

**The calculation and analysis of consumption patterns and a
Consumer Price index for Natal Colony, for the period 1850 to
1909**

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1. Introduction

1.1 Consumer Price Index and its role in the South African economy

Since the earliest information on consumer price indexes was available inflation has been part of the South African economy, playing a vital role in the decisions making process relating to consumption and production patterns. With knowledge of consumer price changes playing a vital role not only with the National accounts of a country to make decisions about future economic conditions (Stadler, 1973), but the Consumer Price index (CPI) in South Africa is also used as a cost of living indicator to show that the correct decisions are made in terms of grant allocation and wage adjustments (Martins, 2003). It is here where the true importance of a reliable Consumer Price Index becomes evident being entangled in other macroeconomic struggles of a developing country.

The research relating to the estimation of a reliable Consumer Price index supports the theoretical importance of estimating such price indexes with large amounts of research dedicated to get a full historical time series for consumer price changes for countries all around the world (Berry, Fording and Hansen, 2000). Supporting the fact that to truly analyse an economy in any time period one has to first understand the price structure changes within that time and space to even attempt any economic analysis.

In South Africa substantial research has also been dedicated to uncover the price information gap that forms when a country like South Africa is looked at from a historical point of view. Research by the likes of Greyling (1987), deZwart (2011) and De Wet (1987) are amongst the popular research done in estimating a historical Consumer Price index for South Africa.

Greyling (1987) and De Wet (1987) calculated the CPI from 1910, given South Africa's unionization in 1910 their study aimed at finding a complete historical

consumer price index for South Africa from its existence as a country. The time before 1910 South Africa did not exist as the name suggest, but the colonies of Natal, Cape, Transvaal and Orange River Colony in that time period did form the building blocks for what would later become South Africa. Little research revolves around these four colonies and their economic and particularly price conditions.

There was a lack of information on prices in South Africa prior to 1910 and although data was limited in the this particular time frame de Zwart(2011) attempted to construct the CPI for Natal and Cape colonies in order to calculate the wages for both from 1850 to 1910. De Zwart (2011) constructed a CPI index for the Natal and Cape colony by means of creating a basket that reflects the basic cost of living. The basket de Zwart (2011) constructed provided around 1940 calories per day, with one of the critics being the replacement of certain products that have similar calorie intake and thus presume them to be the same. This could give a misleadingly unstable CPI index that does not reflect the true nature of the Natal and Cape colony cost of living or consumption patterns.

This paper will provide a redefined CPI index where the replacement of certain items for others just for the sake of estimation is discarded and rather a consumption basket with around 38 goods consumed are used to estimate a more reliable consumer price index for Natal colony using the Fisher method of estimation.

2. Method Estimating a Consumer Price index

When one considered the rich history of research on CPI estimation methods, three methods stand out above every other method, namely the Laspeyres, Paasche, and the Fisher index method. With all three of these methods haven been practiced to some success in the history of constructing historical price indexes the importance revolving around the choice of estimation method remains vital to the calculation of a reliable CPI. What follows is a brief description of these three methods with particular attention being paid to their advantages and disadvantages.

The Laspeyres method has been used as a simple method to calculate the price time series with only the weight of the base year and the given prices for each year to be estimated required for the Laspeyres formula (Steindel, 1997). This simplified method of estimation was popular as the collection of data became

struggling issues and the Laspeyres method was normally used in situations where the surveys were only available in certain frequency intervals.

The Laspeyres method had a significant disadvantage; it suffered from item substitution bias. Item substitution bias comes into play when different products with different weights and their changes have an effect on the general price level (Diewert, 1983).

The Paasche index “measures the current cost, relative to the past cost, of the currently consumed bundle of goods and services”(Steindel, 1997). When one looks at the growth in the Paasche index inflation is understated as with the Paasche method consumer spending is reflected in most part by goods that make up more of household consumption simply because the prices of these goods are rising more slowly (Steindel, 1997).

Consumer price indexes that used the Paasche method, where the weights are kept constant over time allowing for past weights to be used constantly in the time series could have some disadvantages. One critique against this method of estimating an index is that it does not consider the changes in prices overtime to have an effect on the consumption patterns that is represented by the weights (Diewert 1998). As stated by Diewert (1998) using these past weights for changing time series could lead the Paasche method to have a under estimation effect on the index under calculation.

