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PRODUCTIVITY FOR CATTLE RANCHING IN BRAZIL

PASTURELAND DECLINES MIGHT SHOW A NEW PATHWAY

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The Challenge

For Brazil, increasing cattle productivity is critical to raising beef production without increasing forest clearing and thereby meeting the nation's environmental commitments. Currently, pastures cover over 220 million hectares of the nation, and their expansion has been the primary driver of deforestation both in the Amazon and in the Cerrado. The typical pasture of the country's productivity is so low that the intensification of cattle ranching activities could enable cattle productivity to increase at least twofold, reducing the pressure on forests while generating economic benefits. **Therefore, identifying rancher incentives to improve their pastures' productivity will be essential for designing effective environmental and agricultural policies in Brazil in the coming decades.**

This white paper outlines the close connection between cattle productivity and the share of farmland devoted to this activity. Estimates using Agricultural Census data from the last four decades show that these variables are inversely related, indicating that cattle ranching becomes more productive as ranch size declines. Additional empirical exercises suggest that the cost of the land relative to the capital might explain this relationship. Finally, the white paper presents policy lessons that might show a pathway for intensifying cattle ranching without inducing further deforestation.

Lessons for Public Policy

1. Combating illegal deforestation and land grabbing generates incentives for producers to improve their productivity, thereby inducing farmers to intensify their pastures or switch to crop cultivation.

2. Minimizing bottlenecks to agricultural modernization, in general, creates incentives for the conversion of low productivity pastureland into high productivity cropland.

3. Promoting access to credit induces farmers to either intensify their pastures or switch to crop cultivation.

WHAT IS THE ISSUE?

The extremely low level of cattle ranching productivity in Brazil is blatant: today, approximately one head of cattle exists for every hectare of pastureland, based on data from Mapbiomas and IBGE 2018. However, the adoption of better pasture and cattle management practices could potentially alter this scenario. Improvements in land management alone could multiply the productivity of pastures by a factor of 2.0. When these land management improvements are combined with improvements in cattle management (e.g., breeding and feeding of animals), it is possible to multiply cattle ranching productivity by a factor of 2.5 (Martha, Alves & Contini 2012; Cohn et al. 2014).

Therefore, cattle intensification represents a large opportunity for Brazil to simultaneously increase its beef production and reduce pressure on forests, improving economic indicators while meeting its emission goals. Indeed, simulations indicate that the dissemination of more intensive ranching practices would increase output, save forests, and reduce GHG emissions in different scenarios (Cohn et al. 2014).

However, existing agricultural policies fail to promote cattle intensification. The number of heads per hectare increased by only 6.5% from 2006 to 2017 compared to the 27.8% increase in the number of heads per hectare observed from 1995 to 2006. This slowdown in productivity growth is observed in all regions of the country. Nevertheless, it is particularly worrisome in the Amazon, which saw a decline in the number of heads per hectare during the last eleven years.

Our approach

Most discussions about cattle productivity consider ranching in isolation. However, because ranching competes for resources like land and capital with crops, understanding these trade-offs and adopting an integrated approach is fundamental. Farmers' explicit decisions to allocate land and invest in different agricultural activities must be considered. This white paper is based on research and builds on insights from integrated models that consider the choices of heterogeneous farmers to engage and invest in cattle ranching or crop cultivation. Understanding decision-making among farmers is crucial to uncovering new insights into the dynamics of cattle productivity in Brazil.

