



Inflation Dynamics in Zambia

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Abstract

This study assesses the empirical drivers of inflation in Zambia over the period 1994(Q1)-2019(Q4). A single-error correction model is used in which the underlying determinants of both food and non-food components of inflation as well as supply constraints are incorporated in the overall inflation equation. The empirical results reveal that the long-run sources of overall inflation are determined in the external sector market where the exchange rate and world non-food prices drive domestic prices. In the short-run, overall inflation is influenced by movements in the exchange rate, adjustments in energy prices,

imported inflation from South Africa, and changes in maize prices (supply constraints). In addition, the results show that overall inflation exhibits persistence and seasonality. Further, the two sub-components of inflation display different characteristic behavior. This underscores the importance of employing a disaggregated approach to modelling inflation to improve information content and policy response. Three policy lessons can be drawn from these empirical results. The dominant influence of the exchange rate on overall inflation and its sub-components deserves serious policy attention requiring consistent actions to dampen excessive depreciation of the Kwacha against the US dollar. In the case of the pass-through from imported inflation, expanding and diversifying the manufacturing base to limit the current high dependence on imports of final consumer and capital goods remains a policy priority. Finally, the role of supply shocks evident in the impact of maize prices on inflation necessitate immediate significant reforms in the agriculture sector to boost productivity using modern techniques such as irrigation to reduce dependence on rain fed practices.

Introduction

Zambia experienced prolonged episodes of high inflation prior to the mid-1990s. Inflation was less than 1% in 1964 but rose rapidly thereafter and it exceeded 180% by 1993. The key drivers of inflation during this period were excessive money supply growth induced by fiscal deficit financing, pass-through from the sharp depreciation of the Kwacha¹ and supply shocks (Mwenda, 1997; Mwansa, 1998; Pamu and Simuchile, 2004; Mutoti, 2006). However, following implementation of economic reforms in early 1990s, inflation decelerated sharply to below 30% by 1997. By mid-2000, inflation had dropped to single digits and remained anchored around 10%. However, inflation rebounded and accelerated to 21.1% in December 2015 from 7.9% in December 2014 before receding to 6.6% in 2017. The increase in inflation during this period was mainly due to the significant depreciation of the Kwacha against the US dollar², upward adjustment in fuel pump prices, and reduced supply of some food items, mostly maize—the staple food.

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- 1 To eliminate the parallel market for foreign exchange which had emerged during the fixed regime, improve the allocation of foreign exchange previously allocated on non-price criteria, and allow supply and demand to interact in determining the exchange rate, the Kwacha could float against major currencies in October 1985 via a Dutch auction system. However, the auction was suspended in January 1987 and a fixed exchange rate system re-instated after the Kwacha lost over 530% of its value against the US dollar over a 16-month period.
 - 2 The sharp depreciation of the Kwacha was mainly driven by higher than programmed fiscal deficit, falling copper prices due to slower-than-expected growth in China, widening current account deficit, and the strengthening of the US dollar.

High rates of inflation can undermine macroeconomic stability and subsequently impose huge costs on the economy that ultimately lead to lower long-term level of economic growth. In addition, inflation creates uncertainty for firms to invest and consumers to spend, re-distributes income, generates menu costs through frequent price adjustments, and erodes the country's external competitiveness. It is for this reason that inflation remains a widely studied macroeconomic variable. Despite a long history of research interest, policymakers and academics alike continue to focus on inflation and the significance of inflation is now incorporated in most statutes of central banks as a core deliverable (Aron and Muellbauer, 2008). For instance, in Zambia, price stability is incorporated in the Bank of Zambia Act No.43 of 1996 in section 4(1) as a primary function.

