The Role of Food Price Inflation in Lesotho

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Acknowledgements

To my supervisor Dr. Ramessur, T. S.; to my wife Mary and my daughters Jemimah and Jedidah.

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Project/Dissertation Declaration Form

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Abstract

This dissertation analyses the role of food price movements in inflation within the Lesotho's economy. The empirical results from this analysis reveal that food price inflation in Lesotho has generally not only been more volatile and higher than nonfood inflation, but also more persistent than the inflation of nonfood products. Furthermore, the persistent movements in food prices have appeared to be the major source of increasing inflation persistence in Lesotho, which was found to be low but rising over time. Food price movements are also discovered to have significant impact on core inflation, thereby giving evidence that food prices contain some useful information about the underlying inflation trends in Lesotho. On the other hand, the results have shown the presence of strong second-round price effects between food and nonfood inflation. These findings, therefore, implies that the setting and communication of monetary policy in Lesotho should be based on developments in underlying inflation rather than overall inflation However, any attempt to capture the underlying inflation using measures that excludes food items only on the basis of their high volatility would be unjustified.

List of Abbreviations

ADF: Augmented Dickey-Fuller.

AR: Autoregressive.

ARIMA: Autoregressive Integrated Moving Average.

BOS: Bureau of Statistics.

CEMAC: Central African Economic and Monetary Community.

CoreFE: Headline Inflation *Less* Food and Energy.

CorePCW: Persistent and CPI Weighted Measure of Core Inflation.

CorePW: Persistent Weighted Measure of Core Inflation.

CPI: Consumer Price Index.

DM: Modified Diebold-Mariano.

ECB: European Central Bank.

HL: Half-Life.

IMF: International Monetary Fund.

IRF: Impulse Response Function.

LAR: Largest Autoregressive Root.

MSE: Mean Squared Errors.

OECD: Organization for Economic Cooperation and Development.

OLS: Ordinary Least Squares.

SARC: Sum of Autoregressive Coefficients.

Chapter

1

INTRODUCTION

1.1 Background

The recent surges in food prices have raised concerns about the reliability of measures of core inflation in informing monetary policy decisions. Core inflation aims to reflect the underlying inflation by minimising or excluding short-term volatile categories from headline inflation and this often results in exclusion of food and energy items. Since the purpose of monetary authorities is to come up with policies that are consistent with medium-term goals, Cutler (2001) shows that their focus on core inflation, which captures the underlying inflationary pressures rather than transitory fluctuations in prices, can improve the efficiency of monetary policy.

Although measures of underlying inflation play a crucial role in monetary policy considerations, the increasing volatility and significance of food price movements deserve special attention from policymakers. This is because changes in food prices can have a considerable impact on headline inflation. As Rangasamy (2011) highlights, food price inflation can initially influence the overall inflation through its weight relative to other elements within the inflation index. This means that the contribution of food prices to headline price index will be greater if food items constitute a larger share in the consumption basket. Furthermore, increases in food prices can generate second-round effects on aggregate inflation by affecting inflation expectations and wages, and hence resulting in higher inflation even in the future (Cecchetti and Moessner, 2008).

According to Walsh (2011), the greater weight of food in the consumer basket and the higher volatility of its prices, however, do not, on their own, justify the minimisation of food price movements in core inflation measures. The discounting or elimination of food prices from such measures of core inflation is rather justified if they are less volatile compared to nonfood prices, they experience relatively low persistence, or they have little impact on headline inflation over

short intervals. Otherwise, the headline inflation or any core index that assigns more weight on food inflation can perform better in guiding policymakers. Therefore, it is essential to analyse the role played by food prices in overall inflation and determine the extent to which core inflation measures should accommodate changes in food prices.

1.2 Statement of the Problem

In Lesotho, food inflation has relatively tracked overall inflation, which remained in a single-digit territory through the period of 1995 to 2011[1]. During that time, food price inflation in general exhibited a downward trend, averaging nearly 2.3 percent between 1995 and 2002 to approximately 1.9 percent from 2003 to 2011. A clear divergence of food inflation from headline and nonfood inflation, however, occurred during the period of 2002 to 2003, possibly due to fluctuations in exchange rate. In the first quarter of 2002, food inflation reached the peak of about 8 percent while it assumed a negative value close to -1.7 percent in the second quarter of 2003. Food inflation also deviated from nonfood and overall inflation between 2006 and 2008, peaking almost 7.5 percent in the second quarter of 2007, mainly attributable to rising demand during that period of worldwide economic boom. Even though food inflation fell sharply from end of 2008 as a result of the global economic recession, it resumed its upward trend in 2011.

Furthermore, food price inflation within the Lesotho's economy has been higher and more volatile than nonfood and overall inflation. For the entire period between 1995 and 2011, food inflation averaged roughly 1.2 and 1.4 times as much as headline and nonfood inflation, respectively, and its volatility was about twice that of nonfood and overall inflation (see table 1 and table 2). On the other hand, within the period of 1995 to 2002, the contribution of food prices to overall inflation was less proportional to their weight in the Consumer Price Index (CPI), with the ratio of about 0.9. Nevertheless, it is noteworthy that the contribution of food items to headline inflation has increased over time, constituting roughly 1.1 times their weight in the CPI during the last period of 2003 to 2011. In addition, food products have generally contributed higher than energy items to overall inflation since 1995 till 2011, with an average contribution of about 30 percentage points more than that of energy items. All these

[1] See chapter 3 on inflation trends in Lesotho for more details.

developments seem to imply that movements in food prices are the major source of inflationary pressures in Lesotho. Therefore, in line with this idea, the following research questions have been identified.

1.3 Research Questions

i. How persistent are the movements in food prices?
ii. What is the impact of food price movements on core inflation?
iii. How significant are the second-round effects between food and nonfood inflation?

1.4 Research Objectives

The main objective of this dissertation is to analyse the role of food price movements in inflation within the Lesotho's economy. The dissertation aims to determine the persistence of movements in food prices as well as their impact on core inflation. The significance of second-round price effects between food and nonfood inflation is also examined.

1.5 Scope and Organization of the Study

Chapter 2 discusses theoretical developments concerning the role played by food price movements in inflation dynamics as well as their implications in the conduct of monetary policy. Furthermore, the evidence emanating from empirical studies based on advanced, emerging and developing economies on the debate over the issue of whether movements in food prices should be integrated into measures of core inflation is presented.

Chapter 3 offers trends in inflation within the economy of Lesotho and analyses the differences in distribution of shocks in food, nonfood and headline inflation. Additionally, the contribution of the subcomponents of CPI to headline inflation is examined. This is done at disaggregate level in order to facilitate the computation of the some core inflation measures for Lesotho.

Chapter 4 specifies the methodology employed in this dissertation. The Autoregressive (AR) model for estimating persistence in inflation is outlined. In addition, different methods of measuring core inflation and the approach to evaluate their performance are presented. The method of gap analysis is also discussed as to ascertain the pass-through price effects between food and nonfood inflation.

Chapter 5 presents the analysis of results. The persistence of food inflation relative to other subcomponents of the CPI is determined. Furthermore, different measures of underlying inflation are estimated and the analysis on how food price movements affect the optimal measure of core inflation is provided. The evidence on second-round price effects between food and nonfood inflation is also established.

Chapter 6 provides a summary of the main findings that emanated from the analysis of this dissertation as well as some important implications concerning the role of food price movements in the conduct of monetary policy. Suggestions for further research are also offered.

Chapter

2

LITERATURE REVIEW

2.1 Introduction

The literature review discusses the theoretical developments achieved so far concerning the role played by food price movements in inflation dynamics as well as their implications in the conduct of monetary policy. Furthermore, the evidence emanating from empirical studies based on advanced, emerging and developing economies on the debate over the issue of whether movements in food prices should be integrated into measures of core inflation is presented.

2.2 Theoretical Literature

Inflation is defined as a sustained increase in the general level of prices for goods and services. Its measurement represented by different price indices acts as a basis of monetary policy frameworks and provides a guide towards policy decision-making. However, price indices are characterized by frequent movements that policymakers have to contend with. Such fluctuations in price indices basically result from changes in prices of their subcomponents, within which volatile food prices are found. Rangasamy (2011) points to various factors, both domestic and international, that cause movements in food prices. First, shocks from domestic demand, supply and cost factors can have a bearing on domestic food price trends, which in turn can affect the dynamics of overall inflation. Second, international factors such as changes in exchange rate, rising input costs, increasing demand and declining supply can as well result in mounting pressure on food price inflation in the international market.

Nevertheless, as Rangasamy (2011) notes, the extent to which higher global food prices are transmitted into higher domestic prices depends on the pricing techniques of international producers, the rate of depreciation or appreciation of exchange rate and the methods of import

parity pricing. Jongwanich and Park (2011) also present other influences that can distort the pass-through effects from the global food shocks to domestic prices and these include government subsidies and price controls on basic food commodities and the existence of time lag in passing higher input prices to consumers. All these influences can bring about transitory fluctuations in aggregate price indices, which can lower signal to noise ratio in measured inflation. Since such temporary phenomena should not affect the performance of monetary policy, the policymakers are, therefore, faced with a challenge of determining whether movements in price indices represent a high-frequency noise or a build-up of inflationary pressures (Rangasamy, 2011).

According to Cecchetti (1997), the knowledge of the extent to which noise is present in measured aggregate price indices is important since the width of a credible inflation target band depends on the amount of noise present in the targeted price index. In addition, the fact that inflation has some weight in the objective functions of the policymakers merits the proper interpretation of the movements in aggregate prices. Apart from dealing with the issue of noise, monetary authorities also face the problem of bias in aggregate price indices as a result of weighting and measurement errors. While noise causes the short-run fluctuations in measured inflation to inaccurately reflect movements in long-run trends, Cecchetti (1997) shows that the bias leads the long-run average change in the inflation index to be too high. This problem of bias, however, can be solved by conducting careful computations based on highly disaggregated data for the subcomponents of the aggregate price index. On the other hand, as Blinder (1997) points out, the question of bias is not even of great practical importance from the view of monetary policymakers when inflation is significantly above its long-run target.

2.2.1 Measures of Underlying Inflation

The literature also offers several measures addressing the issue of signal to noise ratio that monetary authorities have to deal with when assessing inflation dynamics. As Cecchetti (2009) indicates, the most common measure is core inflation, which captures the underlying component of inflation by excluding certain items (usually food and energy) from its computation that are believed to contain substantial amount of noise or volatility. The theory, however, presents

different definitions of the concept of core inflation. For instance, Bryan and Cecchetti (1994) relates core inflation to the growth rate of money supply while Quah and Vahey (1995) consider it as part of measured inflation with no medium to long-term impact on real output. On the other hand, Blinder (1997) defines core inflation as a durable part of overall inflation and hence it correlates with future inflation. The latter thus makes the concept of core inflation relevant in the conduct of monetary policy based on forward-looking framework.

