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Asymmetric Price Transmission and Market Concentration of the South African Egg Industry

Kingsley Thaba[1]*, Solly Molepo[2,3]

[1]Department of Agricultural Economics and Animal Production, School of Agriculture and Environmental Sciences, University of Limpopo, Sovenga, South Africa, [2]Markets and Economic Research Centre, National Agricultural Marketing Council, Pretoria, South Africa, [3]Faculty of Natural and Agricultural Sciences, North West University, Mmabatho, South Africa.
*Email: kingsley.thaba@ul.ac.za

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ABSTRACT

The South African egg industry is an important segment of agricultural sector, which significantly contributes to food security, gross value of agriculture, employment and provide an affordable source of protein for the population. Despite being consumed by majority of the population, the egg industry supports various value chains, which include baking, confectionaries, feed manufacturing and several downstream industries. This paper explores the asymmetric price transmission and market concentration of the South African egg industry. The secondary monthly data was sourced from the Statistics South Africa (StatsSA) and the egg division of the South African Poultry Association (SAPA), which is ranging from 2017 quarter 1 until 2025 quarter 5. The dataset was subjected to augmented Dickey Fuller (ADF) test to check for stationarity, which find that all variables were stationary after first differencing. The bound test was employed to test for cointegration among the variables, which indicated the presence of cointegration in the selected variables. The findings of the autoregressive distributed lag (ARD) reveals that the lag of consumer price per dozen [$\ln(CPD)_{it-1}$] is ($\beta = 0.117$; $P = 0.024$) and producer price per dozen [ln(PPD)t] is ($\beta = 0.073$; $P = 0.054$), which are statistically affect the [ln(CPD)it]. The results of the error correction term which indicates a 1.7% as a speed of adjustment back to the long-run equilibrium. The policy recommendation is that the policy makers and directly affected groups need to monitor price variations between the producer and consumer prices, especially during the economic shocks.

Keywords: Asymmetric Price Transmission, Market Concentration, Egg Industry, Autoregressive Distributed Lag
JEL Classifications: C32, L11, Q11, Q13, Q55

1. BACKGROUND

The capacity of markets to convey price information both across and along the supply chain is a critical feature underpinning many contemporary economic developments (Paul et al., 2016). As market dynamics continue to evolve, agricultural producers have shown increasing interest in understanding price transmission mechanisms (von Cramon-Taubadel and Goodwin, 2021). The movement of price shocks from producers to retailers represents vertical price transmission, offering insight into the upstream and downstream effects within supply chain relationships (Rose and Paparas, 2023). To gain a clearer perspective on how prices interact at various stages of the marketing chain, it is essential to undertake studies focused on vertical price transmission processes (Tifaoui and Von Cramon-Taubadel, 2017).

Egg production in South Africa has a long history, developing into a well-established agricultural sector over the past century (Nkukwana, 2018). According to Mdletshe (2023), commercial egg production is concentrated in a few key regions, with Gauteng as the largest producer of eggs in South Africa with the market share of 24% followed by Western Cape, Free State and KwaZulu-Natal provinces with shares of 19%, 17% and 13% respectively. These four provinces account for 73% of the production while the remaining 5 provinces have a combined market share of 27%. This is because production follows consumption areas as eggs are perishable and cannot be transported for long distances. These provinces collectively account for most of the country's egg output, while other provinces contribute smaller shares. Production systems range from intensive cage operations to free-range and small-scale enterprises. South Africa not only supplies eggs domestically but also exports to neighbouring countries in the Southern African region. However, despite a robust domestic industry, South Africa occasionally supplements local supply through imports to meet fluctuating consumer demand and to stabilize prices during periods of shortfall.