By and large, no theory can adequately explain inflation, let alone identify a dominant factor of inflation (Durevall et al., 2013). In an open economy setting, inflation is assumed to originate from monetary and foreign sectors acting through the money demand and purchasing power parity, respectively (Durevall and Ndung'u, 2001). Typically, demand-side, and supply-side factors underlie inflation. Demand-side factors are those that raise aggregate demand in the economy through expansionary monetary and fiscal policies. Supply-side factors reflect increases in the cost of production associated with higher wages, input price increases, higher commodity or energy prices, higher import prices, and tax increases. Domestic food supply constraints, world food price increases that ultimately raise domestic food prices, policy changes and external shocks such as poor harvests and energy price hikes are other widely cited drivers of inflation. It is noted that weak institutional frameworks, thin financial markets, and imperfect competition among banks tend to inhibit inflation control in many sub-Saharan African countries (Durevall et al., 2013).

Like Diouf (2007), Durevall et al. (2013), and Adam et al. (2016), this study employs a single-equation Error Correction Model (ECM) approach in analyzing the drivers of overall inflation in Zambia over the period 1994-2019 (post-liberalization) using quarterly data. Both short-run and long-run determinants of the sub-components of inflation are incorporated in a single-equation inflation model. The short-run determinants include control factors in the long-run equilibrium model for both money and domestic food as well as non-food prices and other potential factors suggested by different theoretical models and empirical literature. The long-run determinants are derived from equilibrium relations specified in both money and external markets from which the error correction equations are obtained.

Mwenda (1997), Mwansa (1998), Pamu and Simuchile (2004), and Mutoti (2006) took an aggregated approach to modelling inflation in Zambia. However, recent literature, especially relating to inflation forecasting, emphasizes and recommends a disaggregated approach using the sub-components of the price index. The sub-components provide higher information content and increase inflation forecasting

accuracy. This is particularly useful if the dynamic properties of individual components making up the Consumer Price Index (CPI) vary. By utilizing sub-components, the problem of forcing each CPI component to have the same specification and same response to potential factors is avoided. The aggregate CPI modelling approach assumes that factor elasticity is the same across all the CPI components (Aron and Muellbauer, 2008). Further, a disaggregated approach provides a deeper understanding of the underlying causes of inflation and allows central banks to respond appropriately by adopting a robust response framework that considers structural influences on inflation (Akinboade et al., 2004). With this approach, each component constituting the inflation measure is estimated separately, considering its underlying factors, and then incorporated in the aggregate CPI equation.

In this study, food and non-food inflation (the two main components of the CPI) are estimated separately based on their underlying factors over the period 1994(Q1)-2019(Q4). In turn, the overall inflation model incorporates underlying factors from the two sub-components of the CPI. In addition, the food and overall inflation models take into account supply shocks due to the significant share of food in the CPI basket. This is done to avoid obtaining biased estimates and misguiding policy decision. This aspect of inflation analysis is absent in previous studies on inflation in Zambia. The significance of agriculture in Zambia is reflected in a large share of food of 55% in the CPI basket and therefore requires an explicit inclusion of supply or agricultural output shocks in the modelling of inflation. Further, the food CPI is dominated by maize (bread and cereals sub-group), the staple food. Therefore, changes to maize output due to variations in the weather pattern impose significant effects on food inflation and in turn on overall CPI inflation. This is largely attributed to the high dependence of agricultural production on rainfall in Zambia. Durevall et al. (2013) suggested that world food prices and domestic agricultural production should be explicitly included in the empirical models of inflation in developing economies where the CPI is dominated by food prices to ensure robust results.