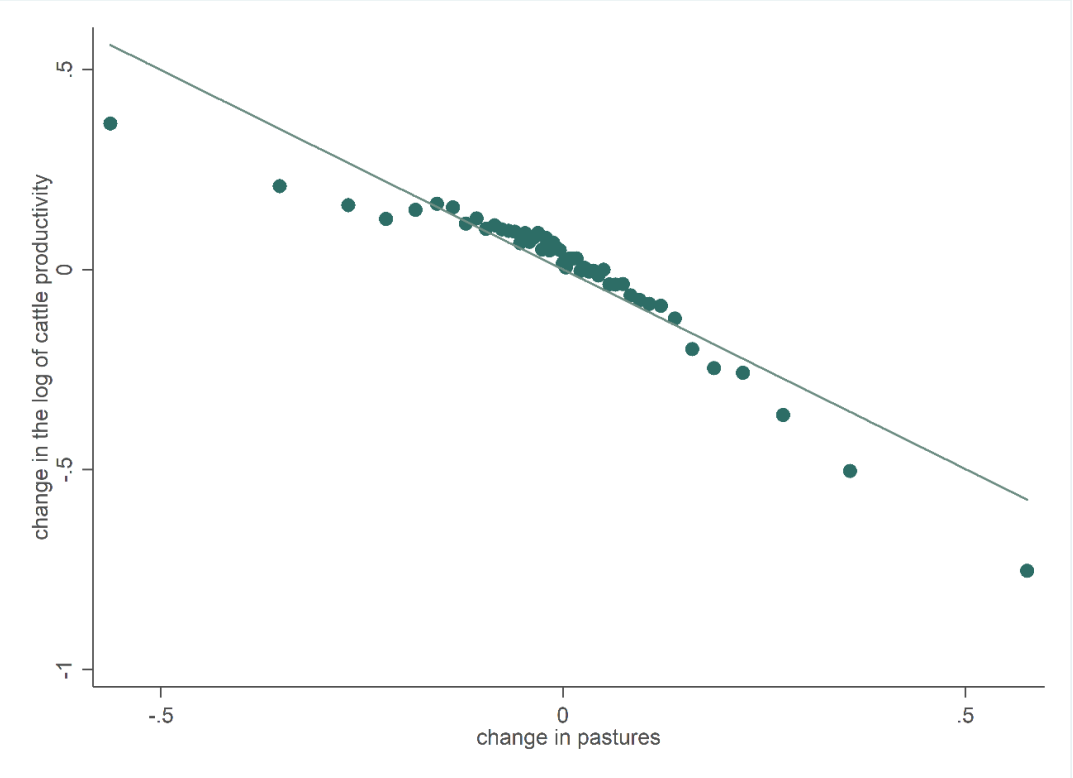
RELEVANT FACTS

Declines in pastureland are connected to increases in cattle productivity

Figure 1 reports the most relevant finding documented in this white paper: there is a strong negative relationship between cattle ranching productivity and the share of pastures. Quantitatively, reducing half of the share of pastures increases cattle ranching revenues per hectare by 20% in the typical municipality of the country. This translates into an increase of 0.25 in the number of heads per hectare per typical municipality. These findings imply that productivity increases offset close to one-fifth of the declines in pastureland.

There are two potential explanations for the negative relationship between cattle productivity and the share of farmland devoted to this activity. First, changes in prices and other incentives might induce ranchers to substitute land for other factors of production, thereby increasing productivity. Second, declines in the relative profitability of cattle ranching compared to farming induce the conversion of low productivity pastures into cropland, simultaneously reducing the size and increasing the productivity of cattle ranching. Understanding the relative importance of these two explanations as well as their determinants is, therefore, central for guiding policies and research on cattle intensification.