According to SAPA (2022), total egg production in South Africa amounted to 24.10 million cases, or 723.07 million dozen eggs. With a gross turnover of R12.60 billion at producer level, eggs retain their position as the fourth largest animal product sector in agriculture in South Africa, after poultry meat (R59.02 billion), beef (R49.32 billion) and milk (R23.84 billion) (source: Department of Agriculture, Land Reform and Rural Development [DALRRD]). Eggs' share of the gross value of animal products was 7.1% and of all agricultural production 3.0%. The total value at retail level was estimated to be R26.27 billion for 2022. About 723 million dozen eggs were sold during the year through various channels.

Concentration of the egg industry in South Africa, commercial egg production is dominated by only three major producers: Eggbert, Nulaid and Highveld Cooperative, which command about 51% of the market share (DALRRD, 2023). With a gross turnover of R14.5-billion at producer level, eggs are the fourth-largest animal product sector in agriculture. According to SAFCEI 2024, the total value of the South African egg market at retail level in 2024 was estimated to be about R26-billion, dominated by only a handful of big players such as Shoprite-Checkers, Spar, Woolworths, Pick n Pay and MassMart (most of which are CGCSA members). In 2022, on average, retailers increased the price of large eggs by more than 100% sold to the public. More damning is the evidence that they do not pass savings on to consumers, according to the competition watchdog in late 2024.

Studies have been conducted to explore price relationships among farm and retail markets within South Africa's agricultural sector. For example, Mosese et al. (2020) investigated the nature of price transmission in the South African potato market. Letting (2020) sought to address knowledge gaps regarding the performance of Limpopo Province's tomato markets by analysing vertical price linkages across different stages of the value chain. Monteiro and Jammer (2024) examined how global wheat prices are transmitted to the domestic wheat market, emphasizing the influence of international prices, and recommended that future research focus on vertical price transmission within domestic supply chains. Swapi et al. (2024) employed a nonlinear autoregressive distributed lag (NARDL) model to capture potential asymmetries in price adjustments along the wheat supply chain. Building on this recommendation, the present study aims to fill this gap by analysing domestic price transmission market concentration in the South African egg industry between farm and retail levels. To achieve this, the study will employ autoregressive distributed lag (ARDL) model to capture potential asymmetries in price adjustments along the egg supply chain.

The aim of this study is to investigate the price transmission and market concentration within South Africa's egg industry by analysing how farmgate egg prices are passed through to retail egg prices over the period from 2000 to 2022. The choice of this timeframe was informed by the availability of consistent and reliable data. Although several researchers have studied price transmission in other agricultural commodities, there has been limited focus on how egg prices are transmitted along the value chain in South Africa. This gap motivated the undertaking of the current research. The objectives of this study are to assess the long-run relationships between farm-level egg prices and retail prices; to evaluate potential transmission between farmgate and retail prices; and to examine egg market concentration.

The objectives of this research were addressed through the application of appropriate estimation techniques. To achieve the first objective, a Bound test for cointegration was conducted to determine whether a long-run relationship exists among the two price levels farmgate and retail in the egg supply chain. The second objective was fulfilled through the analysis of the transmission through ARDL-ECM coefficient estimates between the farmgate price of eggs and the retail price. Lastly, the third objective was accomplished by examining the egg market concentration by using HHI.

2. THEORETICAL FRAMEWORK

2.1. Theory of Asymmetric Transmission

The concept of transmission in economics was introduced by Akerlof, Spence, and Stiglitz during the 1970s and 1980s to help explain why markets sometimes fail (Rosser, 2008). This theory suggests that when buyers and sellers do not have equal access to relevant information, markets can function inefficiently (Meyer and von Cramon-Taubadel, 2004). In agricultural commodity markets, such information imbalances significantly affect price formation. According to Yatsenko et al. (2019), many agricultural businesses have uneven knowledge about factors like future prices, harvest volumes, or other critical variables. This lack of symmetry in information can lead to market power, allowing certain firms to influence prices in ways that affect welfare and distribution outcomes. For example, companies engaged in processing or export often have superior information compared to other participants, enabling them to strengthen their market position over time. Evidence from Levi et al. (2020) shows that when farmers received price information during crop sales to traders, the traders' average profit margins remained unchanged, indicating that price asymmetry was influencing these transactions.