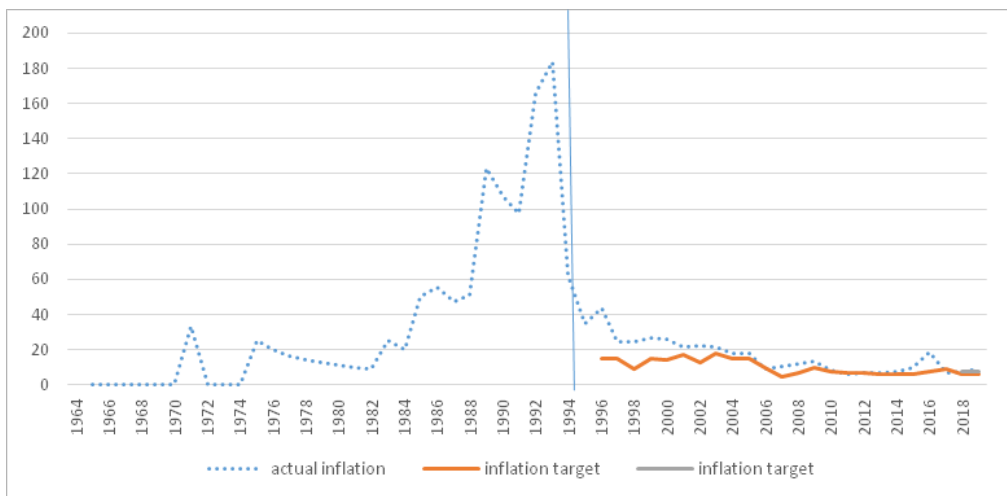
Durevall and Ndung'u (2001) used a single-equation ECM in which the exchange rate, foreign prices and the terms of trade were found to be the key drivers of inflation in Kenya in the long-run. In the short-run, inflation was mainly influenced by growth in money supply and maize prices. Diouf (2007) also used a single-equation approach to model inflation for Mali and concluded that the sources of long-run inflation are monetary and external in nature. In the short-run, supply-side constraints, principally rainfall, impact inflation with a lag. Further, using a single-equation ECM approach to modelling inflation for Chad, Kinda (2011) identified rainfall, foreign prices, exchange rate, and public spending as key drivers, and that rainfall shocks and changes in foreign prices tend to persist for longer periods. Adam et al. (2016) estimated multiple-determinant single equation models for overall inflation and its major components (food, energy, and core inflation) in Tanzania. They established supply-side factors in driving domestic food and energy inflation while demand-side factors are crucial in explaining core inflation.

The empirical results reveal that the long-run sources of overall inflation are determined in the external sector market where the exchange rate and world non-food prices drive domestic prices. In the short-run, overall inflation is influenced by movements in the exchange rate, adjustments in energy prices, imported inflation from South Africa, and changes in maize prices (supply constraints). In addition, overall inflation exhibits persistence and seasonality. Further, the two sub-components of inflation display different characteristic behavior.

Brief description of inflation in Zambia

Inflation was relatively stable prior to 1974 except for a spike in 1971 (Figure 1). However, inflationary pressures intensified from 1975 and reached 9.1% by 1982. Inflation peaked at 183.3% in 1993. The acceleration in inflation over the 1982-1993 period was mostly because of the impact of large fiscal deficit financing through central bank borrowing and the pass-through from the significant depreciation of the Kwacha against the US dollar following the initial floatation of the Kwacha via an auction system between 1985 and 1987.

Figure 1. Actual inflation and target (annual % change): 1964-2019



Source: Zambia Statistics Agency, Bank of Zambia, and author computations

Inflation fell sharply in 1994 to 61.9% but remained relatively high. This followed the implementation of economic reforms to restore macroeconomic stability, during which an aggressive disinflationary stance was prioritized after a prolonged period of stagflation. The reforms included trade and foreign exchange liberalization, price de-regulation, and tighter financial management. In addition, the Government implemented a cash budget system complimented by tight monetary policy measures to restrain excessive monetary expansion (Bank of Zambia, 1994).

Inflation moderated after 1994, declining to below 20% in 2005 and later fell to single digits (8.2%) in 2006 after more than three decades. However, in October 2015, inflation rose sharply to 14.5% and peaked at 22.9% in February 2016. This followed a sharp depreciation of the Kwacha against the US dollar occasioned by lower copper prices attributed to the slowdown in China, uncertainty over the performance of the mining sector (with Glencore scaling down its operations at Mopani), stronger US dollar, deteriorating current account balance, widening fiscal deficit, sovereign rating downgrade and the impact of electricity shortages on economic activity (Bank of Zambia, 2015).

