Wealth, Health, and Inequality:
a study of hyperinflation and households in Zimbabwe

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by

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Abstract

This study focuses on Zimbabwe's first hyperinflation which began in March 2007 and peaked at 231 million percent in July 2008. Through a comparative pre-post analysis, the study investigates hyperinflation's effects on the well-being of households, its empirical chapters assessing changes in asset poverty, asset inequality and child malnutrition before and after the hyperinflation.

The first empirical chapter assesses the shifts in asset poverty. Household holdings of physical assets and recorded access to public utilities are drawn from the 1994, 1999, 2005 (pre-hyperinflation) and the 2010 and 2015 (post-hyperinflation) Zimbabwe Demographic and Health Survey datasets. These are used to construct an asset index, with the 20^{th} and 40^{th} percentiles as relative poverty lines. Asset-derived poverty headcount and poverty gaps are measured and compared across the two periods. The national asset poverty headcount ratio decreased by 27 percent largely driven by of the experience of rural households whose asset poverty headcount fell by 31 percent. In contrast urban households experienced a 51 percent increase in asset poverty in this period.

The second empirical chapter assesses the shifts in asset inequality during the hyperinflation. Rather than focus on income inequality, it continues using asset holdings and constructs pre- and post-hyperinflation asset Gini coefficients for urban and rural households. These show decreased asset inequality during the hyperinflationary period. At a national level, inequality decreased by 7 percent and in rural areas by 2 percent. The decrease in inequality on a national level was mainly attributable to the increase in private assets among rural households. However, there was a 2 percent increase in inequality among urban households, largely attributable to ownership of private assets. Land and livestock were the main drivers of inequality.

The final empirical chapter focuses on the changes in child nutrition during the hyperinflation, and the factors contributing to these changes amongst children under the age of 5. Using Mosley and Chen's (1984) proximate determinants analytic framework, multivariate Logistic regression analyses revealed that wasting and stunting increased with inflation. Other related factors were poor access to electricity, safe drinking water, improved toilets and healthcare; as well as low levels of mother's education and asset wealth.

Acknowledgements

I would like to thank God the Father, my Lord Jesus Christ and my comforter the Holy Spirit who inspired me and sustained me through this arduous process which has been the culmination of my academic career. I will try to move on with the mindset of stewardship and dominion and will do my best to fulfil my part of God's purpose in my generation. Thank you, Lord for Hebrews, 10:38. I will hold onto it as we work on rebuilding Zimbabwe's economy.

Many thanks to my supervisor, Professor Anthony Leiman, who agreed to instruct, mentor and guide me in this PhD. Thank you for rescuing this project Professor! Your vast knowledge as an economist and a Zimbabwean has made me better. Each time you read through, commented on and corrected a version of these chapters, my work improved significantly. My bragging phrase to my family was as follows: "My supervisor is amazing. He knows every word, comma and full stop in my thesis." I also thank Mr. Grown Chirongwe and Mr. John Robertson who assisted me with supplementary data for this thesis.

I now stop to thank my family. Professor Jameson Kurasha – Baba – thank you for having the vision of 'educating Flora' since my childhood. Thank you for doing all within your power, including taking me to the United States of America, to ensure that I become well educated. I wholeheartedly appreciate and thank my mother, Professor Primrose Kurasha who, by example, showed me that it is possible to do and complete a doctorate. She also showed me by her example that this degree is a tool that is meant to be used to lead the world in bettering the lives of ordinary people. I am grateful that she encouraged me to apply for this PhD and always spoke words of reassurance in the early years of my writing. I can still hear her saying, "Unozvigona Popi. Ita mwanangu; unombonzi ani ko iwewe? Ingopedza uone!" Though I finish this doctorate in her physical absence, I am aware that she will live on through my contribution in transforming African economies. Thank you, mhamha nababa for teaching me to live a value-based and thoughtful life and for believing that I am capable of doing anything. To my best friend and partner in process – upcoming Dr. Primrose E. R. Kurasha, I thank you. Thank you for funding part of my studies, believed in and encouraged me. You are the reason why I decided to be strong and finish this degree. Primrose, if I could do it, you most definitely will do it too. The world is waiting for us! I also thank my brother, Mr. Kumbirai Gundani and his wife, Wendy Magoronga who not only funded the last part of my PhD journey, but also helped me find the only Zimbabwean household dataset – Zimbabwe Demographic and Health Surveys – that was available for use by the public when I started my thesis. I am grateful.

I appreciate all my family and friends around the world who supported me throughout my academic training. We finished!

Preface

As I sit here in the Oppenheimer Library at the University of Cape Town in South Africa, I conclude my seven-year journey of my doctoral studies with a smile. I started my research with one goal; to tell the story of Zimbabwe's hyperinflation and how it affected us – the ordinary people in the country. At the height of hyperinflation, in July 2008, I was working at PG Glass Industries as an accounting intern in charge of creditors' accounts. My mammoth task was that of keeping track of price changes in order to determine how much we could pay suppliers of raw materials every day. Given the large quantities of cement, sand and other materials that we used as inputs to manufacture roof tiles and other construction material, I often had to write cheques in trillions and quadrillions of Zimbabwe dollars (Z$). At the end of the day, my work mates and I would be dropped off in town by the driver at work because at this point none of us could afford to service and fuel our cars for the daily work commute. Mostly, the fuel was not available and when it was there, it was expensive. Even then, we were better off than most in the country who did not have jobs and were not getting paid. By the time I finished my internship, half my salary was in cash and the other in the form of beans and rice. This was management's way of keeping us happy because our salary was losing value within a week.

This rough reality was short-lived when I returned to the United States of America (USA) to continue my Bachelor's degree. I was very sad to leave my sister and mother in such horrible conditions. In a country with sporadic supply of electricity and clean water, where we could not drive normally because of the potholes on the roads, which often caused fatal accidents. When I got back to the USA, I was surprised by the attention I got from my classmates. They all wanted to know how life was in Zimbabwe. More importantly, they wanted to see and touch the 20 billion-dollar notes. The average college student in America who could not locate Zimbabwe on the map a year before, now asked about it with curiosity and concern. They had heard our embarrassing story on the news and I was now an object of pity. It was my task to defend my country and talk of a hopeful future where the government would have rectified the economy.

Unfortunately, Zimbabwe's happy day has not yet come and I decided to turn this issue of international mockery into a doctoral thesis. Much of the thesis will be technical, but I will do my best to keep highlighting the plight of the common man who had to sell assets in order to survive and who's children suffered from malnutrition due to the lack of food and good healthcare. This thesis will teach us a few lessons on how government's interference with monetary policy can lead to the destruction of an economy and the demise of an entire society. Africa, please learn and do not do what we did!