According to Demarco (2004), the persistence approach to core inflation advocates that the focus of monetary authorities should be on persistent underlying price developments, rather than on attempting to eliminate volatile items from measures of core inflation. This means that more weight should be assigned to items that are more persistent while those that display little or no persistence are to be given less weight. Demarco (2004) also highlights several factors on what induces persistence in inflation. Some of these factors are related to the pricing behaviour of firms and the nature of underlying shocks within the economy. Other contributing elements include shocks in aggregate demand and supply. If these shocks are persistent, they can result in durable movements in sectoral prices that are likely to be transmitted to aggregate inflation. This is so because prices in both goods and labour markets are not flexible in the short-run due to menu costs or other costs associated with wage contracts.

There are other methods on how to measure core inflation that exist in the literature. In accordance with Wiesiolek and Kosior (2009), however, most of them fall into two broad categories depending on whether they are derived from statistical or model-based approach. Core inflation measures derived from statistical approach use the information from the existing aggregate index and its subcomponents only. The criteria based on the degree of persistence and volatility are then applied to discount or eliminate some of the elements from the overall price index in order to obtain the desired core inflation indices. For example, the trimmed mean and weighted median measures of core inflation follow statistical approach in their analysis. Clark (2001) shows that the trimmed mean removes all large relative price changes from the aggregate inflation index, thereby leaving only the persistent part of inflation, whereas the weighted median measure trims all the midpoint of the distribution of price changes.

Model-based approach, on the other hand, uses multivariate econometric procedures guided by economic theory to determine appropriate core measures of inflation. Mankikar and Paisley (2004) point out that this approach generally employs both the data from overall inflation and the a priori belief about the time-series properties on core inflation to derive the core measures. One example of the model-based measures of core inflation is the Structural Vector Autoregressive (SVAR) model with some long-run identifying restrictions imposed in its analysis (Quah and Vahey, 1995). The model-based approach thus seems to be superior since it jointly applies economic theory and multivariate analysis and incorporates the determinants of inflationary developments in its analysis. Nonetheless, Wiesiolek and Kosior (2009) reveals that the role of its core inflation indices in the conduct and communication of monetary policy is limited due to model specification problems and the involvement of abstract econometric techniques.

2.2.2 Properties and Uses of Core Inflation Measures

Measures of underlying inflation are believed to follow certain ideal properties that enable them to do a good job in guiding monetary policy decisions. Besides being timely and credible, Roger (1998) suggests that core inflation measures should be robust and unbiased with respect to target measure of inflation. This implies that they should perform well in distinguishing persistent and transitory fluctuations in the general inflation. Alternatively, Wynne (1999) recommends that measures of core inflation should be forward-looking in some sense and have a track record of some sort, that is they should exhibit some predictive power with regard to future headline inflation and their properties and performance should be subject to thorough scrutiny and evaluation. Furthermore, these measures of core inflation should be easily understood to the public, be relatively insensitive to new additional information and have some theoretical foundation based on economic theory.

Although such properties are reasonable, there is an argument that they offer little in clarifying statistical conditions for desirable measures of underlying inflation. In line with this argument, Roberts (2005) highlights other properties stating that measures of core inflation should be less volatile than headline measures, be unbiased relative to aggregate inflation and reflect the trend in headline inflation so that the overall measures, on average, tend to revert towards measures of

core inflation. On the other hand, Wiesiolek and Kosior (2009) indicates that properties exhibited by core inflation measures are sometimes derived from the information contained by such measures relative to future values of aggregate inflation or their volatility with regard to headline inflation. While all these properties may be useful in evaluating suitable measures of underlying inflation, Mankikar and Paisley (2004) notes that assessing how well these measures achieve what they are constructed to do may be a more useful method of evaluation.

The theory also puts forward several reasons why core inflation measures are useful in informing monetary policy purposes. In line with Wiesiolek and Kosior (2009), such measures serve as analytical and communication tools, and sometimes as viable targets for monetary policy. As analytical tools, measures of core inflation provide information on the nature of movements in prices and they are helpful in forecasting future inflation developments by reflecting some of the persistent items within the inflation index. Alternatively, as communication tools, core inflation measures are used to describe the performance of past inflation and identify the origin of shocks affecting the economy, thus strengthening the credibility and transparency of monetary policy. At times, core inflation is also adopted as a basis for inflation targeting. This is due to the fact that monetary authorities have more control on core than headline measures and hence greater alignment of inflation expectations towards the persistent trend can be achieved.

2.2.3 Criticisms of Core Inflation Measures

Regardless of their usefulness, measures of underlying inflation still face several criticisms from the literature. For instance, in a setting of inflation targeting, Catao and Chang (2010) argue that the allowance of the distinctive role of food in household utility and the presence of high volatility in food prices can strengthen the rationale of targeting headline inflation, hence making it to be welfare-superior to other monetary policy regimes such as core inflation targeting. This in turn can enhance the credibility gains from targeting the headline index and fortify the considerations related to transparency and avoidance of ad hoc core inflation. Anand and Prasad (2010) also demonstrate that in the presence of financial frictions faced by credit-constrained consumers, the monetary authorities aiming to maximize welfare should focus on targeting headline rather than core inflation. This idea is even more relevant to developing or emerging

economies where food forms a greater part of the consumption basket and a large proportion of consumers are credit-constrained.

Furthermore, according to Mishkin (2007), some measures of core inflation are likely to be influenced by transitory movements in prices because of the changing nature of price shocks, even though such measures attempt to exclude volatile items from the overall inflation index. Additionally, if shocks from the excluded components are rather persistent, headline indices will tend to diverge from core measures for long periods, thereby posing a threat of higher inflationary pressures in the future. This extended divergence between core and headline measures can also result in complications in the communication of monetary policy since core inflation has to be revised before it can accurately reflect the underlying inflation. As a way of tackling these issues, Mishkin (2007) therefore points out that monetary authorities should not rely only on core inflation, but should also consider the broader picture of inflation dynamics provided by headline measures.

2.3 Empirical Literature

There is a growing body of empirical evidence ranging from developed to developing countries on the role of food prices in overall inflation and their implications on measures of core inflation. Nevertheless, it is acknowledged that much of evidence from the empirical studies focuses on advanced and emerging market economies and hence, there is a need for more empirical research based on developing countries.

2.3.1 Developed Countries

In the context of the euro area, Bilke and Stracca (2008) develop a measure of core inflation that emphasizes persistence in price movements at a disaggregate level and assess its performance. They find that food prices are relatively persistent and hence deserve more weight in the core index. Moreover, they discover that, unlike the headline inflation, the persistent measure of core inflation highly correlates with monetary policy decisions from the European Central Bank (ECB), meaning that this measure seems to contain some ex ante information on inflationary

pressures. Similarly, Demarco (2004) analyses the persistence-weighted measure of core inflation for Malta, but the results indicate that food price movements are not persistent. The coefficient for food items is found to be less than zero, meaning that food prices exhibit mean reversion and hence their changes are temporary. In addition, such persistent-weighted measure is revealed to be more useful for inflation targeting since its underlying inflation is relatively more stable than other measures.

Cutler (2001) also studies the role of core inflation in the United Kingdom founded on the same principle of persistence and finds seasonal food items to exhibit a relatively low persistence. The persistent-based core inflation measure is also discovered to outperform other measures in terms of predictive ability. In contrast, measures such as trimmed mean and the one excluding food and energy are revealed to have poor predictive powers. Alternatively, Mankikar and Paisley (2004) examine a range of measures of core inflation under the same economy of the United Kingdom, but their findings are mixed. Only three measures of core inflation, including the one that ignores changes in seasonal food products, from a range of measures that are analysed seem to perform well by meeting the proposed criteria. While the performance of one of the model-based measures is found to be fair, other measures based on statistical approach are found to perform badly. Based on these results, they conclude that no single measure performs well across the board and various core measures bring about different insights in the process of inflation.

Davidson *et al* (2012), on the other hand, explore a variety of factors that could explain the retail food price inflation in the United Kingdom. From their analysis, they find that retail food inflation over the recent years has been more volatile and higher than nonfood price inflation. The world food prices and exchange rate are shown to be the major drivers of retail food price while other factors such as manufacturing costs, unemployment and earnings are found to be less important. The oil prices are also discovered to have an indirect impact on domestic retail prices, especially through their effect on world agricultural commodity prices. Since the impact of the world commodity prices on retail food price inflation is found to depend the duration of the shock, the study recommends that the understanding of the dynamics of commodity price shocks, which are even expected to be higher and more volatile in the future, on domestic retail prices could be important for the purpose of macroeconomic policy.

In the United States, Rich and Steindel (2007) assess the performance of several proposed measures of core inflation, including the conventional ex food and energy series. Though they find that there is no measure that systematically dominates the others, their analysis seems not to justify the common practice of excluding food and energy items from measures of core inflation. They attribute this outcome to a lot of variability in the nature and sources of price movements due to a greater degree of persistence exhibited by food items as well as other commodities. On the other hand, Roberts (2005) evaluates the performance of underlying measures of inflation on the basis of their statistical properties within the Australian economy and finds that the underlying measures that follow statistical approach perform fairly well. The findings also show that headline inflation tends to move towards core measures over time and thus demonstrates a potential to add value to the analysis of inflationary trends in Australia.

The Organization for Economic Cooperation and Development (OECD) (2005) too analyses some measures of core inflation based on evidence in the United States, the United Kingdom, the euro area, Canada and Japan, with aggregate inflation measure less food and energy prices included. The results show all those measures to be less volatile than the overall inflation, implying that they are able to reflect the underlying inflation dynamics. Such core measures also seem to possess useful information about future inflation since headline inflation is found to have a tendency to revert to core indices. Even so, the study reveals that the United States appears to experience a build-up of inflationary pressures, while in other countries such pressures are not observed. Smith (2005) goes beyond to examine the relationship between monetary policy regime, especially inflation targeting, and core inflation measures in the OECD countries and concluded that core inflation is dependent on monetary policy regime. The type of core inflation measure to be adopted is also found to be influenced by the level of accommodation of the monetary authorities and the inflation expectations of the agents.

2.3.2 Emerging Countries

Cecchetti and Moessner (2008) study the aspects of the impact of rising food and energy prices on headline inflation dynamics from a number of countries, including the emerging economies. They discover that in majority of those countries, core inflation exhibits no tendency to move

back to overall inflation, implying that increases in commodity prices do not lead to higher second-round effects on inflation. Furthermore, food price inflation, which is perceived to be relatively persistent, is found to result in greater explanatory power on future headline inflation than energy price inflation. This implies that increasing global food prices may have a significant effect on nonfood prices. The study, however, points out that firm conclusions cannot be drawn since a relatively short sample period is applied during its analysis. This is so because core inflation measures based on persistence mainly depend on the length of the sample as well as the allowance of shifts in the mean of inflation during the estimation process.