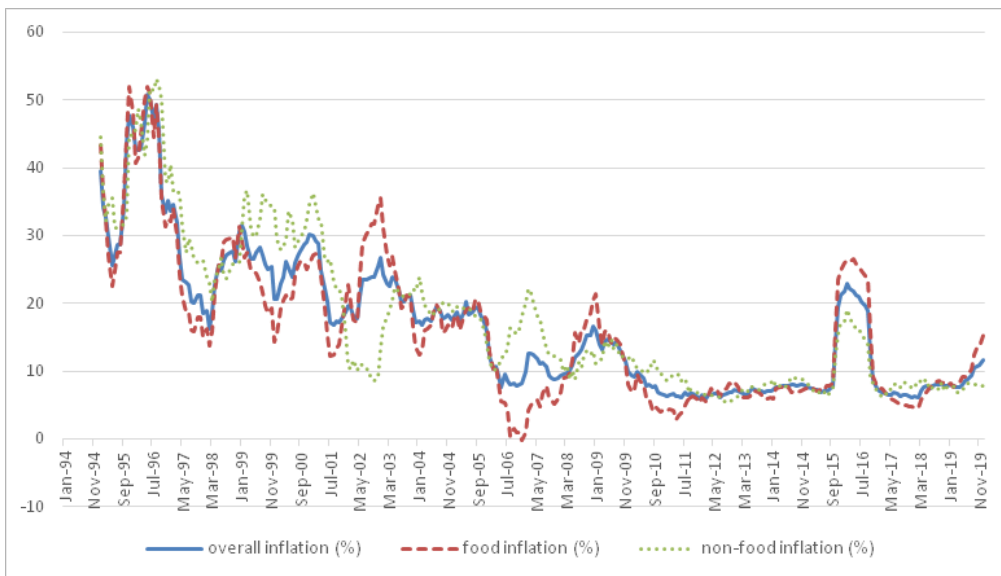
However, inflation decelerated to below 10% by the end of 2016 as base effects dissipated. However, inflationary pressures re-emerged towards the end of the second quarter of 2019 leading to inflation exceeding the target range of 6-8% by the end of the year. The Government introduced a target range of 6-8% in 2018 as a precursor to inflation targeting. A notable observation about the dynamics in inflation over the sample period is that it broadly trended above the target (Figure 1). In this regard, a deeper understand of the underlying drivers of inflation will allow the authorities to design appropriate policy response to align and contain inflation within the set target.

Broadly, inflation in Zambia tends to closely track food inflation (Figure 2). Excess supply of maize due to a favourable agricultural season contributed to the decline in inflation in 2006. Further evidence of the importance of positive agricultural supply shocks was observed in 2006, 2010 and 2017 when inflation slowed down largely on account of a maize bumper harvest. Conversely, periods of drought (that is 1995, 1998, 2001, 2003, 2005, 2013, 2015, 2016 and 2018) are associated with high inflation. Thus, the dependence of agricultural production on rainfall and the substantially large weight of food in the CPI basket makes inflation susceptible to variations in weather conditions. A large body of evidence on the dependence on weather conditions and its effect on inflation exists for several sub-Saharan African countries (Diouf, 2007).

This underscores the significance of supply shocks on overall (headline) inflation. Agriculture output in Zambia is dominated by crop production of which maize has the largest share more than 60% (Figure 3). By and large, agricultural policies have been largely skewed towards the promotion of maize production as the major staple crop. Subsidies are extensively used to support production and manage the maize price. The focus on maize self-sufficiency through various Government support programmes (input subsidies and marketing services) has led to the promotion of maize as a major agricultural crop in the smallholder sector. Maize is predominantly produced by smallholders across the country who depend exclusively on rainfall. As a result, maize output fluctuates significantly from year to year due to changes in rainfall patterns. Any shock to rainfall patterns significantly impacts the supply of maize and