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List of Acronyms and Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
CDF	Cumulative Density Function
CPI	Consumer Price Index
ESAP	Economic Structural Adjustment Program
GDP	Gross Domestic Product
HDI	Human Development Index
IFI	International Financial Institutions
IMF	International Monetary Fund
MDG	Millennium Development Goals
MERP	Midterm Economic Recovery plan
MPI	Multidimensional Poverty Index
PQLI	Physical Quality of Life Index
RBZ	Reserve Bank of Zimbabwe
SADC	Southern African Development Community
SIRDC	Scientific Industrial Research and Development Centre
STD	Sexually Transmitted Disease
UCPCA	Uncentered Principal Components Analysis
UNDP	United Nations Development Program
USAID	United States Agency for International Development
US$	United States Dollar
VAT	Value Added Tax
WB	World Bank
WFP	World Food Program
ZDHS	Zimbabwe Demographic and Health Surveys
ZESA	Zimbabwe Electricity Supply Authority
ZIMPREST	Zimbabwe Program for Economic and Social Transformation
ZimSTAT	Zimbabwe Statistics Office
ZimVAC	Zimbabwe Food Security and Vulnerability Assessment Report
Z$	Zimbabwean Dollar
ZSE	Zimbabwe Stock Exchange

Chapter 1

Thesis Introduction

1.0 Introduction

The first two decades of the 21st century saw the implosion of the Zimbabwean economy, an event with profound consequences for the nation's citizens and the Southern African region as a whole. The implosion involved sharp declines in production, employment and life expectancy, as well as rapid rises in prices. These would include the country's first episode of hyperinflation. At its peak in 2008, the monthly inflation rate was estimated to be 231 162 000 percent, while real GDP fell by an unprecedented rate of 14 percent. Unemployment was in the range of 80 to 90 percent and 3 million of the country's 7 million working-age adults, had migrated in search of jobs and education outside the country. In addition, there was urban-rural migration. Between 2005 and 2010, there was an increase of 1.38 percent in the rural population, while there was a decrease of 2.67 percent in the urban population. Three reasons stand out: First, in the year 2005 there was *Operation Murambatsvina*, the expulsion from cities of informal traders and households dwelling in squatter camps and illegal shelters. Second, with the rising inflation rates the cost of living in urban areas rose faster than household incomes. Without alternative means of support some households moved back to their rural homesteads where they could grow their own food. Third, some urban households were given land in the land resettlement program. They to moved to the rural areas.

With the collapse of the nation's healthcare, water and sanitation systems, disease became rampant and life expectancy declined to 45 years of age. While it is difficult to disentangle the order and causalities behind most branches of the economic crisis, there is one that stands out. This thesis will explore aspects of the first hyperinflation, its causes, its evolution, and its impact on households.

Zimbabwe is a young nation; its modern economy is just over a century old, and it only gained its independence on April 18, 1980. At independence, though the nation had spent fifteen years under international sanctions, it was one of the best performing economies on the continent. The first decade of the independent Zimbabwe was marked by many improvements, particularly in human capital, as the new government emphasized investments in health and education. On the income side, the average GDP per capita was US$834. The main contributors

to national income were the manufacturing and agricultural sectors. However, cracks were already appearing and, between 1990 and 1996, and Economic Structural Adjustment Program (ESAP) was implemented under pressure from the World Bank (WB) and the International Monetary Fund (IMF); it was not a success. Following ESAP, in the years 1997 to 2002, came the rise of an internal political opposition, and its repression. The ruling party's anxiety saw the rise of populism that culminated in a wave of cash hand-outs to 'war-vets' and then land invasions; the events which triggered the next round of price rises. The period 2003 to 2008 marked the depths of the economic crisis, with hyperinflation reaching its highest levels in 2008, which was coincidentally the year that the government lost a heavily contested election. Nonetheless, unwilling to concede power to the opposition party – Movement for Democratic Change – the ruling party yielded to the compromise of shared power in the Government of National Unity. In this new arrangement, the opposition party oversaw the Ministry of Finance and Reserve Bank of Zimbabwe (RBZ) and they managed to control inflation by dollarizing the economy in February of 2009. Thenceforth, the economy rebounded and Zimbabwe experienced stability and growth until the year 2015. However, in the past 5 years, since 2015, the ruling party has regained total control of the economy and it has begun to flounder again, with monthly inflation in May 2020 reaching 15.13 percent and annual inflation recorded as 785.55 percent (Bloomberg, June 16, 2020).

In this introduction, the reader will gain an understanding of what hyperinflation is, how it develops and how economic agents cope under such circumstances. Hyperinflations are not new, and have been well documented and analysed. The following brief overview is provided for any reader who is unacquainted with this literature. The Zimbabwean economy will be a practical example of this theory.

1.1 Hyperinflation theory

Cagan (1956) described hyperinflation as the state pertaining when general prices rise at a rate at or above 50 percent per month, and ending the month after the rate falls below 50 percent. Zimbabwe is not the first country to experience extreme hyperinflation. Hanke and Kwok (2009) suggest that there have been 4 other hyperinflations of similar calibre to Zimbabwe's. They give the example of China, which experienced 2,178 percent inflation in May of 1949, such that prices were doubling every week. Greece had a monthly inflation rate of 13,800

percent in October 1944 and at this point, prices were doubling every 4 days. During the infamous German hyperinflation of October 1923, prices rose at a rate of 29,500 percent per month and doubled every 3.7 days. Hungary in July of 1946 had such extreme hyperinflation that prices doubled every 15 hours and the monthly inflation rate was 4.19x1016%. Only Hungary experienced inflation higher than Zimbabwe where, in November of 2008, the monthly inflation rate was 79,600,000,000 percent and prices would double every 24.7 hours. These are the worst cases of hyperinflation among many others, particularly in Eastern Europe and Latin America (Siklos, 1990).

Dornbusch (1992) suggests that hyperinflationary experiences tend to follow similar patterns; a country is generally heading towards hyperinflation once its monthly inflation rate ranges between 10 and 15 percent consistently. He contends that hyperinflation is usually caused by recurrent budget deficits, often the result of quasi-fiscal expenditures necessitated by corruption or reparation payments owing to a certain segment of society. Citing examples such as Israel, Peru, Mexico, Brazil, Bolivia and Argentina, he shows sources of budget deficits that vary from domestic mismanagement and institutional disintegration, to external shocks and foreign exchange crises. The budget deficits induce the printing of money and this drives the subsequent increase in prices. Siklos (1990) and Capie (1986, January) give the examples of Hungary, China, Lebanon and Peru. Importantly for the analysis of Zimbabwe's experience, they show that these hyperinflations were the result of civil disorder and political unrest which led to both fiscal indiscipline and inefficiencies in tax collection, and thereafter to budget deficits - the printing of money, and ultimately hyperinflation. Cukierman, Edwards, & Tabellini (1989) as well as Huggard and Kaufman (2018) support Capie's hypothesis that political instability leads to hyperinflation, suggesting that it holds true whether a country is democratic or not.

Typically, hyperinflationary periods are characterized by extreme increases in money supply and price levels which compromise the value of real income. In the quantity theory of money, Friedman (1987) shows that prices rise in response to rising money supply. This indeed is the basic credo underlying monetary thinking (Mayer, 1980; McGee, 1989; Fischer, Hall & Taylor, 1981; Pigou, 1917; Lucas, 1972). Inflation is an economy's response to rapidly increasing money supply. When the growth in money is sustained over time it leads to consistent rises in prices. These become built into expectations and eventually manifest as hyperinflation (Cagan, 1956).

