Original Research Article

Analyzing the Impact of Global and Local Factors on Broiler Production in Malaysia: A Time Series Approach

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Abstract: The rising cost of food in Malaysia, particularly broiler meat, presents a significant challenge to maintaining public satisfaction and food security. Recent global events, such as the Russia-Ukraine crisis, highlight the important impact of feed prices on broiler production costs in Malaysia and have damaged the broiler business, which faced a shortage in 2022. This study aims to analyze the factors affecting Malaysia's broiler production, focusing on the influence of broiler population, global corn prices, global soybean prices, and broiler meat retail prices. Using multiple linear regression analysis on secondary time series data from 2000 to 2021, the study found that broiler retail prices and population significantly affected production, while global corn and soybean prices were negatively affected, although it is not statistically significant. The results highlight the need for strategic measures to enhance the broiler industry's profitability, ensuring stable supply and protecting small-scale farmers from market and external crises. This research offers valuable insights for policymakers to develop effective interventions in the broiler market**.**

1. Introduction

Malaysia is not currently experiencing a severe food shortage crisis, it is imperative to address rising food costs promptly to prevent instability, as escalating prices for broiler meat and other foods can lead to public dissatisfaction. Historical parallels can be drawn from the United States, where the feed component of total costs for broiler production surged from 51.8% in 2001 to 68.7% in 2008 during the peak of the food crisis (Donohue & Cunningham, 2009). A similar trend re-emerged in 2022 due to the conflict in Russia and Ukraine, which

has precipitated a significant international food security crisis. This conflict has disrupted food trade, production, and access, severely limiting the flow of Ukrainian agricultural products to European markets. The global agricultural input, particularly fertilizer from Belarus, essential for crops like corn and soybeans, has also become scarce. The Russian agricultural sector has suffered from disrupted transportation lines, reducing the amount of Russian food reaching international markets. These reductions in exports negatively impact global food security, notably affecting Malaysia, which relies on imported components for broiler feed.

Day-old chicks (DOC) represent roughly 22% of the total variable cost in broiler production, with feed accounting for 70% of the costs. The remaining costs, including labor, vitamins, and equipment, constitute less than 9% of the total variable cost (Ravindran, 2013). Numerous researchers identify the high cost of feed as a primary factor in the industry's underperformance, along with a lack of understanding of disease prevention, outbreaks, selection, and mating processes (Elsedig *et al*., 2015; Chanjula & Pattamarakha, 2002). In response to rising production costs in 2022, the Malaysian government implemented a reactive approach to manage the price hikes in feed. This included extreme measures like capping chicken prices at MYR 8.90 until July 2022, then at MYR 9.40 from July 1, 2022 (Daud, 2022; FMT, 2022). The government also provided broiler and layer breeders with subsidies totaling MYR 1.233 billion, the largest sum ever given to broiler breeders (Sulaiman, 2022). Additionally, a ban on chicken exports was imposed on June 1, 2022, to ensure a steady domestic supply. However, special permissions for exports were reinstated two weeks later for certain chicken commodities as local supply improved.

To stabilize local supply, the Malaysian government decided to import broiler meat and banned exports from June 1, 2022. This strategy faced criticism from local farmers and broiler integrators due to potential impacts on the export market, particularly to Singapore. The export ban affected the 3.6 million birds produced monthly for export, about 2% of Malaysia's monthly broiler production. Concerns over the proposed import of frozen chicken led to a reduction in production, fearing an oversupply that could depress prices and revenues. This adjustment caused a temporary shortage of chicken in the market, lasting two to three months until August 2022, when supply and prices stabilized, albeit at a slightly higher retail value.

Therefore, to ensure a stable and sustainable supply of broiler meat in Malaysia, it is crucial to address the factors that enhance the profitability of the broiler industry. This approach is particularly important for protecting small-scale farmers with limited resources

from potential threats posed by market fluctuations and external crises. In this study, the aim was to examine the factors affecting Malaysia's broiler market.

