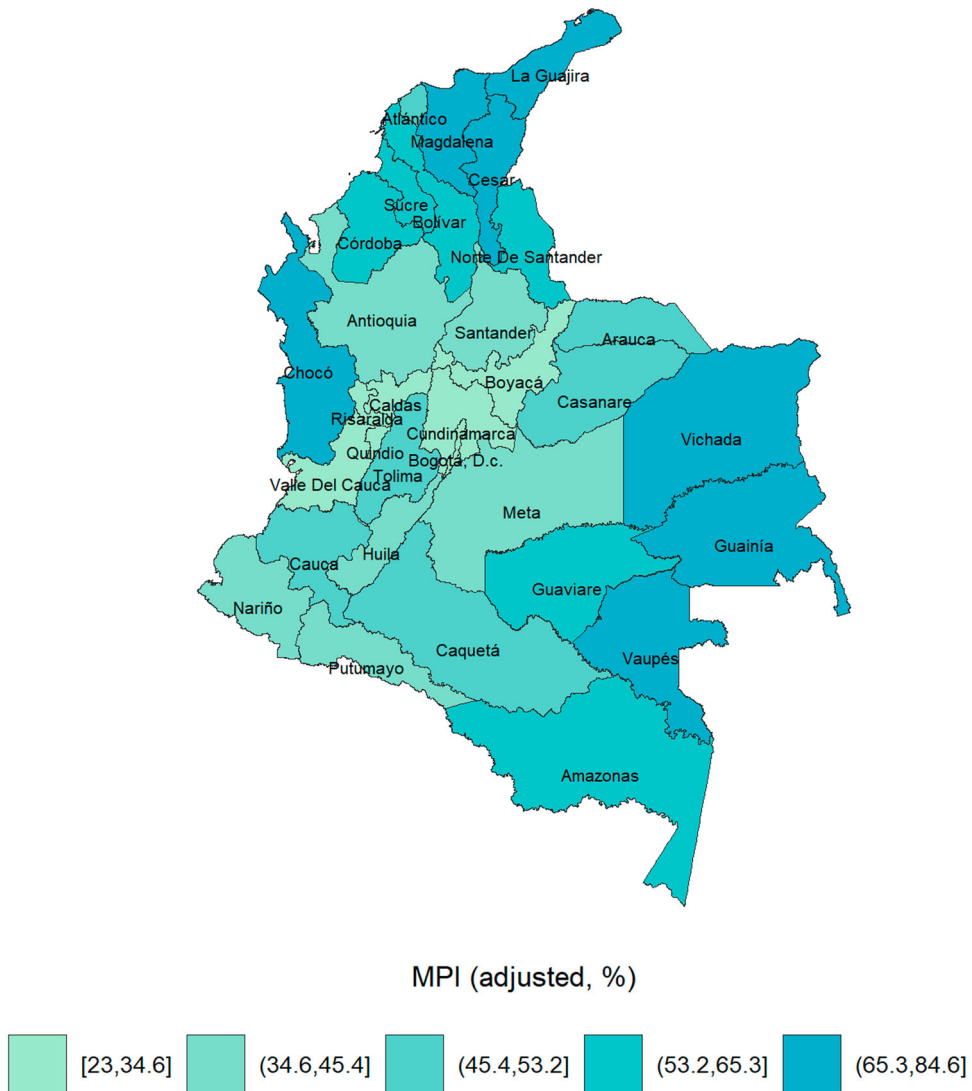


Figure 4. Multidimensional Poverty Index (MPI) adjusted for rural areas, by department.

improving the production parameters of the existing cattle inventory, which can lead to improved income and subsequent expansion of animal numbers.

Technical assistance with good cattle practices is the only variable that reports a negative relationship with cattle production. An increase of 1 pp of UPAs that receive technical assistance could reduce the municipal cattle inventory by 620 heads and milk production by 230 litres.

