# Does anti-corruption effort facilitate agricultural production progress?

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Abstract

Agriculture is critical to the livelihoods of a large proportion of rural households in a number of emerging and transitioning economies. Agriculture is a priority in Kazakhstan and Russia, not just for social reasons, but also for economic diversification. Kazakhstan and Russia are post-Soviet examples of how different supportive policies in the agricultural sector have a range of output effects across diverse entrepreneurial structures. While in some regions, cattle production growth happens due to an increase in heard size, further compensating the decline in cattle production by increasing beef production. One explanation for this line of research is regional differences in governance. These differences include allocation of government support to agriculture, land property allocation, access to bank loans, and effort to control corruption. We assume that the major impediment to agricultural progress, namely cattle and beef, is local corruption that misallocates public resources and benefits-seeking individuals. We investigate how easing bureaucratic corruption affects the upper stream – cattle raising and downstream beef production. Finally, we investigate the effect of institutional differences on livestock production through the lens of entrepreneurial and production effects. The findings highlight that anti-corruption effort has a stronger short-term effect on production, a greater effect on smaller producers, and a more substantial effect on downstream production that requires more technological advantages.

## 1. INTRODUCTION

The analytical effort on the role of domestic governance and institutional influences has only recently begun to focus on agricultural production (T. Herzfeld, Kulyk, & Wolz, 2016; M.-C. Lio & Hu, 2009). The literature demonstrates that agricultural production is often higher in countries with lower transaction costs imposed by regulations (Divanbeigi & Saliola, 2017; M. Lio & Liu, 2008). A wide range of policies aims to increase agricultural production by subsidizing farmers, reducing tariffs, and investing in infrastructure. This has created the potential for increased output, particularly for economies seeking this process as a source of economic growth and diversification. However, in low-quality institutional environments with significant levels of corruption, misallocation of supportive measures and resources may have a detrimental effect on production (Acemoglu et al., 2005; Rose-Ackerman & Luce, 2006).

Post-Soviet Kazakhstan and Russia are examples of how a variety of supportive policies in the agricultural sector, including infrastructure investment, substantial subsidies, and land allotment, result in different output effects across diverse entrepreneurial structures (OECD, 2013, 2017). For example, upon independence, the livestock sector's production levels did not reach those of the Soviet Union. While large enterprises continue to develop following the recession, the production gap widens for smaller farmers. One of the primary reasons for development delays is a lack of institutional quality, resulting from coordination challenges (Satpayev, 2014; Günther G. Schulze et al., 2016).

Livestock production is an interesting and relevant sector to study for several reasons. For many emerging and transitioning countries, livestock production underpins the livelihoods of large parts of rural households. The substantial policy support during the last decade has led to an increased interest in agricultural entrepreneurship. However, bureaucratic corruption leads to misallocation of public resources and budget allocation distortions that benefit large agricultural enterprises and rent-seeking individuals. For small and medium farmers who have few resources but the predominant share of meat

production, institutional quality plays a crucial role not only in the allocation of public services but also in access to natural resources. Such sentiments, along with anecdotal evidence, are linked to the hypothesis that corrupted activity differently affects meat production in the various farm types.

The agricultural sector of an economy includes many corruption risks linked to the allocation of land resources, access to water and energy, distributions of subsidies, access to finance and start-up grants, as well as agribusiness registration. However, the empirical study concentrates on corruption-prone areas such as education, health, justice, and energy, where instances of corruption are more visible to society and involve more stakes (García, 2019; Holmes, 2020; Junxia, 2019; Ozturk, Al-Mulali, & Solarin, 2019). In countries with mineral resource-based economies, where agriculture is viewed as a source of economic diversification, the function and importance of anti-corruption measures in non-resource extraction sectors must be better understood and linked to institutional weaknesses.

The aim of this research is to contribute to broader debates about the economic impact of domestic governance and anti-corruption activities on agriculture sector growth in Russia and Kazakhstan, namely cattle and beef production, by examining various farm configurations. With a unique dataset on corruption crime rates in Kazakhstan and Russia for 2010 - 2019, a neoclassical growth model is employed. To our knowledge, we are the first to analyze how corruption control affects the production of a particular agricultural commodity.

## 2. LITERATURE REVIEW

Although there are differences in definitions of corruption, the general term for corruption - the abuse of power by the public office for personal gain in a manner that contravenes the rules of the game – is widely accepted (Aidt, 2003). Corruption takes both monetary and nonmonetary forms at different levels of governance hierarchies (Caiden, 2001; Thomas Herzfeld & Weiss, 2003). Corruption measurement is an

ambiguous concept that is easy to hypothesize but difficult to test (Heywood & Rose, 2014). In the agricultural sector, corruption is not an exception, yet none of the indicators that measure the institutional quality in the agricultural sector captures the different dimensions of corruption (EBA, 2017; Msellati et al., 2012).

There are two sorts of corruption: individual-level corruption, where basic legislation only works on paper while implementing officials reap personal rewards, and higher-level organized system corruption, which leads to greater state devastation (Caiden, 2001). Some literature distinguishes corruption as a political or bureaucratic phenomenon (Thomas Herzfeld & Weiss, 2003). We concentrate on individual-level corruption since anti-corruption legislation in Kazakhstan and Russia focuses on individualistic corruption cases rather than firm-level "wrongdoing". Nonetheless, we are still entangled in higher-level corruption because individual-level corruption may be linked to an organized system that rewards political allies rather than just private beneficiaries (Rose-Ackerman, 2010).

A society with a high level of rent-seeking is more likely to undergo political reforms that introduce inadequate methods to combat corruption (Acemoglu, 1995). Corruption is a significant impediment to growth in transition economies (Kotchegura, 2018). When corruption is prevalent in an economy, it becomes more difficult to successfully audit a corrupt official, which prevents the economy from becoming highly compromised (Lui, 1986). The attractiveness of corrupt action is based on the likelihood of detection and punishment. For purposes of punishment, it is crucial that the corrupt bureaucrat is apprehended by a non-corrupt official, rather than bribing the regulating agency into not reporting the case and thus avoiding punishment (Andvig & Moene, 1990).