In the case of China, Porter (2010) investigates the main drivers of inflation and discovers that supply and foreign demand pressures have a substantial impact on overall nonfood inflation. Although the impact of domestic demand pressures is found to be little, the study indicates that they have an indirect influence on nonfood inflation through their impact on domestic food prices. Furthermore, a rise in food inflation in the Chinese mainland is found to increase inflation in the non-mainland. Alternatively, in their examination of the role of food prices in overall inflation in India, Mishra and Roy (2011) find out that food price inflation is consistently higher than nonfood, fairly persistent, and has a significant pass-through to nonfood inflation. Again, they reveal that while moderate co-movements exist between domestic and international food price inflation, there is strong correlation between changes in food prices relative to nonfood prices and headline inflation.

Additionally, da Silva Filho and Figueiredo (2011) look at the performance of core inflation measures in Brazil based on some key statistical criteria for good measures of underlying inflation. From their analysis, they discover that measures such exclusion and trimmed mean core indices perform poorly since they are biased and do not seem to be helpful in predicting overall inflation. As a reason for their finding, they argue that food prices, at least in most aggregate level, and the prices of other excluded items are much less volatile and hence do not deserve their elimination from measures of core inflation. Similarly, Vargas *et al* (2009) evaluate the performance of various measures of core inflation in Colombia but they find that no particular measure of underlying performs better than other measures. Hence, they conclude that the assessment of inflationary pressures should not rely only on a single or few indicators of

underlying inflation since some measures could capture the signals that are missed by other indicators.

Furthermore, Vargas *et al* (2009) recommend that the analysis of underlying inflation measures should be accompanied by a careful examination of the persistence of shocks and a close monitoring of their impact on inflation expectations. This is because they discovered that inflation expectations partially move with shocks, which is an outcome that reflects a degree of monetary policy. Kim *et al* (2009) also assess the underlying inflation measures in South Korea using the criteria of deviations from the trend and the predictive ability. They find that the trimmed mean core inflation has relative superiority in the ability to track the underlying trend of inflation over the exclusion-based core inflation while these two core measures have no meaningful differences on the basis of predictability. The exclusion-based core inflation, however, is shown to be comparatively superior in the sense of being readily understood by economic agents and possessing transparency and hence each indicator has its own usefulness.

In the case of Sri Lanka, Gupta and Saxegaard (2009) determine the usefulness of the official measure of underlying inflation, which is constructed by excluding all movements in food and fuel prices from the overall inflation, relative to other measures of core inflation that are proposed in the literature. They find that the majority of non-official core inflation measures suggest that there are times at which the official measure of underlying inflation have understated inflationary pressures. Although the official measure of core inflation is shown to contain useful information about the future path of headline inflation, the results still indicate that its use could be inadequate as a communication tool because of its biasedness with overall inflation. In line with the degree of uncertainty surrounding the measurement of underlying inflation in Sri Lanka, which shows that the appropriate measurement is unlikely to remain constant over time, the study concludes that a suite of core inflation measures that can be continuously updated and statistically evaluated would therefore be helpful.

Wiesiolek and Kosior (2009) focus on core inflation measures for Czech Republic, Hungary and Poland and they discovered that such core measures play an in the conduct of monetary policy as they are used as guides for monetary policy decisions and as communication tools. However,

they reveal that the majority of the underlying inflation measures fail to fulfil all the evaluation criteria proposed in the literature. Furthermore, the exclusion-based measures, which are used intensively by the monetary policymakers in the countries examined, are found to be prone to many weaknesses as a result of the recent global food and energy price shocks, among other factors. The study, therefore, suggests that a set of different core inflation measures could be used in order to reduce the risk that each measure could at times offer some misleading information about the underlying inflation developments. It also points out that the knowledge gained through experience with the use of various measures of underlying inflation could help monetary authorities to decide when it is justified to apply a certain core inflation measure.

Rangasamy (2009) also evaluate the performance of various core inflation measures in South Africa in terms of how well they can predict headline inflation and discovers that the measure of underlying inflation based on the level of inflation persistence for each commodity and the weight of that commodity in the consumption basket outperforms other core measures. The results reveal that such persistent weighted measure of core inflation tracks headline inflation quite well and hence it provides a good indication of underlying inflation trends within the South African economy. The study, therefore, recommends that this core measure could be a useful addition to the range of indicators considered for monetary policy decision-making. On the other hand, Rangasamy (2011) offers the analysis of trends in food price movements within the South African economy and finds out that such movements play a major role in generating inflationary episodes in South Africa. Apart from their higher volatility, greater persistence and larger contribution to headline inflation, the results show the developments in food prices to have strong second-round impacts and thus merit special attention from monetary authorities.

In their study on measurement of price indices in Peru, Armas *et al* (2009) also find that food commodities suffer frequent relative price changes due to seasonality and supply shocks and they also weigh quantitatively high in the consumption basket. As a result, they suggest that monetary policy in such a noisy environment needs to track a number of inflation indicators and assess the value of their information on a real-time basis. However, after carrying out their proposition, they discovered that there is no suitable indicator that is best at all times. On the other hand, Lahura and Vega (2011) propose the relatively new measures of underlying inflation for Peru

based on wavelet functions and multiresolution analysis and evaluate the performance of such measures using the criterion on forecasting ability and the one that relies on long-run properties of core inflation indicators. From their results, they find that the wavelet-based core inflation measures are superior to the official core inflation in Peru. These wavelet-based core inflation measures are also shown to react much less to transitory shocks and they are found to improve the short-term inflation forecasts.

Alternatively, Eckstein and Segal (2009) examine the response of monetary policy in Israel to external shocks from factors such as international food and energy prices. The results from their analysis reveal that monetary policy should respond to core inflation in order to maximise the welfare of the household, despite the fact that such an attempt is found to result in higher economic loss in terms of the output gap and consumption gap. On the other hand, the study indicates that if headline inflation can deviate from core inflation for a long time, monetary authorities that respond to core inflation rather than headline inflation could face difficulties in communicating with the public and explaining the advantages of their policy decision. The study, however, points out that its conclusions cannot be generalised since the analysis adopted ignores credibility considerations and contains some price components that are not flexible.

2.3.3 Developing Countries

Habermeier *et al* (2009) review inflation developments associated food and energy price shocks in different countries, with developing economies included. They discover that surging food and energy prices due to global excess demand as well as supply factors are the main drivers of inflation in those countries. For the period considered, they also find the rate of overall inflation to be higher than that of core inflation, which excludes food and energy items, with the existence of a large gap between headline and core inflation measures. Moreover, the study finds underlying inflation in most of those countries to be rising along with overall inflation, indicating the presence of second-round effects. In the region of Central African Economic and Monetary Community (CEMAC), Caceres *et al* (2011) also show that global food and energy prices are the main drivers of noncore inflation, with largest effect of their shocks occurring after four or five

quarters in noncore inflation and then decaying substantially over time. However, second-round effects in that region are generally revealed to be less significant.

On the other hand, Hussain and Zaman (2008) analyse the dynamics of inflation in Bangladesh and find that headline inflation is driven mainly by movements in food prices. Besides persistent increases in some of the food commodities, the larger weight of food items in the consumption basket and the greater magnitude of food price inflation relative to nonfood inflation are cited as the reasons why food price movements play a major role in overall inflation within that country. In line with the observation that inflationary pressures facing the Bangladesh economy are dominated by food price inflation, Shahiduzzaman (2009) goes further by looking at how to measure core inflation in that economy. Focusing on the common measure that excludes some of the volatile food products as well as the trimmed mean approach, the study discovers that these measures of core inflation have strong relationship with money growth and can, therefore, be credibly used for the purpose of monetary policy formulation.

Among a range of countries examined by Walsh (2011), food price inflation is found to be significantly higher than nonfood inflation, particularly in developing countries, implying that core inflation measures ignoring food price developments are likely to reflect lower inflation even in the long run than overall measures. Food price shocks in many of those countries are also discovered to be relatively persistent and highly volatile, meaning that their slow dissipation can result in higher inflation expectations for both food and headline inflation. Furthermore, the results reveal that food price shocks are quickly disseminated in to nonfood prices and this transmission effect is found to be more profound in developing economies than in developed ones. Based on such strong transmission effect as well as the observed high volatility of and right skew to food prices, the study thus concludes that core inflation measures minimising food price movements are likely to underestimate the medium-term effects of food price shocks.

Chapter

3

INFLATION TRENDS IN LESOTHO

3.1 Introduction

The chapter offers trends in inflation within the economy of Lesotho and analyses the differences in distribution of shocks in food, nonfood and headline inflation. Furthermore, the contribution of the subcomponents of CPI to headline inflation is examined. This analysis is done at disaggregate level in order to facilitate the computation of the core inflation measure for Lesotho.

3.2 Headline, Food and Nonfood Inflation

Lesotho has experienced single digit inflation all the way through 1995 to 2011. Inflation in general has exhibited a downward trend, with headline inflation averaging nearly 2 percent during 1995 to 2002 and 1.6 percent in the last period of 2003 to 2011. Nonfood inflation also fell, on average, from 1.8 percent in the period between 1995 and 2002 to 1.3 percent during 2003 to 2011. On the other hand, food price inflation has relatively tracked overall inflation, averaging approximately 2.3 percent between 1995 and 2002 to 1.9 percent from 2003 to 2011. A clear divergence of food inflation from headline and nonfood inflation, however, occurred during the period of 2002 to 2003, possibly due to fluctuations in exchange rate. In the first quarter of 2002, food inflation reached the peak of about 8 percent while it assumed a negative value close to -1.7 percent in the second quarter of 2003. Food inflation also deviated from nonfood and overall inflation between 2006 and 2008, peaking almost 7.5 percent in the second quarter of 2007, mainly attributable to rising demand during that period of worldwide economic boom. Even though food inflation fell sharply from end of 2008 as a result of the global economic recession, it resumed its upward trend in 2011 (see figure 1 and table 1).