2.2. Market Power Theory

Market power theory suggests that companies may merge or coordinate their activities to restrict output or strengthen their ability to influence product pricing. Among the main explanations for why prices adjust asymmetrically, one of the most frequently cited is the dominance of market power in processing and retail sectors (Digal and Ahmadi–Esfahani, 2002). Typically, downstream food businesses with significant market influence tend to pass through price increases that threaten their margins more rapidly than price decreases that could benefit them (Peltzman, 2000 and Vavra and Goodwin, 2005). More precisely, market power in these downstream stages can suppress the prices paid to upstream suppliers below what would prevail in a perfectly competitive market and can discourage new competitors from entering or even drive existing firms out. As Swinnen and Vandeplas (2010) notes, companies exercising market power are often able to maintain higher prices compared to more competitive environments, which can lead to higher consumer prices cascading through the supply chain. Conversely, firms with strong bargaining positions may also negotiate lower input costs, exerting downward pressure on producer prices that can ripple across the value chain (Altenburg, 2006).

3. MATERIALS AND METHODS

3.1. Dataset and Analytical Techniques

The study adopted the monthly time series data of two variables namely: Producer price per dozen and consumer price per, which were sourced from SAPA and StatsSA. The data contained around 34 observations ranging from quarter 1 of 2017 until quarter 5 of 2025. The data was transformed into logarithms to compress the ranges of data, which assists in making data amenable to various statistical analyses.

3.2. Model Specification

3.2.1. Autoregressive distributed lag

The step after data compilation and cleaning is to determine the stationarity order of the selected variables. This applied the Augmented Dickey Fuller test, as developed by Dickey and Fuller (1979). The findings of the ADF test shows that the selected variables are stationary after first differencing and small size of sample prompted the use of the ARDL. The mathematical equation of the ARDL model is expressed as follows:

$$\ln\left(CPD\right)_{it} = \beta_0 + \sum_{i=1}^{p}\beta_1 \ln\left(CPD\right)_{t-1} + \sum_{i=0}^{p}\beta_2 \ln\left(PPD\right)_t$$
$$+\theta_1 \ln\left(CPD\right)_{t-1} + \theta_1 \ln\left(PPD\right)_{t-1} + \varepsilon_{it} \quad (1)$$

This study adopted bound test to test the presence of cointegration among the chosen variables. The assumption was to set the hypothesis where all long run coefficients are equivalent to zero, which indicates no cointegration. The null hypothesis is only rejected if the long run coefficients are not equal to zero. The cointegration equation is expressed as follows for both null and alternative hypotheses:

$$H_0: \delta_1 = \delta_2 = \delta_3 = 0 \quad (2)$$

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq 0 \quad (3)$$

The occurrence of the cointegration is explained by the collective significance of F – statistics, which tested against the sum of critical values conforming to various levels of significance. The existence of cointegration amongst the selected variables happens when the value of the calculated F – statistics is higher than critical value of the upper bound. Conversely, if the F – statistics value is smaller than the critical value of the lower bound, it highlights that the variables are not cointegrated. In situations where the calculated statistics falls between the critical values of lower and upper bounds, then the cointegration results are inconclusive. The study adopted the Akaike Information Criterion (AIC) to establish the lag length. If there is a presence of cointegration, then the error correction model (ECM) is expressed, which caters the variations of short run dynamics together with long run adjustment as follows:

$$\Delta \ln\left(CPD\right)_{it} = \beta_0 + \sum_{i=1}^{p}\beta_1 \Delta \ln\left(CPD\right)_{t-1}$$
$$+\sum_{i=0}^{p}\beta_2 \Delta \ln\left(lnPPD\right)_t + \lambda ECT_{it} \quad (4)$$

Where Δ denotes differencing first operator, the concept term is represented β_0, the following variables were included in the model $\ln(lnPPD)_t$ and $\ln(CPD)$. The coefficients of independent variables are represented by β_1 until β_2. The λECT_{it} is expressing the error correction term, while λ is representing the speed of adjustment towards an equilibrium in a long run.