Kazakhstan and Russia inherited corruption from the Soviet era. In the Soviet Union, corruption was rooted in the contradictions of an overcentralized economy. When the Soviet system of government collapsed, but a replacement had not yet been

established, corruption became an emerging mechanism of the market systems (Rigi, 2017). Corruption acted as a compensation mechanism, accelerating the decision-making process without clear legal standards (Satpayev, 2014). In modern Kazakhstan and Russia, corruption serves as a means of extracting rent and ensuring the loyalty of subordinates in the administrative hierarchy (Satpayev, 2014; Günther G. Schulze et al., 2016). The legal framework governing corruption in independent Kazakhstan and Russia has been weakly consolidated. Appropriate regulation can be found in a variety of legal acts that address corruption directly or indirectly. In Kazakhstan, the introduction of the Law on Anti-Corruption came into force in 1998, whereas Russia enacted federal anti-corruption law only in 2008 (Janenova & Knox, 2020; Gunther G. Schulze & Zakharov, 2018)

## 3. OVERVIEW OF LIVESTOCK GROWTH AND FARMING

In Kazakhstan, cattle and meat production have been viewed as a tool of economic diversification and a way to ensure self-sufficiency in the food supply (Kvartiuk & Herzfeld, 2021; Oshakbayev & Bozayeva, 2019; Pomfret, 2016). The agriculture sector's authorized strategic development programs bolster the argument for the livestock sector's critical role in achieving these objectives. In Kazakhstan Development Program of Agro-Industrial Complex for 2010-2014 prioritized food security, efficiency and competitiveness, and export enhancement. The consequent Agribusiness 2013-2017 Development Program emphasized enhancing the industry's efficiency and competitiveness by enabling agricultural business. In the 2017-2021 agricultural development agenda, the agro-industrial complex was identified as a driver of economic diversification (Petrick et al., 2018). The development of the livestock industry became the top priority for the Ministry of Agriculture.

The Russian State Agricultural Development Program and Agricultural Markets Regulation for 2008–2012 envisioned agriculture's development by achieving three primary objectives: developing rural areas, increasing competitiveness of domestically

produced agricultural products, and conserving and reproducing agricultural lands. The food self-sufficiency strategy was designated as one of the primary targets (Belyaeva, 2018). Then, in the following program for 2013–2020, which prioritizes social and rural prosperity, the development of the Sub-Program "Development of the Beef Cattle Industry" demonstrates the livestock sector's importance (Vassilieva, 2012).

The development of cattle over the last three decades following the collapse of the Soviet Union could be defined as a roller coaster. Kazakhstan's beef and cattle production output dropped annually between 1990 and 1999 due to the transitional slump. Kazakhstan began a sector recovery in 2000 but has yet to achieve the Soviet-era level of production (Figure 2). Between 1990 and 1999, Russia's beef and cattle production fell precipitously. Following 1999, the industry started its recession by maintaining increasingly severe negative rates. Beef production has been increasing in Russia since the 2000s, while it began increasing in Kazakhstan in 2010 (Figure 3).

Following the collapse of the Soviet Union, large-scale livestock commodities production on formerly collective and state farms has virtually ceased. Historically significant state enterprises either sold and butchered their livestock or distributed it to independent farmers (Anderson & Swinnen, 2008; ur-Rahim et al., 2014). While the bulk of cattle in modern Kazakhstan are confined in the household, Russia has a more dispersed herd structure (Figure 4).

Whereas individual farms have seen the most dramatic changes in herd size in recent years, enterprises have had the most dramatic increases in meat yields per head, from 129 to 213 kg per head in Kazakhstan and 179 to 206 kg per head in Russia between 1999 and 2019 (Figure 4). Increases in meat yield per head offset the fall in cattle numbers in Russian enterprises, resulting in increased beef production. Nonetheless, the industry's recent rebound from the early 1990s recession appears to have mainly bypassed household farmers. This begs the question: What has changed in the

agricultural sector's institutional framework to account for the different performance of various farm types relative to the overall livestock sector?

## 4. CONCEPTUAL FRAMEWORK

### 4.1 Theoretical background

The conventional neoclassical theory posits that if an agrarian economy has low-income levels and little inequality between groups, poor rural areas grow proportionately faster than affluent rural areas. A predominance of small family farms should help to boost growth (Deller et al., 2003; Kuznets, 1955). The institutional theory of growth postulates that political and economic institutions affect resource productivity (Acemoglu et al., 2005; Acemoglu & Robinson, 2008). Institutions indirectly impact economic growth through entrepreneurship (Sobel & Hall, 2008).

The role of corruption in growth expresses two different views. On the one hand, corruption is an obstacle to development (Buchanan & Tullock, 1962; Cole et al., 2009; Rose-Ackerman & Truex, 2012). On the other hand, in some instances, corruption is believed to foster development when the government is inefficient (Egger & Winner, 2005; Leff, 1964; Levy, 2007). While corruption has a small average effect on GDP per capita growth, it is a likely source of unsustainable development (Aidt, 2009).

The evidence for the inconsistency of corruption with economic growth does not imply that corruption is harmful in all circumstances. To determine the viability of this line of research, one needs to condition the relationship between corruption and economic growth on governance structures. Additionally, the relationship should be non-monotonic, with increasing growth effects occurring only at low levels of corruption. This is because entrepreneurs are supposed to benefit from isolated instances of corruption, not systemic corruption (Aidt, 2009). We add to this debate by arguing that corruption may have a dual effect on growth depending on the type of entrepreneurship.

As such, we intend to examine the impact of anti-corruption initiatives on different categories of farmers.

The establishment of causality is another major obstacle. To begin, in a single growth regression, it is impossible to account for all potential growth factors. The omitted variables are likely to be correlated with corruption, and their effects are therefore incorrectly attributed to corruption. Second, the causality may begin with growth and end with corruption, rather than vice versa. For example, increasing kleptocrats' desire for rents from economic growth may result in combating corruption in order to maintain power through citizen appeasement (Aidt & Dutta, 2008). A growing economy has more resources available to invest in anti-corruption measures. In either case, growth may result in a decrease in corruption (Paldam, 2002).

Even if corruption might have a negligible effect on growth, it remains a significant impediment to sustainable development. Much more work is required to determine the robustness and causality of the correlation between corruption and the rate of growth, as well as to develop more accurate measures of genuine growth indicators (Dasgupta, 2010). We hope to contribute to the literature by examining true growth indicators such as cattle headcount and volume of meat produced across various farm types. Additionally, we intend to use dynamic panel data models, which produce more efficient estimates than static regressions.

### 4.2 Conceptual background

Given the importance of the business climate for agricultural production, we believe that a non-inclusive institutional framework could be a source of coordination and cooperation failures and lead to a comparative advantage for various farm types. As a result, the question of which type of farmers are most vulnerable in various institutional environment scenarios has arisen when producing livestock products. Therefore, we formalize differences in anti-corruption efforts, access to bank loans, cooperation rates, the share of privately owned land, and government support as differences in a domestic

institutional framework that controls connections between private economic actors and the government. Figure 1 depicts the conceptual framework that guides our analysis. The framework refers to the main actors involved in the meat production sector in Kazakhstan and Russia along the meat production value chains.