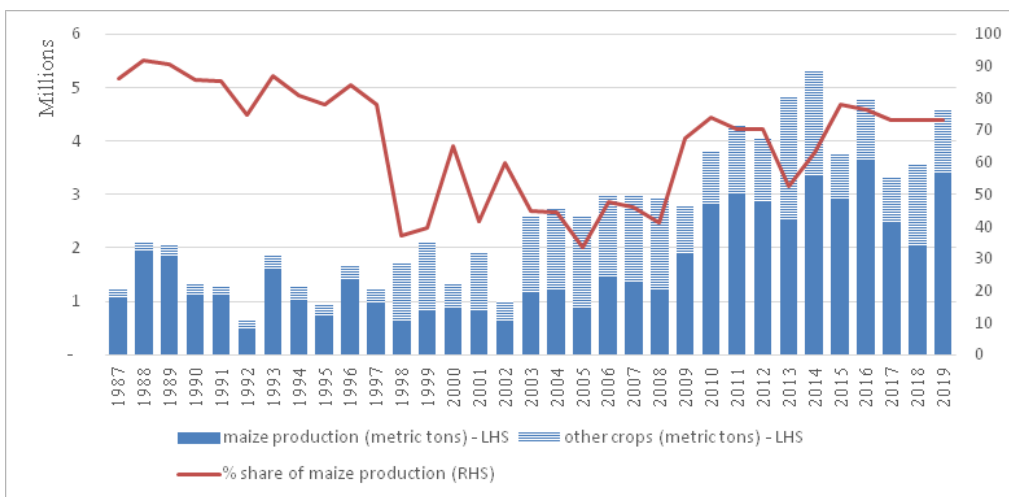
in turn its price³. Figure 4 shows the rainfall pattern over the sample period. The rainy season runs from December to April. Rainfall progressively declines from May and is at its lowest around June/July.

Figure 2. Overall inflation and food inflation (annual % change)



Source: Bank of Zambia and author computations

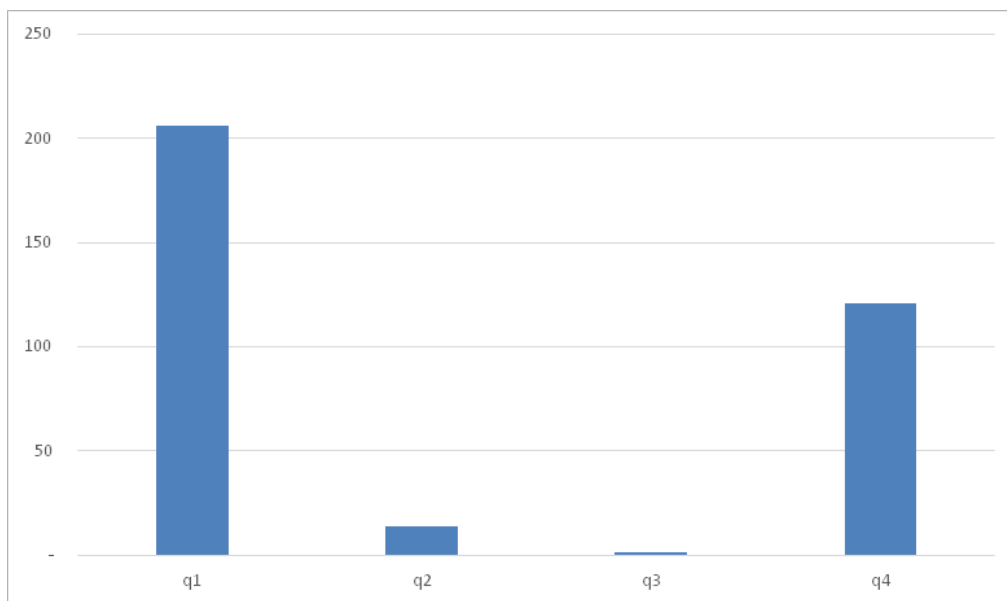
Figure 3. Crop production and share of maize: 1987-2019