Robustness tests

The results of the previous section analyse the relationship between cattle production and gender of the main producer at the municipal level. It is possible, however, that the lower participation of women in cattle production (between 22 and 25%) affects these estimates. To verify the negative relationship between gender participation and production, we reconstruct the main estimates at the UPA level, so that the gender of the producer is represented by a dichotomous variable that

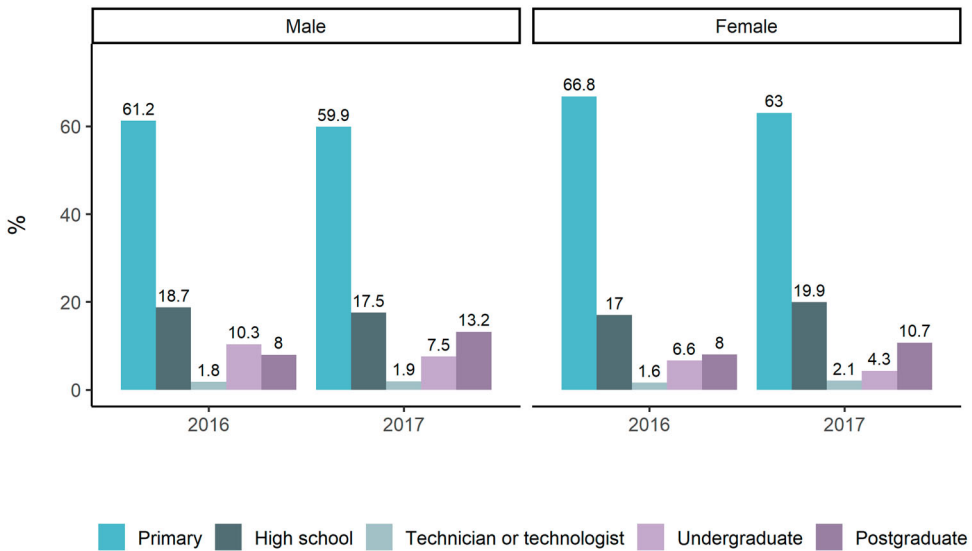


Figure 5. Educational level of male and female cattle producers.

takes the value of 1 when the main producer is a woman. The other control variables are maintained: the agricultural area of the UPA in hectares, access to credit (the UPA reports having approved agricultural credit), the number of agricultural workers of the UPA, and access to technical assistance in good cattle practices (the UPA reports having received assistance on these issues).

Table 3 presents the results of the estimates at the UPA level. Column 1 focuses on cattle inventory and column 2 on milk production, both in thousands. We find that women headed UPAs have (on average) fewer head of cattle and lower milk production. Therefore, the negative relationship between cattle production and gender that we find in Table 2 is maintained when we perform the analysis at the municipal level. The results suggest that women headed UPAs have on average of 20 cattle less and produce 10 litres of milk less than those headed by men. The positive effect between agricultural area and production is sustained, as well the one related to the number of workers (larger UPAs or with more workers report more animals and milk production). However,

Table 3. Relationship between cattle inventory and milk production in UPAs according to the gender of the principal producer.

	Dependent variable:	
	Cattle inventory (thousand heads) (1)	Milk production (thousand litres) (2)
Female producer (yes = 1)	-0.02*** (0.001)	-0.01*** (0.0004)
Size of the UPA (ha)	0.0003*** (0.0000)	0.0001*** (0.0000)
Approved agricultural credit (yes = 1)	-0.01*** (0.001)	-0.01*** (0.001)
Agricultural workers UPA (yes = 1)	0.004*** (0.0001)	0.003*** (0.0000)
Receives technical assistance in good cattle practises (yes = 1)	0.01*** (0.001)	0.02*** (0.001)
Mean of the dependent variable	0.04	0.03
Year	2014	2014
Observations (N)	402,906	402,844

Notes: Standard errors are robust to heteroskedasticity. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Data source: National Agricultural Census (DANE 2014a).

things change for technical assistance: at the individual level, production would benefit from receiving technical assistance. The opposite happens with credit. Access to agricultural credit is associated with UPAs with lower cattle inventory and milk production.