Sargent and Wallace (1975) formalised this in terms of rational expectations. As the public experience money growth, they determine the rate of inflation. The history of money growth influences expected inflation. As the actual inflation rate matches the expected inflation, it induces further money growth and this cycle leads to hyperinflation. Generally, the value of money and real cash balances drops. Overall, real cash flow balances decline because of the rate of depreciation in the value of money as a result of the fluctuating prices. Cardoso (1992) proves this point in her study of Brazil's hyperinflation and shows that real cash balances and the share of the real monetary base decreased as inflation increased. This shows that the effect of inflation on households is through real wages, due to imperfect indexation. Wages do usually rise at a slower rate than inflation. As a result, households are not able to consume as much as they did priori to hyperinflation because the purchasing value of their money decreases.

As the value of money continues to decline with hyperinflation, the amount of money held by households decreases as they store their wealth in assets. Keynes (1923) asserts that households will often substitute money for inflation-proof assets as inflation rises. Ball (1969) agree that hyperinflations are marked by drastic changes in the amount of real cash balances held by households in an economy. In fact, as inflation rises and the desire for real cash balances decreases, the quantity of assets held increases. This is because the assets held by households, in the form of equity, land and non-perishable consumer goods are seen as a form of reserves.

1.2 The case of Zimbabwe

Any who lived in Zimbabwe through the hyperinflation period witnessed this theory in reality. By 2005, the local currency – the Zimbabwe dollar (Z$) – was effectively out of use. Barter became a norm; trade took place using with petrol coupons, bags of maize meal, bricks and consumer goods taken from homes. Any asset considered a luxury was sold in exchange for food, which had become extremely expensive due to low availability. Those in business who had access to foreign currency began trading with US dollars and those closer to the southern border, were trading with the South African Rand. However, the majority of the populace resorted to barter trade, they could not access foreign currency and had lost faith in the local currency. The Zimbabwe dollar was no longer functional as a medium of exchange, unit of account, store of value and definitely not a standard of future payment (Jevons, 1882). The public did not want to hold the Zimbabwe dollar at all.

Instead, the US dollar was in demand and the public would not take it to the bank because it would not be released thereafter. It became common knowledge that only certain elite members of the society, with networks in the RBZ, were recipients of the US Dollar. As a result, most minerals and crops were often exported through illegal means and the earnings also remitted through unofficial channels in order to avoid the RBZ at all costs, where the foreign currency earnings would be exchanged at a discount. It was an abnormal form of existence and it was remarkable that households and firms survived. But before reflecting on household coping mechanisms, it is important to survey the processes that led to the hyperinflation.

1.2.1 Macroeconomic deterioration

Cross (pers. com. 2020) says that Zimbabweans began to suffer the real effects of hyperinflation on the parallel market in 2005. However, the Reserve Bank of Zimbabwe (2014), Robertson (pers. com. 2020), Hanke and Kwok (2009) show that hyperinflation began in March of 2007 when the monthly increase of the price level exceeded 50 percent. As seen in Figure 1, while inflation was high from 2003 onwards, the hyperinflation really manifested itself in the years 2007 and 2008.

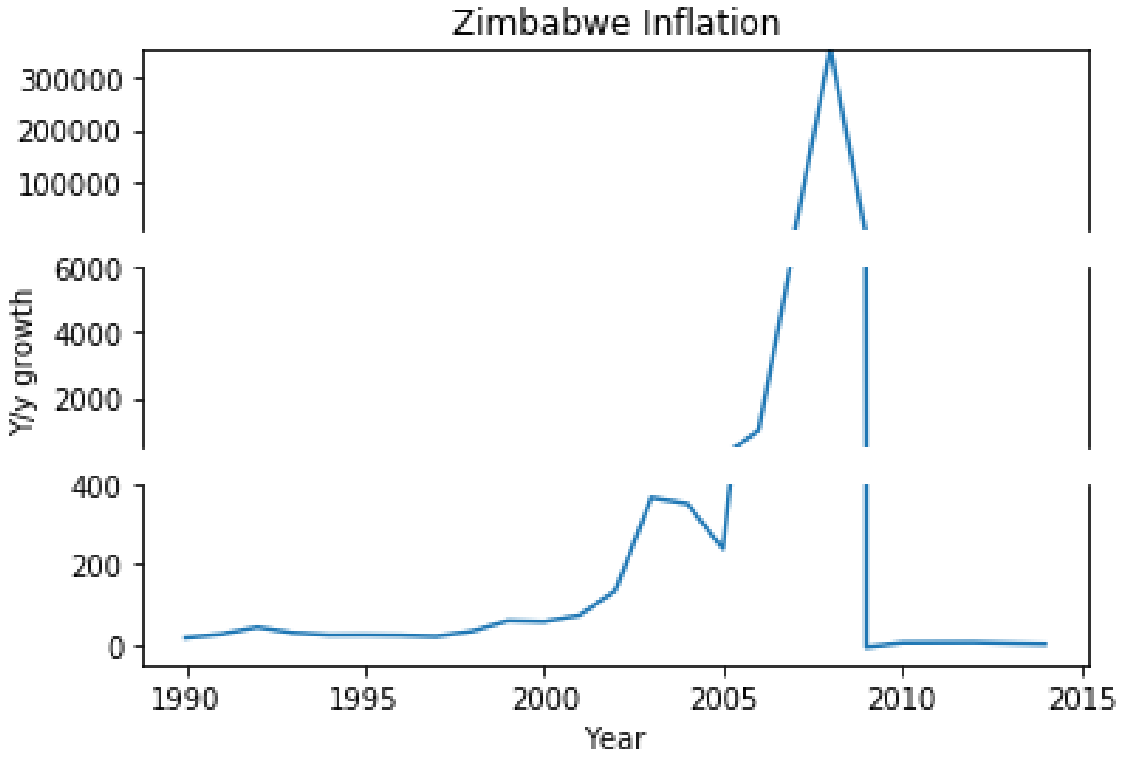


Figure 1: Zimbabwe's annual inflation trend, 1990 to 2015

Source: The Reserve Bank of Zimbabwe

Notes: The y-axis shows the year on year change in prices.

2008 was the year when Zimbabwe's economy reached the bottom of the trough of its recession. Real GDP was estimated to have fallen by 14 percent over the year (Robertson, pers. com. 2020), on top of a cumulative decline of 40 percent from 2000 to 2007. Using the official exchange rate, the value of the local currency declined so much that bank deposits whose purchasing power had been the equivalent of US$1 billion in 2005, were only worth US$300 million 3 years later. Government expenditure, which was worth US$1.4 billion in 2005 in terms of purchasing power parity fell to US$258 million in 2008. An even worse story is told of national revenue which in 2005 was equivalent to US$1 billion and by 2008 was US$133 million; along with a consolidated budget deficit amounting to 80 percent of GDP (Robertson, pers. com. 2020). The IMF (2009) reported significant expenditure by the RBZ on quasi-fiscal activities in 2008. National finances spent on elections, parastatals, subsidized direct lending, provision of capital to farmers and so on, amounted to US$1.1 billion which was 36 percent of the GDP that year. According to Robertson (pers. com. 2020), monthly inflation was 231 162 000 percent by July of 2008, up from 585.8 percent in 2005. Year on year food inflation had reached 1.1 trillion percent.

