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Statutory measures in the egg industry – The effect on food security and employment

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This paper investigates the effect of statutory measures in the Egg Industry on food security and job creation. A non-parametric estimation technique based on the Cobb-Douglas production framework was used in the analysis. The results indicate that statutory levies have a role to play in enhancing food security and job creation within the economy.

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This paper investigates the effect of statutory measures in the Egg Industry on food security and job creation. A non-parametric estimation technique based on the Cobb-Douglas production framework was used in the analysis. The results indicate that statutory levies have a role to play in enhancing food security and job creation within the economy.

1. Background

The contribution of the egg industry in the South African economy especially in terms of food security, employment as well as foreign exchange earnings are well articulated in the Egg Organisation Report (2016), ITC (2016), and DAFF (2016) reports, among others. Despite the good performance of the egg industry, it is worthwhile to emphasise that the high production costs, mainly due to high feed costs, render the industry less competitive in comparison with the key global players (e.g. Brazil, the Netherlands and the United Kingdom) in the poultry industry. Therefore, interventions aimed at fostering the industry's performance are anticipated to further enhance economic development. The proposed establishment of statutory measures that are meant to purposely address the challenges encountered in the egg industry, is one of the envisioned developmental initiatives. These statutory measures shall in part be used to address the limitation of the high cost of feeds and also to increase the number of layering birds produced within the country, among other uses. Previously (2011-2014), the poultry industry (broiler and eggs) collectively established statutory measures but these were discontinued. During this period, levies, registrations, as well as records and returns were dealt with as a collective. In terms of levy expenditure, the egg industry used to receive approximately one third of the total levy income of the total collection. It is thus upon this backdrop that we estimate how the establishment of statutory measures for the egg industry alone, is likely to impact on the country's food security status, as well as on employment in the agricultural sector.

2. Literature review: Statutory measures and the poultry industry in South Africa

2.1 Statutory measures

Since deregulation, majority of the industries collect statutory levies as provided for by the Marketing of Agricultural Products Act, No. 47 of 1996 (MAP Act). A statutory levy is a charge per unit of an agricultural commodity at any point in the marketing chain between the producer and the consumer, which is collected to finance a number of functions, namely administration, information and liaison, transformation, research, consumer assurance and consumer education (NAMC, 2015). In 2009, South Africa Poultry Association (SAPA) introduced the industry statutory levy with the aim to create a new primary funding mechanism for the poultry industry. The establishment of these statutory levy was to accelerate the implementation of transformation for smallholder farmers, establish improved industry training and development activities, adequately fund disease and production research and development and engage in professional marketing activities (SAPA, 2016). Following careful consideration SAPA has applied for statutory measures in the egg industry. This is mainly to fund, transformation, consumer education, consumer assurance and research and development.

2.2 Egg industry overview

The total gross value of agricultural production is the total production during the production season, valued at the average basic prices received by producers. **Figure 1** illustrates the contribution of eggs in terms of gross value of agricultural production, from 2012 to 2016. The gross value of eggs increased under the reviewed period by 26.34% and reached its highest level of R10 billion during 2016.

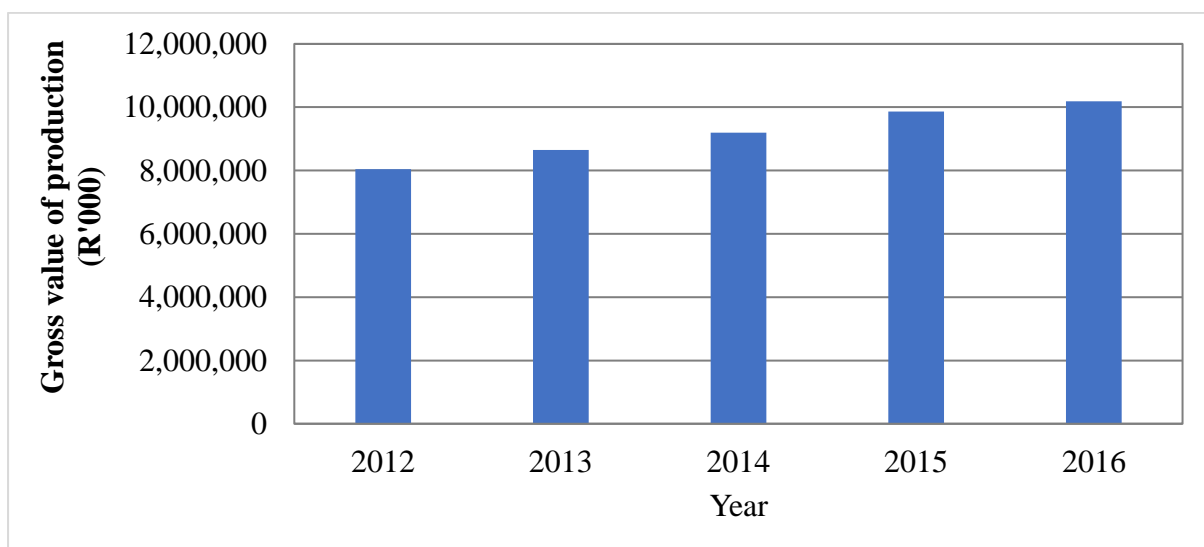


Figure 1: Gross value of egg production

Source: DAFF (2017)