Source: Ministry of Agriculture and Author Computations

3 Besides the weather, maize output is affected by fertilizer use and seed variety.

Figure 4. Quarterly average rainfall pattern (mm): 1994-2019



Source: Zambia Meteorological Department and author computations

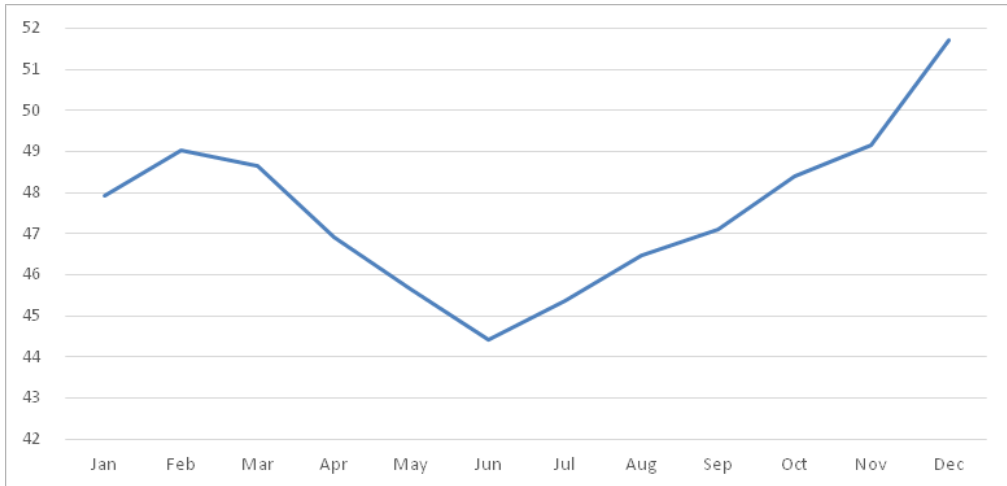
Due to the dependency on rainfall, maize is grown between December and April (lean period – low supply and high demand). During this period, maize prices are relatively high and only decline in the second and third quarters (harvest period) and are usually at their lowest in the latter quarter (Figure 5). The gradual fall in maize prices from the end of the first quarter, preceding the onset of the marketing period, largely reflects Government intervention through the sale of cheaper maize grain from strategic reserves as well as reduced demand for maize grain and its products as other food items become available. This dampens the price of the staple food through substitution. The variations in maize prices are reflected in food inflation due to the relatively high weight of maize grain and its products in the CPI basket. The total weight of maize as a single product is 64.98⁴, representing 11.8% and 6.5% in the food CPI and overall CPI, respectively.

Maize prices are influenced by the Government through agencies created by an Act of Parliament. These agencies (previously crop marketing boards) administer national food reserves. Food reserves serve as a buffer stock to cushion maize price variability and provide liquidity in the maize market. Trade in maize is regulated by the Government through the issuance of export and import licenses. Under this arrangement, the prevailing maize price may not necessarily reflect supply shortages in the food sector as the Government may import maize and sell at below market

4 The weight of 64.98 is broken down as follows: maize mealie meal (breakfast)=32.26; maize mealie meal (roller)=16.77; and maize grain=15.95.

price to keep the price of mealie meal low. Maize prices are also set above the market to support producers but subsidize millers by selling maize grain at lower prices to manage final consumer mealie meal prices.