Discussion

This research delves into the gender gaps in agriculture using the case of cattle ranching in Colombia. The results show differences in the participation of men and women in multiple aspects. Specifically, it is found that men predominate cattle farming, and women's participation is generally low. This may originate from the difficulties women face in inheriting family businesses and land, given the gender biases in the generational transfer that favour first-born sons over daughters (Cavicchioli, Bertoni, and Pretolani 2018; Grubbström and Sooväli-Sepping 2012). Likewise, women have less weight in productive decision-making. This corresponds to the findings of a study on the participation of women cattle producers in Costa Rica, who actively contribute to productive work but do not have full participation in decision-making (Rivas Herrera, Ramírez, and Chacón Cascante 2017), and studies from Colombia indicating that family structures and gender roles limit the time they can dedicate to decision-making and associativity (Ramírez et al. 2015). Likewise, gender roles can impede women leadership by assigning work to women in private spaces (such as caring for the home and animals) and to men in public spaces (such as the sale and marketing of products) (Bhanotra et al. 2015; Gumucio et al. 2016; Najjar, Baruah, and Al-Jawhari 2019; Rivas Herrera, Ramírez, and Chacón Cascante 2017). This division reduces women's economic power and can be an additional obstacle for them to be the main decision makers.

The differences also extend to education, access to credit, and farm size. Although farmers in general experience difficulties in obtaining education and formal credit, the barriers faced by rural women are even more complex (FAO 2010, 2017; Kaur and Kapuria 2020). We observed that there are fewer women producers with university degrees and more with primary school studies than men. This echoes findings by FAO (2010) on the lower educational level of women farmers. There is also a greater concentration of women in smaller UPAs. Likewise, women tend to request less formal credit, but once they do, no gender differences are found in the percentage of granted credits.

The aforementioned factors can affect the production of women-led UPAs. The estimates of the econometric model reveal a negative relationship between cattle production and women's participation at the municipal level. Municipalities with more women-led UPAs tend to have lower cattle inventories and milk production. This coincides with empirical evidence from other developing countries (Machina and Lubungu 2019; Njuki and Mburu 2013; Waithanji, Njuki, and Bagalwa 2013). Cattle households in Kenya, Tanzania, and Mozambique feature only 25% of women who manage and own cattle, and the number of animals they own is lower than that of men (Njuki and Mburu 2013). In Zambia, women belonging to men-headed households have fewer cattle than male family members, and women-headed/women-only households have fewer cattle than men-headed households (Machina and Lubungu 2019).

There are multiple hypotheses about the reasons for the lower cattle inventory when it comes to women. On the one hand, cultural differences and gender roles can hinder women's access to cattle, considering that they play a specific role in production unrelated to administration and commercialisation, but focused on care and cleaning (Gumucio et al. 2016; Machina and Lubungu 2019; Triana Ángel and Burkart 2019). On the other hand, time constraints caused by housework and limited access to information/technical assistance can also impair their ability to maintain and increase cattle inventories (Gumucio et al. 2016; Machina and Lubungu 2019). Farm size is also a determinant of the number of animals, and since farms managed by women tend to be smaller, land can be a limiting factor for production and income generation (Croppenstedt, Goldstein, and Rosas 2013; Machina and Lubungu 2019). These factors, combined with the lower educational level and

access to credit found (descriptive analysis), help us understand the reasons behind the negative relationship between cattle production and women's participation (econometric analysis).

We also found a negative relationship between technical assistance in good cattle practices and cattle production. Although extension and technical assistance services have been identified as productivity promoters and household income (Anderson and Feder 2004), the empirical evidence on their effectiveness is mixed (Anderson and Feder 2003). Their success depends largely on how they are provided and the conditions of farmers (Anderson and Feder 2003, 2004).

Also, it depends on their relevance in the context of rapidly advancing telecommunications in rural areas (Alex et al. 2004; Farrington 1994). This has led to some countries finding positive results from the transmission of information, while others observed difficulties in maintaining well-trained and up-to-date extension workers, leading to negligible impacts on production (Anderson and Feder 2004; Benson and Jafry 2013). The negative relationship found in this study may originate from the limited effectiveness of the service, either because cattle producers receive it infrequently, the information is not relevant to their sociocultural and agro-ecological context, or simply because it is outdated.

The wide coverage of the used census data allows the identified relationships to have national scope and manages to represent the situation of cattle producers in rural Colombia. Although the applied methodology does not allow establishing a causal relationship between gender and cattle production, our quantitative findings are in line with the results of other studies conducted in Colombia with qualitative (Gumucio et al. 2016; Triana Ángel and Burkart 2019) and mixed approaches (Ramírez et al. 2015).