After reading and discussing the country's earlier with local economists (Leiman, Kanyenze, Ndlela, Robertson and Cross, pers. com. 2020), it became apparent that the year 1997 was the tipping point of the Zimbabwean economy. This was soon after the Economic Structural Adjustment Program (ESAP) ended. On November 14, 1997, the so called 'Black Friday', the value of the Zimbabwean Dollar (Z$) against the US Dollar (USD$) dropped by approximately 74 percent[1].

Importantly, the inflation was not a purely monetary phenomenon, neither in its causes nor in its consequences. There were a number of reasons for the downfall of Zimbabwe. First, the failure of ESAP and the subsequent negative rebound effect. Second, the government of Zimbabwe overspent on the military for the Congolese war, with expenditure estimates in the range of US$33 million a month[2]. Third, the Shoko (2013) attributes the currency devaluation to the compensation of Z$50,000 plus monthly pensions of Z$2,000 to each of 50,000 war veterans in 1997. These gratuities were demanded by the war veterans in repayment for their contribution to the liberation war of 1964 to 1979. Due to the fact that these expenditures were not budgeted for, they necessitated a large deficit, seen in the Figure 3 below, and as the RBZ printed money to meet this demand, inflation soared. The fourth, and arguably main cause of hyperinflation, was the decline in agricultural output, due to unsystematic land reform of 1997. This resulted in a scarcity of commodities such that by January 1998, the price of maize

[1] See Ndlela, D. (2002). "Zimbabwe's Economy since 1990".
[2] See Kanyenze, G., Kondo, T., Chitambara, P., and Martens, J. (2011) "Beyond the Enclave".

meal had risen by 47 percent. By 2001, the IMF reported that the economy had suffered a 23 percent cumulative decline in output since 1997.

In an interview about the Zimbabwean economic crisis, Robertson (pers. com. 2020) said that, "Hyperinflation was caused by the land reform because it broke the back of Zimbabwe's biggest industrial sector – agriculture – and we have been suffering ever since. The government has not fixed that problem." When land was taken off the market, the country's biggest single business sector, commercial farming, was literally brought to its knees. Previously, commercial farming had been the biggest employer in the country; producing the biggest proportion of export revenues; producing the bulk of raw materials for the manufacturing sector in Zimbabwe (which was the 2nd biggest industrial sector in the country); and generating a very high percentage of government's tax revenues (directly and indirectly).

The economy's sensitivity to disruption in agriculture can be seen in the diagram below. The period of the land reform and the first land invasions, and the drought of 1998, being highlighted.

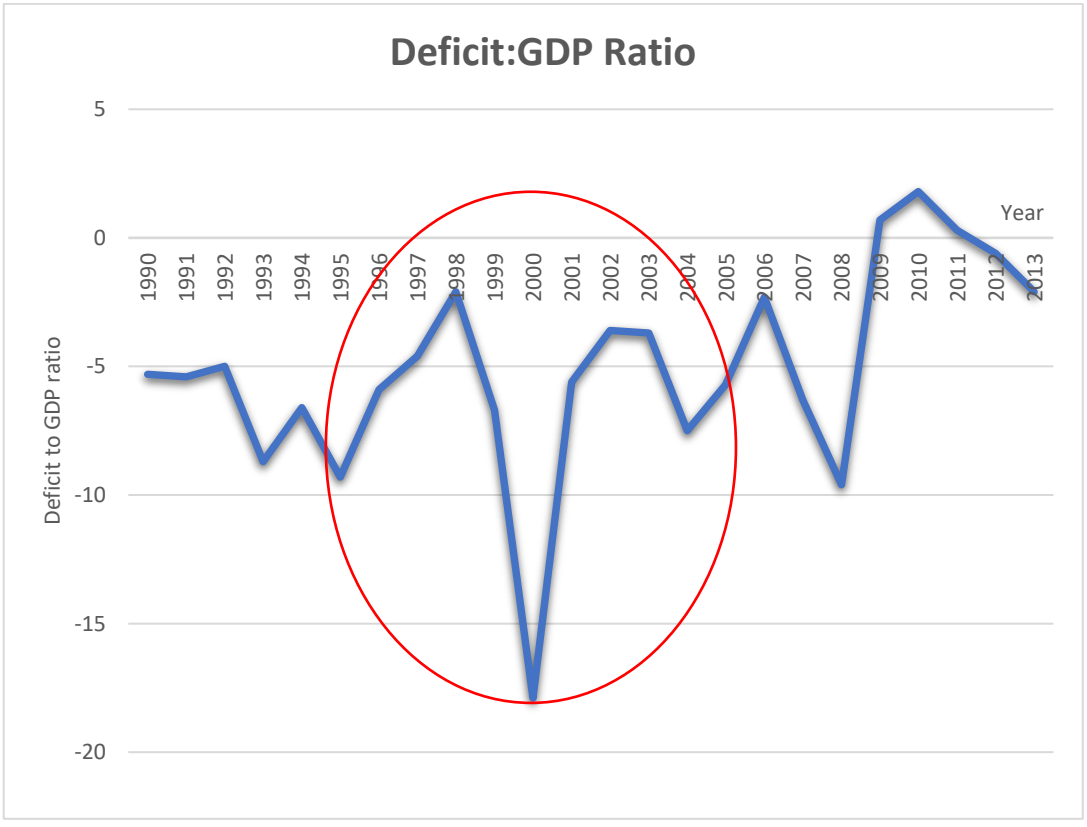


Figure 2: Zimbabwe's deficit to GDP ratio trend, 1990 to 2013

Source: Unpublished CSO statistics[3]

[3] Labour and Economic Development Research Institute in Zimbabwe (pers. com. 2014).

Sectors with backward and forward linkages to agriculture employed tens of thousands of people who paid income tax. So, the linkages between manufacturing, commerce and commercial agriculture were important and the government virtually closed down this major industry. The land reform process was accompanied by a poor rainy season. He combination led to a significant decrease in crop production, which affected local consumption as well as agricultural exports. For example, in 1997, Zimbabwe produced approximately 250 000 tons of (irrigated) wheat, which was the national average historically. However, this decreased to 25 000 in 2008. This was not only in the case of wheat, but as seen in Figure 3, volumes of maize fell by 80 percent; tobacco production declined by 60 percent; cotton by 70 percent; sugar by 30 percent; tea and flowers by 40 percent.