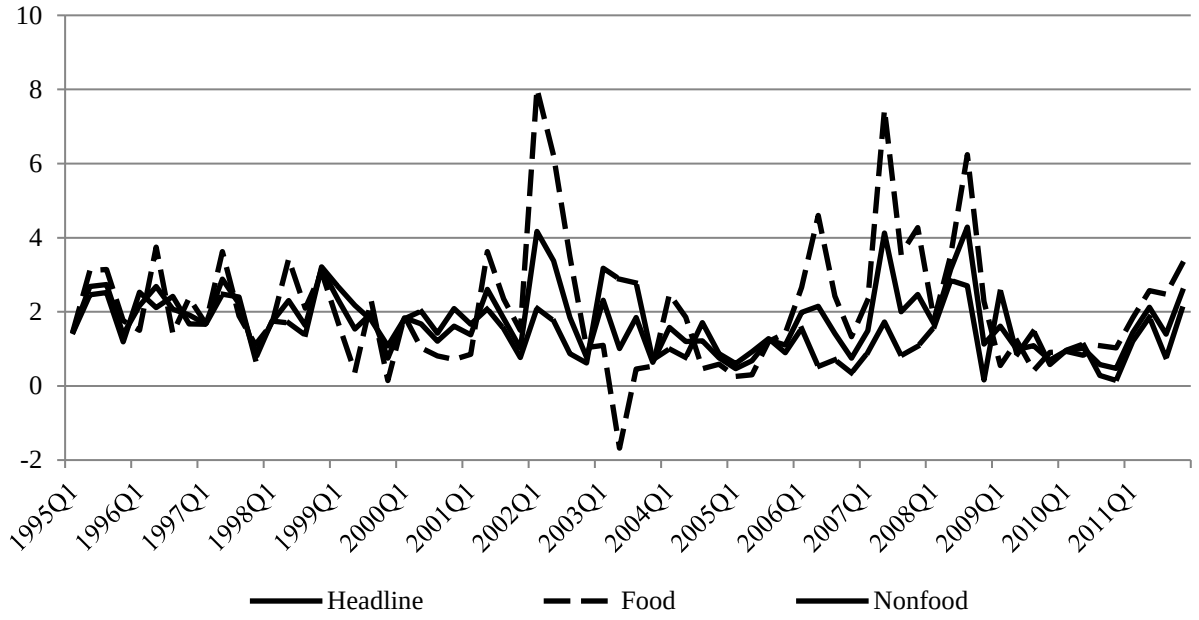

Figure 1. *Headline, food and nonfood inflation in Lesotho (in percent)*

Source: Own computations with data from Lesotho Bureau of Statistics (BOS).

Figure 1 portrays the trends in headline, food and nonfood inflation within the Lesotho's economy for the period between 1995 and 2011. During that period, food inflation was generally higher and more volatile than headline and nonfood inflation, with its peaks much higher and steeper and troughs less pronounced than headline and nonfood inflation. This is also supported by the evidence from table 1, showing that food inflation averaged roughly 1.2 and 1.4 times as much as headline and nonfood inflation, respectively, from 1995 to 2011. Furthermore, since 1995, the volatility of food inflation as captured by the standard deviation was about twice that of nonfood and overall inflation.

Table 1. *Mean and volatility of headline, food and nonfood inflation*

	Mean			**Volatility (standard deviation)**		
Period	**Headline**	**Food**	**Nonfood**	**Headline**	**Food**	**Nonfood**
1995-2002	1.98	2.29	1.82	0.78	1.63	0.62
2003-2011	1.55	1.91	1.29	0.92	1.76	0.84
1995-2011	**1.75**	**2.09**	**1.54**	**0.87**	**1.70**	**0.78**

Source: Own computations with data from Lesotho BOS.

A close relationship between food and headline inflation can also be observed from figure 1. This is confirmed by the existence of strong and positive correlation of about 0.84 between movements in food and headline inflation[2]. Although correlation does not necessarily imply causation, this suggests that overall inflation in Lesotho could be driven mainly by movements in food prices. On the other hand, even though headline and nonfood inflation were fairly correlated, with the value of approximately 0.65, a weak and insignificant correlation between food and nonfood inflation was found. Therefore, this could imply that the pass-through effects between food and nonfood prices are limited.

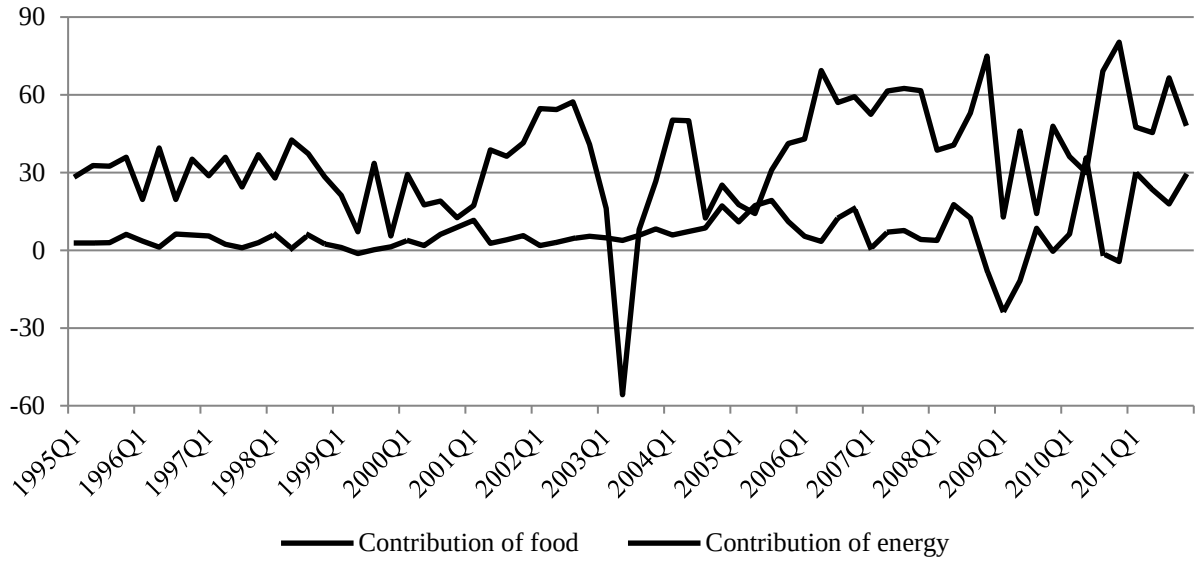

Figure 2. *Contribution of food and energy to headline inflation (in percent)*

Source: Own computations with data from Lesotho BOS.

Alternatively, figure 2 offers a comparison between the contribution of food and energy items since 1995, where energy is represented by electricity, gas and other fuels in the CPI basket. For the whole period considered, the contribution of food products to overall inflation was generally higher, averaging about 30 percentage points more than that of energy items. Nevertheless, as shown by table 2, which reflects the contribution of the CPI components to headline inflation relative to their weight in the CPI basket (denoted as relative contribution), the contribution of

[2] See table A1 in the appendix.

energy items relative to their weight in the CPI basket exceeds that of food commodities, with the ratio of about 1.4 during the last period of 2003 to 2011.

Table 2. *Weight and relative contribution of CPI components to headline inflation*

Subcomponents of CPI	**Contribution to CPI inflation**		**Weight in CPI basket**		**Relative contribution**	
	1995-2002	**2003-2011**	**1995-2002**	**2003-2011**	**1995-2002**	**2003-2011**
[1]	[2]	[3]	[4]	[5]	[6]=(2/4)	[7]=(3/5)
Food	31.01	40.43	35.32	37.01	0.88	1.09
Bread and cereals	16.06	14.36	20.00	18.00	0.80	0.80
Meat	3.61	6.68	3.59	4.30	1.01	1.55
Fish	0.33	0.46	0.40	0.39	0.84	1.19
Milk and eggs	1.78	3.10	1.64	3.00	1.08	1.03
Oils and fats	1.17	2.61	1.20	1.95	0.98	1.33
Fruits and vegetables	4.51	9.65	3.87	5.71	1.16	1.69
Other food products	3.95	4.52	4.62	3.65	0.86	1.24
Non-alcoholic beverages	1.15	1.06	1.34	1.13	0.86	0.94
Alcoholic beverages and tobacco	6.24	1.59	6.80	1.22	0.92	1.30
Clothing	13.22	6.91	9.91	10.76	1.33	0.64
Footwear	10.08	5.12	7.02	6.67	1.44	0.77
Electricity, gas and other fuels	3.72	8.66	3.57	6.14	1.04	1.41
Housing and water charges	0.02	4.38	0.21	4.47	0.09	0.98
Furniture and carpets	14.14	2.41	9.85	2.82	1.44	0.86
Household appliances and utensils	4.36	0.69	3.37	0.88	1.29	0.78
Other equipment, textile and maintenance	6.58	4.40	4.62	5.71	1.42	0.77
Health	1.82	1.03	1.58	1.88	1.15	0.55
Transport	9.01	8.37	8.16	8.47	1.10	0.99
Communications	0.01	1.77	0.12	1.24	0.06	1.43
Recreation and culture	1.75	1.40	1.83	2.39	0.96	0.59
Education	2.37	1.49	3.00	2.75	0.79	0.54
Other goods and services	3.52	5.74	3.30	6.47	1.07	0.89

Source: Own computations with data from Lesotho BOS.

The contribution of food prices to overall inflation, on the other hand, was less proportional to their weight in the CPI basket between 1995 and 2002, with the ratio of nearly 0.9. Nevertheless,

the contribution of food items to headline inflation has increased over time, constituting about 1.1 times their weight in the CPI basket during the last period of 2003 to 2011. Other food items, except of bread and cereals, have also contributed more than their weight in the last period, with fruits and vegetables contributing approximately 1.7 times their weight in the CPI basket. All the developments discussed so far, therefore, seem to imply that food price movements are the major source of inflationary pressures in Lesotho. This idea is even more plausible since food items constitute a larger part of the CPI basket, currently weighing about 37 percent of the overall index. If this is the case, then monetary authorities will have to consider food price dynamics when formulating measures of core inflation.

Chapter

4

METHODOLOGY

4.1 Introduction

The chapter specifies the methodology employed in this dissertation in order to determine the role of food price movements in Lesotho. The AR model for estimating persistence in inflation is outlined. In addition, different methods of measuring core inflation and the approach to evaluate their performance are presented. The method of gap analysis is also discussed as to ascertain the pass-through price effects between food and nonfood inflation.

4.2 Model Specification

4.2.1 Estimating Inflation Persistence

The dynamics of inflation can be determined through persistence measures, which indicate the adjustment of inflation towards shocks over time. As Rogers (1998) points out, there are two main approaches of measuring inflation persistence. The first approach is based on univariate time series models that distinguish trend inflation from shocks in order to identify the persistent part of inflation. The second approach employs the multivariate analysis founded on economic theory to determine the impact of various disturbances on inflation. Although the latter approach seems to be attractive in the sense that it incorporates the determinants of inflationary developments as well as economic theory, Wiesiolek and Kosior (2009) reveals that the role of its core inflation indices in the conduct and communication of monetary policy is limited due to some model specification problems and the involvement of abstract econometric techniques. Therefore, in line with this argument, the univariate time series rather than the multivariate approach is followed in the analysis of this dissertation.

As shown by Pivetta and Reis (2006), the measures of inflation persistence result from the estimation of the univariate AR model of the form:

$$\pi_t = \mu + \sum_{i=1}^{k} \alpha_i \pi_{t-i} + \varepsilon_t \quad (1)$$

where π_t is the inflation rate at time period t, μ and α_i are parameters, ε_t is the white noise disturbance and k is the optimal lag length. From equation (1), inflation persistence is captured by the Sum of Autoregressive Coefficients (SARC), defined as:

$$\lambda = \sum_{i=1}^{k} \alpha_i \quad (2)$$

A value of λ close to or greater than unity implies that the effect of the shock on inflation is long-lasting. Conversely, if λ is close to zero, then the shock on inflation is short-lived. However, the major drawback with this measure is that it has a larger value for a series with an impulse response function where inflation increases and declines rapidly, than for a more persistent series with the impulse response that decays slowly but rises by little from the onset. Nevertheless, Andrews and Chen (1994) considers the SARC method to be the most informative scalar measure for assessing inflation persistence.