Considering our results, it is key that future research on gender disparities in agriculture and livestock consider information on the characteristics of the producers, as well as other variables associated with the environmental, economic, cultural, and social contexts of the municipalities in which they live. This can be achieved through the application of mixed methods.

This study also highlights the importance of including a gender approach in policymaking to improve rural women's access to land, education, credit, technical assistance, and associativity. Strategies that promote the development in rural areas of developing countries should always include a multiplicity of efforts that must be synergistically articulated. This should not only include the search for objectives, but also control actions in the face of the creation of unexpected dynamics resulting from processes of social intervention. In this sense, it is important to pay attention to strategies such as facilitation of access to credit, which is a useful tool to promote agricultural activities and the empowerment of women in rural areas. Yet, it makes no sense when it is not adequately accompanied by comprehensive strategies that seek to transform other dimensions of the rural context, or in other words: an increase in resources for and access to credit does not solve the structural problems that lead to discrimination and hoarding. In this way, it is not only necessary to support the UPAs led by women with low interest rates to increase their capacities to acquire cattle and productive inputs, but also to accompany them with financial education programmes (for men and women) that contain a financial component to avoid the "genderisation of credit" and the proper management of the resources granted, seeking to prevent dynamics observed in the literature (Guérin, Morvant-Roux, and Villarreal 2014; Guérin, Nordman, and Reboul 2019), such as the diversion of women's credits for purposes of social reproduction and the stress derived from non-payment of debts.

Furthermore, improving the educational level and the access to quality information/technical assistance can create opportunities for women to generate income and accumulate capital, in addition to increasing their bargaining power over household resources. The presence of gender roles in the division of productive activities in cattle households highlights the importance of awareness-raising activities with both men and women, so that women begin to be recognised as capable of managing and commercialising end-products. In this way, women can increase the compensation for their work and manage the income from their activities, which would benefit their decision-making power at home and in their community. In conclusion, improving the production capacity

of women not only impacts livelihoods, but also boosts production at the national level, contributes to the development and economic growth, and helps reduce inequalities in the sector.

Conclusions

By using census information of national coverage, credit data, and annual statistics of the agricultural sector, this research explored how gender inequalities in the Colombian cattle sector affect household cattle production. Cattle is a key activity for the development and economic growth of (rural) Colombia. Among producers there exist, however, gender differences in access to education, productive resources, and credit, which affect their production capacities.

The descriptive analysis shows that only one out of four cattle producers are women, but that nearly half of them are heads of households responsible for the well-being of their families. Women also participate less than men in production decision-making, tend to have lower educational levels, request fewer agricultural credits, and have smaller farms. The econometric analysis found that the municipalities where there are more female producers have lower milk production and cattle inventories, which coincides with the empirical evidence for other developing countries and may originate in the difficulty of women in accessing education, financing, and land, but also in time restrictions caused by domestic work, limiting their participation in extension activities and cooperatives. Likewise, the existing gender roles burden women with unpaid care and cleaning activities, instead of the administration and commercialisation of cattle, directly affecting their ability to own cattle.

Our results bring to consideration how gender gaps in agriculture, and particularly in the cattle sector, have the potential to affect national agricultural production, and with it the well-being of rural families that depend on it, highlighting the importance of policy decisions that feature a gender approach. Through an active intervention of the State, particularly through education programmes, credits for rural women, awareness creation of gender roles, and land tenure/inheritance regulations, a first step can be taken towards reducing gender gaps.

The quantitative approach and national coverage of this study make it an important contribution to the literature on gender gaps in the Colombian cattle sector and developing countries. This is key, given that, to date, there are no known studies that combine census information with credit data and agricultural characteristics to analyse gender disparities among cattle producers with a spatial approach. Future research could benefit from combining quantitative and qualitative approaches that consider the sociocultural and agroecological contexts of producers since they can permeate gender-related production differences.