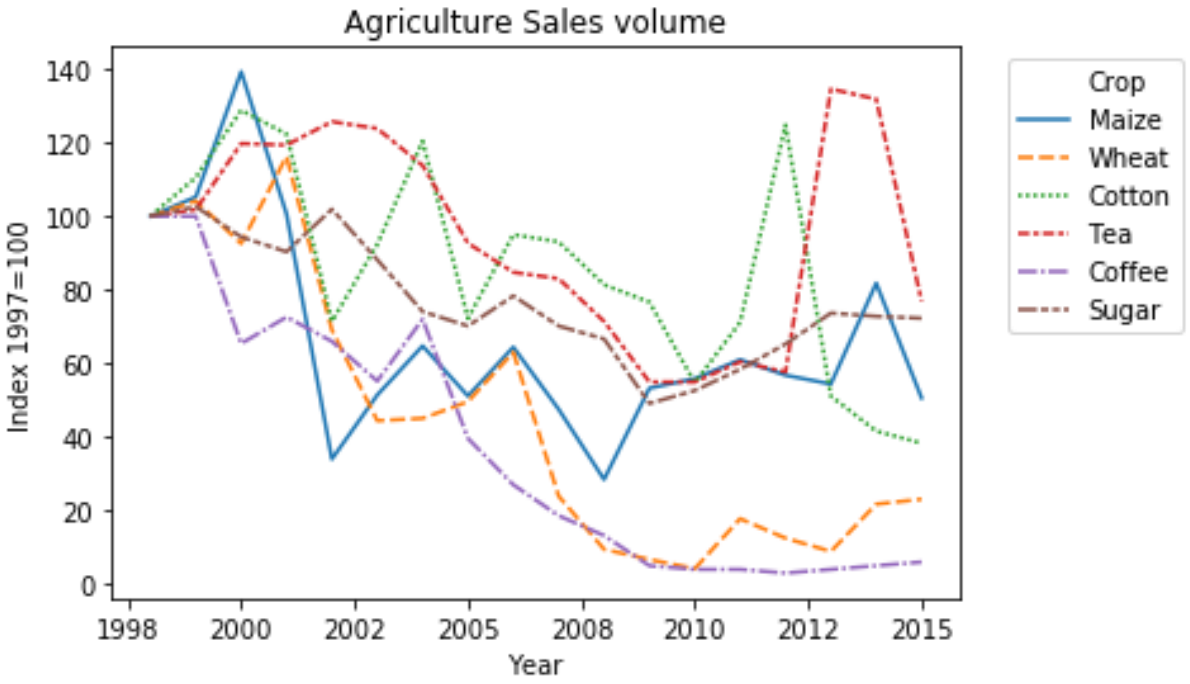


Figure 3: Zimbabwe's Agriculture Sales trends, 1998 – 2015

Source: Robertson Economic Information Services

In agreement, Cross (pers. com. 2020) estimates a 70 percent decrease in production across the agricultural sector between 1997 and 2008. These declines in output in the agricultural sector drove a decline in GDP. Figure 4 shows that from 1998 to 2008, GDP growth became negative, with annual falls ranging from -1 percent to -14 percent.

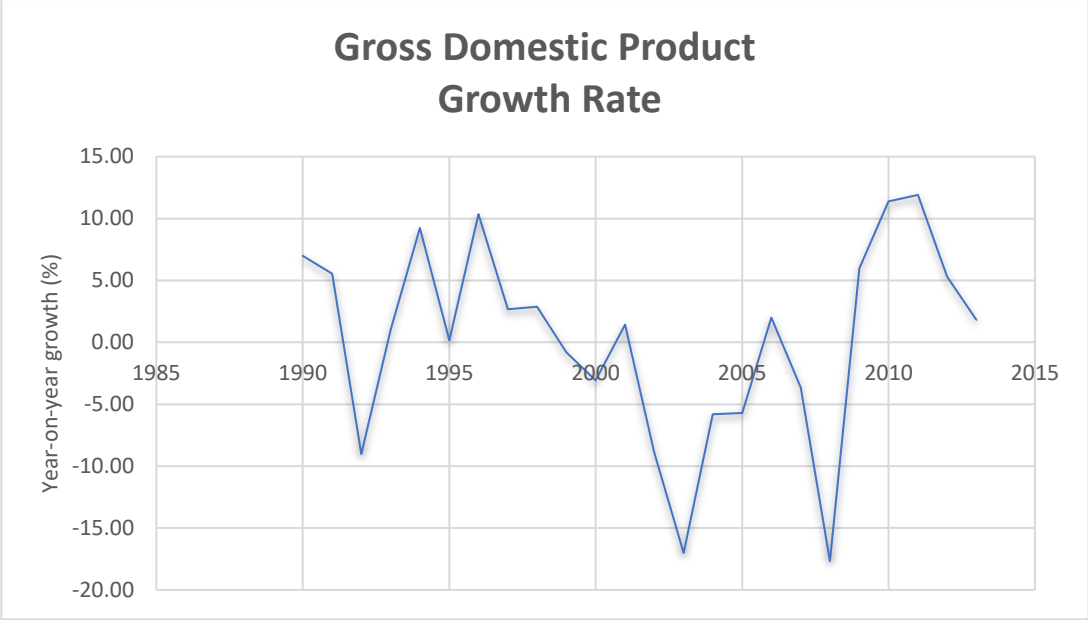


Figure 4: Zimbabwe's GDP growth rate trend, 1990 – 2015

Source: World Bank Data Portal

It is worth noting that, apart from land reform, another contributing factor to the significant decline in agricultural output was poor rainfall. Zimbabwe suffered severe droughts in 1991, 1998, 2002 and 2012. Figure 5 shows the maize output patterns in Zimbabwe over the period of the study. The quantity of maize produced declined during low rainfall years.

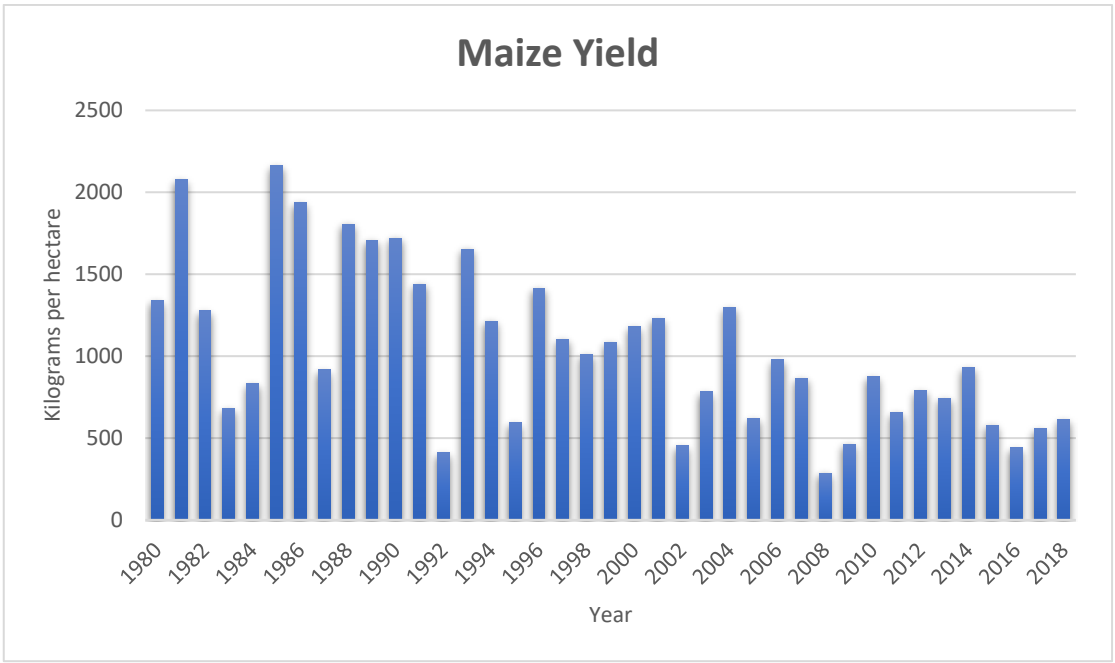


Figure 5: Zimbabwe maize yield trend, 1980 - 2018

Source: Food and Agriculture Organization of the United Nations[4]