Although not to be considered in the analysis of this dissertation, other univariate measures of inflation persistence presented by Pivetta and Reis (2006) include the Largest Autoregressive Root (LAR) and the Half-Life (HL). In the case of the LAR, its magnitude captures the long-run effect of the shock on inflation such that the higher the size of the LAR, which is suppose to range between zero and unity, the more persistent the shock is on inflation. However, this method experiences the problem of ignoring the effect of other roots in its measurement. The HL, on the other hand, is defined as the number of periods required to reduce the Impulse Response Function (IRF) below half following a unit shock. Although the HL measure is simple and intuitive, it suffers from a problem associated with oscillating dynamics. For instance, it

critically underestimates the persistence of a series when the IRF is oscillating and its estimates are close to infinity for the series that are highly persistent, leading to difficulties in capturing the changes in persistence of inflation over time.

4.2.2 Measuring Core Inflation

A number of core inflation measures designed to reflect the underlying inflationary pressures exists in the literature. However, the most common measure of core inflation is the exclusion method. As Cecchetti (2009) indicates, this measure eliminates certain elements from overall inflation that are believed to contain substantial amount of noise and this often results in exclusion of food and energy items. Nevertheless, the process of eliminating food and energy items only on the basis of their volatility when measuring core inflation may be unjustified. This is because those items may form part of the persistent volatile elements that can reduce the signal to noise ratio and if that is the case, they should be included during the estimation of core inflation measures. This argument, therefore, is in line with the definition by Blinder (1997) that core inflation is a durable or persistent part of aggregate inflation.

As an alternative way of measuring of core inflation, the persistence approach has gained a lot of support from the empirical literature. For instance, the evidence emanating from different studies shows the persistence-weighted measure of core inflation to outperform other core measures in terms of capturing the underlying inflation trends (Cutler, 2001; Demarco, 2004; Bilke and Stracca, 2008). As Demarco (2004) notes, the persistent weighted approach to core inflation advocates that the focus of monetary authorities should be on persistent underlying price developments, rather than on attempting to eliminate volatile items from measures of core inflation. This means that more weight should be assigned to items that are more persistent while those that display little or no persistence are to be given less weight.

In line with Cutler (2001), the persistence-weighted measure of core inflation can be constructed as follows:

$$\pi_t^{pw} = \sum_{j=1}^{n} \lambda_j \pi_t^j \tag{3}$$

where π_t^{pw} is the persistent weighted measure of core inflation at period t, λ_j is the inflation persistence weight of commodity j in the CPI basket, with all inflation persistence weights normalised such that $\sum_{j=1}^{n} \lambda_j = 1$, and π_t^j is the inflation rate of commodity j at time period t.

Alternatively, Babetskii *et al* (2007) suggest another weighting procedure in the calculation of the persistence-weighted measure of core inflation, which combines the information on inflation persistence and the weight of the commodity in the CPI basket in the following way,

$$\pi_t^{pcw} = \sum_{j=1}^{n} \beta_j \pi_t^j \tag{4}$$

where π_t^{pcw} is the persistent and commodity weighted measure of core inflation and π_t^j is the inflation rate of commodity j, all at period t. On the other hand, β_i is the simple average of the inflation persistence weight of commodity j and the weight of commodity j in the CPI basket. The outliers in this kind of weighting process do not get exaggerated weights and hence the contribution of each commodity in the CPI basket to core inflation is likely to be captured accurately (Rangasamy, 2009).

Since core inflation aims to capture the underlying inflation trends, the performance of its measures can be evaluated using the predictive ability criterion, which shows that core inflation should be a good predictor of headline inflation. According to Cutler (2001), the optimal measure of core inflation should, therefore, be the one that minimises the Mean Squared Errors (MSE) captured as follows:

$$MSE = \frac{1}{T} \sum_{i=1}^{T} \left(\pi_t^c - \pi_{t+l}^h\right)^2 \tag{5}$$

where T is the number of observations, π_t^c is the core inflation measure at period t and π_{t+l}^h is the headline inflation l-step ahead from time period t.

Harvey *et al* (1997), on the other hand, suggest the use of the modified Diebold-Mariano (DM) test statistic, which is estimated with Newey-West corrected standard errors that allow for heteroscedastic autocorrelated errors, in order to assess of the equality of the prediction of MSEs. The modified DM test statistic is then given by

$$DM = \left\{\frac{T + 1 - 2(l+1) + [l(l+1)/T]}{T}\right\}^{\frac{1}{2}} S_1 \tag{6}$$

where

$$S_1 = \left[\hat{V}(\bar{d})\right]^{-\frac{1}{2}}\bar{d} \tag{7}$$

and $\bar{d}$ is the mean difference in the prediction errors while $\hat{V}(\bar{d})$ stands for the estimated variance. This test statistic, therefore, performs well in small-sample estimations.

4.2.3 Determining Second-Round Price Effects

The estimation of second-round price effects between food and nonfood inflation is necessary since movements in food prices can pose a threat to monetary policy goal of price stability if their shocks are transmitted into nonfood inflation. Hence, in accordance with Rangasamy (2011), the presence of such second-round effects between food and nonfood price shocks the can be captured through the method of gap analysis represented by the following two equations:

$$\pi_t^n - \pi_{t-k}^n = \varphi_n + \delta_n\left(\pi_{t-k}^h - \pi_{t-k}^n\right) + \varepsilon_t^n \tag{8}$$

$$\pi_t^f - \pi_{t-k}^f = \varphi_f + \delta_f\left(\pi_{t-k}^h - \pi_{t-k}^f\right) + \varepsilon_t^f \tag{9}$$

where π_t^n is nonfood inflation, π_t^h is headline inflation, π_t^f is food inflation (all at period t), φ and δ are the corresponding parameters, and k is the number of lags.

Equation (8) reflects the impact of food inflation, given by the gap between headline and nonfood inflation, at time period $t-k$ on the increase in nonfood inflation between period t and $t-k$. Similarly, equation (6) captures the impact of nonfood inflation, given by the gap between headline and food inflation, at period $t-k$ on the increase in food inflation between time period t and $t-k$. Therefore, if δ_n (δ_f) is positive and significant, then changes in food (nonfood) prices affect the prices of nonfood (food) items, meaning that there is presence of pass-through effects from food (nonfood) prices.

4.3 Method of Analysis

The Augmented Dickey-Fuller (ADF) test of unit root is employed on all variables in order to determine their stationarity condition. The standard maximum likelihood Autoregressive Integrated Moving Average (ARIMA) approach is then applied to estimate the AR(k) model represented by equation (1), with the order of autoregression (k) based on information criteria or theory. Furthermore, the estimates of inflation persistence for the subcomponents of CPI, as shown by equation (2), together with their corresponding weights in the CPI basket are used to compute the persistent and commodity weighted measure of core inflation, given by equation (4). The performance of this measure of core inflation, in comparison with other measures such as the persistent weighted measure of core inflation given by equation (3) and the exclusion method derived from headline inflation less food and energy items, is then determined on the basis of its ability to predict overall inflation. Finally, the method of Ordinary Least Squares (OLS) is used to estimate equations (8) and (9) as to ascertain the evidence of second-round price effects between food and nonfood inflation.

4.4 Description of Data

The dissertation uses the dataset on CPI from the Lesotho Bureau of Statistics (BOS), which includes the information on all the subcomponents in the CPI basket. Nonfood CPI, however, is

derived from the overall CPI using food CPI and its weight in the CPI basket. The rate of inflation is then calculated on quarterly basis from the first quarter of 1995 to the fourth quarter of 2011 (1995Q1-2011Q4).

4.5 Data and Methodological Limitations

There are some limitations related to the data and methodology used in this dissertation. First, due to the unavailability of data for the subcomponents of the CPI, the analysis is restricted to the period between 1995 and 2011[3]. Second, the univariate approach of measuring inflation persistence is used and this method does not fully explain the reasons behind the behaviour of inflation persistence as compared to other multivariate models that offer more rigorous analysis of determinants of inflation. Third, other factors such as globalisation can affect the dynamic properties of inflation persistence and they are better captured using the Markov-switching models to estimate the persistence of inflation. Lastly, the dissertation does not adopt the forward-looking model based on expectations such as the New Keynesian Phillips curve with time-varying inflation trend, which is capable of explaining inflation dynamics quite well as compared to backward-looking models. However, there is evidence that forward-looking models are not able to sufficiently account for high levels of inflation persistence in some countries (Rangasamy, 2009).

[3] The data available prior 1995 is on retail price index, but it is inconsistent with the analysis of this dissertation since it is based on CPI data.

Chapter 5

ANALYSIS OF RESULTS

5.1 Introduction

The chapter attempts to shed a light on whether movements in food prices are the main source of inflationary pressures within the Lesotho's economy. Hence, the persistence of food inflation relative to other subcomponents of the CPI is determined. Furthermore, different measures of underlying inflation are estimated and the analysis on how food price movements affect the optimal measure of core inflation is provided. The evidence on second-round price effects between food and nonfood inflation is also established.

5.2 Inflation Persistence Estimates

The inflation persistence in Lesotho was estimated at both aggregate and disaggregate levels for the period of 1995 to 2011 and that period afterwards was divided into two other periods (1995-2002 and 2003-2011). The persistence estimates for headline, food and nonfood inflation were also obtained through recursive estimation in order to determine the behaviour of inflation persistence over time. The recursive estimates are then depicted in figure A1 (in the appendix) while table 3 provides the persistence estimates of inflation at aggregate and disaggregate level. As it can be observed from those results, inflation in Lesotho has generally exhibited low persistence throughout the period of 1995 to 2011, with the estimate of about 0.3 for both headline and nonfood inflation and 0.4 for food inflation. Nevertheless, there is a significant increase in inflation persistence from the period between 1995 and 2002 to the period of 2003 to 2011, with persistence of food inflation estimated at approximately 0.5 in the latter period. The recursive estimates also confirm that inflation persistence in Lesotho has been increasing over time, probably driven by persistent movements in food prices, which remained significantly higher than the persistence of nonfood and headline inflation for the period of 2003 to 2011.

Table 3. *Persistence estimates for the subcomponents of CPI*

Persistence Estimates	**1995-2011**	**1995-2002**	**2003-2011**
Headline	0.27**	0.06	0.34**
Nonfood	0.26**	0.11	0.26*
Subcomponents of CPI			
Food	0.41***	0.29*	0.47**
Bread and cereals	0.46***	0.41**	0.47***
Meat	-0.04	0.00	-0.07
Fish	0.26**	0.22	0.38**
Milk and eggs	0.14	0.04	0.30*
Oils and fats	0.58***	0.50**	0.49***
Fruits and vegetables	0.09	-0.05	0.18
Other food products	0.08	-0.02	0.22
Non-alcoholic beverages	-0.07	-0.04	-0.13
Alcoholic beverages and tobacco	-0.23	-0.21	-0.29
Clothing	0.54***	0.49***	-0.04
Footwear	0.32***	0.27**	-0.14
Electricity, gas and other fuels	0.36***	0.36**	0.36**
Housing and water charges	0.30***	0.31**	0.23*
Furniture and carpets	0.14	0.05	-0.05
Household appliances and utensils	0.38***	0.17	0.35***
Other equipment, textile and maintenance	0.50***	0.06	0.35**
Health	0.11	0.03	-0.03
Transport	0.09	0.06	0.03
Communications	0.10	-0.05	0.07
Recreation and culture	0.16	-0.20	0.33
Education	-0.15	-0.14	-0.21
Other goods and services	0.42***	0.41***	0.27*

Source: Own computations.