By province, SAPA in 2014 reported that approximately 76% of the birds in the South African poultry industry were used for meat production, while the remaining 24% were used in the egg industry. In the egg industry, growth in terms of both number of day old pullets placed per annum and egg production, has averaged around 1.7% and 2.7%, respectively, since 2006. To put these numbers in perspective, annual population growth between 2004 and 2008 was 1.4% and between 2008 and 2014 was around 1.5% per annum (SAPA, 2014).

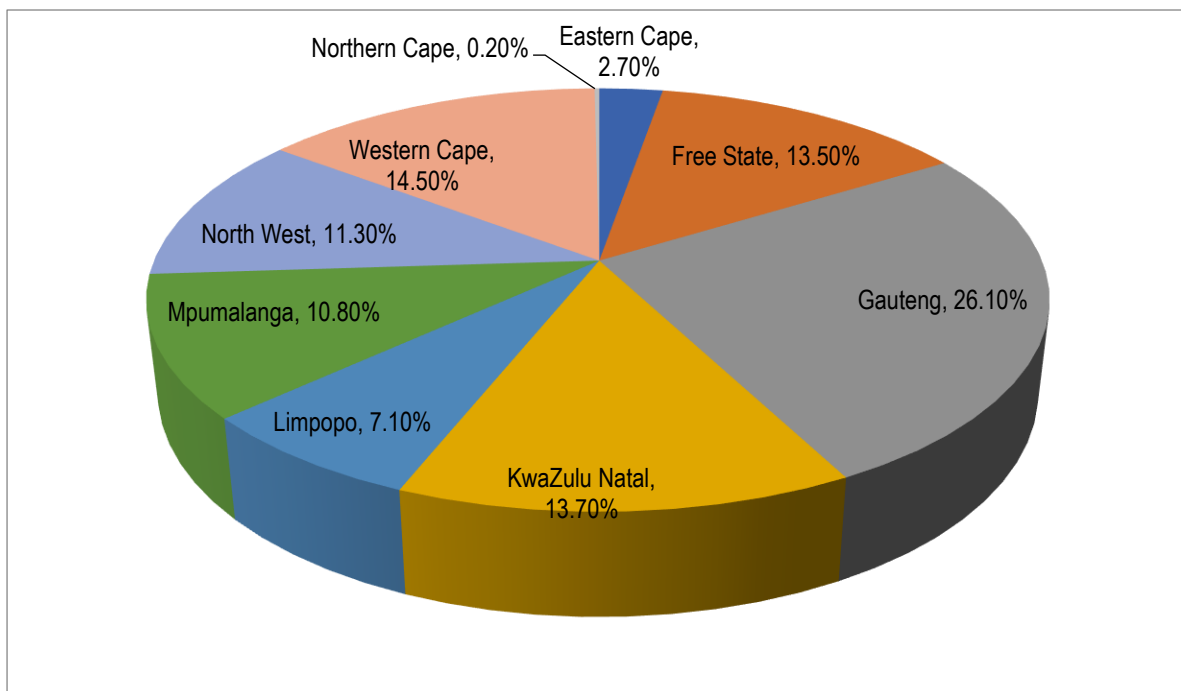


Figure 2: Eggs production by province

Source: SAPA (2016)

Eggs are produced throughout the country as shown in **Figure 2**. Gauteng is the largest producer of eggs with the market share of 26.1% followed by the Western Cape, Kwa-Zulu Natal, Free State and North West, 14.5%, 13.7%, 13.5% and 11.3%, respectively. Northern and Eastern Cape have the lowest market share of 02% and 2.7% respectively.

Figure 3 shows the annual average national layers from 2012 to 2017. The size of the national layer flock in 2012 was 25 million hens, followed by large fluctuations. From 2012 to 2017, the annual average layers decreased by 7.48%. In 2017, the egg industry had an

average flock of 23.1 million hens, representing a decrease of 1.8 million hens (-6.6%) compared to 2016.