With both the Laspeyres and Paasche methods being prone to suffer from item substitution bias, the former leading to overestimate the general price level while the latter tends to underestimate the general price level, the solution to this problem was found within the constructing of the Fisher method that is defined as a geometric mean from the Laspeyres and Paasche method (Fisher 1992). The fisher method therefore cancels out the differences in the Laspeyres and Paasche method to remove the item substitution bias that might arise within the price index estimates. Giving a more reliable price index to with those calculated from the Laspeyres and Paasche method.

In this paper the preferred method of estimating the price index for the Natal Colony is the Fisher procedure derived by Fisher (1992). In which he used the geometric

mean of the Laspeyres and Paasche methods to estimate a price index. This study with regards to the Natal Colony historical CPI from 1850 to 1909 uses the Fisher method to estimate the historical index for the Natal colony while eliminating the item substitution bias that might arise when the Paasche or Laspeyres method is used.

While work on the historical CPI for the Natal and Cape colonies has been done by de Zwart (2011) during 1850 to 1910. De Zwart (2011) used the Paasche method to estimate a barebones consumer basket the results of his estimation is theoretically proven to have and underestimated price index for both Natal and the Cape colony. One of the aims of this article will also be to compare the price index from this particular article with the one from de Zwart (2011) and find the reliability within his estimation in the difference with this paper when the two methods of Fisher and Paasche is used on the same time frame to calculate the CPI for the Natal colony.

It is important to mention that the disadvantages from both the Paasche and Laspeyres method does not make these methods incorrect in practice as the choice of which index method of estimation to use is normally based on the information that is wished to be obtained from the index numbers. In cases where the interest relates to the dynamics of money over time the Fisher or Marshall-Edgeworth indices are used (Bialek, 2012). The Laspeyres method the most simple of the methods are normally is in cases like South Africa's current CPI as weights are kept constant between survey periods. The Paasche method also allows for non-changing weights to be used in the index estimations. Making the Paasche method a desirable method when data is confined to certain limitations.

3. Research design

3.1 The process of calculating a CPI for the Natal Colony during 1850 to 1909

The process to estimate a Consumer Price index for Natal during the British colonial reign included four vital steps. The first step was the collection of data from the Natal Official Blue Books, the official government publication giving a statistical register of the Natal colony from 1850 to 1910. These Natal Blue Books was received in hard copies and digitalizing them into a suitable format to use in economic and econometric analysis was a time consuming and sometimes difficult process. The second step revolves around finding the correct price time series data for all the

products with the specified consumer basket and also choosing the method of estimation to calculate the weights needed for the CPI estimation. Thirdly the basis year needs to be specified and then lastly the CPI Index can be calculated. What follows is a complete description of the process went through to construct the CPI for Natal during British Colonial reign of 1850 to 1909.

3.2 Primary data

The main source of data for this paper was obtained from the process of digitalizing the Official Blue Books of Natal. These Blue Books contain valuable statistical information regarding the economy of the Cape and Natal colonies. Although there are substantial other economic information in the Blue Books the data for this paper uses the import values and quantities as well as the household consumption values to estimate the Consumer Price Index for Natal during 1850 to 1909. The process that was required to collect the data was done by viewing the Blue books of the Natal colony that was the official publication of the British administrative record of the Natal and Cape colony.

The process of obtaining the Natal Consumer Price index was defined by substantial time consuming work to digitalize the Natal Blue books with some older versions if the Blue books being difficult conditioned to digitalize. After the digitalization of the data the process of filtering the data to construct a consumption basked did not come without its obstacles. As the consumption information was not always captured in values but mostly was captured in the quantities consumed or valued consumed, making the process difficult to convert to the quantities to individual prices when the only some of the variables had values and quantities, the two inexcusable factors in calculating prices of products.

