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Determinants of Broiler Production and its Economic Impact: Panel Data Evidence from Indonesia's Core Provinces

Samuel Alkadri[1], Ahmad Rodoni[2], Elmiwati[3]
[1]Borobudur University, Indonesia, Sam.manihuruk@gmail.com
[2]Universitas Islam Negri, Indonesia, Ahmad.rodoni@uinjkt.ac.id
[3]Universitas Borobudur, Indonesia, Elmiwati@borobudur.ac.id

Corresponding Author: Sam.manihuruk@gmail.com[1]

Abstract: The broiler chicken industry is a vital component of Indonesia's agricultural sector, possessing significant potential for economic growth and food security. However, it is constrained by challenges including high capital requirements, price volatility, and structural inefficiencies within its core-plasma partnership model. This study aims to analyze the primary determinants of broiler production and quantify its subsequent impact on regional economic output. Using a balanced panel dataset from 2000 to 2023 across five key provinces in Java—which collectively represent the national production hub—this research employs panel data regression analysis to examine the influence of the number of core farmers, price, bank credit, and domestic investment on broiler production volume. A subsequent model assesses the impact of production on Gross Regional Domestic Product (GRDP). The findings reveal that the number of farmers, bank credit, and domestic investment are significant positive drivers of production. Conversely, price exhibits a significant negative relationship, a counter-intuitive result attributed to structural market failures within the core-plasma system where input costs are controlled by output buyers. Furthermore, the analysis confirms that broiler production has a significant and positive impact on GRDP, underscoring the sector's role as an engine for regional economic growth. The study concludes that unlocking the industry's full potential requires policy interventions focused on reforming partnership models and enhancing access to capital for farmers.

Keyword: Broiler Chicken Production, Domestic Investment, Bank Credit, Gross Regional Domestic Product, Panel Data Analysis

INTRODUCTION

The broiler chicken industry stands as a cornerstone of Indonesia's agricultural economy and a critical pillar of national food security. Its strategic importance is recognized within national development frameworks, including the Ministry of Research's National Research Priorities for 2020-2024 and the Asta Cita vision, which links robust food production to the enhancement of human capital through improved nutrition. This study focuses on the epicenter of Indonesia's broiler industry: five key provinces on the island of

Java (West Java, Central Java, East Java, Banten, and Yogyakarta). These provinces collectively account for approximately 68.21% of the national output, making them a highly representative sample for a deep analysis of the sector's dynamics and challenges.

Despite its potential for high profitability, the industry is beset by persistent structural problems. It is characterized by high capital intensity, which creates significant barriers to entry and expansion, particularly for smallholder farmers. Furthermore, the sector is subject to extreme price volatility, exposing producers to substantial financial risk. At the heart of these challenges lies a fundamental structural inefficiency: the core-plasma partnership model. In this system, the core company often acts as both the sole supplier of critical inputs (such as day-old chicks and feed) and the primary buyer of the finished broilers. This creates a power imbalance that can lead to an "unequal partnership system", constraining the profitability and viability of plasma farmers. This dynamic has fueled a significant academic debate regarding the primary factors influencing broiler production. Some scholars prioritize investment in technology and management efficiency as the key drivers of productivity. Others argue that price stability is the most critical factor for small farmers who are highly vulnerable to market fluctuations, while a third perspective emphasizes that access to capital through bank credit and domestic investment is the fundamental prerequisite for growth in a capital-intensive sector.

This research addresses a notable gap in the existing literature. Previous studies on Indonesia's broiler sector have typically been limited by shorter analytical periods (often a maximum of 10 years) and a narrower set of explanatory variables (a maximum of five). This study distinguishes itself by utilizing a comprehensive 24-year panel dataset spanning from 2000 to 2023 and integrating a broader set of variables to provide a more robust and nuanced analysis. The core problem investigated is not merely a matter of optimizing production inputs, but rather of understanding how the sector's potential as a powerful economic engine is constrained by its internal structural conflicts. This duality frames the entire analysis. Accordingly, this paper pursues two primary objectives:

1. To analyze the simultaneous and partial influence of the number of core farmers, price, bank credit, and domestic investment on broiler chicken production in Java's five main producing provinces.
2. To quantify the impact of broiler chicken production on the Gross Regional Domestic Product (GRDP) of these provinces.