Notes

1. UPA: Unidad Productiva Agropecuaria (Agricultural Production Unit). The UPAs are defined by the National Administrative Department of Statistics (DANE 2014a) as the organisational unit of agricultural production, in which agricultural, forestry, and/or aquaculture goods are being produced.
2. We considered the participation of UPA members in decision-making according to their gender, based on information from 2017. The measure is a percentage that compares the number of individuals by gender who make decisions over the total of individuals within the UPA. The indicator follows the formula $Participation_g = 100 * Individual_g / Total_Individuals_UPA$, where g represents the gender of the individuals involved in decision-making.

Acknowledgements

This work was carried out as part of the CGIAR Research Program on Livestock and the CGIAR Initiative on Livestock, Climate and System Resilience. We thank all donors who globally support our work through their contributions to the CGIAR System. The views expressed in this document should not be taken as the official views of these organizations.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by CGIAR Research Program on Livestock; CGIAR Initiative on Livestock, Climate and System Resilience.

Data availability statement

The data that support the findings of this study were derived from the following resources available in the public domain: [DANE 2014a; DANE 2015a; DANE 2017: Censo Nacional Agropecuario – CNA, <https://www.datos.gov.co/widgets/6pmq-2i7c>; DANE 2014b; DANE 2015b; DANE 2016: Encuesta Nacional Agropecuaria – ENA <https://www.dane.gov.co/index.php/estadisticas-por-tema/agropecuario/encuesta-nacional-agropecuaria-ena>; FINAGRO 2017: Estadísticas <https://www.finagro.com.co/estad%C3%ADsticas/estad%C3%ADsticas>]. The extracted and curated data are available on request from the corresponding author, SB.

Notes on contributors

Ana Milagros Pirela Ríos is an economist and quantitative research specialist focused on data-driven approaches to answer questions in applied economics. She has experience in Latin America.

Manuel Francisco Díaz Baca is a political scientist and economist focused on public policy analysis, qualitative adoption studies, and macro-analyses for the livestock sector in developing countries. He has experience in Latin America and the Caribbean.

Karen Johanna Enciso Valencia is an economist focused on livestock economics, and particularly on supporting the adoption of improved forages for cattle feeding. She has experience in Latin America and the Caribbean, and Eastern Africa.

Natalia Triana Ángel is an anthropologist and gender scientist focused on qualitative gender and youth studies, rural education, and historical analyses for the livestock sector in developing countries. She has experience in Latin America and the Caribbean, and Eastern Africa.

Stefan Burkart is a socio-economist and senior scientist focused on research that supports technology adoption along livestock value chains in developing countries. He has experience in Latin America and the Caribbean, Eastern and Southern Africa, Southeast Asia, and Europe.

ORCID

Manuel Francisco Díaz Baca  <http://orcid.org/0000-0001-8996-5092>

Karen Johanna Enciso Valencia  <http://orcid.org/0000-0003-3264-6343>

Natalia Triana Ángel  <http://orcid.org/0000-0003-4427-0355>

Stefan Burkart  <http://orcid.org/0000-0001-5297-2184>

References

- Afriyie, Kwadwo, John Kuumuori Ganle, Alexander Yao Segbefia, Pauline Kamau, and Grace Wamue-Ngare. 2020. "Contextual Factors Which Affect the Success of Microcredit Programs Among Women." *Journal of Developing Societies* 36 (2): 229–254. doi:10.1177/0169796X20909032.
- Alex, Gary, Derek Byerlee, Marie Helene-Collion, and William Rivera. 2004. *Extension and Rural Development: Converging Views on Institutional Approaches*. Agriculture and Rural Development Discussion Paper 4. Washington, DC: World Bank.
- Anderson, Jock Robert, and Gershon Feder. 2003. *Rural Extension Services*. World Bank Policy Research Working Paper, 2976. Washington, DC: The World Bank.
- Anderson, Jock Robert, and Gershon Feder. 2004. "Agricultural Extension: Good Intentions and Hard Realities." *The World Bank Research Observer* 19 (1): 41–60. doi:10.1093/wbro/lkh013.
- Benson, Amanda, and Tahseen Jafry. 2013. "The State of Agricultural Extension: An Overview and New Caveats for the Future." *The Journal of Agricultural Education and Extension* 19 (4): 381–393. doi:10.1080/1389224X.2013.808502.