[4] United Nations (2020) http://www.fao.org/faostat/en/#data/QC

Both the drought and land reform resulted in a decline in agricultural output and the expected export revenues. This implied the significant decline of foreign earnings which affected Zimbabwe's ability to service international debt. From independence till the land reform era the nation had enjoyed lines of credit with more than 100 international banking institutions. These lines of credit meant that Zimbabwe could import on credit and pay later. The ability to incur international debts was predicated on a steady inflow of foreign earnings from export industries, of which commercial agriculture was the biggest. With its closure, the ability to meet debt service payments disappeared. The international banks that had previously offered Zimbabwe credit, simply withdrew their lines of credit.

When foreign finance to Zimbabwe was eventually suspended in 1999, the nation's arrears to the World Bank had reached US$27 million, to the IMF were SDR53.7 million, and the government's external debt was US$381 million (IMF, 2001). The resumption of foreign funding was made conditional upon improved macroeconomic policy and debt repayment until which time the World Bank would shift to funding social protection and AIDS related activities only.

The government, wholly unprepared, now had to find foreign exchange to meet import bills which had previously been funded through credit lines. The biggest were fuel imports for which Zimbabwe was accustomed to having 6 months' credit. Suddenly, cash payment was required for new fuel as well as for the fuel that had been bought on credit over the previous 6 months. The government had difficulty doing both so debt accumulated quickly and the nation's credit rating slumped. In order to cope with the new reality and sustain itself, the government of Zimbabwe engaged in a cycle of short-term borrowings which resulted in ever greater external debt accumulation. These short-term loans, mainly from private creditors, were characterised by high interest rates (Bond, 1998; Jones et al. 2011). According to Ndlela (2010), the nation's total debt by 2010 was US$5.7 billion, of which 91 percent was external. This external debt included arrears of US$3.65 billion and sovereign debt of US$1.1 billion. Between 1980 and June 2009, Zimbabwe owed domestic creditors US$460 million; the IMF US$135 million; China, US$950 million and the Paris Club, US$2.1 billion (Leo and Moss, 2009).

The IMF and WB did a joint analysis of debt sustainability in Zimbabwe[5]; it found that Zimbabwe owed US$8.8 billion to the rest of the world by the end of 2010. This amounted to 118 percent of GDP, implying that the nation was fully leveraged at that stage. Arrears of US$5.95 billion accounted for 68 percent of this debt of which 19 percent was owed to International Financial Institutions.

[5] See IMF, (2011). "Joint IMF/World Bank Debt Sustainability Analysis".

The government's loss of access to foreign credit and of the shortage of foreign currency also curtailed the ability to import the raw materials, intermediate goods and capital needed to produce manufactures, many of which would ordinarily have later been exported. Most of the country's exports had some imported content, and as result the country's foreign earnings declined even further. Figure 6 illustrates the declining trade balance from 1998 to 2008. Evidently, the country mostly had a positive trade balance until the year 2000. Thereafter it progressively became negative with really bad period beginning during the hyperinflation period of 2007 and 2008. Ever since, the nation has not recovered from import dependency.

Once started, the country's economic decline fed on itself: With less foreign currency, Zimbabwe struggled to import fuel. Motorists were forced to spend long hours in queues of cars at fuels stations, reducing the productivity of labour. The shortage of funds meant that government failed to maintain infrastructures such as roads, railways, water and sanitation systems, again lowering factor productivity. Zimbabwe's urban infrastructure broke down, potholes and broken street and traffic lights raised the cost of running a vehicle, and again commerce and industry suffered.

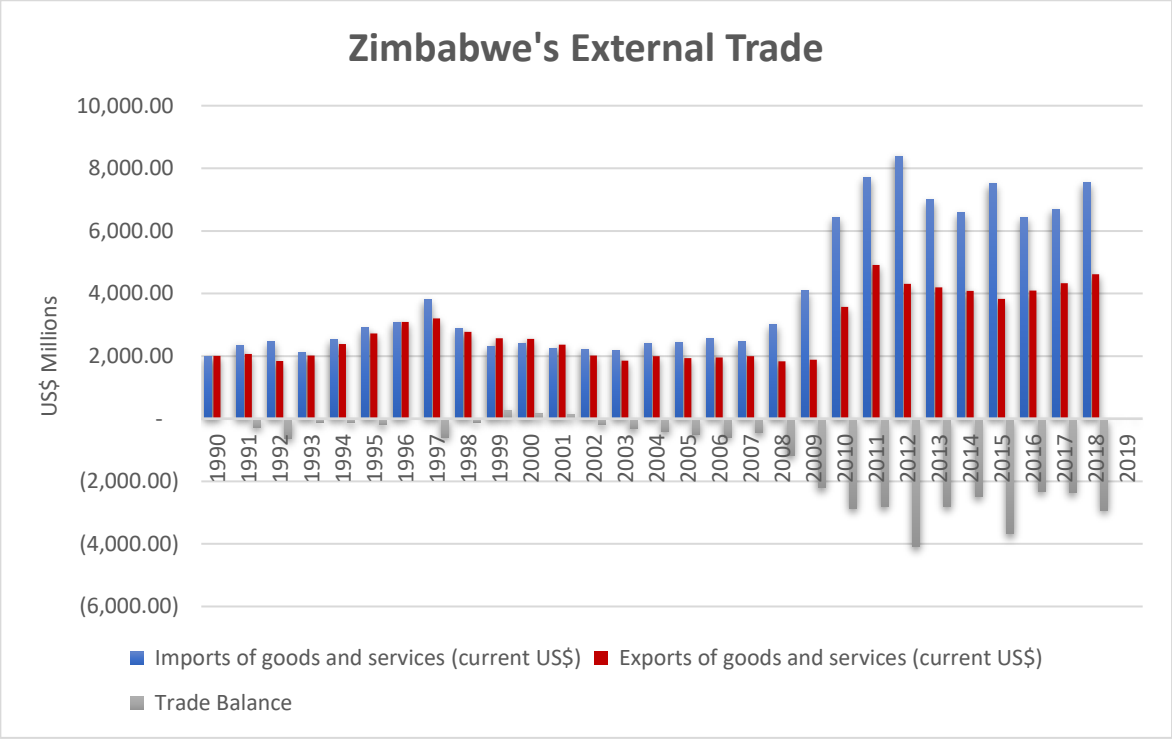


Figure 6: Zimbabwe's External trade trend, 1990 – 2018

Source: Robertson Economic Information Services

As the farm invasions of the land reform period disrupted agricultural production, the government's main import priority became food. Zimbabwe's farming sector had extensive backward and forward linkages; hence, the closure of large-scale farms damaged the viability

of the multitude of firms that depended on them. The invasions also meant the loss of many elementary schools, high schools and clinics located and supported on the farms, and the incomes of farm workers. When the 4 500 farms were forced to close, approximately 496 000 farm workers lost their jobs and livelihood. However, the agricultural sector's close ties to the rest of the economy meant that many others lost their jobs indirectly. (Robertson, pers. com. 2020).