3.3 Filtering data and constructing the time series prices for all the consumer goods

The second step was the filtering of data to ensure that each product within the CPI basket did have enough data points to reflect the time frame worked with. The process to estimate a Consumer price index for Natal was time consuming in the amount of information that was available to digitalize from the Natal Blue Books. In first there was around 206 products captured from the home consumption and

imports information in the blue books. In the process of filtering through the data points the desired goal remained to capture a Consumer basket that remains constant for the time frame of 1850 to 1909. As the objective remained to observe the changes in consumer patterns over time, the need for a fixed consumer basket with constant quality and similar characteristics over time was vital. The process to eliminate most of these products that in practice formed a small part of the total consumer basket is justified by the estimation of a historical CPI time series for Natal during 1850 to 1909. A period in South Africa's timeline covered by darkness in terms of information available on the economic conditions

From these Natal Blue Books the home consumption values of all the products consumed were also found. While there was no home consumption quantities statistics available to calculate the home consumption prices the import prices was used for the Consumer basket as the difference between imports and consumption was substantially low. Showing that imported goods were directly consumed by the Natal population and while there might be some measurement errors within the CPI calculated in this paper the errors seem to be small and insignificant compared to the benefits of calculating a CPI for Natal colony with the more reliable and modern Fisher method.

3.4 Method of Estimation and weights calculation

After the prices were calculated the next step was to identify the weights to generate the Consumer Price Index. As the fisher method was the preferred method of estimation the weights had to be calculated for each year as to keep with the changes in the prices over the years. The weights were calculated according to the total home consumption values for each product as every year had different consumption patterns in the time frame of 1850 to 1909.

3.5 Selection of a Basis Year

After the weights has been calculated the third steps was to identify the correct basis year to base the Consumer price index on. The process of choosing a reliable basis year is vital to the estimation of a reliable index. The basis year which according to Stadler (1973) should be the most normal year and should not be far in the past given the specific time series was chosen to be 1861. As in this case the year 1861

was chosen as the basis year above the 1904 year which was one of the other options but being too close to the war of the early 1900s, which should have had a major impact on the consumption and production within the Natal colony.

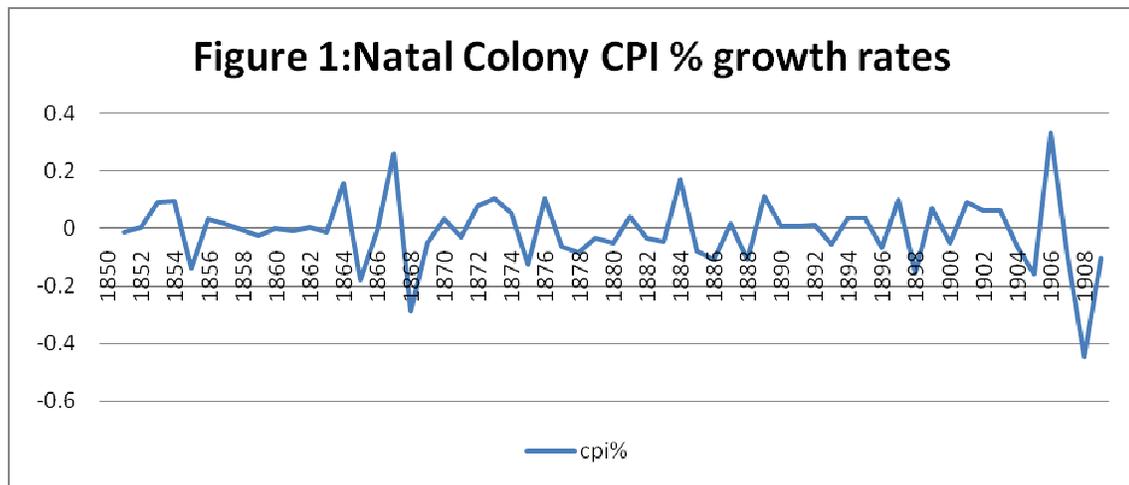
3.6 Calculation of the Natal Consumer price index for 1850 to 1909

After all the filtering and estimations has been completed what was left was to calculate the Natal Consumer Price Index. With a final CPI that is represented by 38 different products that where consumed in Natal Colony during 1850 to 1909. The products within this consumer basket consist of the most vital components to household consumption and together with other less consumed products form a reliable Consumer basket for Natal during 1850 to 1909. The number of products would have been more if not for the breaks in statistical information for some of the products which had to be removed in order to keep the desired time frame of 1850 to 1910.