- Bhanotra, Adhiti, Vivek Wankhade, Shabir A. Khandey, and Pranav Kumar. 2015. "Role of Rural Women in Decision Making Process Regarding Livestock Management." *Journal of Animal Research* 5 (3): 555. doi:10.5958/2277-940x.2015.00093.5.
- Brown, Warren. 2001. "Microinsurance – The Risks, Perils and Opportunities." *Small Enterprise Development* 12 (1): 11–24. <https://dialnet.unirioja.es/servlet/articulo?codigo=6862886>.
- Cable, Sherry. 1992. "Women's Social Movement Involvement: The Role of Structural Availability in Recruitment and Participation Processes." *The Sociological Quarterly* 33 (1): 35–50. doi:10.1111/j.1533-8525.1992.tb00362.x.
- Cavicchioli, Daniele, Danilo Bertoni, and Roberto Pretolani. 2018. "Farm Succession at a Crossroads: The Interaction Among Farm Characteristics, Labour Market Conditions, and Gender and Birth Order Effects." *Journal of Rural Studies* 61: 73–83. doi:10.1016/j.jrurstud.2018.06.002.
- Ciparisse, Gérard. 2003. *Multilingual Thesaurus on Land Tenure*. Rome: FAO.
- Cole, Shawn, Thomas Sampson, and Bilal Zia. 2009. *Financial Literacy, Financial Decisions, and the Demand for Financial Services: Evidence from India and Indonesia*. Working Paper 09-117. Cambridge, MA: Harvard Business School.
- Croppenstedt, Andre, Markus Goldstein, and Nina Rosas. 2013. "Gender and Agriculture: Inefficiencies, Segregation, and Low Productivity Traps." *The World Bank Research Observer* 28 (1): 79–109. doi:10.1093/wbro/lks024.
- DANE. 2014a. *Censo Nacional Agropecuario 2014*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE. 2014b. *Encuesta Nacional Agropecuaria (ENA)*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE. 2015a. *Censo Nacional Agropecuario – Cuarta entrega de resultados*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE. 2015b. *Encuesta Nacional Agropecuaria (ENA)*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE. 2016. *Encuesta Nacional Agropecuaria (ENA)*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE. 2017. *Encuesta Nacional Agropecuaria (ENA)*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE. 2019. *Cuentas nacionales trimestrales*. Bogotá: Departamento Administrativo Nacional de Estadística.
- DANE, Ministerio de Agricultura y Desarrollo Rural. 2021. *Situación de las Mujeres Rurales en Colombia*. Bogotá: Departamento Administrativo Nacional de Estadística.
- de Castro, Eduardo Rodrigues, and Eryl Cardoso Teixeira. 2012. "Rural Credit and Agricultural Supply in Brazil." *Agricultural Economics* 43 (3): 293–302. doi:10.1111/j.1574-0862.2012.00583.x.
- D'Espallier, Bert, Isabelle Guérin, and Roy Mersland. 2011. "Women and Repayment in Microfinance: A Global Analysis." *World Development* 39 (5): 758–772. doi:10.1016/j.worlddev.2010.10.008.
- Eccles, Jaquelyne Sue. 1986. "Gender-Roles and Women's Achievement." *Educational Researcher* 15 (6): 15–19. doi:10.3102/0013189X015006015.
- FAO. 2002. *Land Tenure and Rural Development*. Rome: FAO.
- FAO. 2004. *Política de desarrollo agrícola: conceptos y principios*. Rome: FAO.
- FAO. 2009. *Equidad entre géneros en la agricultura y el desarrollo rural*. Rome: FAO.
- FAO. 2010. *El estado mundial de la agricultura y la alimentación. Las mujeres en la agricultura. Cerrar la brecha de género en aras del desarrollo*. Rome: FAO.
- FAO. 2017. *The Future of Food and Agriculture: Trends and Challenges. In The Future of Food and Agriculture: Trends and Challenges*. Vol. 4, Número 4. Rome: FAO.
- FAOSTAT. 2020. *Agri-Environmental Indicators, Land Use Indicators*. Rome: FAO.
- Farrington, John. 1994. *Public Sector Agricultural Extension: Is There Life After Structural Adjustment?* ODI Natural Resource Perspectives 2. London: Overseas Development Institute.
- Fedegán. 2021. *Cifras de referencia del sector ganadero colombiano*. Bogotá: Fedegán.
- Feder, Gershon, Tongroj Onchan, and Yongyuth Chalamwong. 1988. "Land Policies and Farm Performance in Thailand's Forest Reserve Areas." *Economic Development and Cultural Change* 36 (3): 483–501. doi:10.1086/451671.
- Feder, Gershon, Tongroj Onchan, Chira Hongladarom, and Yongyuth Chalamwong. 1988. *Land Policies and Farm Productivity in Thailand*. Washington, DC: World Bank.
- FINAGRO. 2017. *Créditos otorgados por departamento – Detalle del género del beneficiario*. Bogotá: FINAGRO.
- Fletschner, Diana. 2008. "Women's Access to Credit: Does It Matter for Household Efficiency?" *American Journal of Agricultural Economics* 90 (3): 669–683. doi:10.1111/j.1467-8276.2008.01143.x.
- Fletschner, Diana. 2009. "Rural Women's Access to Credit: Market Imperfections and Intrahousehold Dynamics." *World Development* 37 (3): 618–631. doi:10.1016/j.worlddev.2008.08.005.
- Grubbström, Ann, and Helen Sooväli-Sepping. 2012. "Estonian Family Farms in Transition: A Study of Intangible Assets and Gender Issues in Generational Succession." *Journal of Historical Geography* 38 (3): 329–339. doi:10.1016/j.jhg.2012.03.001.
- Guérin, Isabelle, Solène Morvant-Roux, and Magdalena Villarreal. 2014. *Microfinance, Debt and Over-Indebtedness: Juggling with Money*. London: Routledge.
- Guérin, Isabelle, Christophe Nordman, and Elena Reboul. 2019. *The Gender of Debt and the Financialisation of Development. Insights from Rural Southern India*. Working Papers CEB 19-016. Bruxelles: ULB – Université Libre de Bruxelles.