Figure 1. Size vs. Productivity in Cattle Ranching

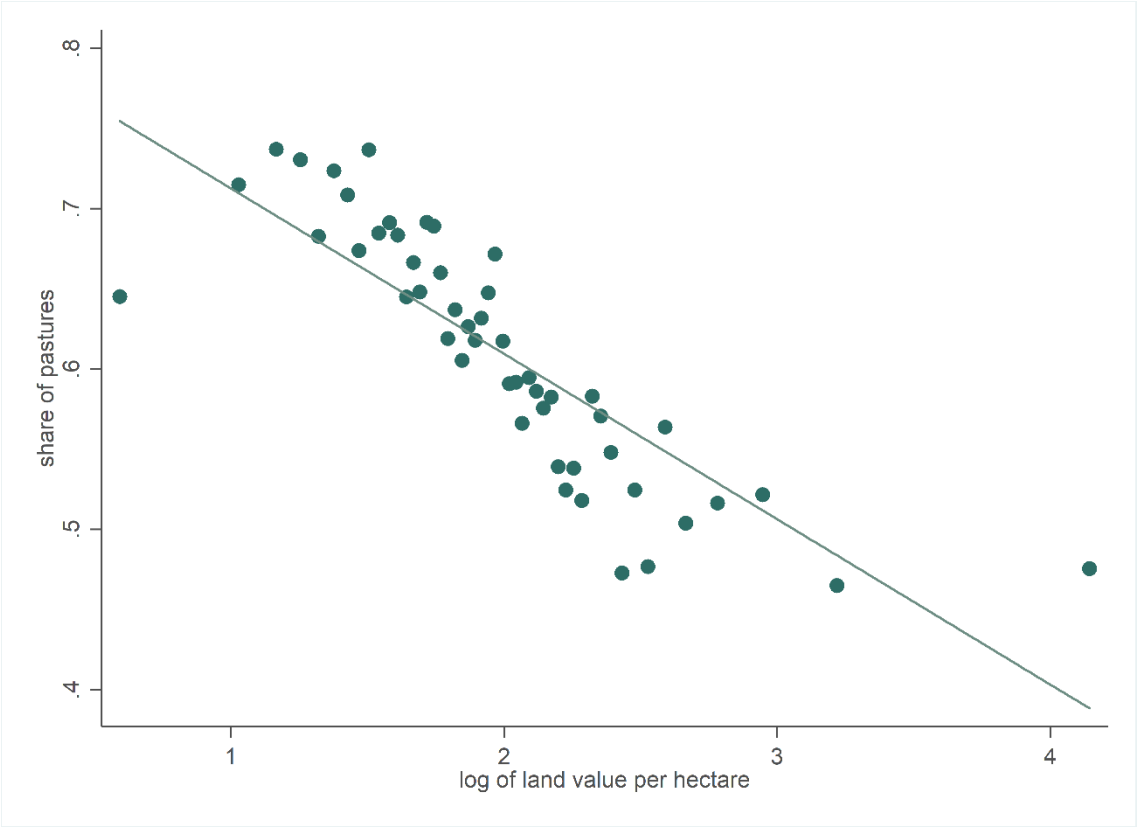


Note: The blue dots plot the average change in the log of cattle productivity in 50 evenly spaced bins of change in pastures (as a share of the total area devoted to farming). The solid blue line plots the fit of a linear regression of the change in the log of cattle productivity on the change in the share of pastures.
Source: Agricultural Census, 1970-2006.

Increases in land prices predict declines in pastureland and increases in cattle productivity

The **cost of accessing land** might be the key to explaining the inverse relationship between cattle ranching productivity and the share of pastures. On the one hand, this cost is negatively correlated with the size of pastures (Figure 2) and maintains a positive correlation with cattle productivity (Figure 3). **This means that the more expensive the hectare of farmland in the region, the smaller the pastureland is, and the more productive the cattle ranching is.** Simplified calculations indicate that land values explain at least one-third of the inverse relationship between cattle ranching productivity and the share of farmland devoted to this activity.