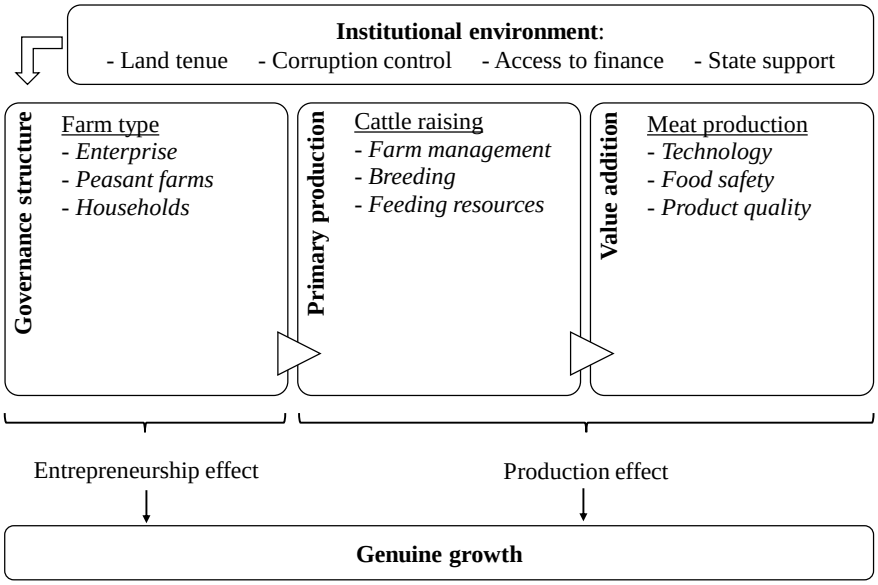


*Figure 1. Conceptual framework*

Regions with strong economic institutions continue to outperform regions with weak institutions, owing to the fact that strong institutions foster entrepreneurship and innovative production (Campbell & Rogers, 2007; Kreft & Sobel, 2005). We assess the genuine growth of the livestock sector through the lens of the entrepreneurship and production effects. While regional differences in entrepreneurship exist, the productive contribution of entrepreneurial activities varies significantly more due to their allocation of resources between productive activities such as innovative production and unproductive activities such as rent-seeking (Baumol, 1996). We imply that anti-corruption efforts effectively influence the distribution of productive entrepreneurship.

Further, we link endogenous innovation to the production effect on growth. As animals go from the raising to slaughter stage, the factors and processes of production involve more steps and higher production costs (Hobbs, 1996). When producing meat, quality

standards should be ensured, such as product consistency, traceability, and safety. For instance, to ensure traceability, all cattle should be identified and registered in the database. Furthermore, the beef should be classified and verified according to sanitary and veterinary regulations to ensure food safety standards (Tultabaieva, 2012). In regions with lower governance efficiency, smaller and legally untitled farmers may not be able to fulfill these requirements and end up producing fewer products compared to larger counterparts. The smaller farmers could also fail to innovate in the production due to the lack of complementary services and technology to develop them (Escobal & Cavero, 2012; Toufique, 2005).

The production effect influences both the cattle-raising stage and meat production. It is estimated that around 34% of peasant farmers across Kazakhstan and 15% in Russia constitute the total cattle herd size. Yet the share of produced meat by the same farmers is 21% in Kazakhstan and 4% in Russia that is significantly lower than herd size. That difference in production shares of value-adding products from the same value chains may suggest that peasant farmers need institutional support related to access to finance, technologies, breeds, protein content feeding to ensure the producibility of quality meat.

The cattle raising and beef production effects of varying degrees of the institutional framework and governance efficiency are embedded into the theoretical assumptions of the linear dynamic panel data approach that is selected as the empirical estimation strategy for analytical purposes. Using the selected model, we aim to understand how institutional support relates to livestock production for different farm types across various regions in Kazakhstan and Russia. In other words, we take a new look at how institutional support differences influence the supply changes through the entrepreneurial and production effects. Therefore, the linear dynamic-panel data model fits into our conceptual framework by capturing the aspects of the institutional framework and governance efficiency along with various levels of livestock production value chains.

### 4.3 Hypothesis

We hypothesize the anticipated effects of the institutional framework, such as anti-corruption efforts, access to bank loans, cooperation rates, shares of privately-owned land, and government support, on meat production given our conceptual framework.

Governments with decentralized functions efficiently allocate public goods and services where preferences differ among regions. However, coordination of public agencies within a multi-layer government framework —among the executive bodies and the administration—is difficult enough, which complicated in different authorities' interaction (Spahn, 2001). In Kazakhstan and Russia, the budget allocation and policy decisions for agricultural needs are made at the highest centralized authority level while the execution of the budget programs is implemented at the regional level. This may call for specific institutional provisions and rules for policy coordination that may reduce the conflicts at the regional level during the redistribution of public goods and services. One question that needs to be raised is how does institutional support affect livestock production at the regional level? We link this issue to the entrepreneurial effect in our conceptual framework since inclusive institutional support reduces transaction costs of bilateral exchanges between agribusinesses and therefore increasing production growth (Sartorius & Kirsten, 2007). Following this, we hypothesize that a more inclusive institutional framework in a region increases production due to its ability to shape regions' coordination strategies in the livestock sector (Hypothesis 1). We anticipate that government support and services facilitate both herd size increase and meat production regardless of farm type.

One of the main goals of a government is to effectively formulate and implement sound policies (Kaufmann, Kraay, & Mastruzzi, 2009). The literature on government efficiency has highlighted that larger government expenditure relative to production growth lowers efficiency in a respective sector of the economy (Hauner & Kyobe, 2010; Rahmayanti & Horn, 2010). Our conceptual framework implies whether institutional

framework and governance efficiency can deliver complementary services during the upper stream livestock production level. The purpose of this investigation is to understand whether governance efficiency at the regional level leads to enhanced production. We expect that effective governance positively affects all stages of the meat supply chain. We hypothesize that governance effectiveness enhances the level of cooperation needed in value addition meat production rather than just facilitating herd size growth regardless of farm type (Hypothesis 2).

The analysis of anti-corruption efforts assesses a region's effort against bureaucratic corruption. Cole et al. (2009) and Zakharov (2019) suggest that anti-corruption effort is most related to investment. The authors argue that foreign direct investments are attracted to regions with relatively high levels of government efficiency and actively involved in the fight against corruption. Gillanders and Parviainen (2018) found that regions with more frequent cases of abuse of public offices than their national average are associated with challenges in doing business. While linking anti-corruption efforts to production in our conceptual framework, we attempt to understand what type of farmers are most resilient to corruption control. We anticipate that easing corruption leads to better performance both in animal raising and meat production through the increased investments, inclusive access to resources and services, with the effect to be larger for upper stream than for lower stream value-added products (Hypothesis 3).

## 5. METHODOLOGY

### 5.1 Data

Our dataset embraces 78 Russian and 18 Kazakh regions spanning from 2010 to 2019, of which 73 Russian and 14 Kazakh regions remain in the data subset[1]. We obtain

[1] We exclude certain regions for geographical reasons: for example, the Mangistau region in Kazakhstan, which is located in a desert zone; and the Kamchatka Krai in Russia's East-North, which is located in a freezing area. Additionally, we omit cities of administrative significance, which have the same status as regions.

production rate data and proxies for institutional environment and governance efficiency indicators from various sources for the years 2010-2019. We obtain livestock production data from the National Statistical and Ministry of Agricultural offices, as well as corruption open case crime rates from Ministries of Internal Affairs. The expenditures on agricultural services and support were obtained from Ministries of Finance, while loans rates for agriculture were gathered from Central banks of the countries.