The estimation of a CPI for the Natal colony is the first of its kind for this particular time frame in South Africa's history using the modern technique of the Fisher method (1992). The degree to which the estimated CPI can be used as a proxy for general price changes for the Natal colony can also be justified by the contribution of home consumption for Natal to the GDP of Natal in 1850 to 1910 as it averages around 75% over the 60 years.

Empirical results

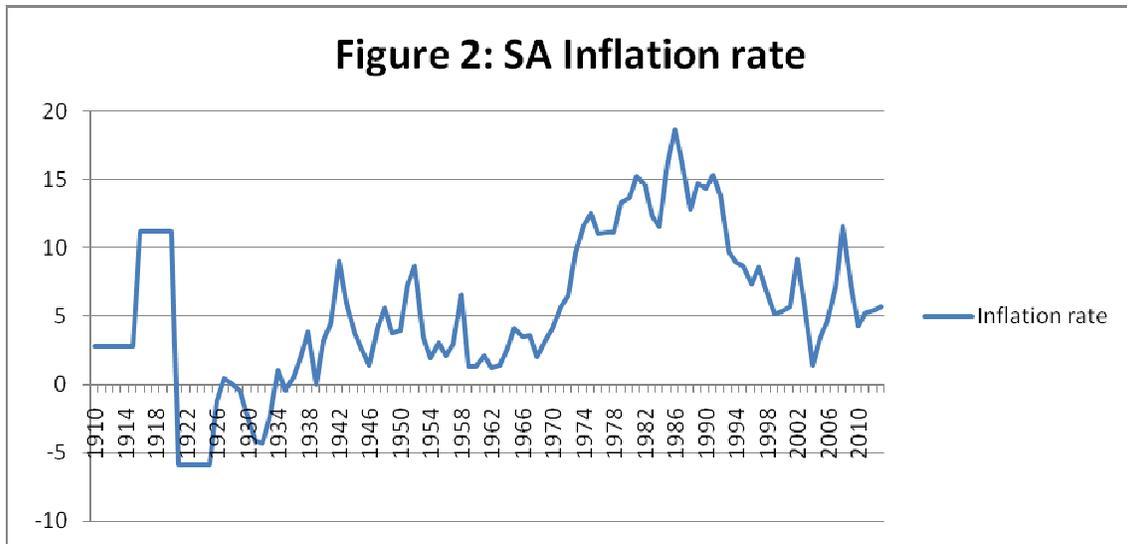
4.1 Volatile Inflation rate



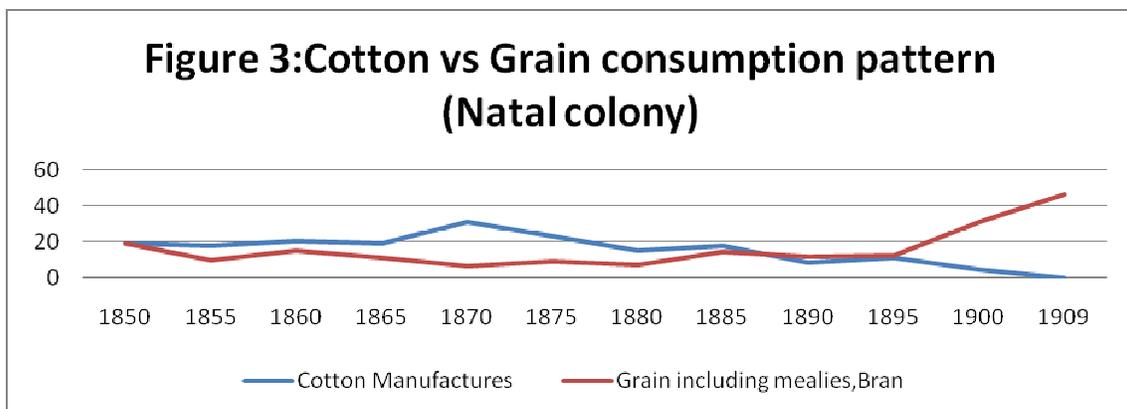
From Figure 1 which shows the CPI growth rate one can observe it to be very volatile over the 59 year period of 1850 to 1909. The research on South Africa's historical inflation rate supports this high volatility finding with De Wet (1987) reporting a volatile historical inflation rate during the 1910 to 1960s, leading to the conclusion that South Africa and peoples consumption patterns in the country has been heavily affected by this volatility in the inflation rate.