In many cases the farms were taken by party political functionaries. However, where small-scale farmers were given access to the land, they did not get title, could therefore not secure bank loans, and largely depended on government subsidies. Unfortunately, these subsidies were an unbudgeted national expense. The only alternative was to monetize the deficit; effectively to print more money. The result can be seen in figures 7a and 7b below.

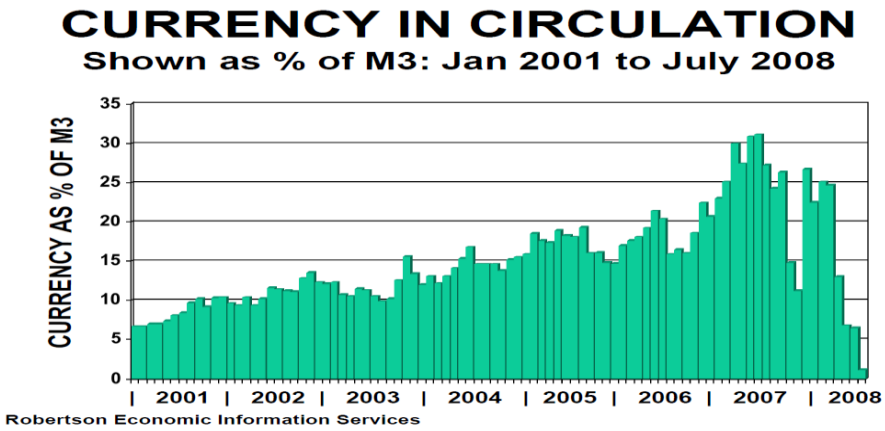


Figure 7a: Currency in circulation in the Zimbabwean economy, 2001 – 2008

Source: Robertson Economic Information Services

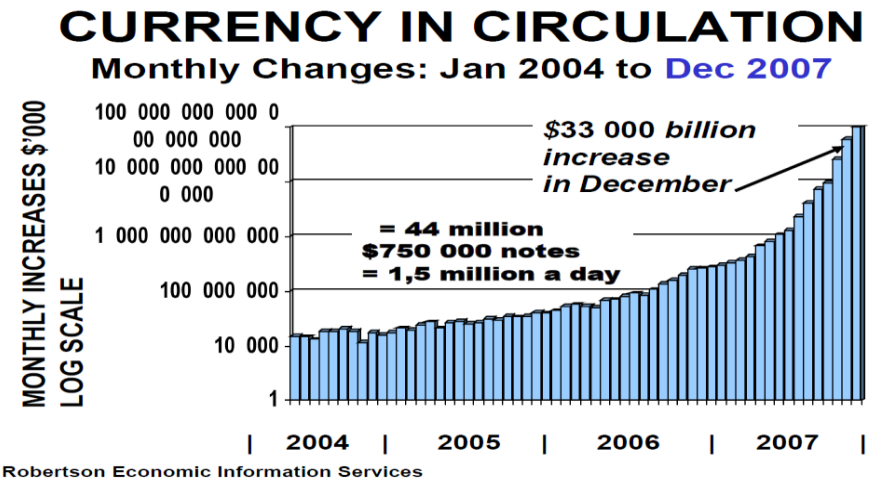


Figure 7b: Currency in circulation in the Zimbabwean economy, 2004 – 2007

Source: Robertson Economic Information Services

An increase in the amount of cash circulating in the financial system was apparent from 2001 to 2008. As was mentioned in the theoretical section above, money supply increases result in increased inflation rates. Just before hyperinflation, in February 2007, the Reserve Bank of Zimbabwe added Z$137 billion worth of cash to the economy. In March, the currency in circulation was increased by Z$372 billion. In April, currency in circulation rose by Z$658 billion and in May, by Z$1 470 billion, consisting of 14.7 million Z$100 000 notes. By June, the Reserve Bank had added 43 million Z$100 000 notes into the system and in July, 24.5 million Z$200 000 notes. In September 2007, the currency in circulation increased by Z$8 500 billion, in the form of 42.5 million Z$200 000 notes. The trend continued and the Zimbabwean economy received and extra 61.5 million Z$200 000 notes, amounting to Z$12 300 billion in October 2007. In November 2007, the currency in circulation was increased by Z$18 400 billion in the form of 92 million Z$200 000 notes. This amounts to an average of Z$3 million injected into the economy daily. In December 2007, the currency in circulation increased by Z$33 000 billion, which is tantamount to Z$1.5 million a day in the form of 44 million Z$750 000 notes. All this information was given by Robertson (pers. com. 2020).

As a result of this extreme growth in money supply, the Zimbabwean dollar lost its value. Between September 2007 and September 2008, the daily foreign exchange rate on the parallel market had increased by 20 billion percent. For the politically connected few who were able to access foreign currency, the cross-rate gap between the official and parallel exchange rates became a source of income (Leiman, pers. coms. 2020). As a means of controlling the exchange rate and inflation, the Reserve Bank truncated the currency. On the 1st of August 2008, ten zeros were dropped from the currency. Immediately after this change US$1 was officially worth Z$100, but a hundred days later, on November 17, 2008, US$1 was worth Z$100 quadrillion. In these four months, there was tremendous currency depreciation. This is clearly seen in Figure 8, which shows the exchange rate depreciation between January 2006 and November 2008. In January 2006, on the official market, US$1 converted to Z$99 201, but on the parallel market US$1 was worth Z$115 500. By November 2008, US$1 was worth Z$70 179 010 in official circles, yet it would fetch Z$20 000 000 000 000 000 000 on the parallel market (Robertson, pers. com. 2020).