According to the production theory, a profit-maximizing farmer will respond favorably to commodity prices and adversely to the prices of complementary inputs, ceteris paribus. (Foltz et al., 2004). Additionally, the contemporary literature on-farm growth has placed a premium on the interaction of quasi-fixed variables such as operational size, technology, and management (Petrick & Götz, 2019). Larger enterprises may well invest in new machinery and equipment, which may result in increased herd size and meat production. In Russia and Kazakhstan, subsidies are provided by direct disbursements tied to livestock-related expenses or through interest subsidies (OECD, 2013, 2017).

To quantify anti-corruption efforts, we use Svensson's (2005) legalistic definition of corruption - 'the misuse of public office for private gain' - because misuse involves violations of legal standards. To ensure that the overall number of registered corruption criminal cases is a representative measure of a region's anti-corruption effort, we target the entire population of the region (Solon et al., 2015).

Assuming that intrinsic corruption levels across the regions are comparable, the number of registered cases under direct investigation by procurator's offices of each region weighted by the total population serves as a decent proxy for anti-corruption effort. The registered cases include those charged with corruption, bribery, extortion, and abuse of public power. Examples of corruption crimes include public officials accepting unofficial rewards to accelerate their duties, offering preferential treatment in granting government contracts, as well as citizens who pay bribes in order to get leniency in

punishment, bypassing law enforcement, or expediting bureaucratic operations. These measures are the most applied quantitative indicators of anti-corruption efforts and have been used in previous studies as a proxy for corruption control (Cole et al., 2009; Johnson et al., 2010; Zakharov, 2019).

Following the theoretical review, we postulate that regional cattle and beef output is determined by a set of characteristics presented in Table 1. As expected, resource endowment varies greatly between regions, while price indices fluctuate over time. Human capital and technologies, like financial resources, differ significantly among regions. The incidence of corrupt activity varies substantially both among the individual regions and within a region over time. The number of agricultural cooperative structures varies similarly to registered corruption crimes per capita.

*Table 1. Descriptive statistics of independent variables*

| Variable | Mean | Std. dev. overall | Std. dev. between | Std. dev. within |
|---|---|---|---|---|
| ***Output and input price*** | | | | |
| Price index of livestock outputs | 105.882 | 6.679 | 1.423 | 6.527 |
| Price index of livestock inputs | 107.100 | 22.908 | 5.658 | 22.206 |
| ***Resource endowments*** | | | | |
| Area of hayfields, thous. ha | 329.486 | 385.719 | 387.721 | 2.708 |
| Area of pastures, thous. ha | 2817.934 | 5635.633 | 5649.912 | 411.363 |
| All forage harvested for livestock, thous. tons | 208.627 | 269.284 | 254.299 | 92.280 |
| ***Human capital and technologies*** | | | | |
| Labor employed in agriculture | 19.699 | 18.442 | 18.216 | 3.424 |
| Number of tractors | 7058.765 | 6924.002 | 6913.165 | 598.517 |
| ***Support*** | | | | |
| Gov. expenditures to ag. services, thous. USD | 56277.750 | 55109.130 | 48031.460 | 27456.720 |
| Bank loans for agricultural needs, thous. USD | 175.340 | 275.100 | 232.474 | 148.981 |
| ***Cooperation and coordination structures*** | | | | |
| Area of privately owned land, thous. ha | 1492.927 | 1761.474 | 1770.078 | 45.142 |
| Number of agricultural cooperatives | 318.402 | 1244.422 | 395.521 | 1180.580 |
| Registered corruption crimes per capita | 0.084 | 0.052 | 0.032 | 0.041 |

The cattle number count is characterized by low regional variation over time in herd size and beef produced (Table 2). In Russia, most of the cattle are concentrated among

peasant farmers and enterprises, while in Kazakhstan, the lion's share of the cattle herd size belongs to households. In both Russia and Kazakhstan, households are the primary producers of beef. In Russia, in contrast to Kazakhstan, enterprises outnumber peasant farmers in beef production.

*Table 2. Descriptive statistics of dependent variables*

| Variable | Mean | St. dev. overall | St. dev. between | St. dev. within |
|---|---|---|---|---|
| *Cattle number, thous. heads* | | | | |
| ***Russia*** | | | | |
| Enterprices | 118868.1 | 119233.4 | 118038.5 | 21179.4 |
| Peasant farms | 121031.9 | 140851.4 | 140459.0 | 17664.7 |
| Households | 31711.3 | 41038.4 | 40268.7 | 9074.8 |
| ***Kazakhstan*** | | | | |
| Enterprices | 40836.3 | 35950.9 | 34311.9 | 14012.4 |
| Peasant farms | 304589.6 | 180389.7 | 166096.7 | 82794.7 |
| Households | 136851.0 | 115098.2 | 106701.2 | 51455.2 |
| *Beef produced, thous. Tons* | | | | |
| ***Russia*** | | | | |
| Enterprices | 7405.9 | 8318.4 | 7940.8 | 2628.6 |
| Peasant farms | 1737.4 | 2185.5 | 2050.9 | 788.4 |
| Households | 12729.8 | 14554.6 | 14498.3 | 2048.7 |
| ***Kazakhstan*** | | | | |
| Enterprices | 2490.1 | 2685.6 | 2111.3 | 1750.0 |
| Peasant farms | 6135.0 | 6489.4 | 6077.5 | 2779.2 |
| Households | 24035.2 | 13541.0 | 13920.1 | 1718.1 |

From the descriptive standpoint, it appears as though the widely held belief that production growth is dependent on a strong business climate is inconsistent. Despite the anti-corruption effort's shortcomings, productivity growth in the livestock sector may expand and decline depending on the type of entrepreneurship structure (Figure 5-7).

There are two questions that arise: Is a healthy business climate required for agricultural production growth? And does the expansion of enterprises and peasant farms to households have a negative impact on livestock production growth? The literature attempting to address these questions is mixed despite the fact that research confirms the general belief that productivity is linked to an inclusive institutional environment.

For example, Divanbeigi and Saliola (2017) found a positive relationship between good regulatory practices and agricultural productivity. Olsson and Svensson (2010) found a relationship between inclusive institutions and production. Other studies, such as Kalyuzhnova and Belitski (2019) as well as Mendoza, Lim, and Lopez (2015), show that corruption may facilitate employment growth and sales growth.