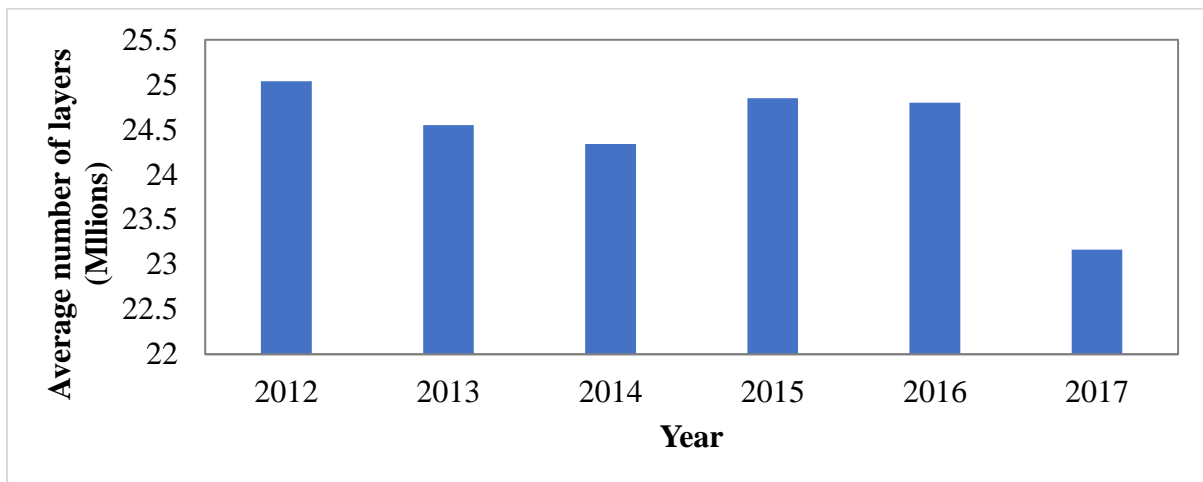


Figure 3: Average number of layers per annum

Source: SAPA (2017)

There are three major egg producing companies in South Africa. These producers combined add to 51% of the egg production in the market, with Small and Medium Size Enterprises (SMMEs) producing the remaining 49%. Quantum Foods (2016) reported that Nulaid is the largest egg producer in South Africa from the 2013/14 to 2015/16 production year. Nulaid has produced 32% of the total egg production. Nulaid farms are located in the Western Cape, Eastern Cape, Free State, Gauteng and North West provinces. Highveld and Eggbert are also major commercial egg producers, contributing 12% and 7%, respectively (DAFF, 2014).

According to DAFF (2014) there are two major importers of genetic breeds, Hyline and Lohnmann; importing genetic breeds known as “grandparents”. Lohnmann produces eggs which produce day old chicks called “parents” which are sold to Pioneer Foods through its Nulaid division and to Golden Lay through its Avichick division. These “parents” are reared to maturity to produce fertile hatching eggs, the eggs produced by these “parents” are then incubated and the day-old chicks that hatch are then called “pullets”. “Grandparents” produce “parent” stock which in turn produce hatching eggs for day-old commercial layers and independent rearing farms whom are not involved in rearing point of the lay hens.

Figure 4 presents a schematic egg production process until it reaches the point of Lay Hens. On the 21st week the layers produce at least 50% and grandparents will again be imported after 17 months or 72 weeks.

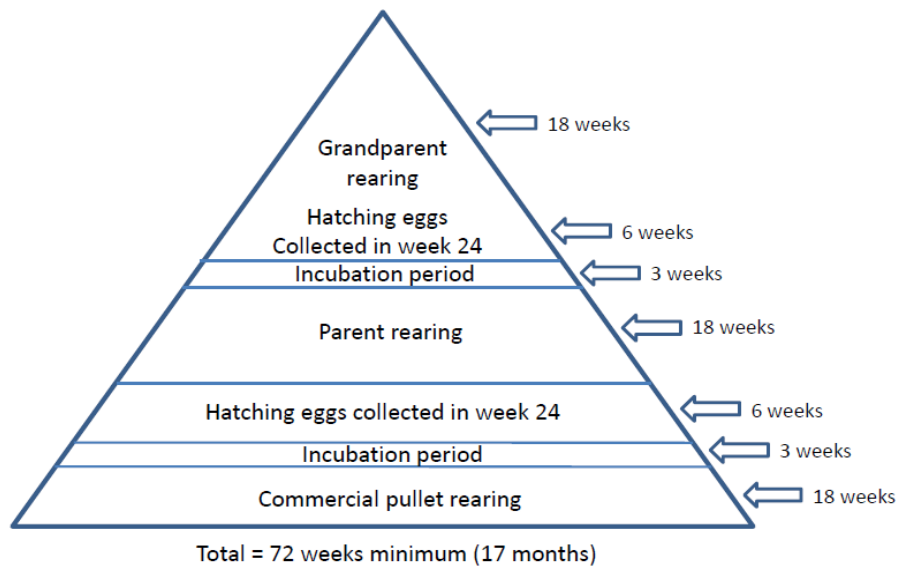


Figure 4: Egg production process

Source: SAPA (2014)

With regards to egg production, the industry has realised a positive trend since 2005 (**Figure 5**). The egg industry produced 456 550 tons in 2017, compared to the 375 210 tons produced in 2005, representing an increase of 21.7% over the depicted period. For the last 10 production years (2008-2017), the egg industry was producing at an average of 450 470 tons per annum.