* Indicates significance at 10 percent level.

** Indicates significance at 5 percent level.

*** Indicates significance at 1 percent level.

According to Khemangkorn *et al* (2008), the increase in inflation persistence can be associated with the lack of monetary policy discipline. This is because the impact of (supply) shocks on inflation under the accommodative monetary policy environment lasts for longer periods and hence, the inflation tends to be more persistent as well. The similar explanation could be offered for the increasing inflation persistence in Lesotho, for the country has lost its monetary policy

autonomy through the operation of the fixed exchange rate regime where its currency (loti) has been pegged one to one to the South African currency (rand). This situation could have been exacerbated by the mounting inflationary pressures from movements in food (and energy) prices that occurred in the last period between 2003 and 2011. However, further research on the reaction of monetary policy to changes in inflation dynamics is needed in order to ascertain the impact of the accommodative monetary policy on inflation persistence.

The estimates in table 3 also reveal that food price inflation has generally been more persistent than nonfood inflation and this implies that food price shocks have had more lasting adverse impact on the prices of food items relative to nonfood products. Such relatively high persistence of food inflation has been driven mainly by the movements in prices of bread and cereals as well oil and fats, with the persistence estimates of about 0.5 and 0.6, respectively, for the period of 1995 to 2011. Thus, food price inflation in Lesotho is not only more volatile and on average higher than nonfood inflation as shown in the previous chapter, but also more persistent than the inflation of nonfood products. This finding appears to be quite consistent with the empirical evidence provided in Walsh (2011) that shows the same to hold for food inflation in many developing countries. Hussain and Zaman (2008) also cite the persistent increases in food commodities as well as the greater magnitude of food price inflation relative to nonfood inflation as the reasons why food price movements play a major role in overall inflation in Bangladesh.

The relatively high persistence of food price inflation in Lesotho has some important implications for the conduct of monetary policy. First, any measure of core inflation that excludes food items only on the basis of their high volatility would be unjustified. Second, the increasing persistence of food inflation could result into higher inflation expectations with adverse spillover effects on wage demands and underlying inflation. The International Monetary Fund (IMF) (2011) shows that such second-round effects could even be larger under the presence of excess demand pressures and if inflation is already above the target and thus strong policy response from the monetary authorities would be required. Lastly, the relatively high persistence and volatility of food prices coupled with their large weight in the CPI basket call for the setting and communication of monetary policy to be based on developments in underlying inflation rather than overall inflation (IMF, 2011).

Alternatively, the analysis at disaggregate level provides an indication of other main products driving the persistence of aggregate inflation within the economy of Lesotho. On top of bread and cereals as well as oil and fats, the other products that had the persistence estimates higher than that of headline inflation for the period of 1995 to 2011 included clothing; footwear; electricity, gas and other fuels; housing and water charges; household appliances and utensils; other equipments, textile and maintenance; and other goods and services. However, some of these products experienced a deep decline in inflation persistence from the period between 1995 and 2002 to the period of 2003 to 2011. The clear examples in this case can be observed with the persistence estimates for clothing and footwear components. Nonetheless, this could be expected since the relative contribution of both clothing and footwear to headline inflation had fallen sharply in the last period between 2003 and 2011[4].

5.3 Measures of Core Inflation

The estimation of the three different measures of core inflation for Lesotho is undertaken in this dissertation. The first measure is derived from headline inflation less food and energy, where energy comprises electricity, gas and other fuels. On the other hand, the second measure of core inflation is estimated using the weights based only on inflation persistence estimates while the computation of the third measure incorporates both the weights from the inflation persistence estimates and the CPI basket. The performance of all these measures is then evaluated on the basis of their ability to predict headline inflation with the aim to determine the optimal measure of underlying inflation for Lesotho.

5.3.1 Headline Inflation Less Food and Energy (CoreFE)

The CoreFE is estimated as headline inflation less food and energy, which is the most common approach of measuring the underlying inflation. The relationship between CoreFE and headline inflation is then depicted in figure 3. As it can be observed from that figure, these two measures of inflation seemed to converge to each other during the period before 2002. After that period, however, CoreFE significantly diverged from the headline inflation. Although the apparent

[4] See table 2 in chapter 3.

divergences that occurred in 2002 and 2003 were somehow temporary, the ones that took place during the period of 2005 to 2008 and from 2010 onwards seem to be persistent. In those two latter periods, the CoreFE did not only deviate from headline inflation, but also remained significantly lower than the overall inflation. This shows that the CoreFE had missed the recurring shocks from movements in food and energy prices that occurred during those two latter periods and as a result, its accuracy in terms of capturing the underlying inflationary pressures within the Lesotho's economy is challenged.

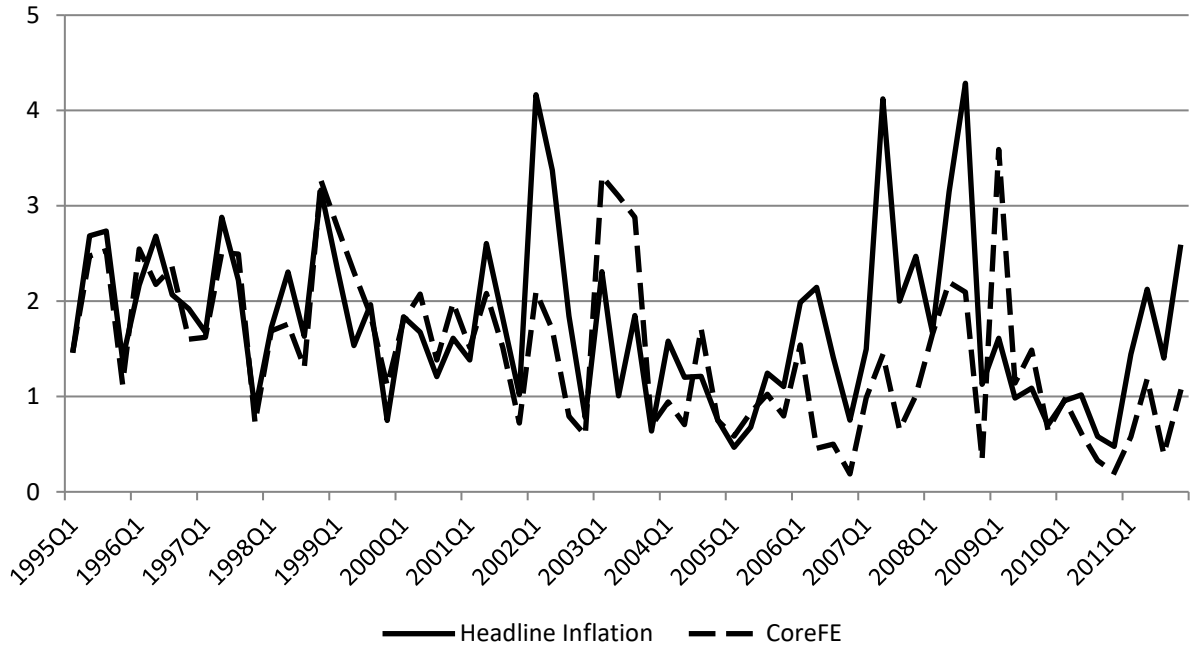

Figure 3. *Headline inflation and CoreFE (in percent)*

Source: Own computations.

5.3.2 Persistent Weighted Measure of Core Inflation (CorePW)

The CorePW as an alternative measure of core inflation for Lesotho is computed using the weights from the inflation persistence estimates of the 22 subcomponents of the CPI as shown in table A2 (in the appendix). Unlike the CoreFE, this measure assigns higher weight to more persistent price movements since they contain more information about future inflation. Figure 4 then portrays the CorePW along with the headline inflation. The CorePW seems to track the

overall inflation better than the CoreFE, with most of the peaks being accurately identified. Even though there were times when CorePW deviated from headline inflation, such occurrences were short-lived. However, the outliers under the CorePW could have got exaggerated weights and hence the contributions of some components in the CPI basket to this measure of underlying inflation could likely have been distorted. For instance, the oil and fats categories had the highest inflation persistence estimate of roughly 14.8 percent (12.2 percent) during the period of 1995 to 2002 (2003 to 2011), but their weight in the CPI basket constituted only 1.2 percent (2 percent).

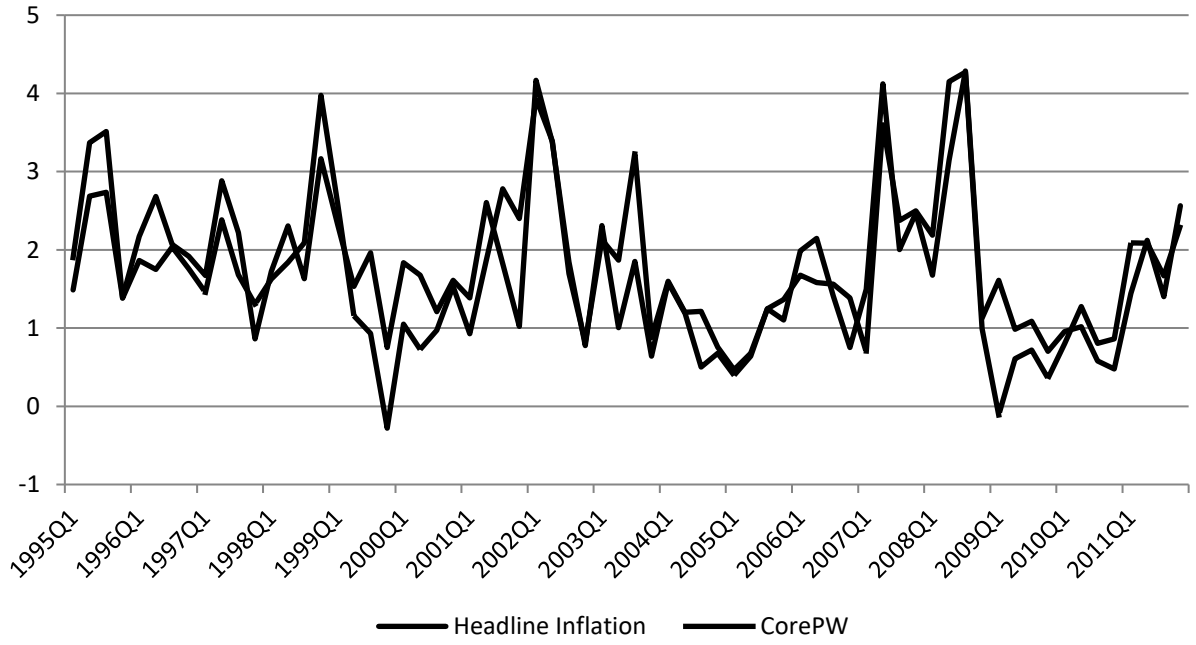

Figure 4. *Headline inflation and CorePW (in percent)*

Source: Own computations.