### 5.2Empirical framework

The theory suggests that an inclusive institutional environment has a positive effect on output development via entrepreneurial activity. The purpose of this study is to investigate the effect of anti-corruption efforts on output growth in various farm types. If the theory is right, a favorable business climate should promote rather than hinder agricultural production development regardless of farm type. We model current production growth rates in terms of historical production levels and present factors:

$$ln(y_{i,t}/y_{i,t-1}) = \alpha_0 + \alpha_1 ln(y_{i,t-1}) + \beta_1 AC_{i,t} + \sum_{j=2,\dots,m} \beta_j Z_{i,t} + u_i + \mu_t + \varepsilon_{i,t}, \quad (1)$$

where $y_{i,t}$ and $y_{i,t-1}$ are either enterprice, peasant farms, or household livestock production rates for two distinct time periods; $AC_{i,t}$ is anti-corruption effort weighted by government size in region *i* at a period *t*; $Z_{i,t}$ is a vector of control variables; $u_i$ is region-specific fixed effect; $\mu_t$ is time-specific fixed effect; and $\varepsilon_{i,t}$ represents an error term. Given this specification, the core relationship can be expressed as

$$\partial ln(y_{i,t}/y_{i,t-1}) / \partial_1 ln(y_{i,t-1}) = \alpha_1, \quad (2)$$

where $\alpha_1 < 0$ denotes convergence, or the quicker growth of the regions that produce the least, and $\alpha_1 > 0$ implies divergence.

Livestock output is influenced by the previous year's production values. For instance, a larger cattle headcount in a particular region leads to larger production in subsequent years. Differences among regions emerge only in the long run as a result of structural

changes in social capital, infrastructural development, and institutional environment. Consequently, the model may suffer from serial correlation. The lagged variable in Equation (1) is endogenous to the fixed effects in the error term. Thus, even in fixed or random effects situations, OLS estimates of the model will be inconsistent, as the lagged variable will still be correlated with the unobserved panel-level effects.

Such issues can be handled by specifying a Generalized Method of Moments (GMM) estimator for the linear dynamic panel model (Arellano & Bond, 1991; Holtz-Eakin et al., 1988). The assumption for system GMM estimation implies that instruments utilized as the lagged dependent variables among the regressors are uncorrelated with the fixed effects. As long as this assumption holds, the econometric model control for time-invariant unobserved effects, which allows estimating the long-run effect of anti-corruption efforts in livestock production. (Roodman, 2009). The GMM estimator is constructed by first differencing the Equation (1):

$$Y_{i,t} - Y_{i,t-1} = \alpha_1\big(ln(y_{i,t-1}) - ln(y_{i,t-2})\big) + \beta'(X_{i,t} - X_{i,t-1}) + (\mu_t - \mu_{t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}), \quad (3)$$

where $Y_{i,t} - Y_{i,t-1}$ is the first difference in growth rates $ln(y_{i,t}/y_{i,t-1}) - ln(y_{i,t-1}/y_{i,t-2})$; $X_{i,t}$ includes both $AC_{i,t}$ and $Z_{i,t}$.

Lagged variables demonstrate weak properties for first differences in GMM models (Dithmer & Abdulai, 2017). Utilizing instruments that account for a small proportion of the variance in possibly endogenous explanatory variables might result in inefficient and biased coefficient estimations. (Bound et al., 1995). To address this problem, we use a two-step System-GMM estimator that incorporates finite-sample standard error correction (Windmeijer, 2005). To explore the validity of the identifying assumptions, we specify Arellano & Bond's (1991) tests of autocorrelation and Hansen's (1982) test of overidentifying restrictions.

## 6. RESULTS

The results of the application of Equation (3) to the regional panel dataset for cattle are shown in Table 3, and for beef production are shown in Table 4. In the tables, we present only the effect of anti-corruption efforts on production growth. The appendix contains the complete table of results. Apart from the estimates for anti-corruption, the majority of the parameter estimates have the expected signs. In particular, the coefficients for output price indices are positive while those for input price indices are negative, as predicted by economic theory.

The estimated coefficients for lagged log of cattle herd count and lagged log of beef produced as stated in Equation (2) are all negative and less than one. This denotes convergence or the evidence of faster growth of the regions with lower production, which is consistent with growth theory.



*Table 3. Estimates of cattle headcount growth across farm types based on a dynamic model*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Total | Enterprises | Peasant Farms | Households |
| Ln cattle number (t-1) | -0.628*** | -0.520*** | -0.411*** | -0.789*** |
| | (0.111) | (0.094) | (0.056) | (0.145) |
| Registered corruption crimes per capita | 0.585 | -0.070 | -0.289 | 2.062*** |
| | (0.446) | (0.332) | (0.340) | (0.739) |
| Registered corruption crimes per capita squared/1000 | -945.634 | 478.497 | 1052.122 | -4150.823** |
| | (948.349) | (1106.948) | (843.422) | (1695.901) |
| Observations | 529 | 525 | 529 | 525 |
| Number of regions | 86 | 86 | 86 | 86 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

*Table 4. Estimates of beef production growth across farm types based on a dynamic model*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Total | Enterprises | Peasant Farms | Households |

| | | | | |
|---|---|---|---|---|
| Ln beef produced (t-1) | -0.813*** | -0.894*** | -0.550*** | -0.492*** |
| | (0.070) | (0.107) | (0.163) | (0.133) |
| Registered corruption crimes per capita | 0.454** | 1.438** | 0.051 | 0.439** |
| | (0.185) | (0.598) | (0.584) | (0.202) |
| Registered corruption crimes per capita squared/1000 | -1260.495** | -5581.162*** | 511.937 | -1037.022* |
| | (562.607) | (1795.876) | (1912.599) | (543.295) |
| Observations | 602 | 601 | 596 | 602 |
| Number of regions | 86 | 86 | 86 | 86 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Following our Hypothesis 1, we observe the non-uniform effect of anti-corruption efforts on growth. In herd size growth, only household farmers are associated with anti-corruption efforts. In beef production, aside from households, anti-corruption efforts relate to enterprises' beef production growth. However, these relationships are non-linear and take a concave shape. U-shape relationship between anti-corruption effort and production growth suggests that extreme low-level and high-level anti-corruption efforts are associated with higher production growth.

Against anticipation of Hypothesis 2, we observe those anti-corruption efforts differently associated with various entrepreneurship structures. While easing corruption relates to cattle production growth only for households, beef production growth and anti-corruption activities association mater both for enterprises and households.

The result partially verifies our expected Hypothesis 3. While in the upper-stream beef production chains association between anti-corruption efforts confirmed for enterprises and household against only households in cattle production, the magnitude of the anti-corruption effect is higher for the lower stream production effect. The anti-corruption effort is more effective in lower stream production value chains, which require more food safety controls and more technological advantages than upper stream production.

When we estimate the production volumes instead of the growth rates, which are presented in Table 5 and Table 6, we observe that anti-corruption relates to cattle production for all types of farmers and is associated with beef production for peasant

farmers and households. We may assume that anti-corruption activities are more effective in the short-run (production model) rather than in the long run (growth model). We may assume that in the long run, firms may adjust to anti-corruption regulations and bypass law enforcement.