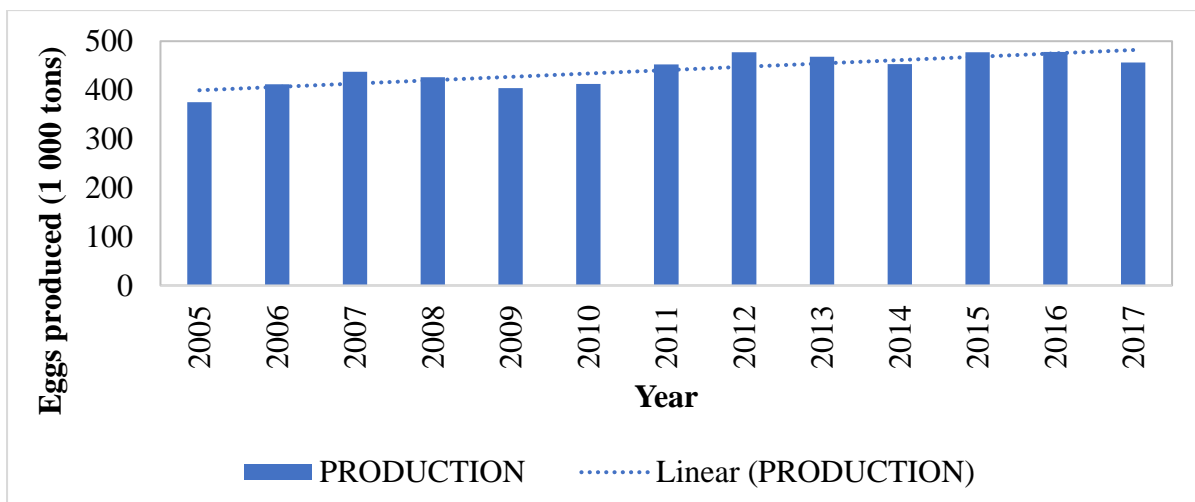


Figure 5: Egg production over the years

Source: DAFF (2018)

In terms of egg quality, eggs are produced in varying sizes and grades (Grade A, B and C) in the market. Only grade A is sorted in the packing facilities according to weight. Grade A is sold at retail markets for household use. The Grade A sized according to Jumbo (70g), X Large (63g), Large (56g), medium (49g), small (42g) and Pee Wee (less than 42g). Grade B is used mostly in bakeries and Grade C is sent to egg breakers for processing (DAFF, 2014).

Eggs are the most balanced source of nutrients for human consumption. Proteins of other meats are benchmarked against that of eggs for its ability to support and enhance growth in young animals and humans. The demand for eggs are affected by population, real income growth and changing of life styles

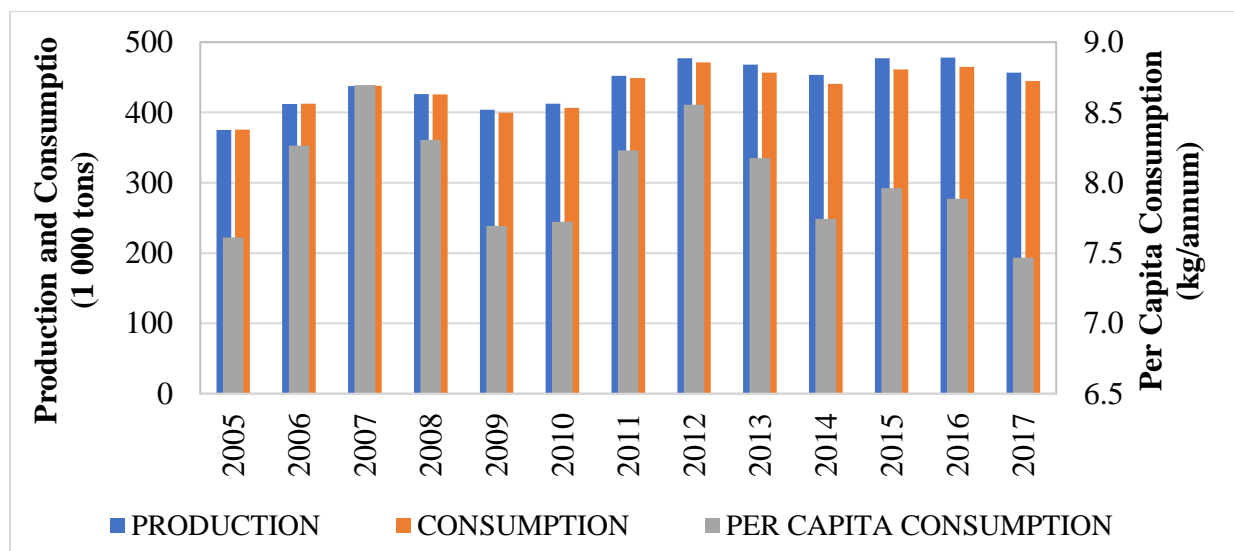


Figure 6: Eggs production vs consumption (2005-2017)

Source: DAFF (2018)

Figure 6 illustrates the trends in egg production and consumption between 2005 and 2017. South Africa’s egg production was sufficient to meet local demand. In 2017, egg consumption reached 448 840 tons compared to the 464 850 tons consumed during 2016 (-4.3%). Production during 2017 decreased with 4.5%, from 477 930 tons in 2017 to 456 55 tons in 2017, eminent from the AVI outbreak during 2017

Feeds play a critical role in production performance of the egg industry. **Figure 7** illustrates the movement in feed prices from 2012 to 2017. SAPA used the weighted average feed price indicator which includes distribution but excludes medication, additives and value added tax (VAT). It is noted that between 2012 and 2017, the feed price increased by 25.07%. In 2017, the weighted average layer feed price for 2017 was recorded as R3 627/ton. This followed a year-on-year decrease of 10.86% when compared with 2016. Furthermore, national feed sales for the layer industry from 1 April 2015 to 31 March 2016 amounted to 951 536 tons.