5.3.3 Persistent and CPI Weighted Measure of Core Inflation (CorePCW)

The CorePCW employs an alternate weighting procedure that is different from the one used in the computation of the CorePW. With the aim of correcting for the presence of outliers, the CorePCW is derived from the both the inflation persistence estimates and the weights of the commodities in the CPI basket as reflected in table A2 (in the appendix). For example, the oil and fats categories under the CorePCW are allocated the weight of about 8 percent (7 percent)

during the period of 1995 to 2002 (2003 to 2011), which is considerably lower than their inflation persistence estimate of 14.8 percent (12.2 percent) but much higher their weight in the CPI basket of 1.2 percent (2 percent). Figure 5 then offers a comparison between the CorePCW and the headline inflation. In that figure, the CorePCW appears to track the headline inflation quite well, with the peaks and troughs accurately identified. Hence, this measure seems to perform better than the CorePW and the CoreFE in terms of capturing the underlying inflation trends in Lesotho. However, firm conclusions cannot be made at this point since the performance of any measure of core inflation depends on its ability to predict headline inflation.

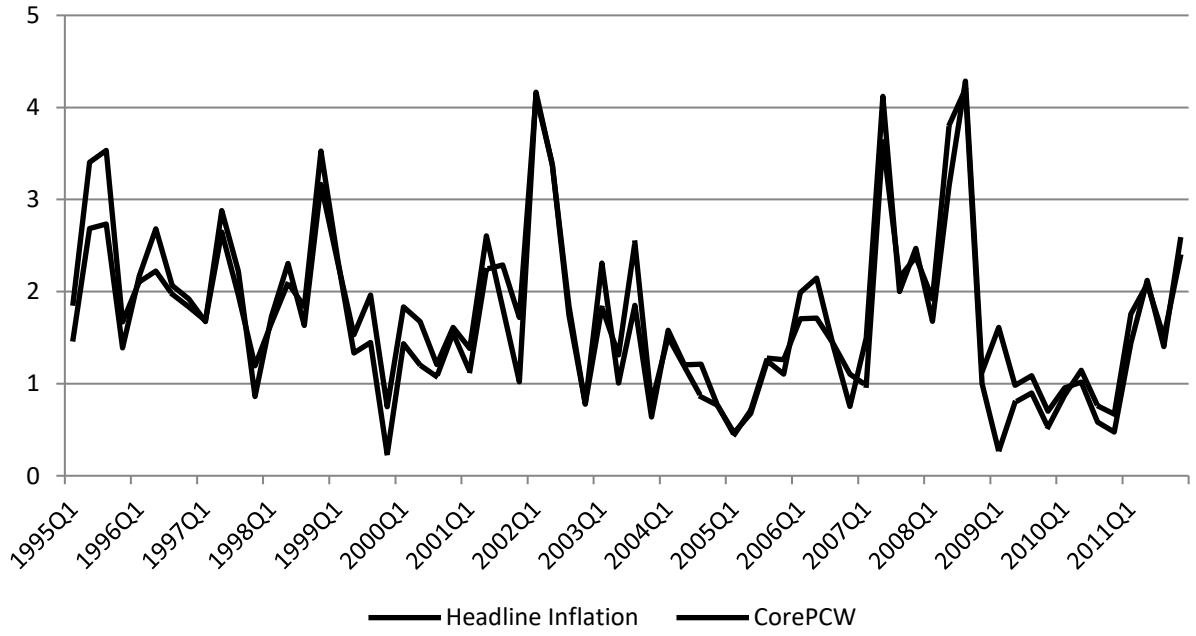

Figure 5. *Headline inflation and CorePCW (in percent)*

Source: Own computations.

5.3.4 Evaluation of Core Inflation Measures

The MSE approach is applied to ascertain the relative accuracy of different measures of core inflation in terms of their ability to forecast the headline inflation. The test results for this approach are presented in table 4 and the lower the MSE the better the predictor. The DM test statistic is then used to subject the results to the test of the null of equal forecast accuracy between the underlying measure with the lowest MSE and the other measures of core inflation.

The results show the CorePCW to have the lowest MSE estimate and the null hypothesis of equal forecast accuracy between the CorePCW and the other measures of underlying inflation is rejected by the DM test statistic. On the other hand, the CoreFE as a popular measure of core inflation is outperformed by both the CorePCW and the CorePW. Hence, as Cutler (2001) points out, the persistence-weighted measures of underlying inflation seem to possess the ability to exploit the statistical information in the time series properties of the disaggregated components of the CPI, which is useful in forecasting the overall inflation.

Table 4. *Relative accuracy of core inflation measures*

Core Inflation Measure	MSE	DM
CorePCW	0.13	
CorePW	0.32	4.15***
CoreFE	0.73	3.12***

Source: Own computations.

*** Indicates significance at 1 percent level.

As mentioned earlier, the IMF (2011) recommends the setting and communication of monetary policy in economies where food prices are not only persistent but also have a larger weight in the CPI basket should be based on underlying inflation rather than headline inflation, especially if the inflation expectations within those economies are less anchored. Nonetheless, the success of such monetary policy would depend to a great extent on the choice of the appropriate measure of underlying inflation. This issue is vital in the conduct of monetary policy in Lesotho since food prices did not only prove to be more persistent than the prices of nonfood items but they also had a high share of about 37 percent (35 percent) in the CPI basket during the period of 2003 to 2011 (1995 to 2002). Given the results from the evaluation of core inflation measures, the CorePCW thus seems to be the optimal measure of underlying inflation for Lesotho. The fact that it has the ability to reflect changes in inflation that are likely to be sustained over the medium term better than other core measures (CorePW and CoreFE) makes it to be suitable for the setting and communication of monetary policy in Lesotho.

5.3.5 Impact of Food Price Movements on Core Inflation

The impact of food price movements on core inflation is captured by the contribution of food products to CorePCW, which has been shown the best indicator of underlying inflation in Lesotho. For comparison purpose, the contribution of food commodities to CorePCW is illustrated alongside that of energy items in figure 6. Since 1995, the contribution of food prices to CorePCW has generally been higher than that of energy prices. On average, food commodities contributed about 44 percent to CorePCW for the whole period, while energy items contributed approximately 7 percent. This shows that the contribution of food products to CorePCW was more than that of energy items by 37 percentage points and this difference is even higher than the one at which the contribution of food to headline inflation exceeded that of energy, which was about 30 percentage points. Therefore, it is evident that movements in food prices contain some useful information about the underlying inflationary pressures within the economy of Lesotho and hence they merit special attention in monetary policy decision-making.

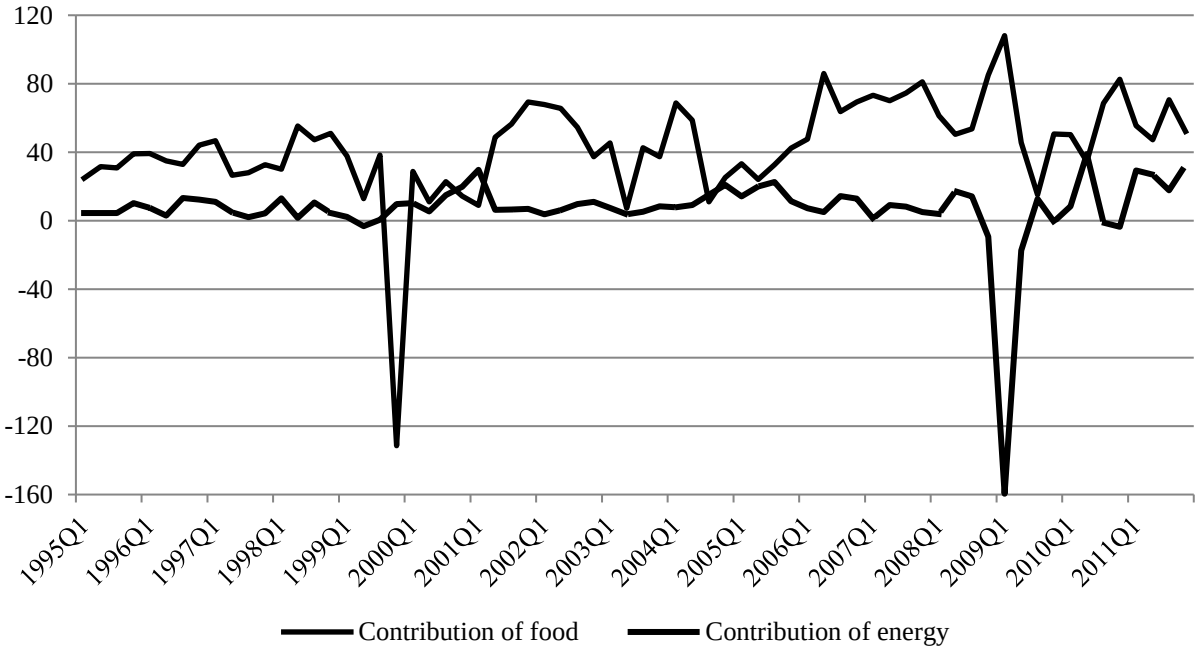

Figure 6. *Contribution of food and energy prices to CorePCW (in percent)*

Source: Own computations.

5.4 Second-Round Price Effects

The second-round price effects between food and nonfood inflation were estimated for the period of 1995 to 2011. Table 5 then reflects the pass-through price impacts of food inflation into nonfood inflation. The slope coefficients (δ_n) at all lags are positive, but the coefficient at first-quarter lag is insignificant while all others are significant. This implies that there are pass-through price effects from food into nonfood inflation, especially from second-quarter lag onwards. The fourth-quarter lag has the largest coefficient of about 0.7, which means that every 1 percent increase in food inflation four quarters ago leads to a rise of about 0.7 percent in nonfood inflation. Although these transmission effects from food price shocks into nonfood prices seem to be strong, especially over time, Walsh (2011) indicates that the monetary authorities should not overreact to such transitory shocks by tightening monetary policy prematurely. This is because the attempt to stabilize inflation in the face of highly volatile food commodities could result in considerable economic loss in terms of higher volatility in output as well as in household income (IMF, 2011).

Table 5. *Second-round price impacts of food inflation*

Lags in quarters	**Adjusted R-squared**	**Constant (φ_n) (standard error)**	**Slope coefficient (δ_n) (standard error)**
$k = 1$	-0.01	-0.01	0.10
		(0.12)	(0.17)
$k = 2$	0.04	-0.08	0.33*
		(0.13)	(0.18)
$k = 3$	0.13	-0.14	0.57***
		(0.13)	(0.17)
$k = 4$	0.20	-0.16	0.64***
		(0.12)	(0.16)

Source: Own computations.