*Table 5. Estimates of cattle production across farm types based on a static model*

| VARIABLES | (1) Total | (2) Enterprises | (3) Peasant Farms | (4) Households |
|---|---|---|---|---|
| Registered corruption crimes per capita | 0.683** | 1.072* | -2.216** | 1.832*** |
| | (0.333) | (0.629) | (0.923) | (0.439) |
| Registered corruption crimes per capita squared/1000 | -1.112 | -1.311 | 7.064** | -4.230*** |
| | (0.832) | (1.580) | (2.904) | (1.111) |
| Observations | 774 | 770 | 774 | 772 |
| R-squared | 0.185 | 0.121 | 0.345 | 0.446 |
| Number of regions | 86 | 86 | 86 | 86 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

*Table 6. Estimates of beef production across farm types based on a static model.*

| VARIABLES | (1) Total | (2) Enterprises | (3) Peasant Farms | (4) Households |
|---|---|---|---|---|
| Registered corruption crimes per capita | 0.718** | 0.844 | -1.076** | 1.684*** |
| | (0.342) | (0.641) | (0.492) | (0.433) |
| Registered corruption crimes per capita squared/1000 | -2.000** | -1.528 | 2.701** | -4.735*** |
| | (0.992) | (1.834) | (1.292) | (1.336) |
| Observations | 774 | 774 | 774 | 774 |
| R-squared | 0.111 | 0.093 | 0.327 | 0.325 |
| Number of regions | 86 | 86 | 86 | 86 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In addition, we observe that for peasant farms relationship between easing corruption and production rates is concave in contrast to the convex relationship for households and enterprises. From this, we may assume that for peasant farmers, corruption may be a greasing wheel while for enterprises and household sand wheel.

## 7. CONCLUSIONS

In this study, we investigate how differences in institutional environment influence progress in cattle and beef production in Kazakhstan and Russia. These differences include allocation of government support to agriculture, land property allocation, access to bank loans, and effort to control corruption.

Employing a neoclassical growth model, we found out that inclusive institution and governance efficiency indicators are more associated with production growth among enterprises and households while negatively with the production rates of peasant farmers. This may suggest that peasant farmers are more flexible in a less favorable institutional environment while households and enterprises, which are the main driver sources of livestock production both in Russian and Kazakhstan, require stronger institutional support. The findings highlight that anti-corruption effort has a stronger short-term effect on production, a greater effect on smaller producers, and a more substantial effect on downstream production that requires more technological advantages.

What we need to achieve further: we have to study how corruption affects sustainable development indicators for the livestock sector that might include economic measures such as Productivity of labor, Productivity of land, Profitability, Market orientation, Farm viability; Environmental measures such as GHG emissions per farm, GHG emissions per kilogram of output, Nitrogen (N) balance, Emissions from fuel and electricity; and Social indicators Household vulnerability, Education level, Isolation risk, Demographic viability, Work-life balance (Ryan et al., 2016).