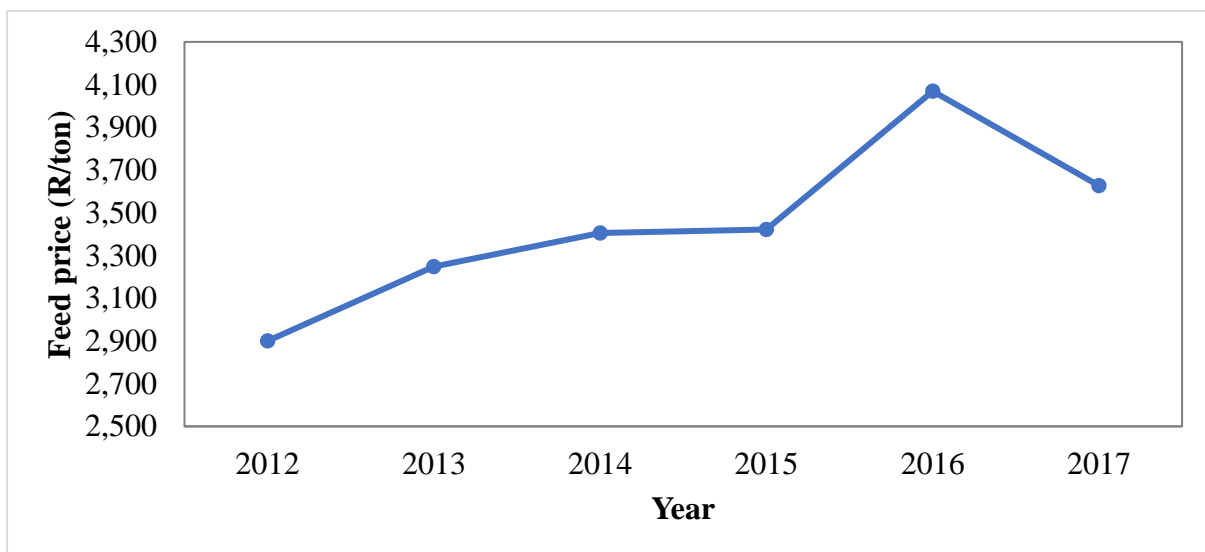


Figure 7: Average layer feed price

Source: SAPA (2017)

During December 2017, 73 700 tons of layer feed were expected to be consumed; 10 500 tonnes (- 12.5%) less than in December 2016. An average g/hd intake of 110.9 was forecasted for the month. Feed conversion was estimated at 1.57kg/dozen or 2.25kg/kg (SAPA, 2018).

2.2.1 Domestic Market for eggs

Domestically, eggs are sold to major retailers including Pick- 'n-Pay, Shoprite Checkers, Spar, Woolworths, Massmart and SMME's retailer sectors. Demand may fluctuate, but supply remains relatively stable as a result of the lengthy production cycle. The egg industry is responsible to manage the imbalance between supply and demand and the producers then determine the price of their commercial eggs weekly, by taking into account the number of eggs sold in retail stores during the previous week. **Figure 8** illustrates the trends for retail prices of eggs from January 2012 to December 2017. Between December 2017 and

December 2016, the prices for 0.5 dozen, 1.5 dozen and 2.5 dozen increased by 8.5%, 22.2% and 20.5%, respectively.