This should relate to theory where price stability was not regulated by any monetary authority in the time frame under speculation. In this particular time frame and even the preceding years in South Africa prices were determined by the market forces of supply and demand. This meant the structural events such as the first and second world wars had a major impact in the demand and supply of products leading to volatile changes in some of the prices.

From the figure 2 below one can observe the historical inflation rate for South Africa over a time period from 1910 to 2013, showing the volatile nature of the South African inflation. This aligns with the volatile inflation rate during the 1850s to 1909 in the Natal colony, showing that inflation by nature in South Africa has experienced volatile time periods.



4.2 Grain and Cotton Consumption: A change in significance

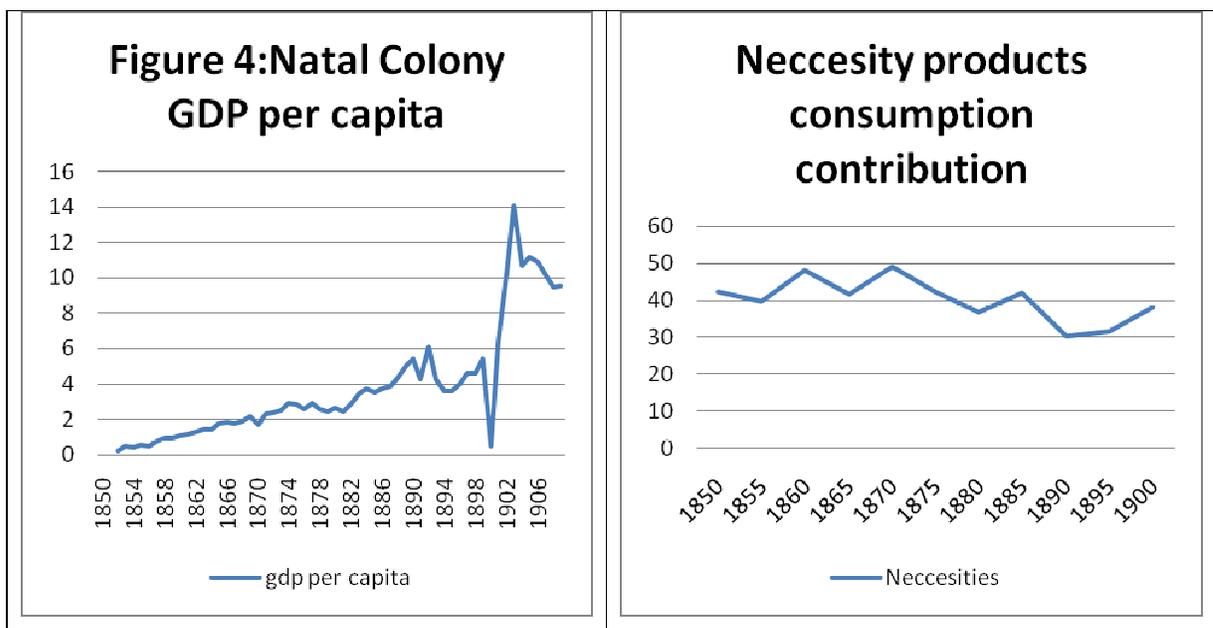


From figure 3 we can observe the change in consumption patterns for two of the most used products in Natal. Cotton and Grain make up almost 40% of the consumption in Natal during 1850 to 1909 and it's interesting to observe the change in consumption for both these products. Grain production was low for most part of the 1800 with Natal not being known for its agricultural production and it's only after 1895 that Natal started to increase their consumption of grain. The reason for this sharp rise in consumption of grain could be due to the increase in production of grain that originated from the Anglo-Boer wars that stopped grain production in Transvaal and Orange River colony during 1899 and 1902. Natal had to supply their own grain production and the consumption of this grain without transportation issues led to people of Natal consuming more grain during the 1895 to 1909. The consumption of

grain has become the more significant of the two products which could be due to the large population growth seen in the Natal province in the period from 1870 to 1910 (Greyling & Verhoef, 2010)

The change in consumption of the cotton industry can be seen from the graph to show a downward trend as cotton reached its peak in 1870 but then gradually decreased to almost zero in 1909. This could be due to the substitute nature of cotton in general as an input to clothing.