2. The Impact of Feed Prices on the Production

Several previous studies have demonstrated a negative association between broiler feed prices and broiler production. Ezeh *et al.* (2012) found that increased feed intake is associated with higher production levels, indicating that encouraging higher feed intake can enhance production outcomes. However, if feed prices rise, it becomes challenging to purchase sufficient feed, leading to a decrease in production output. This correlation between feed intake and production output aligns with classical production theory. Casasnovas-Oliva and Aldanondo-Ochoa (2014) examined the impact of livestock feed prices on milk production costs in Spanish dairy farms. Their findings suggest that a 1% increase in milk production leads to a 1.118% increase in the quantity of purchased livestock feed, implying that any increase in milk production is associated with a higher increase in feed use. Thus, feed price trends should be considered when assessing dairy farm production and profitability. Similarly, De Frahan *et al.* (2011) studied Belgian dairy farms from 1996 to 2006 and found a long-run feed demand elasticity of -0.664 for feed prices. Pierani and Rizzi (2003) also found similar results in their research on Italian dairy farms from 1980 to 1992, with short-run feed demand elasticities of -0.312 for feed prices and 1.483 for milk production, showing a decrease in milk production if feed prices increase.

Njoroge *et al.* (2015) found that the short-run and long-run feed price response elasticities for broiler finisher mash consumed were inelastic, indicating that a small change in feed prices results in a less than proportionate change in broiler production. The study concluded that production mainly depends on feed price variability, corroborated by extensive empirical literature on livestock feed prices and poultry production (Kailikia, 1992; Mutua *et al.*, 2010; Ndegwa *et al.*, 2012).

Casasnovas-Oliva and Aldanondo-Ochoa (2014), De Frahan *et al.* (2011), Pierani and Rizzi (2003), and Njoroge *et al.* (2015), find a negative correlation between feed prices and production. However, in countries like China that do not heavily rely on feed imports, production does not show significant causality from feed prices, as demonstrated by Zhou and Koemle (2015). Pang *et al.* (2021) highlighted the importance of retail prices in affecting agricultural production.

3. Methodology and Data Collection

In the study, multiple linear regression was used to analyse the broiler. The estimated function for broiler production is:

$$AYQP_t = \alpha_1 + \alpha_2 AYLVBO_t + \alpha_3 AYFEC_t + \alpha_4 AYFES_t + \alpha_5 AYRP_t + e_t \qquad (1)$$

where,   AYLVBO   = Broilers population (head)

AYFEC   = Global corn price (US \$/MT)

AYFES   = Global soybean price (US \$/MT)

AYRP   = Broiler meat retail price (RM/kg)

Note that the error term (e_t) must be identical independent normally distributed and mean equal to zero and constant variance. The broiler population (AYLVBO), the broiler feed price such as global corn (AYFEC) and soybean price (AYFES), and the broiler meat price (AYRP) determine the broiler meat production (AYQP). Broiler production is the practice of growing chickens specifically developed for meat production, known as broilers. It includes all actions associated with the breeding, feeding, growing, and processing of broiler chickens for meat production. The broiler population is the total number of broiler chickens raised in a certain area or farm. It tells how many broilers are present and ready for meat production. Broiler meat is explicitly defined as meat produced by broiler birds, which are bred and kept primarily for flesh. Broiler meat, as opposed to chicken meat, comes from hens that are specifically developed to grow quickly and produce a significant amount of meat.

In this study, secondary time series data was utilized, sourced from the Department of Veterinary Services (DVS), Federal Reserve Economic Data (FRED), and the World Bank Group. The variables for broiler production (AYQP), broiler population (AYLVBO), and broiler meat retail price (AYRP) were obtained from various years of the DVS statistical report publications, covering the period from 2000 to 2021. Additionally, annual data for global corn prices (AYFEC) and global soybean prices (AYFES) from 2000 to 2021 were gathered from the Federal Reserve Economic Data (FRED).

4. Findings and Discussions

Table 1 provides a summary of the statistical analyses of the data. The Jarque-Bera test's p-value was greater than 0.05 and failed to reject the null hypothesis. This indicates that all sample data is normally distributed.

Table 1. Summary of Statistics for Dependent and Independent Variables

Estimator	AYQP	AYFEC	AYFES	AYRP
Mean	1,259,411.818	169.934	346.149	6.966
Median	1,292,750.000	165.045	348.620	7.225
Minimum	1,755,200.000	298.440	537.760	8.800
Maximum	639,250.000	88.220	168.750	4.890
Std. Dev	376,973.351	63.436	113.493	1.300
Coefficient of variation	0.299	0.373	0.328	0.187
Skewness	-0.264	0.649	0.064	0.374
Kurtosis	-1.438	-0.347	-0.999	1.412
Observations	22	22	22	22
Jarque-Bera	2.151	1.653	0.930	2.340
p-value	0.341	0.438	0.628	0.310

The broiler production is driven by four independent factors which are the broiler population (AYLVBO), global corn price (AYFEC), global soybean price (AYFES), and the broiler retail price (AYRP). The summary of the estimated regression is shown in Table 2.