Figure 5. Trend in monthly average maize price (Kwacha/50kg bag): 1994-2019

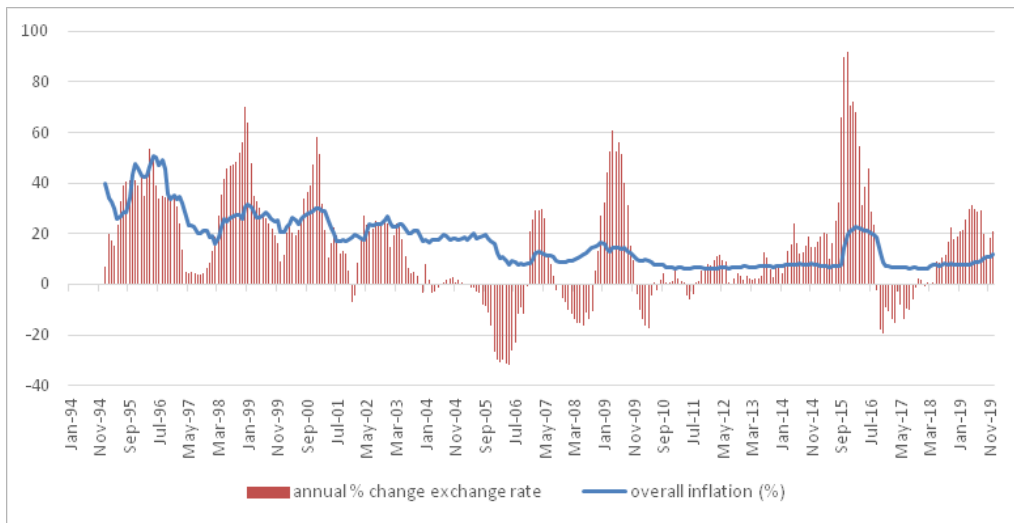


Source: Bank of Zambia and author computations

The significance of external shocks transmitted through the exchange rate and energy (oil) prices on inflation was notable during 2008-2009 and post-2011 periods (Figure 6). The influence of the global financial crisis of 2008/2009 is reflected in higher inflation in 2008 and 2009 through the exchange rate channel as copper prices⁵ fell markedly. The pass-through from the depreciation of the Kwacha to CPI inflation in Zambia ranges between 0.41 and 0.49 (Zgambo, 2015). Aron et al. (2014) provides a comprehensive review and evidence on the pass-through from the exchange rate to domestic CPI in developing and emerging market economies that include Zambia. It is noteworthy from figure 6 that periods of sustained and occasional sharp depreciation of the Kwacha against the US dollar (1995-96, 1997-98, 2000, 2008/09, and 2015) are associated with rising inflation. Conversely, the fall in inflation, notably in December 2005 and May 2006 as well as between September 2016 and February 2017, is associated with the appreciation of the Kwacha.

5 Copper is Zambia's main export commodity, accounting for over 70% of foreign exchange earnings. Chipili (2016) provides evidence that the Kwacha is a commodity currency—movements in the Kwacha exchange rate are affected by movements in the copper price over time. In turn, the exchange rate influences inflation.

Figure 6. Overall inflation and changes in the exchange rate (%)

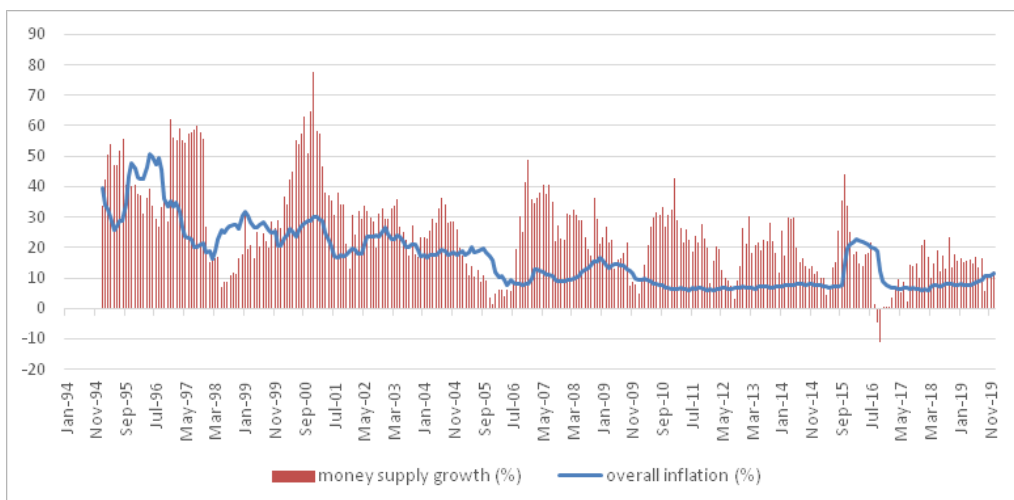


Source: Bank of Zambia and author computations

Note: a positive change in the exchange rate denotes a depreciation and a negative change an appreciation

There are traces of the predicted positive relationship between money supply and inflation with lags in some periods in figure 7. For instance, inflation generally rose when money supply grew steadily from mid-1998 and reached the peak at end-2000. The exception was 1999 inflation trended down. However, the declining trend in inflation from mid-1996 until early 1998 and between 2010 and 2011 was not associated with relatively strong money growth. The empirical association of the two variables is established in section 6.