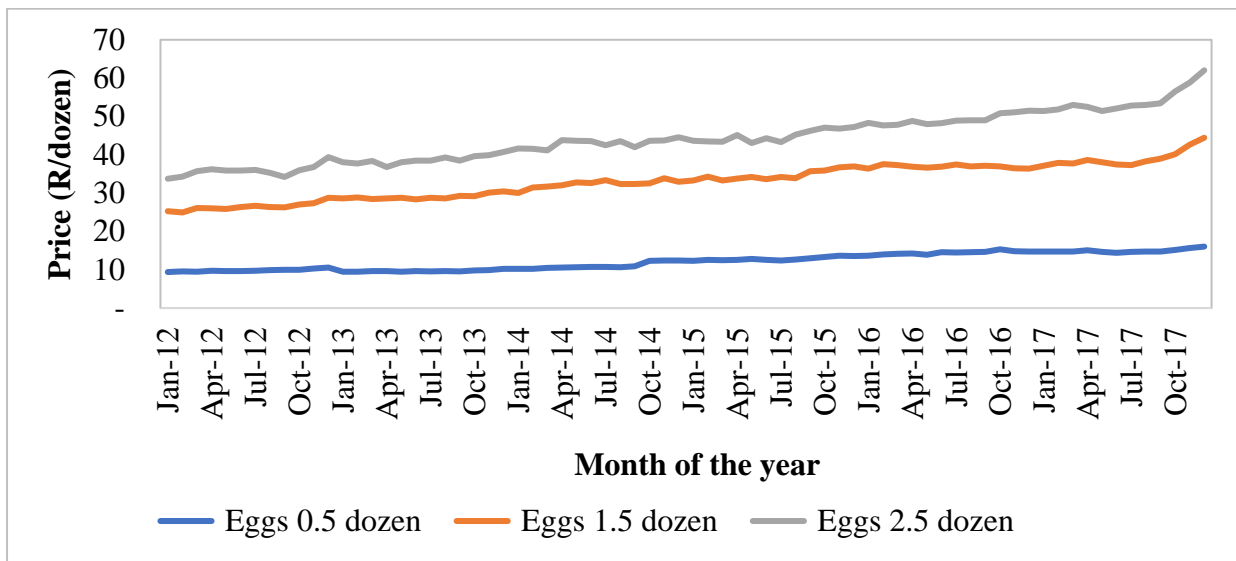


Figure 8: Monthly retail prices of eggs

Source: Stats SA (2018)

Figure 9 illustrates the trends of the official Producer Price Index (PPI) and Consumer Price Index (CPI) since 2012, with December 2016 as a base year. As input costs rise, the producer price tends to adjust automatically over time and this is reflected in changes to the PPI. The PPI for eggs has consistently lagged behind the other indexes, except for a short period at the end of 2015 and then soaring end of 2017.

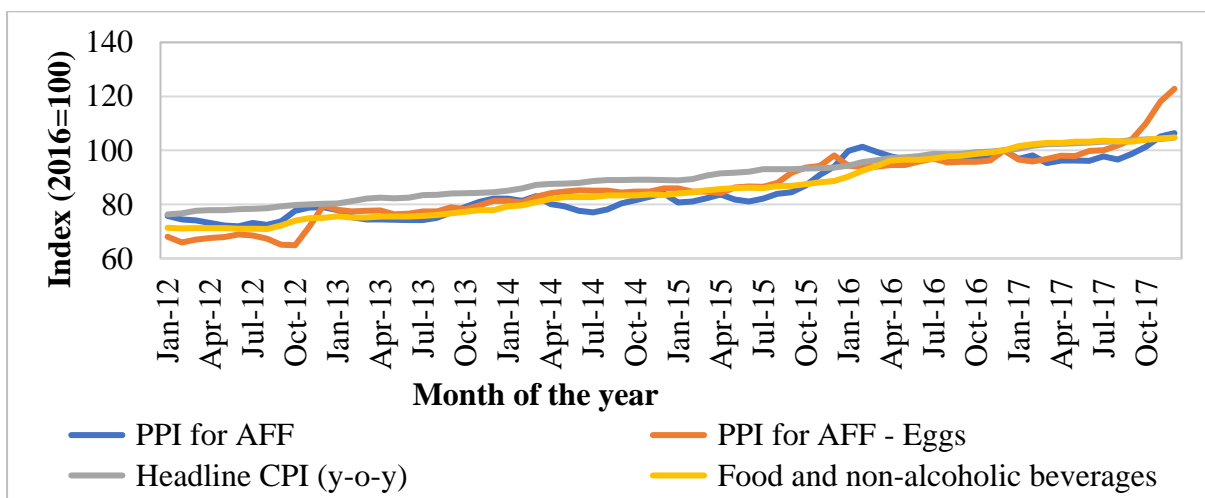


Figure 9: Producer Price Index (PPI) and Consumer Price Index (CPI)

Source: Stats SA (2018)

2.2.2 Employment in the eggs industry

Table 1 shows an estimated number of employees in the egg industry for 2016. The employment model bases its predictions on the average number of laying hens in South Africa, subsequently calculating the number of layer breeders required to produce the commercial layer flocks. Assumptions are made on the staffing requirements per unit in the vertically integrated industry. The total number of employees was estimated to have decreased by 0.2% compared to 2015.

Table 1: Number of employees

	Workers	Supervisors	Managers	Total
Grandparent rearing	16	6	3	25
Grandparent laying	7	6	3	16
Parent hatching	33	6	3	42
Parent rearing	110	21	5	136
Parents	60	16	5	81
Pullet hatching	192	24	6	222
Rearing	1 530	146	36	1 712
Laying	1 736	165	83	1 984
Packing	2 162	316	105	2 583
Processing	71	16	8	95
Support staff	953	0	159	1 112
Total	6 870	722	416	8 008

Source: SAPA (2017)

2.2.3. Industry's outlook

By the end of 2017, South Africa's rand buoyed by positive sentiments following the ANC's December presidential election. No new outbreaks of avian influenza (AI) have been reported since late October but the egg industry has been seriously affected by the disease and over 4 million birds were culled, squeezing egg production and pushing up prices. Good rains in the maize-growing regions of the country supported a bumper harvest in the 2016/2017 season and global soybean prices were also moderated – so market conditions support a return to profitability and growth for farmers not affected by the AI culls. However,

some businesses may never reopen and others face huge losses with little assistance from government coffers.