METHOD

This study employs a quantitative, ex-post facto research design utilizing an inferential statistical approach to analyze the determinants of broiler production and its economic impact. The analysis is based on a balanced panel dataset that combines time-series data from 2000 to 2023 (a 24-year period) with cross-sectional data from five key broiler-producing provinces in Indonesia: West Java, Central Java, East Java, Banten, and the Special Region of Yogyakarta. This combination results in a total of 120 observations, providing a robust basis for econometric analysis. The secondary data used in this research were compiled from official government sources, including Bank Indonesia (BI), the Ministry of Agriculture, the Ministry of Trade, the Ministry of Investment, and the Central Bureau of Statistics (BPS).

Operational Variables

The variables included in the analysis were selected based on economic theory and data availability, and are defined as follows :

1. Dependent Variable (Y): Broiler Chicken Production. This variable represents the total output of the broiler industry and is measured in tons per year for each province.

2. Independent Variables (X):
   a. Number of Farmers (X_1): This refers to the total number of core farmer corporations (Peternak inti) operating within each province. It serves as a proxy for the scale and capacity of the organized production sector.
   b. Price (X_2): This is the average annual selling price of broiler chicken at the producer level, measured in Indonesian Rupiah (IDR) per kilogram.
   c. Bank Credit (X_3): This variable captures the total credit disbursed by the banking sector to the livestock sub-sector within each province, measured in millions of Rupiah. It represents the availability of external financing for operational and investment needs.
   d. Domestic Investment (X_4): This variable measures the value of realized domestic investment flowing into the livestock sub-sector, measured in millions of Rupiah. It reflects capital formation from domestic sources.
3. Dependent Variable 2 (Z): Gross Regional Domestic Product (GRDP). This variable represents the economic contribution of the livestock sub-sector to the regional economy and is measured in millions of Rupiah at constant prices.

Econometric Model Formulation

The study utilizes a two-model approach to address its research objectives. The relationship between the variables is specified in the following panel data regression models :

1. Model 1: Determinants of Broiler Production
   This model examines the influence of the four independent variables on broiler production volume.
   $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + et$
   Where Y is broiler production for province i at time t, X1 to X4 are the independent variables, β0 is the intercept, β1 to β4 are the coefficients, and ϵit is the error term.
2. Model 2: Economic Impact of Production
   This model quantifies the impact of the predicted broiler production volume on the GRDP of the livestock sub-sector.
   $Z = \beta_0 + \beta_1 \hat{Y} + et$
   Where Z1 is the GRDP for province i at time t, $\hat{\mathbf{Y}}$ is the estimated broiler production from Model 1, β_0 is the intercept, β_1 is the coefficient, and μit is the error term.

Analytical Technique

The data were analyzed using panel data regression techniques to account for both time-series and cross-sectional variations. To determine the most appropriate estimation model, a series of specification tests were conducted. The selection process involved choosing among the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). The decision was guided by the following statistical tests as outlined in the research framework:

1. Chow Test: Used to choose between the pooled OLS (CEM) and the FEM.
2. Hausman Test: Used to determine the appropriateness of the FEM versus the REM by testing for correlation between the unobserved individual effects and the regressors.
3. Breusch-Pagan Lagrange Multiplier (LM) Test: Used to select between the CEM and the REM by testing for the presence of significant individual random effects.

Prior to the final model estimation, the data were also tested to ensure they met the classical linear regression model assumptions, including normality of residuals, absence of severe multicollinearity, homoscedasticity, and no serial autocorrelation. The results of these diagnostic tests confirmed the suitability of the data for the chosen regression techniques.