Figure 2. Size vs. Land Values



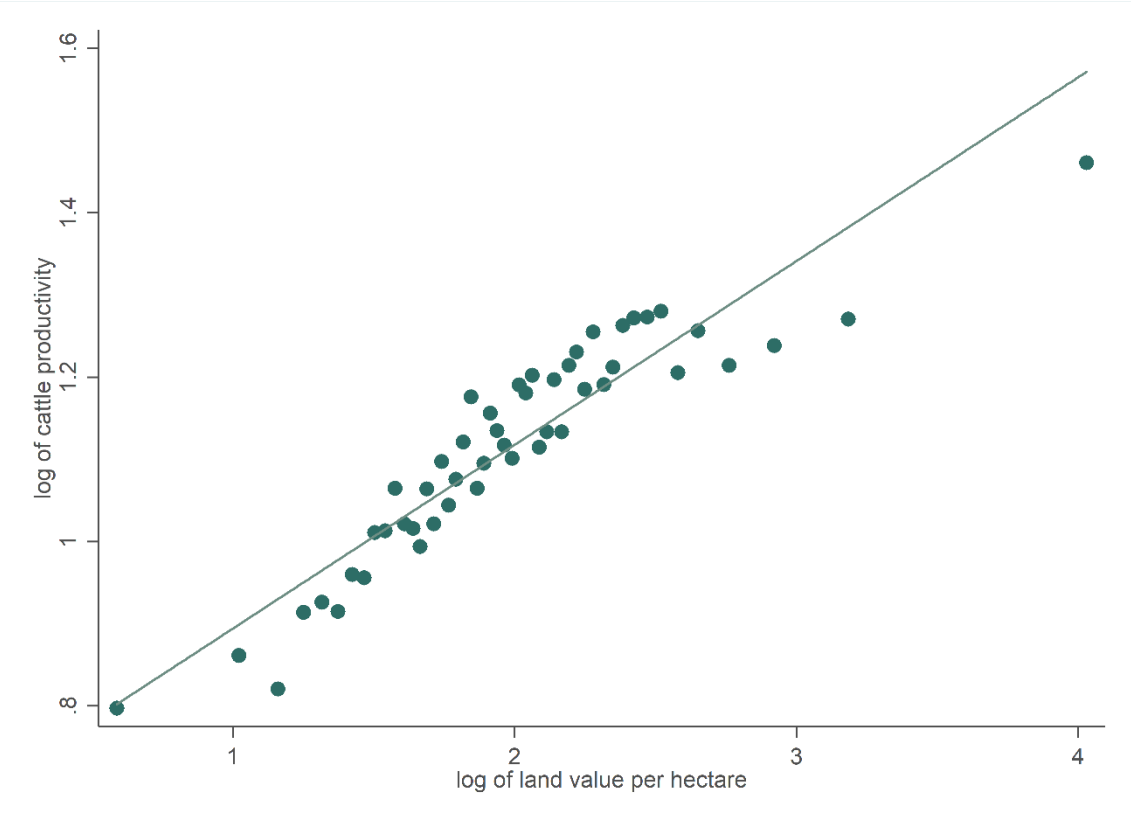
Note: The blue dots plot the average share of pastures (as a share of the total area destined to farming activities) in 50 evenly spaced bins of the log of land values. The solid blue line plots the fit of a linear regression of the share of pastures on the log of the land value per hectare.
Source: Agricultural Census, 2006.

Two factors explain this relationship. First, because ranching is less capital intensive than crop cultivation, more farmers will choose to ranch when the price of land is low compared to the price of capital. This investment decision reduces cattle productivity, once the cost of accessing land is low conditional on the cost of accessing capital. Even low productivity ranchers will find it profitable to produce beef extensively instead of engaging in other, more productive, economic activities.

Second, even farmers who choose to ranch irrespective of the land-to-capital prices will use more land and less capital when the price of land is low compared to the price of capital. This implies that ranchers will invest fewer resources in improving their pastures, in supplementing their cattle feeding, or in improving management practices. Therefore, their pastures will be less intensively used, and their ranches will be less productive.

Regardless of the mechanism, the power of land values in explaining this relationship proves how price incentives are crucial when thinking about cattle intensification in Brazil. These incentives seem to be fundamental not only in determining how intensively beef is produced, but also in influencing the decision to produce beef in the first place. Therefore, the design of public policies should incorporate the importance of these incentives for cattle intensification. It is also important to observe that land cost reflects countless factors, such as the presence of well-designed property rights and the supervision of public land invasions.

Figure 3. Productivity vs. Land Values



Note: The blue dots plot the average log of cattle productivity in 50 evenly spaced bins of the log of land values per hectare. The solid blue line plots the fit of a linear regression of the log of cattle productivity on the log of the land value per hectare.
Source: Agricultural Census 2006.

HOW CAN BRAZIL MAKE PROGRESS ON THIS ISSUE?

Discussion and Recommendations

The facts documented in this white paper indicate that the low levels of cattle intensification in Brazil are not only a question of the under-adoption of profitable technologies. They are also related to the low profitability of intensive cattle ranching or the lack of incentives for crop cultivation. Therefore, public policy formulation should concentrate on the relative profitability of extensive cattle ranching versus other economic activities. This white paper outlines three sets of policies that – while not directly focused on promoting cattle intensification – might have a positive impact over it.

1. Combating illegal deforestation and land grabbing generates incentives for producers to improve their productivity, thereby inducing farmers to intensify their pastures or switch to crop cultivation.

By allowing farmers to expand at a low cost, illegal deforestation and land grabbing increase the profitability of extensive low productive cattle ranching. Cattle intensification might, therefore, be an important, but unintended, consequence of policies focused on controlling illegal deforestation, stopping land grabbing, and increasing tenure security in Brazil. Indeed, the absence of negative consequences of the efforts to combat deforestation on economic growth suggests this mechanism might be relevant in practice (e.g., Assunção et al., 2017). This implies that preserving the existing environmental policies, implementing the Forest Code, and improving tenure security more broadly are fundamental to normalizing land markets in Brazil. Taking these steps would bring juridical safety for producers while promoting intensification of cattle ranching.