Local consumption of eggs (130 per capita per annum in 2017) remains disappointingly low. With per capita consumption in countries such as the US, Russia, Mexico, Japan and China exceeding 220 eggs per annum and, in some cases, approaching an egg a day, there remains considerable scope in the SADC region to increase local per capita consumption. With meat prices relatively high as farmers continue to restock and rebuild herds after years of drought, egg farmers might have enjoyed increased sales as the cheapest animal protein – but the avian influenza outbreak resulted in egg shortages and pushed prices up by more than 20 %. Per capita consumption in 2018 may well fall short of the 2017 mark (SAPA, 2018).

The unemployment rate in the 3Q 2017 remains at the 27.7% level reached in Q1 and Q2 2017. Unemployment is at the highest level since 2003. The expanded unemployment rate, which includes discouraged work-seekers, was slightly higher, q-o-q, at 36.8%. The unemployment rate has not dropped below 21.5 % in the last 15 years. Economist Mike Schussler, presenting the 16th UASA South African Employment report, pointed out that South African unemployment levels are more severe than in several war-torn countries, including Iraq, Libya and the Yemen (timeslive.co.za).

Inflation averaged 5.3% in 2017 compared to 6.3% in 2016 (Stats SA). Inflation steadily dropped through 2017 as food prices eased and was recorded. The Governor of the Reserve Bank reported a deterioration in the inflation forecast but expects it to remain within the target range (below 6%) for the forecast period (SARB). CPI inflation is still expected to average 5.3% in 2017 but has been revised upwards to 5.2% in 2018 (from 5.0% previously) (SARB). The main drivers in the revised 2018 forecast are rising international oil prices, domestic wage growth and a weaker exchange rate. South Africa was a net importer of almost 1.33 million tons of maize in the 2016/2017 season. The National Agricultural Marketing Council (NAMC) in the Supply and Demand Estimates Report estimates white maize available for export this season at 2.84 million tons at end of April 2018, and 2.38 million tonnes of yellow maize (NAMC, 2018).

3. Analytical approach

The analysis uses annual time series data from 2011 to 2014. The short time period is constrained by the data availability and results should therefore be interpreted with caution. Cognisance should also be taken that voluntary statutory measures in the poultry industry exist, but these measures are beyond the scope of this analysis. In addition, this period is of interest given that SAPA (2015) acknowledges that the poultry industry registered significant fluctuations in industry's growth, both in terms of meat and egg production. Although the establishment of statutory measures entails levies, registrations as well as records and returns, the analysis focuses only on levies, given that these are utilised for the core functions of the industry.

To ascertain how the establishment of statutory measures (*levies in particular*) affect food security, the following assumptions or scenarios were taken into account.

- It was assumed that one third (33%) of the total statutory levy expenditure from the total poultry industry was utilised by only the egg industry.
- About 70% of the levy¹ received by the egg industry will be used to enhance the industry's production capacity, especially by addressing the issue of high feed costs.
- The industry has good breeds of layer chicken and there is sufficient infrastructure to accommodate larger numbers of birds at a given point in time.

The analysis was based on the methodological framework of the Cobb-Douglas production function, which shows the relationship between inputs and outputs. The model indicates that food security, as measured by the number of eggs produced is a function of the industry's production capacity, labour and capital inputs. In this instance, production capacity refers to the number of layers kept by firms, largely dependent on the ability to feed the birds. Hence the reference to high feeding costs. Since poultry production is largely influenced by yellow maize prices and electricity costs among other factors, estimating the effect of a levy was done in two steps.

First, the effect of the levy was estimated on the egg industry's production capacity (i.e. the average number of birds kept for egg production, per quarter). This estimation was then used to predict number of birds. The predicted values were then used in second stage of the analysis to assess how the predicted production capacity, as a result of the levy, would affect the food security status. The number of eggs was used as a proxy for food security as it

¹ As per statutory measures guidelines, it is mandatory that 20% of the levy income is devoted to transformation. Also, in relation to the other industries, 10% is used for registrations, administration, records and returns (NAMC, 2015.)

relates to the fact that eggs are the most balanced source of nutrients for human consumption. Thus, the higher the number of birds kept for egg production, the higher the likelihood of producing more eggs, especially when the birds are well fed. The number of employees within the poultry industry was used as a proxy for labour input while the value of capital assets on commercial farms was used to proxy for capital input.