RESULT AND DISCUSSION

This section presents the empirical findings from the panel data regression analysis. It is divided into two main parts: the first examines the factors determining broiler production, and the second analyzes the economic contribution of this production to the regional economy.

Determinants of Broiler Production

For the first model, which investigates the determinants of broiler production, a series of specification tests were conducted to select the most appropriate estimation technique. The Chow test and Hausman test both yielded statistically significant results, indicating that the Fixed Effect Model (FEM) was the most suitable for analyzing the data. The FEM accounts for unobserved, time-invariant heterogeneity across the five provinces, thereby providing more robust and unbiased estimates. The results of the FEM regression are summarized in Table 1.

Table 1.Panel Regression Results for Determinants of Broiler Production (FEM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Number of Farmers (X_1)	29968.71	4697.277	6.380017	0.0000
Price (X_2)	-4.386978	0.972848	-4.509419	0.0000
Bank Credit (X_3)	4.014843	1.617109	2.482729	0.0145
Domestic Investment (X_4)	1.370119	0.832683	1.645427	0.1027*
Constant (C)	-52749.16	24002.94	-2.197612	0.0301
Model Statistics				
R-squared	0.937315			
Adjusted R-squared	0.932797			
F-statistic	207.4693		Prob(F-statistic)	0.0000
Note: Significant at the 10% level.				

The regression results show an Adjusted R-squared of 0.9328, indicating that approximately 93.3% of the variation in broiler production across the five provinces can be explained by the independent variables in the model. The F-statistic is highly significant ($p<0.001$), confirming the overall validity of the model.

The coefficients for the Number of Farmers (X_1), Bank Credit (X_3), and Domestic Investment (X_4) are positive and statistically significant. The coefficient of X_1 (29968.71) implies that, on average, the addition of one core farmer corporation is associated with an increase in annual production of nearly 30,000 tons. This finding confirms the hypothesis that expanding the base of core producers directly translates to greater production capacity. Similarly, the positive coefficients for Bank Credit and Domestic Investment

underscore the critical role of capital in this industry. As a capital-intensive sector, access to financing for operational costs (feed, chicks) and investment (modern housing, equipment) is a fundamental prerequisite for growth. An increase in credit and domestic investment provides the necessary fuel for farmers to scale up their operations and improve productivity.

The most striking result from this model is the coefficient for Price (X_2), which is -4.387 and highly significant. This finding is counter-intuitive, as it contradicts the standard Law of Supply, which posits that higher prices should incentivize producers to increase output. This anomaly points not to an economic paradox, but rather to a deep-seated structural market failure within the industry. The dissertation repeatedly highlights the "unequal partnership" where core companies function as both input suppliers and output buyers. This dual role creates a perverse incentive structure. When the final market price for broilers increases, the core company can capture the additional margin by raising the prices of the inputs it sells to its plasma farmers (e.g., day-old chicks, feed). Consequently, the higher market price does not translate into higher profits for the plasma farmers who are undertaking the actual production. Instead, their margins are squeezed from the input side, effectively disincentivizing any expansion of production. Therefore, the negative price coefficient is not measuring a typical supply response; it is an empirical manifestation of the power asymmetry in the core-plasma relationship. It quantifies the extent to which price signals are distorted by a market structure that penalizes, rather than rewards, the primary producers in response to favorable market conditions.

The Economic Contribution to Gross Regional Domestic Product

For the second model, which assesses the impact of broiler production on regional economic output, the specification tests (including the Hausman and Breusch-Pagan LM tests) indicated that the Random Effect Model (REM) was the most efficient and appropriate estimator. The REM is suitable when individual-specific effects are assumed to be random and uncorrelated with the independent variables. The results of the REM regression are presented in Table 2.