Appendix A

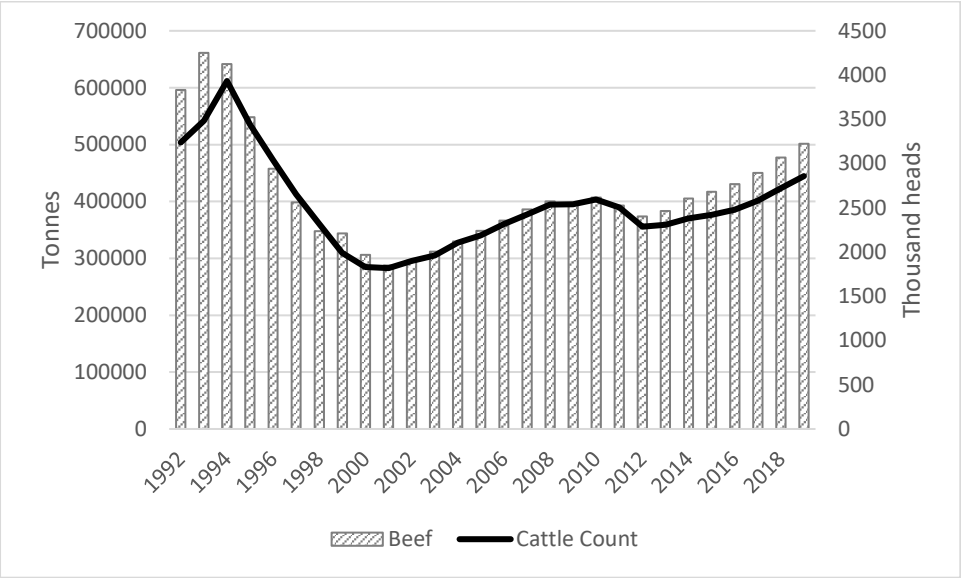


*Figure 2. Beef production and cattle headcount, Kazakhstan 1992–2019*

***Source***: FAOSTAT

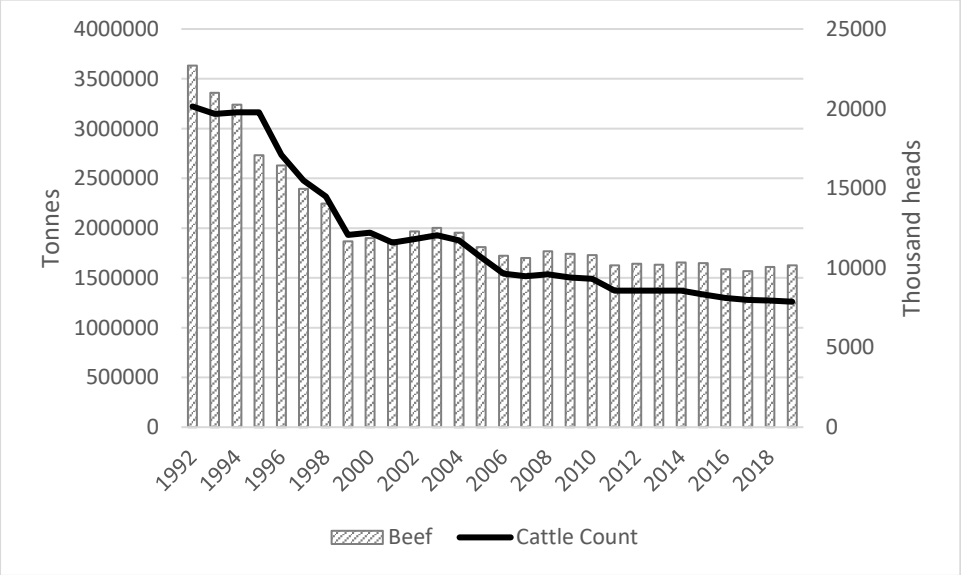


*Figure 3. Beef production and cattle headcount, Russia 1992–2019*

***Source***: FAOSTAT

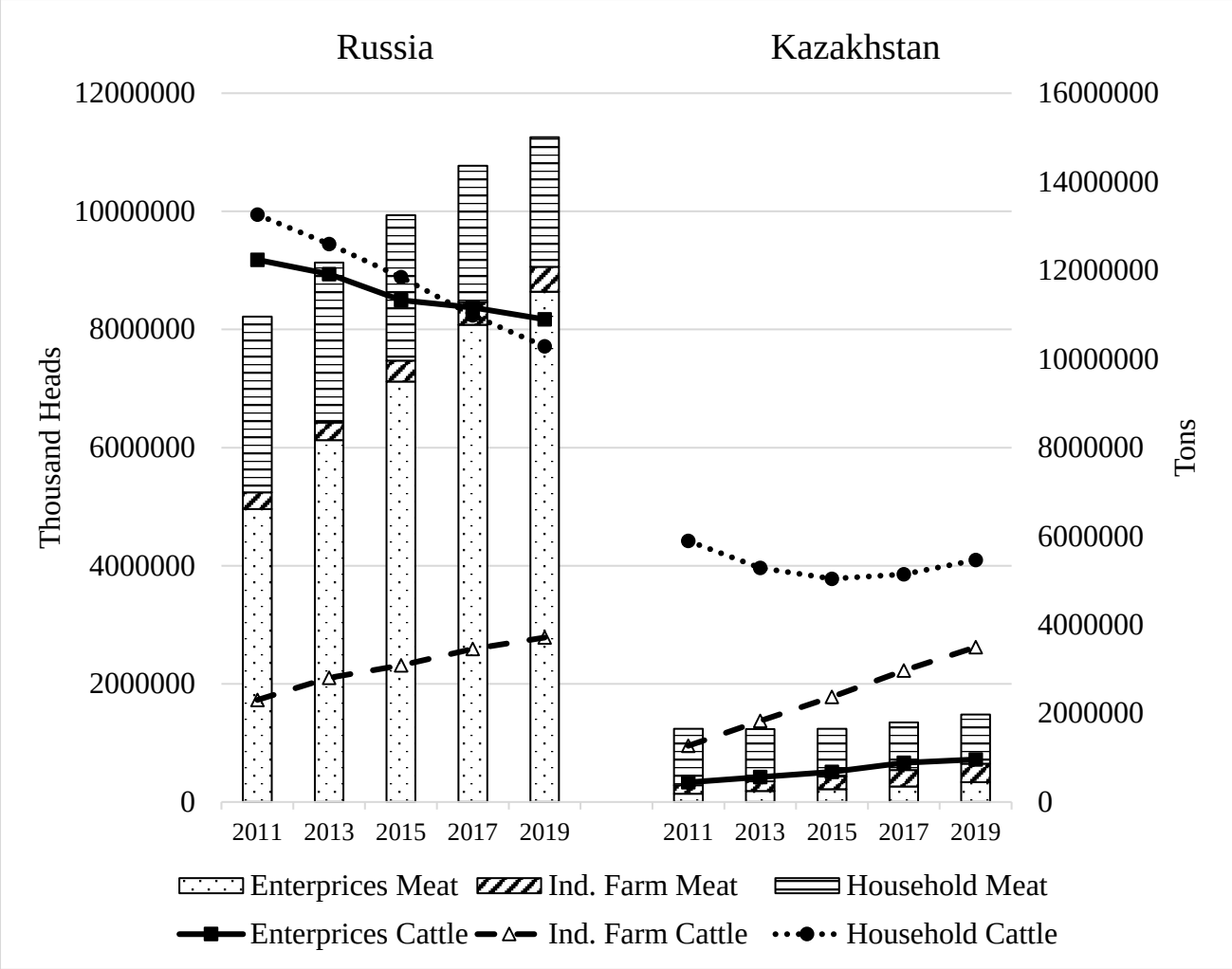


*Figure 4. Cattle herd size and meat production rates in live weight before slaughter by farm type in Kazakhstan and Russian Federation (2011–2019), author's illustration based on National Statistics offices*

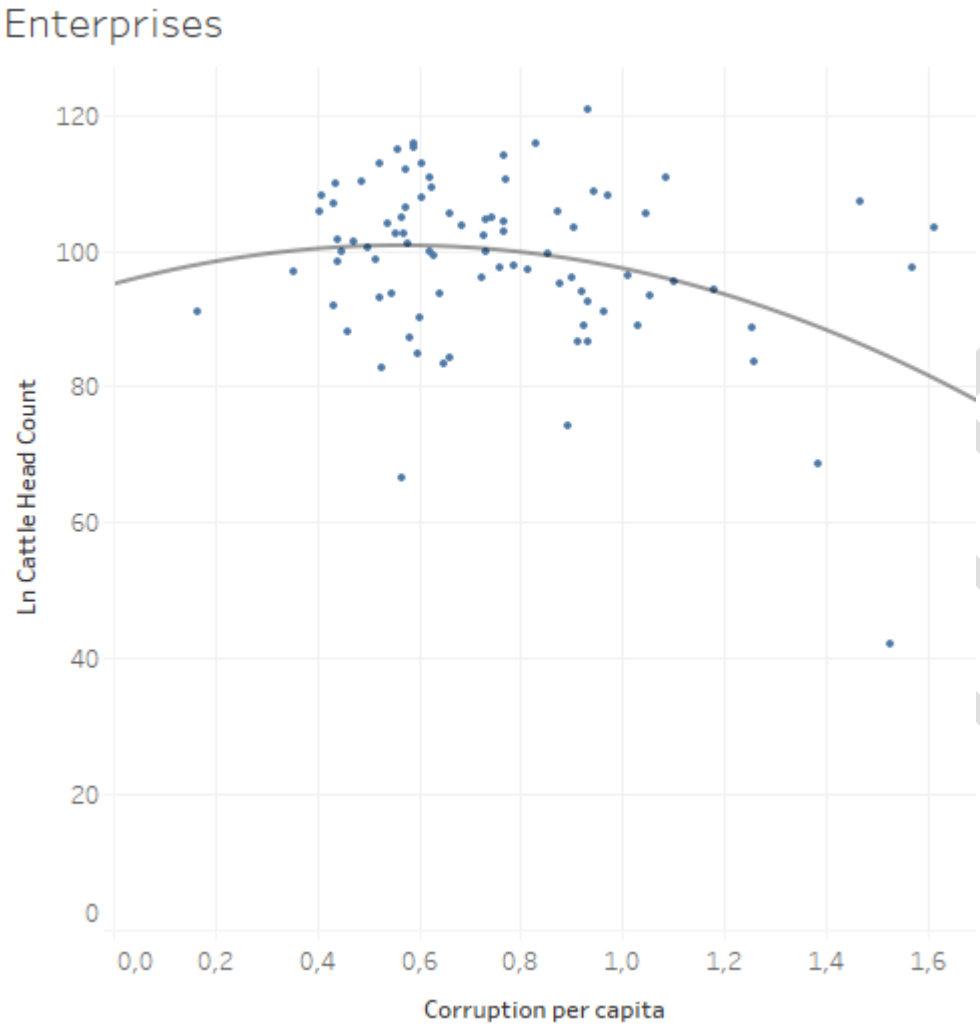


*Figure 5. Relationship between anti-corruption effort per capita and cattle herd size for enterprises.*