The reduced model is then illustrated as:

$$FS(P, L, K) = \beta_0 P^{\beta_1} L^{\beta_2} K^{\beta_3} \dots\dots\dots (1)$$

Where:

FS = Food security (number of eggs produced)

P = Production capacity (number of birds kept for egg production - layers)

L = Labour input (number of employees in the agricultural sector)

K = Capital input (value of capital assets on commercial farms)

β_0 = total factor productivity

β_1 , β_2 and β_3 denote output elasticities for production capacity, labour and capital inputs, respectively.

Data on the average price of yellow maize was obtained from SAFEX, while the number of eggs produced, the value of capital assets on commercial farms (i.e. machinery, implements, vehicles & tractors) and employment data in the agricultural sector were obtained from DAFF (2016). The size of the national layering flock was computed basing on SAPA (2015), in which it was noted that 24% of all birds in the poultry industry are used in egg production. It is worthwhile to note that the computed numbers differ from what is quoted by SAPA (2017). This may be attributed to the fact that this analysis does not necessarily disaggregate between day-old chick, pullets or matured laying hens and also does not take into account birds affected by diseases or other causes of death.

In estimating the effect on employment, the employment variable in equation one was then used as the dependent variable, with the same data sources discussed in the previous paragraph. The current and the previous industry's production capacity influence the extent to which individuals are employed in the agricultural industry. Therefore, two variables were included in the specified model, *lnLayers* for the current production capacity, and (*Lag_lnLay*) as a lagged variable implying that the status quo of employment in the current

period also tends to influence future employment. Due to the small sample size, quantile regression, a non-parametric estimation technique was used.

In order to estimate the number of jobs that may be created as a result of levy expenditure on the egg industry, the marginal elasticity of the employment model was multiplied with the average number of jobs created per year. Similarly, 70% of the projected levy income was then multiplied with the marginal value after the first derivative of the employment equation.

3.0 Empirical results

In this section the results are discussed. The results are presented in the following order. We first discuss the food security results, followed by the effect on employment.

a) Food security results

Results in first stage of the analysis reveal that at all significance levels, the levy increased the industry's production capacity by approximately 19.4% (see Table below). The effect of the price of yellow maize (*lnYM_Pr*) in this case is insignificant.

Table 2: Effect of levy on the number of layers

In layers	Coefficient	Std Error	t value
In YM_Pr	-0.137	0.080	-1.71
InEgg _Levy	0.194***	0.018	10.96
_cons	1.185**	0.508	2.33
Pseudo R ²	0.742		
Raw sum of deviations	0.413		
Min sum of deviations	0.107		

In the second stage of the analysis, findings (Table below) suggest that the increased productive capacity of the industry (increased number of laying birds) had a positive and significant effect (70% increase) on South Africa's food security status. That is, levy expenditure aimed towards improving the industry's production capacity is associated with about 70.1% increase in egg production, which is used as a proxy to measure of food security.

Table 3: Effect of levy on egg production (food security)

InFS	Coefficient	Std Error	t value
------	-------------	-----------	---------

Hat Inlayers	0.701**	0.127	5.52
InLbr	2.04e-14	0.100	0.00
InK	-0.169	0.549	-0.31
_cons	9.793***	0.322	30.43
Pseudo R ²	0.586		
Raw sum of deviations	0.172		
Min sum of deviations	0.071		

b) Employment results

Levy expenditure in the egg industry is associated with about 39% increase in job creation, per quarter (Table 4 below).

Table 4: Effect of levy expenditure on employment

InLbr	Coefficient	Std Error	t value
InEgg_Levy	0.390***	0.779	5.01
InLayers	-1.339**	0.561	-2.39
Leg_InLay	-0.307	0.408	-0.75
_cons	5.674***	0.526	10.79
Pseudo R ²	0.644		
Raw sum of deviations	0.437		
Min sum of deviations	0.156		

Basing on the marginal results levy expenditure in the egg industry is associated with 0.871 employment factor. By using 677.25 thousand, the mean number of jobs created in the agricultural sector, it can be urged that over 500 thousand more jobs are bound to be created (*directly or indirectly*) with the egg industry per quarter due to the establishment of a levy within the industry. Hence, by assuming that about 70% of the projected levy collection will be used to enhance the industry's production capacity while holding other conditions constant, Table 5 illustrates the anticipated number of people that shall be employed (on average).

Table 5: Estimated number people to be employed

Year	Projected levy income	70% of levy income used for boosting production capacity	Mean number of people employed per quarter
2018/19	7368438	5157906.6	13457
2019/20	7810544	5467380.8	13508
2020/21	8279177	5795423.9	13558
2012/22	8775928	6143149.6	13609

Sources: Authors' calculations & NAMC's statutory measures' division

The projected number of jobs shall not only be within the egg industry but they are interlinked to other industries within the agricultural sector.

4.0 Conclusion & Policy Recommendations

Basing on the research findings, it is prudent to conclude that statutory levies have a role to play in enhancing food security and job creation within the economy². As a policy recommendation, there is a need to establish statutory levies in the egg industry.

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² Notably, study findings should be used in cognisance of the fact that the estimated number of birds kept for egg production did not disaggregate birds into day old-chicks, pullets of mature laying flock.

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