Table 2. Summary of Broiler Production Regression Analysis

Variable	Coefficient	Standard Error	t-statistic	P-value
C	-593778.17***	86784.838	-6.842	0.000
AYLVBO	0.003***	0.001	4.130	0.001
AYFEC	-610.914	831.643	-0.735	0.473
AYFES	-0.034	508.323	0.000	0.999
Variable	**Coefficient**	**Standard Error**	**t-statistic**	**P-value**
AYRP	184,482.375***	32961.685	5.597	0.000
R-squared	0.976			
F-statistic	176.220***			

Note: *** represents significance at the 1% significance level.

The R-squared value of 0.976 indicates that 97.6% of the variation in broiler production in Malaysia can be explained by the variations in the broiler population

(AYLVBO), global corn price (AYFEC), global soybean price (AYFES), and broiler meat retail price (AYRP). This leaves approximately 2.4% of the variation to be accounted for by other unknown factors, signifying a strong goodness of fit for the estimated regression model. Furthermore, the F-statistic is highly significant at the 1% level, implying that the exogenous variables are jointly significant in explaining broiler production.

The regression coefficient for the broiler retail price (AYRP) is 184,482.375, which is statistically significant at the 1% level. This suggests a positive influence of broiler retail price on broiler production. Specifically, broiler production is expected to increase by 184,482.375 metric tonnes for every unit increase in broiler retail price, holding other factors constant. This finding is supported by the studies of Pang *et al.* (2021) and Bashir *et al.* (2019), which also conclude that broiler retail price is positively correlated with production and significantly impacts it.

The regression coefficient for broiler population (AYLVBO) is 0.003, indicating a positive influence on broiler production. Holding other factors constant, broiler production is expected to increase by 0.003 metric tonnes for every unit increase in broiler population. The *p*-value for AYLVBO is 0.001, below the 1% significance threshold, affirming a significant causal impact of broiler population on production. This rejects the null hypothesis of AYLVBO's lack of causal influence on broiler production. Yitbarek (2019) supports these findings, showing a positive correlation between livestock population and production from 1960 to 2005.

The regression coefficient for global corn price (AYFEC) is -610.914, indicating a negative influence on broiler production. Holding other factors constant, broiler production is expected to decrease by 610.914 metric tonnes for every unit increase in global corn price. However, the *p*-value for AYFEC is 0.473, above the 1% significance threshold, suggesting no significant causal impact on broiler production at the 1% level. This result aligns with studies by Casasnovas-Oliva and Aldanondo-Ochoa (2014), De Frahan *et al.* (2011), Pierani and Rizzi (2003), and Njoroge et al. (2015), which found feed prices negatively correlated with production. Conversely, Zhou and Koemle (2015) argue that feed price does not significantly impact production output.

The regression coefficient for global soybean price (AYFES) is −0.034, indicating a negative influence on broiler production. Holding other factors constant, broiler production is expected to decrease by 0.034 metric tonnes for every unit increase in global soybean price. The p-value for AYFES is 0.999, above the 1% significance threshold, indicating no

significant causal impact on broiler production at the 1% level. This finding is consistent with the studies by Casasnovas-Oliva and Aldanondo-Ochoa (2014), De Frahan *et al*. (2011), Pierani and Rizzi (2003), and Njoroge *et al*. (2015), which found feed prices negatively correlated with production.

5. Conclusion

The findings of this study demonstrate that the broiler retail price and broiler population are significant factors positively influencing broiler production in Malaysia. A 1% increase in broiler retail price leads to a substantial rise in production, highlighting the importance of market prices in driving production decisions. Conversely, while global corn and soybean prices negatively impact broiler production, their effects are not statistically significant within the studied period. This suggests that while feed prices are crucial, other factors also play a significant role in production outcomes. The high R-squared value of 0.976 indicates a robust model, explaining 97.6% of the variation in broiler production through the included variables.

The implications of these results are crucial for policymakers. Effective price controls, subsidies, and strategic import-export regulations can stabilize the broiler market and ensure a consistent supply. This approach is particularly vital for safeguarding small-scale farmers who are more vulnerable to price fluctuations and external shocks. The study underscores the need for a balanced policy mix that considers both domestic production dynamics and global market conditions. Future research could further explore the impact of additional variables, such as technological advancements and disease management practices, to provide a more comprehensive understanding of the broiler industry's drivers.

Conflict of Interest: The authors declare no conflict of interest in this work.

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