3.2.2. Herfindahl–Hirschman index (HHI)

The Herfindahl–Hirschman index (HHI) is a widely used indicator of market concentration that captures both the number of firms in a market and how unevenly market shares are distributed among them (Tirole, 1998). It is calculated by summing the squares of each participant's market share, effectively weighting larger shares more heavily.

It is given by the following equation.

$$HHI = \sum_{i=1}^{N}\left(Eggbert, Nulaid, and\ Highveld\ Market\ Share_i\right)^2 \quad (5)$$

Where N is the number of participants and ENH represent participant's market share in per unit or in percentage. This index is very simple where it cannot reveal the complete information when the system is subjected to variation in load and with transmission constraints.

4. RESULTS AND DISCUSSION

4.1. Descriptive Results

Table 1 shows the summary statistics of variables included in the model, using central tendency, standard deviation, minimal values and maximum values. The mean producer price of eggs per dozen is R 19, 52, which indicates price that the producer receives for every (dozen) 12 eggs sold at farm gate. The minimum price charged at farm gate is R 14, 44 per dozen, while the maximum producer price is equivalent to R 25, 85. The standard deviation for $\ln(PPD)_t$ is 3.32, which reflects how data is spread from its average.

The mean for the consumer price per dozen is equal to 39.04, which implies that on average the consumer is paying at least R 39, 04 for every dozen (12 eggs) sold at retail level. The standard deviation for 9.95, which indicates how data is spreading away from the mean. There, Table 1 shows that on minimum consumers can pay at least R 18, 48, while the maximum price for a dozen of eggs might reach R 60, 92.

4.2. Inferential Results

4.2.1. Unit root test

The first procedure is to test for stationarity using the Augmented Dickey Fuller (ADF) test. Table 2 indicates that the two variables included in the model, which are $\text{In}(PPD)_t$ and $\text{In}(CPD)_t$ are stationary after first differencing. The underlying assumption for stationarity test is that the test statistical value be greater than the critical value 95% confidence level. Therefore, the test statistics of $\text{In}(PPD)_t$ after first differencing is 8.443, which >2.895 and it statistically significant at 1% level. The variable $\text{In}(CPD)_t$ posses the test statistics of 6.481, which is higher than 2.894 critical value at 95% confidence level.

The bound test was employed to test for cointegration among the variables. The results of cointegration test reveals the presence of cointegration since the values of calculated F-statistics is higher than −5.73 upper bound, also t-statistics is greater than the upper bound value of −3.22. Therefore, the variables in the model are integrated which necessitates performing of both short-run dynamic effects and long-run equilibrium relationships of prices at consumption and producer levels.

4.2.2. Cointegration test

Table 3 presents the ARDL analysis results, which indicates that the $\ln(CPD)_{it-1}$ and $\ln(PPD)_{it}$ are statistically significant at 10% level. Overall, the ARDL model reveals a good fit, with the R^2 value of 92 which indicates that greater portion (92%) of the variation in consumer prices per dozen are explained by lag of consumer prices per dozens and producer prices per dozen. The overall fit of the model is explained by F – statistics which is 25.08, with a P = 0.008. The Akaike information criterion (AIC) was employed to select the lag length structure, which resulted into (1,0) lag length for the selected variables. The coefficient associated with the lag of consumer price per dozen is 0.117 with a P = 0.024, implying that the prices of eggs in previous month significantly influence the prices of the following month. Furthermore, the coefficient of producer prices per dozen is equivalent to 0.073, with a P = 0.05. The implication is that a unit increase in producer price per dozen leads to 7.3% increase in consumer price per dozen.