- Gumucio, Tatiana, Maria Alejandra Mora Benard, Jennifer Twyman, and Maria Camila Hernandez Ceballos. 2016. *Género en la ganadería: Consideraciones iniciales para la incorporación de una perspectiva de género en la investigación de la ganadería en Colombia y Costa Rica*. Documento de trabajo CCAFS no. 159. Copenhagen: CCAFS.
- Haller, Max, and Franz Hoellinger. 1994. "Female Employment and the Change of Gender Roles: The Conflictual Relationship Between Participation and Attitudes in International Comparison." *International Sociology* 9 (1): 87–112. doi:10.1177/026858094009001006.
- Kaur, Simrit, and Cheshta Kapuria. 2020. "Determinants of Financial Inclusion in Rural India: Does Gender Matter?" *International Journal of Social Economics* 47 (6): 747–767. doi:10.1108/IJSE-07-2019-0439.
- Lawry, Steven, Cyrus Samii, Ruth Hall, Aaron Leopold, Donna Hornby, and Farai Mtero. 2017. "The Impact of Land Property Rights Interventions on Investment and Agricultural Productivity in Developing Countries: A Systematic Review." *Journal of Development Effectiveness* 9 (1): 61–81. doi:10.1080/19439342.2016.1160947.
- Machina, Henry, and Mary Lubungu. 2019. "Understanding Intra-Household Gender Disparities of Smallholder Livestock Production in Zambia." *AgriGender Journal of Gender, Agriculture and Food Security* 04 (02): 11–24. doi:10.19268/JGAFS.422019.2.
- Najjar, Dina, Bipasha Baruah, and Nadira Al-Jawhari. 2019. *Decision-Making Power of Women in Livestock and Dairy Production in Jordan*. Lebanon: ICARDA.
- Narayanan, Suda. 2016. "The Productivity of Agricultural Credit in India." *Agricultural Economics* 47 (4): 399–409. doi:10.1111/agec.12239.
- Njuki, Jemimah, and Samuel Mburu. 2013. "Gender and Ownership of Livestock Assets." In *Women, Livestock Ownership and Markets: Bridging the Gender Gap in Eastern and Southern Africa*, edited by Jemimah Njuki, Elizabeth Waithanji, Joyce Lyimo-Macha, Juliet Kariuki, and Samuel Mburu, 1st ed., 21–38. London: Routledge. doi:10.4324/9780203083604.
- Price, Mindy, Alessandra Galie, Jennifer Marshall, and Ngozichukwuka Agu. 2018. "Elucidating Linkages Between Women's Empowerment in Livestock and Nutrition: A Qualitative Study." *Development in Practice* 28 (4): 510–524. doi:10.1080/09614524.2018.1451491.
- Ramírez, Juan Mauricio, Susana Martínez-Restrepo, Adriana Sabogal, Erika Enríquez, Ricardo Salas, and Viviana Rodríguez. 2015. *Barreras de acceso de la mujer rural a crédito, programas asociativos y a la formalización de la tierra en el Norte del Cauca y el Sur del Tolima*. Bogotá: USAID, Fedesarrollo.