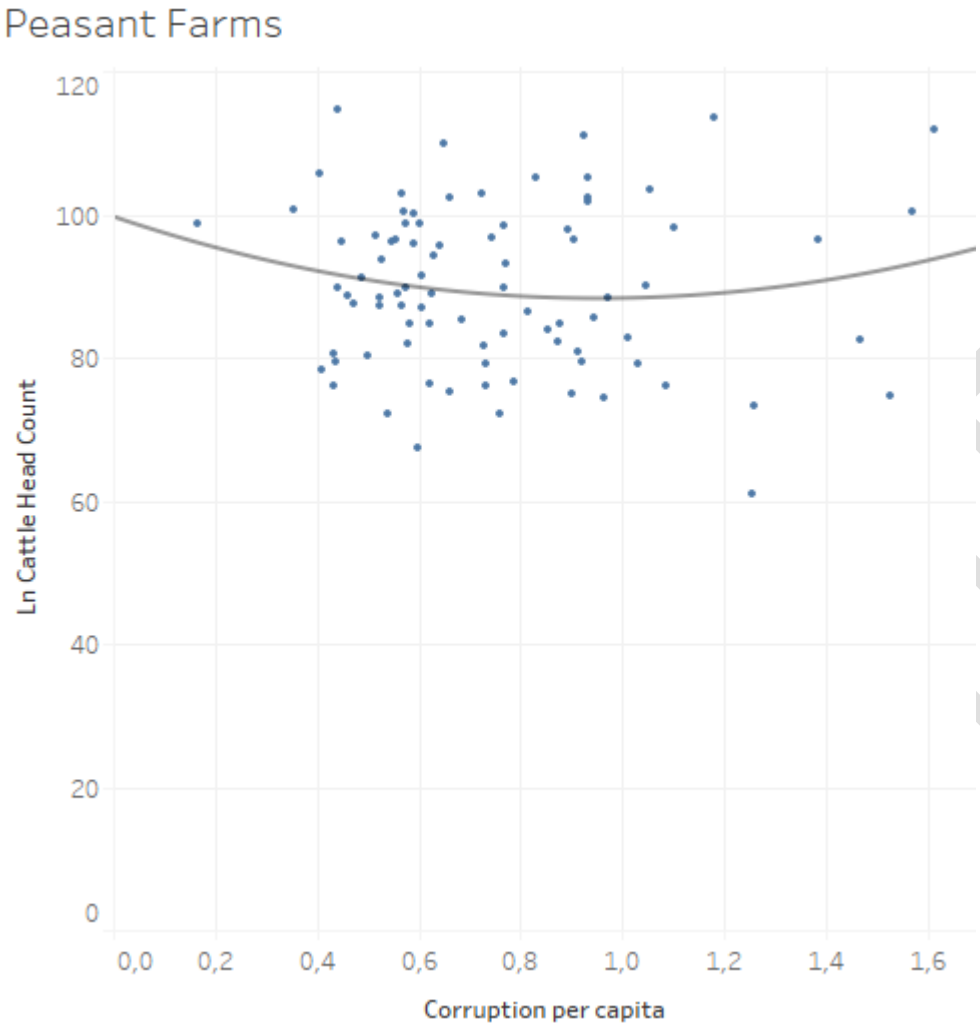


*Figure 6. Relationship between anti-corruption effort per capita and cattle herd size for peasant farmers.*

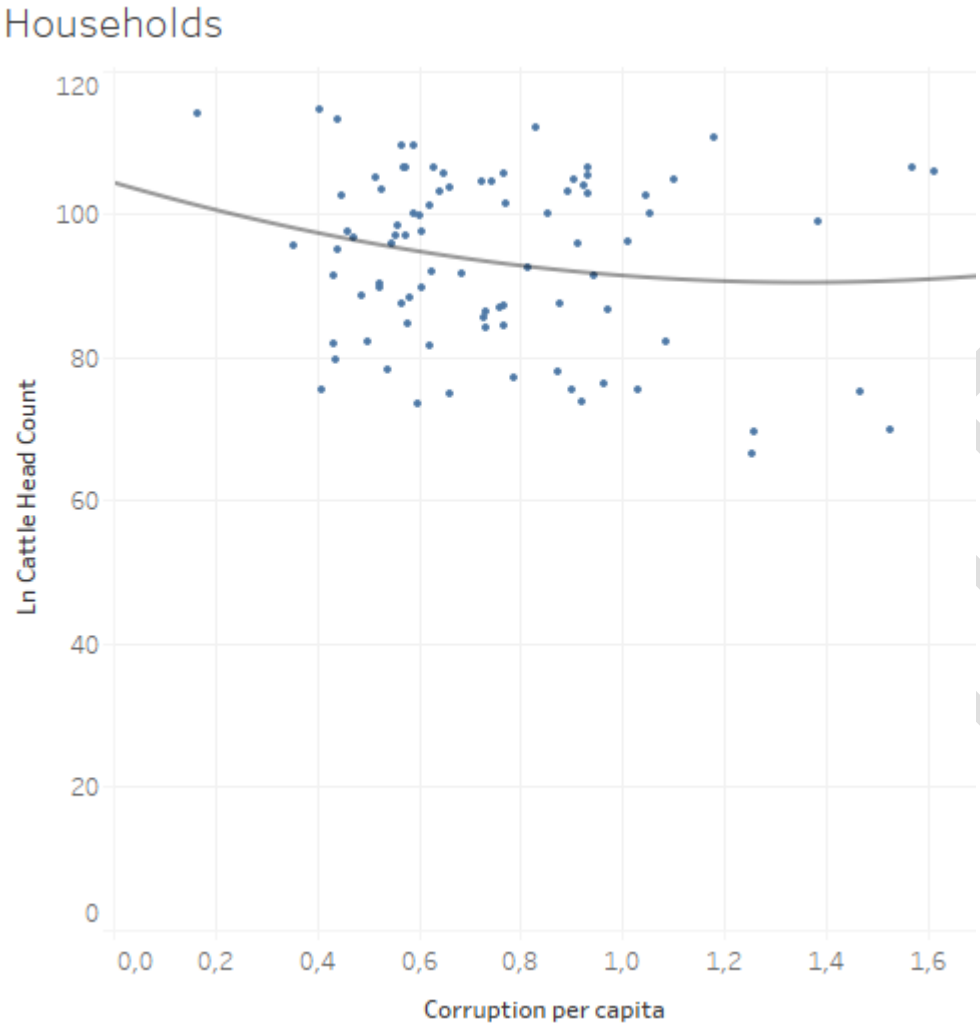


*Figure 7. Relationship between anti-corruption effort per capita and cattle herd size for households.*

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