4.2.3. Error correction model (ECM)

Table 4 presents the results of the error correction model (ECM) which determines long term equilibrium association of variables and showing short run dynamic effects among the variables. The error correction term (ECT) is negative and statistically significant at 5% level. The coefficient value of ECT is −0.115, which indicates that variables adjust to their long run equilibrium with a speed 11.5% after a shock. The constant term is positive significant, with a coefficient value of 0.017 and P = 0.043. Therefore, when holding all other variables constant (ceteris paribus), the $\ln(CPD)_{it}$ increases by 1.7%. In short run, when a $\ln(PPD)_{it}$ rise by one unit, results in 6.5% increase in consumer price per dozen.

4.2.4. Diagnostic test

Tables 5 and 6 shows the results of the diagnostic tests. The Durbin Watson illustrates that the model does not suffer from

Table 1: Summary of statistics of the variables

Price series	Obs	Mean	Standard deviation	Min	Max
In $(PPD)_t$	101	19.52	3.32	14.44	25.85
In $(CPD)_t$	101	39.04	9.95	18.48	60.92

Source: Own compilation, 2026

Table 2: Stationary test for variables

Variables	ADF test			
	Level [I (0)]		Level [I (1)]	
	t-stats	5% CV	t-stats	5% CV
In $(PPD)_t$	−0.461	−2.892	−8.443***	−2.895
In $(CPD)_t$	−1.470	−2.892	−6.481***	−2.894

Source: Own calculations, 2026

Table 3: Bound test for cointegration

Cointegration test	Calculated test stats	95% lower bound	95% upper bound	Decision
F-stats	65.040	4.94	5.73	Cointegrated
t-stats	−11.236	−2.86	−3.22	Cointegrated

Source: Own calculations

Table 4: ARDL analysis

Variables	ln $(CPD)_{it}$	
	Coefficient	Prob.
Constant	0.005**	0.031
ln $(CPD)_{it-1}$	0.117**	0.024
ln $(PPD)_{it}$	0.073*	0.054
Lag length	ARDL (1, 0)	
R^2	92	
Adj. R^2	90	
F-Stats	25.08	
Prob (F-Stats)	0.008	

**denotes significant at 5% level (P≤0.05) and *represents at 10% significant level (P≤0.1). Source: Own calculations, 2026

Table 5: Error correction model (ECM) results

Variables	ln $(CPD)_{it}$	
	Coefficient	Prob.
Constant	0.017**	0.043
ECT_t	−0.115***	0.002
Long-run results		
Ln $(PPD)_{it}$	0.121**	0.041
Short-run results		
Δln $(PPD)_{it}$	0.065*	0.060
R^2	80	
Adj. R^2	57	

**denotes significant at 5% level (P≤0.05) and * represents at 10% significant level (P≤0.1). Source: Own calculations, 2026

Table 6: Diagnostic tests

Test	Statistics/P-value	Decision
Durbin-Watson	2.06	No serial correlation
Breusch-Godfrey test	0.943 (0.163)	No autocorrelation
White's test (Heteroskedasticity)	23 (0.003)	No heteroskedasticity
Jarque Bera (Normality)	1.945 (0.528)	Normal distribution

Source: Own calculations, 2026

Table 7: HHI summary

Level of concentration	Market power	HHI1	Egg market
Non-concentrated market	Low, if any	<1500	
Moderately concentrated market	Moderate	1500-2500	
Highly concentrated market	High	>2500	3.268*

Source: Own compilation, 2026

serial correlation, since its value is 2.06 which is close to per the rule of thumb. Furthermore, the Breusch-Godfrey test was adopted to check for the presence of autocorrelation in the residuals, with a Chi-square value of 0.943 and P = 0.163 confirms no presence of autocorrelation. The white test was adopted to test for heteroskedasticity, which represents the presence of non-constant variance of the residuals. The Chi-value of 23 and P = 0.003, which indicates that there is no heteroskedasticity in the series. The study adopted the Jarque Bera to check the normality of the residuals. The statistical value of 1.945 and P = 0.565 suggests that the residuals are distributed normally.