Figure 7. Overall inflation and money supply growth (%)



Source: Bank of Zambia and author computations

This brief discussion highlights the importance of various sources of inflation (demand-pull, cost-push, and supply-side factors).

Data sources

All the data except real GDP, world food prices, world non-food prices, and the US Treasury bill yield rate were sourced from the Bank of Zambia. Real GDP data were obtained from the Zambia Statistics Agency. The proxy for world food prices was obtained from the World Bank Commodity Price Data (The Pink Sheet) while the US Treasury bill yield rate and the proxy for world non-food prices were taken from the Federal Reserve Bank of St Louis Economic Database.

Conclusion and policy recommendations

This study assessed the underlying empirical drivers of inflation in Zambia over the period 1994(Q1)-2019(Q4). Monetary and external factors as well as supply constraints were considered. A single-error correction model was adopted in which the underlying determinants of both food and non-food components of inflation and supply constraints were incorporated in the overall inflation equation.

The empirical results have revealed that the long-run sources of overall inflation are determined in the external sector market where the exchange rate and world non-food prices drive domestic prices. In the short-run, overall inflation is influenced by movements in the exchange rate, adjustments in energy (diesel) prices, imported inflation (from South Africa), and supply constraints (changes in maize prices). In addition, overall inflation exhibits persistence and seasonality. Further, a diminished role of money supply in inflation dynamics over the sample period is established. This contrasts evidence from previous studies that identified money supply as one of the key determinants of inflation.

The two sub-components of inflation display different characteristic behavior. While inertia is absent in both food and non-food inflation, the former exhibits seasonality, reflecting largely the influence of weather conditions on maize (predominately rain fed) that dominates the food sub-index. The absence of inertia in food inflation is like the findings by Durevall et al. (2013) for Ethiopia. In the long-run, domestic food and non-food prices are influenced by developments in the external sector where world food prices and producer prices in South Africa adjusted for the exchange rate matter. In the short run, the drivers of domestic food inflation are changes in the exchange rate and supply constraints (maize prices). In the case of non-food inflation, the growth in money supply as well as changes in the exchange rate and diesel (energy) prices matter in the short run. These findings underscore the importance of a disaggregated approach to inflation modelling which helps in identifying the underlying characteristic behaviour of each sub-component.

The empirical results highlight the role for the authorities to manage demand-side factors reflecting a combination of both demand and cost-push factors. Specifically, the empirical results have reconfirmed the dominant role of the exchange rate in accounting for swings in overall inflation and its sub-components. This underscores the need for the authorities to undertake policy actions to dampen excessive depreciation of the Kwacha. In addition, the significance of imported inflation from South Africa calls for policies to expand and diversify the manufacturing base to limit the current high dependence on South Africa for imports of final consumer and capital goods. The data from January to April 2018 show that the share of food imports from South Africa in total food imports is about 50%. Thus, any shock to food production and/or prices in South Africa will be immediately transmitted to Zambia.

The role of supply shocks evident in the impact of maize prices on inflation calls for significant reforms in the agriculture sector to boost productivity using modern techniques such as irrigation to reduce dependence on rain fed practices. In addition, better use of fertilizer, improved seed, and access to credit especially among poor rural households will contribute to boosting productivity. Further, investment in the road infrastructure, especially feeder roads in rural areas, and improved storage facilities to mitigate distributional and overhead costs will moderate agricultural product prices and ultimately stabilize inflation.

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