Table 2. Panel Regression Results for the Impact of Broiler Production on GRDP (REM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Broiler Production ($\hat{Y}$)	0.026927	0.000804	33.49733	0.0000
Constant (C)	359.9530	498.8350	0.721587	0.4720
Model Statistics				
R-squared (weighted)	0.905449			
F-statistic	1130.004		Prob(F-statistic)	0.0000

The results in Table 2 show a highly significant and positive relationship between broiler production and the GRDP of the livestock sub-sector. The coefficient for Broiler Production is 0.026927, with a p-value of 0.0000. This indicates that for every one-ton increase in broiler production, the regional GRDP from the livestock sector is expected to increase by approximately 0.027 million Rupiah (or 26,927 Rupiah), holding other factors constant.

This finding empirically validates the role of the broiler industry as a significant contributor to regional economies. The magnitude of this impact can be understood through the sector's function as a high-velocity economic multiplier. The dissertation notes the

remarkably short production cycle for broilers, typically between 28 to 32 days. This rapid turnover means that capital is injected, circulated, and regenerated within the local economy at a much faster pace compared to other agricultural sub-sectors with longer cycles, such as cattle ranching or perennial crops. This high velocity creates powerful forward and backward linkages. An increase in broiler production stimulates immediate demand in upstream industries, including feed mills, hatcheries, and veterinary services. Simultaneously, it fuels activity in downstream industries such as slaughterhouses, food processing plants, logistics, and retail. Each of these linked activities generates its own value-added, which is captured in the aggregate GRDP figures. Therefore, the significant impact on GRDP is not merely a reflection of the direct value of the poultry itself; it is amplified by a rapid and continuous cycle of economic activity that permeates the entire regional value chain, making the broiler sector a particularly potent engine for short-term economic growth.

CONCLUSION

Summary of Findings

This study provides robust empirical evidence on the key factors driving broiler production in Indonesia and quantifies the sector's contribution to regional economic growth. The analysis concludes that access to capital, through both bank credit and domestic investment, alongside an expanding base of core farmers, are fundamental drivers of production growth. However, this potential is significantly constrained by a structural market failure, evidenced by a negative relationship between price and production. This anomaly reflects a power imbalance in the core-plasma partnership model that disincentivizes production expansion among plasma farmers. Despite these internal challenges, the research confirms that the broiler sector serves as a powerful engine for regional economies, with increases in production translating into significant positive gains in Gross Regional Domestic Product.

Policy Implications

The findings of this research lead to several actionable policy recommendations aimed at unlocking the full potential of the broiler industry while ensuring its development is equitable and sustainable.

1. Reforming the Core-Plasma Partnership Model: The most critical policy intervention required is the reform of the existing partnership structure. The negative price coefficient is a clear indicator of a conflict of interest where core companies control both input costs and output prices, to the detriment of plasma farmers. It is recommended that regulators introduce policies that legally separate the function of input supply from the role of output purchasing. This would prevent core companies from using input prices to absorb gains from favorable market conditions, thereby creating a more transparent and equitable market where price signals properly incentivize production.
2. Enhancing Access to Capital for Farmers: The strong positive impact of credit and domestic investment highlights the urgent need for targeted financial policies. The government should work with financial institutions to expand access to low-interest credit schemes, such as the People's Business Credit (KUR), specifically for plasma farmers. This would reduce their dependence on core companies for financing and empower them to invest in productivity-enhancing technologies. Furthermore, creating specific investment incentives for domestic firms to modernize broiler infrastructure, such as developing more closed-house systems and improving processing facilities, would strengthen the entire value chain.
3. Promote and Direct Domestic Investment: Recognizing the positive contribution of Domestic Investment, the government should create a more attractive and predictable

investment climate for the broiler value chain. This can be achieved through targeted fiscal incentives, streamlined regulations for building modern farm infrastructure, and promoting investment in downstream processing to increase value-added activities.

Integrate Broiler Sector into Regional Development Strategies: The demonstrated strong link between broiler production and GRDP underscores the need for regional governments to formally integrate the sector's development into their broader economic growth plans. This includes supporting the development of essential infrastructure (e.g., roads, electricity, cold chains) and facilitating the integration of the broiler value chain to maximize its economic multiplier effect.

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