Figure 1 shows test the variation in the average over a period. This represents the sequence of sums for the data set included in the model. It is critical to trace the sum of dataset as it increases across a series. The graph of the cumulative sum (CUSUM) is situated within the 5% critical lines or boundaries, which implies that the model is stable.

4.2.5. Herfindahl–Hirschman index (HHI)

Herfindahl–Hirschman index (HHI) measures the market concentration, reflecting the degree of competition within an industry (Table 7). According to DALRRD (2021) market share for the South African commercial egg production sector is dominated by producers (Eggbert, Nulaid, and Highveld Cooperative) together control approximately 51% of the market, while the remaining 49% is supplied by small, medium, and micro enterprises (SMMEs) and the developing sector.

$$HHI = \sum_{i=1}^{N} (51\%)^2 \quad (6)$$

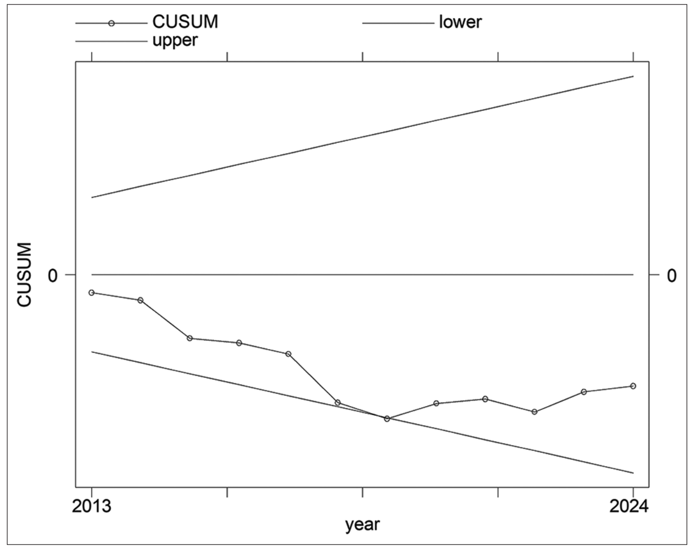
$$HHI = (17)^2 + (17)^2 + (17)^2 + (49)^2 \quad (7)$$

$$HHI = 0.0289 + 0.0289 + 0.0289 + 0.2401 = 0.3268 \quad (8)$$

$$HHI = 0.3268 \times 10.000 = 3.268 \quad (9)$$

With an HHI of 3.268, the South African egg industry is considered highly concentrated. This suggests in South African commercial egg production sector significant market power is held by the top producer's name Eggbert, Nulaid, and Highveld Cooperative.

Figure 1: Cumulative (CUSUM) test



Source: Own calculations

5. CONCLUSION AND RECOMMENDATIONS

The study objective was to analyse the symmetric price transmission and market concentration of the South African egg industry as from quarter one of 2017 until quarter five of 2025. The set hypothesis has been proven empirically. The findings reveals that consumer price per dozen is influenced by the lag (previous monthly price) of consumer price per dozen and producer price per dozen. Furthermore, the industry is experiencing a market concentration few large firms with a high level of asymmetric price transmission on dozens of eggs among producers and consumers. Notably, a one-unit shift in producer price triggers at least 7 times rise in the price of eggs at consumer level. Therefore, the results are compatible with priori views which indicates that retailers are responding more rapidly to price shock or any economic shocks when their margins are squeezed than when are stretched. The market power of the large egg producing firms and retailers makes it easy to transfer higher price shocks to the consumers but hold back when prices drop. However, the occurrence of asymmetric price transmission does not mostly translate to market power and concentration throughout the supply chain, but at any segment of the value chain. It is evident that the more the market is concentrated there is a higher-level price asymmetry.

Even though this paper demonstrated that industries with market concentration possess a high standard of price transmission than those markets that are less concentrated. This recommends further studies to assess the level of concentration at various segments of the egg supply chain in order to establish occurrence of concentration from farm to plate. The policy recommendations is that the regulator needs to monitor prices frequently, especially when there is movement resulting from policy shocks whether upwards or downwards.

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