* Indicates significance at 10 percent level.

*** Indicates significance at 1 percent level.

Alternatively, table 6 offers the results on the impact of pass-through effects from nonfood to food prices. All the slope coefficients (δ_f) at different lags are positive and highly significant

and they also increase with time. This shows that the transmission effects from nonfood to food inflation are long-lasting. In addition, the second-round price impacts of nonfood into food inflation are also higher than in the case of vice versa. For instance, an increase of 1 percent in nonfood inflation three or four quarters ago leads to a rise of 1.3 percent in food inflation. As Rangasamy (2011) shows, the bidirectional relationship between food and nonfood price shocks has an implicit support for the monetary policy goal of overall stability. Therefore, further analysis on how shocks from prices of different nonfood commodities impact food inflation could help the monetary authorities to be vigilant about movements in food prices and hence design appropriate policy measures in order to control food price inflation.

Table 6. *Second-round price impacts of nonfood inflation*

Lags in quarters	**Adjusted R-squared**	**Constant (φ_f) (standard error)**	**Slope coefficient (δ_f) (standard error)**
$k = 1$	0.19	0.28	0.78***
		(0.21)	(0.19)
$k = 2$	0.26	0.36	1.07***
		(0.25)	(0.22)
$k = 3$	0.35	0.42*	1.30***
		(0.26)	(0.22)
$k = 4$	0.33	0.42	1.30***
		(0.26)	(0.23)

Source: Own computations.

* Indicates significance at 10 percent level.

*** Indicates significance at 1 percent level.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This dissertation intended to analyse the role of food price movements in inflation within the Lesotho's economy. Chapter one stated the nature of the problem that the dissertation aimed to address together with some research questions and objectives. The theoretical and empirical evidence concerning the role played by food price movements in inflation dynamics as well as their implications in the conduct of monetary policy were discussed in chapter two while chapter three offered the trends in inflation within the economy of Lesotho. Chapter four specified the methodology employed in this dissertation and the analysis of results was presented in chapter five. Some concluding remarks, policy recommendations and suggestions for further research are provided in this chapter.

6.2 Summary of findings

The empirical results from the analysis of this dissertation revealed that food price inflation in Lesotho has generally not only been more volatile and higher than nonfood inflation, but also more persistent than the inflation of nonfood products. This implies that food price shocks have had more lasting adverse impact on the prices of food items relative to nonfood products. Such relatively high persistence of food inflation has been driven mainly by the movements in prices of bread and cereals as well oil and fats. Furthermore, the persistent movements in food prices appeared to be the major source of increasing inflation persistence in Lesotho, which was found to be low but rising over time.

Alternatively, food price movements were discovered to have significant impact on core inflation. This was captured by the contribution of food products to the optimal underlying

measure of inflation based on the level of inflation persistence for each commodity and the weight of that commodity in the consumption basket. The contribution of food prices to such core inflation measure was found to be much higher than that of energy prices, thereby giving the evidence that movements in food prices contain some useful information about the underlying inflation trends in Lesotho.

The results, on the other hand, have shown the presence of strong second-round price effects between food and nonfood inflation. These effects were long-lasting and increasing with time. For instance, every 1 percent increase in food inflation four quarters ago led to a rise of about 0.7 percent in nonfood inflation while the same increase of 1 percent in nonfood inflation four quarters ago resulted in a rise of 1.3 percent in food inflation. Although the pass-through effects from food to nonfood prices seems to be much lower than in the case of vice versa, they are still strong enough to lead to higher underlying inflationary pressures within the Lesotho's economy.

6.3 Policy Recommendations

The analysis of the role of food price movements in Lesotho has some important implications for the conduct of monetary policy. First, given the relatively high persistence of food price inflation, any measure of core inflation that excludes food items only on the basis of their high volatility would be unjustified. Second, the high volatility and persistence of food prices coupled their large weight in the consumption basket call for the setting and communication of monetary policy to be based on developments in underlying inflation rather than overall inflation (IMF, 2011). In this case, the core inflation measure based on the level of inflation persistence for each commodity and the weight of that commodity in the consumption basket could be adopted since it performs better than other measures in terms of reflecting changes in inflation that are likely to be sustained over the medium term.

Finally, the presence of strong second-round price impacts of food inflation could require the tightening of monetary policy in order to avoid the adverse spillover effects on wage demands and underlying inflation. According to IMF (2011), such second-round effects could even be larger under the presence of excess demand pressures and if inflation is already above the target.

However, Walsh (2011) indicates that the monetary authorities should not overreact to transitory food price shocks by tightening monetary policy prematurely. This is because the attempt to stabilize inflation in the face of highly volatile food commodities could result in considerable economic loss in terms of higher volatility in output as well as in household income (IMF, 2011).

6.4 Areas for Further Research

There are some areas for further research that could extent the analysis of this dissertation. First, the studies on the reaction of monetary policy to changes in inflation dynamics are needed in order to determine the causes of increasing inflation persistence in Lesotho. This is because the univariate approach of measuring inflation persistence used in this dissertation does not fully explain the reasons behind the behaviour of inflation persistence as compared to other multivariate models that offer more rigorous analysis of determinants of inflation. Second, the Markov-switching models could be applied to estimate the persistence of inflation due to their ability to capture other factors such as globalisation that affect the dynamic properties of inflation persistence. Lastly, the forward-looking models based on expectations such as the New Keynesian Phillips curve with time-varying inflation trend are capable of explaining inflation dynamics quite well relative to the backward-looking models such as the one employed in the analysis of this dissertation (Rangasamy, 2009).

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Appendices

Table A1. *Correlation matrix for headline, food and nonfood inflation*

	Headline	Food	Nonfood
Headline	1.0000		
Food	0.8473***	1.0000	
Nonfood	0.6536***	0.1585	1.0000

Source: Own computations.

*** Indicates significance at 1 percent level.

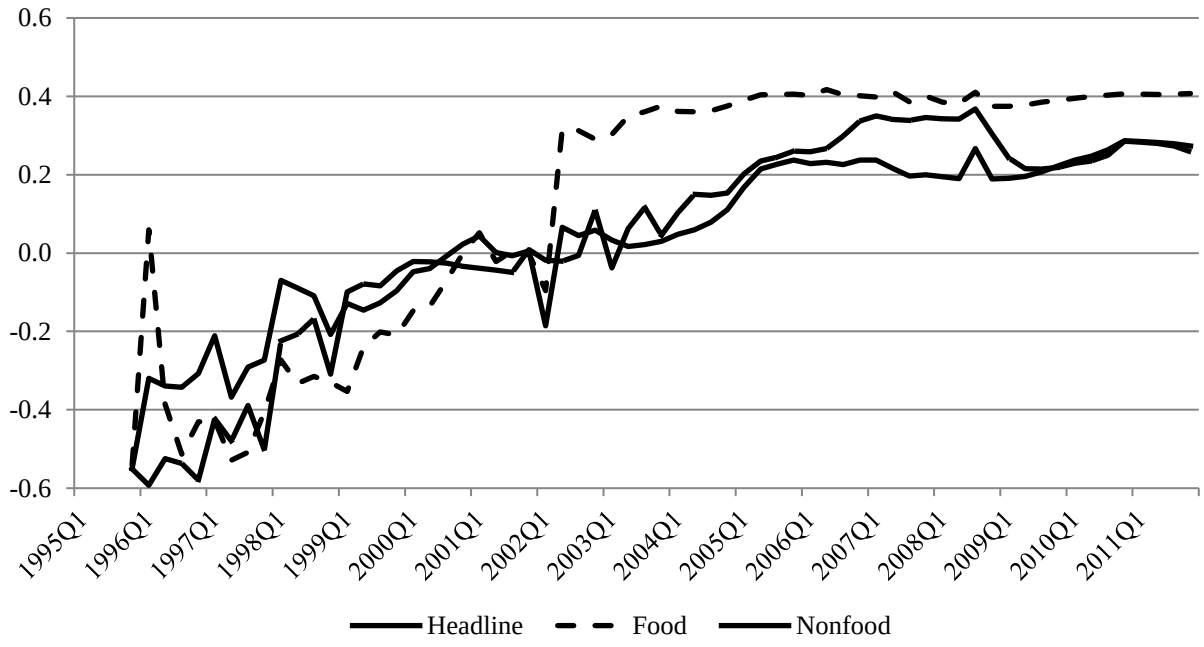

Figure A1. *Recursive estimates for the persistence of headline, food and nonfood inflation*

Source: Own computations.

Table A2. *Weights used in calculation of core inflation measures (in percent)*

Subcomponents of CPI	**Persistence weight**		**Weight in CPI basket**		**Core inflation weight**	
	1995-2002	**2003-2011**	**1995-2002**	**2003-2011**	**1995-2002**	**2003-2011**
[1]	[2]	[3]	[5]	[6]	[8]=(2+5)	[9]=(3+6)
01. Bread and cereals	12.13	11.66	20.00	18.00	16.07	14.83
02. Meat	0.00	0.00	3.59	4.30	1.79	2.15
03. Fish	6.51	9.43	0.40	0.39	3.45	4.91
04. Milk and eggs	1.18	7.44	1.64	3.00	1.41	5.22
05. Oils and fats	14.79	12.16	1.20	1.95	7.99	7.06
06. Fruits and vegetables	0.00	4.47	3.87	5.71	1.93	5.09
07. Other food products	0.00	5.46	4.62	3.65	2.31	4.55
08. Non-alcoholic Beverages	0.00	0.00	1.34	1.13	0.67	0.56
09. Alcoholic beverages and tobacco	0.00	0.00	6.80	1.22	3.40	0.61
10. Clothing	14.50	0.00	9.91	10.76	12.20	5.38
11. Footwear	7.99	0.00	7.02	6.67	7.50	3.34
12. Electricity, gas and other fuels	10.65	8.93	3.57	6.14	7.11	7.54
13. Housing and water Charges	9.17	5.71	0.21	4.47	4.69	5.09
14. Furniture and carpets	1.48	0.00	9.85	2.82	5.66	1.41
15. Household appliances and utensils	5.03	8.68	3.37	0.88	4.20	4.78
16. Other equipment, textile and maintenance	1.78	8.68	4.62	5.71	3.20	7.20
17. Health	0.89	0.00	1.58	1.88	1.24	0.94
18. Transport	1.78	0.74	8.16	8.47	4.97	4.61
19. Communications	0.00	1.74	0.12	1.24	0.06	1.49
20. Recreation and culture	0.00	8.19	1.83	2.39	0.91	5.29
21. Education	0.00	0.00	3.00	2.75	1.50	1.37
22. Other goods and services	12.13	6.70	3.30	6.47	7.72	6.59

Notes: Core inflation weight is a simple average of persistence weight and weight in CPI basket.

Source: Own computations.