2. Minimizing bottlenecks to agricultural modernization, in general, creates incentives for the conversion of low productivity pastureland into high productivity cropland.

There are many bottlenecks to the uptake of agricultural modernization: high transportation costs, poor storage facilities, lack of intermediaries, inadequate extension services, etc. However, because crop cultivation depends on these types of infrastructure and institutions more than cattle ranching does, the bottlenecks keep a large share of the farmers producing mainly beef and a lower share of them producing crops. Therefore, policies aimed at reducing these bottlenecks could also promote cattle intensification by stimulating the reconversion of pastures into cropland. Indeed, there is evidence that improvements in infrastructure, like the expansion of the electric grid, generated pasture to cropland conversion (Assunção et al. 2016).

3. Promoting access to credit, in general, might induce farmers to either intensify their pastures or switch to crop cultivation.

Cattle ranching is less capital intensive than crop cultivation (Assunção and Bragança 2015). This implies that reducing the cost of capital in comparison to the cost of land might induce farmers to convert their low productivity pastures into high productivity cropland. Indeed, there is evidence that credit shocks cause farmers to switch from cattle ranching to crop cultivation (Assunção et al. 2019). Furthermore, reducing the cost of capital in comparison to the cost of land might induce farmers who continue to produce beef to use more capital and less land. This, too, would increase cattle productivity. These mechanisms suggest that improvements in credit conditions, in general, might be effective in reducing the excessive size of the cattle industry and improve cattle productivity.

CONCLUSION

This white paper summarizes an inverse relationship between cattle size and productivity in Brazil. Using municipality-level data, it highlights that the number of heads per hectare (a standard productivity measure) is inversely related to the share of farmland used as pastures. It additionally discusses how land prices are an important driver of this relationship.

These findings bring to the forefront of the discussion of cattle intensification issues that are not typically considered, such as bottlenecks to agricultural modernization or the functioning of land and credit markets. By reducing the prevalence of less productive ranches, Brazil can promote cattle intensification while limiting deforestation. In this sense, policies that aim at removing bottlenecks for the uptake of agricultural modernization or improving the functioning of land and credit markets have great potential to expand highly productive farming, while reducing the negative pressure on the environment.

The standard academic literature provides a solid foundation for these public policy recommendations. Countless theoretical models and empirical papers discuss the existence of a negative relationship between size and productivity in agriculture in general. Farm-level evidence indicates smaller plots are more productive than larger plots whereas country-level evidence indicates that smaller agricultural sectors are more productive than large ones (Feder 1985, Barrett 1996, Assunção & Braido 2007, Barrett et al. 2010, Lagakos & Waugh 2013, Young 2013, Abay et al. 2019). These inverse relationships have been important to changing the focus of agricultural policies as they bring to the forefront of the discussion broader issues such as economy-wide efficiency levels or the functioning of input and output markets. The results highlighted in this white paper show that such questions are also relevant from Brazilian agriculture – especially for cattle intensification choices.

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ABOUT CPI AND INPUT

With deep expertise in policy and finance, Climate Policy Initiative (CPI) works to improve the most important energy and land-use practices around the world. Our mission is to help governments, businesses, and financial institutions drive growth while addressing climate risk. Our Brazil office is affiliated with the Pontifical Catholic University of Rio de Janeiro (PUC-Rio) and has close collaborations with prominent research universities around the world.

The Land Use Initiative (INPUT - Iniciativa para o Uso da Terra) counts on a dedicated multidisciplinary team of experts who work at the forefront of how to increase environmental protection and food production. INPUT aims at analyzing and influencing the creation of the next generation of low-carbon economy policies in Brazil. CPI's work for the initiative is currently supported by Norway's International Climate and Forest Initiative (NICFI), Children's Investment Fund Foundation (CIFF), Gordon & Betty Moore Foundation, Instituto Clima e Sociedade (iCS), Instituto Ibirapitanga, and the World Wildlife Fund (WWF).

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