4.3 Impact of rapid wealth growth rates on the consumption pattern of Natal

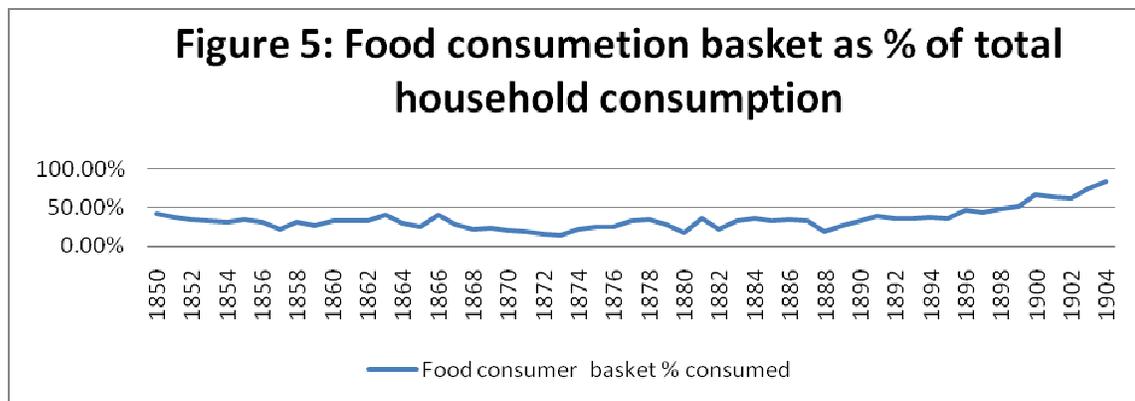


Another key finding is the change in the consumption pattern of the necessities variables over time and while products like cotton, woollen manufactures (wool) and grain still make up a significant part of the consumption basket in Natal there is a decreasing trend in the consumption of these necessity products from 1850 to 1909. Especially after the 1890s the consumption of wool and cotton was become less significant in the overall consumption basket. And products like meat, Rice & Paddy and Timber overtook these more basic products like cotton and wool in the race to become the most significant consumed product in Natal. While no product matched the consumption of grain the constant increase in consumption of products like meat, timber and Rice and Paddy showed increase in wealth of the Natal Population with a shift from the basic products to these more luxurious products. This confirms the

work done by Magee, Greyling and Verhoef (2015), where they showed the Natal colony to have a significant growth in wealth over the time of 1850 to 1910 also shown from the graph above with the spike in GDP per capita for Natal from 1902.

4.4 Percentage contribution of food items to total consumption in Natal

Food items consumption pattern in Natal during 1850 to 1904 can be seen from figure 5 below, showing the summed consumption of all food products. From the diagram one can observe the u shaped nature of food consumption overtime, reaching an all-time high of over 60% in 1904. Indicating that the ratio of food consumption to total consumption has increased throughout the years and has become more and more significant in the households consumption in Natal during 1850 to 1904. Again the growth in Natal Population could have played a major part in this growth in food consumption over the time frame of 59 years.



4. Conclusion

The calculation of a CPI for Natal during 1850 to 1909 sheds some light on the consumption pattern changes that occurred within this colony and forms a vital part of the history of inflation for South Africa. The importance of this improved CPI for the Natal Colony cannot be underestimated. As Natal and the other colonies formed an important part of the history and creation of South Africa, with the historical price and consumption patterns in this time of colonial rule had a major impact on the way South Africa moved forward after unionisation in 1910.

While this historical price index calculated from the Natal colony cannot be seen as the price index for the whole of South Africa during 1850 to 1910, with three

other notably colonies of Cape, Transvaal and Orange River Colonies being left out. These three colonies also have a role to play in the determination of a reliable CPI for the South Africa during the 19th century. This being said the Natal Colony CPI already sheds some much needed light on this economical darkly unknown time period in South Africa's history.

The estimation of CPIs of the other colonies is seen as future research work with substantial work and resource consumption the consumer price Index for Cape colony and with more difficulty the Transvaal and Orange River colony could be released in the future. The Cape colony is still in the progress of estimating a CPI index and within the near future the redlined consumption basket for the Cape Colony will be added to the literature presented with the Natal Consumer price Index.

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