- Rivas Herrera, Constansa, Felicia Ramírez, and Adriana Chacón Cascante. 2017. "Mujeres y Ganadería: Participación y toma de decisiones de las mujeres ganaderas en la mitigación y adaptación frente al cambio climático en el marco de NAMA GANADERÍA del distrito de Santa Cruz de Turrialba, Costa Rica." In *De la práctica a las políticas: experiencias latinoamericanas en género, cambio climático y agricultura*, edited by Kelly Witkowski and Montserrat Blanco Lobo, 69–78. San José: Unión Europea and IICA.
- Sam, Vichet. 2021. "Formal Credit Usage and Gender Income Gap: The Case of Farmers in Cambodia." *Agricultural Finance Review* 81 (5): 675–701. doi:10.1108/AFR-05-2020-006.
- Sarangi, Niranjana. 2007. "Microfinance and the Rural Poor: Impact Assessment Based on Fieldwork in Madhya Pradesh, India." *Paper presented in Conference on Sustainable Development & Livelihoods, Delhi School of Economics, Delhi, 6–8 February*.
- Sharma, Puspa Ray. 2008. "Micro-Finance and Women Empowerment." *Journal of Nepalese Business Studies* 4 (1): 16–27. doi:10.3126/jnbs.v4i1.1026.
- Silong, Asenath Kotugan Fada, and Yiorgos Gadanakis. 2020. "Credit Sources, Access and Factors Influencing Credit Demand Among Rural Livestock Farmers in Nigeria." *Agricultural Finance Review* 80 (1): 68–90. doi:10.1108/AFR-10-2018-0090.
- Smith, Robert E. 2004. "Land Tenure, Fixed Investment, and Farm Productivity: Evidence from Zambia's Southern Province." *World Development* 32 (10): 1641–1661. doi:10.1016/j.worlddev.2004.05.006.
- Smith, Lisa C., Usha Ramakrishnan, Aida Ndiaye, Lawrence Haddad, and Reynaldo Martorell. 2003. "The Importance of Women's Status for Child Nutrition in Developing Countries: International Food Policy Research Institute (IFPRI) Research Report Abstract 131." *Food and Nutrition Bulletin* 24 (3): 287–288. doi:10.1177/156482650302400309.
- Triana Ángel, Natalia, and Stefan Burkart. 2019. *Between Silences and Opportunities: Gender and Bovine Livestock in Latin America, a State of the Question*. Infonote. Cali: International Center for Tropical Agriculture (CIAT).
- Trivelli, Carolina, and Hildegardi Venero. 2007. *Banca de desarrollo para el agro: experiencias en curso en América Latina*. Lima: Instituto de Estudios Peruanos (IEP).
- USAID, UT Econometría, and Marulanda Consultores. 2014. *Assessment of Rural and Agricultural Finance and Financial Services in Colombia*. Final Assessment Report. English Version. Bogotá: USAID.
- Waithanji, Elizabeth, Jemimah Njuki, and Nabintu Bagalwa. 2013. "Gendered Participation in Livestock Markets." In *Women, Livestock Ownership and Markets: Bridging the Gender Gap in Eastern and Southern Africa*, edited by Jemimah Njuki, Elizabeth Waithanji, Joyce Lyimo-Macha, Juliet Kariuki, and Samuel Mburu, 1st ed., 39–59. London: Routledge. doi:10.4324/9780203083604.