CURRENCY CONVERSIONS
US DOLLARS TO ZIMBABWE DOLLARS AT PARALLEL RATE, THEN BACK TO TO US DOLLARS THROUGH OFFICIAL RATE

	Starting with... US Dollars	Parallel Rate Z$ per US$ rate	US$100 converts to:	Official Rate Z$ per US$ rate	US$100 converts to:
Jan 2006	100	115 500	11 550 000	99 201	116
Jul 2006	100	550 000	55 000 000	101 195	544
Jan 2007	100	5 000	500 000	250	2 000
Jul 2007	100	150 000 000	15 000 000 000	15 000	1 000 000
Jan 2008	100	10 000 000	1 000 000 000	322 500	3 101
Jul 2008	100	800 000 000 000	80 000 000 000 000	71 520 000 000	1 119
Aug 2008	100	2 500 000	250 000 000	32 050	7 800
Sep 2008	100	750 000 000	75 000 000 000	132 300	566 893
Oct 2008	100	20 000 000 000 000	2 000 000 000 000 000	682 092	2 932 157 929
Nov 2008	100	20 000 000 000 000 000 000	2 000 000 000 000 000 000 000	70 179 010	28 498 549 637 563

Figure 8: Currency conversions in the Zimbabwean economy, 2006 – 2008

Source: Robertson Economic Information Services

Evidently, the zeros still came back after a series of truncations of the Zimbabwean dollar. In July 2006, 3 zeros were removed and in August 2008, 10 more zeros were removed. After a number of other instances, a total of 25 zeros were removed between June 2006 and November 2008. All this was done in an effort to control the extreme hyperinflation which was necessitated by printing and adding large amounts of money into the economy.

As money supply grew, Zimbabwe experienced very high levels of inflation until firms began to anticipate the inflation. Unfortunately, even attempts to control money supply growth would probably have failed due to the politicization of the RBZ at this point. By 2008, the RBZ's quasi-fiscal expenses on agricultural equipment, parastatals, elections and lending subsidies had reached US$1.1 billion (IMF, 2009). These necessitated the printing of money, which resulted in rapid growth of money supply and eventually uncontrollable inflation. In response, inflation was built into firms' daily pricing policies. The resulting momentum ensured that inflation continued to rise. Expectations made inflation a self-fulfilling prophecy. Since people expected inflation to rise, firms factored it into pricing their product and households converted cash into goods as fast as they could. The combination of rapid price increases in shops, money printed by the government and rising transactional velocity of circulation ensured hyperinflation.

Inflation continued to increase as government borrowed and printed more money to meet its recurring expenditures. They borrowed more money by selling treasury bills. However, since they set interest rates below the rate of inflation, investors experienced negative real interest

rates. The government had statutory reserve ratios for pension funds and insurance companies. This was a forced lending system with interest rates for those far below the rate of inflation.

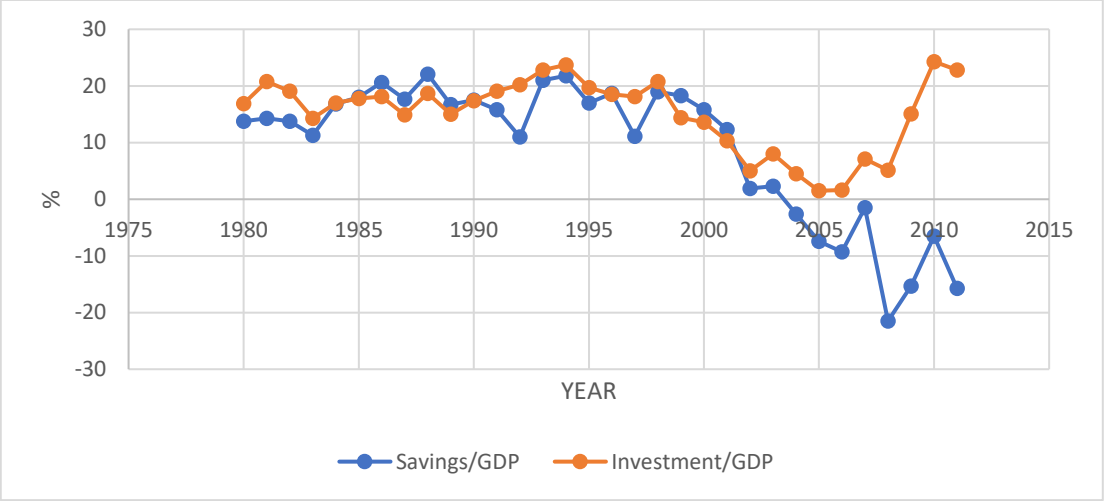


Figure 9: Zimbabwe's savings and investments trends, 1980 - 2012

Source: Unpublished CSO statistics[6]

Indeed, as seen in Figure 9, savings as a percentage of GDP decreased and fixed capital formation investment followed the same trajectory. Indeed, on the ground, industry was closing down and infrastructure was collapsing. The Zimbabwean economy visibly deteriorated as both government and private sector did not have the money needed to invest in maintenance. This is because national and corporate reserves were losing value due to negative real rates of interest. So, the money that was available was used entirely to maintain daily activity, not to repair plants and equipment. The visible rise in investment at the height of hyperinflation alongside a decrease in savings is most likely a sign of firms hedging against inflation through the purchase of fixed assets. Property was a classic investment at this time, as buildings and building materials were being purchased to safeguard against inflation. Chirongwe (pers. com. 2020) says that residential property sales in the country increased by 27 percent, from 11,061 in 2000 to 14,024 properties in 2004. This available data indicates an upward trajectory in property acquisition during the economic crisis and times of high inflation.

1.2.2 Assets

According to Leiman (pers. com. 2020), this culture of investing in property is part of the fibre of the Zimbabwean society. In Zimbabwe, there is a long tradition of home ownership, ownership of livestock in the rural areas, and of trading in equities. The first stock exchanges

[6] Provided by the Labour and Economic Development Research Institute in Zimbabwe.

opened shortly after the arrival of the pioneer column. With such a long history of asset ownership, it is no surprises that Zimbabwean households would resort to securing their savings in property. In hyperinflation, savings that are held in such real assets are far more secure than savings in cash, bank accounts or bonds, which are common to urban households. The urban poor were therefore the worst affected. In the rural areas, the life of small-scale farmers was affected – productivity declined as farmers saved rather than selling an entire crop and purchasing new hybrid seeds, as usual. Livestock held their value. The biggest problem was the attempts by government to control food prices. Production of cash crops suffered, but the rural population could at least feed themselves. In cities, the rich owned real assets, while the poor had savings accounts at the post office. As savings lost their value to inflation, many households converted them to assets; ranging from televisions to homes.

Businesses were similarly affected by the persistently high inflation and their coping mechanism was to invest in equities as a means to secure the value of their money. The Chief Executive Officer of a local asset management firm, agreed with the previously cited economists that the printing of money by the Reserve Bank, in order to fund government, was the root of hyperinflation. This was similar to what happened in Brazil in 1980. In Zimbabwe, much like it was in Brazil, trading in equities for the money market was not wise because the government was expected to default on treasury bill interest payments. If they paid, the interest rates would be lower than the prevailing inflation rate, such that investors would experience a loss. As a result, the best investment strategy during the hyperinflation period was to create a diverse portfolio of equities, instead of gambling with the volatile money market. The reliable equities were for high quality listed companies. Such companies have "…simple sustainable business models with strong cashflows and low debt levels… By their nature – such stocks tend to be defensive…" The certainty of returns was higher with such an investment. The resultant, dividend income, capital gains and interest were reliable sources of cash for retired investors and the capital kept growing (Legat, pers. com. 2020).

While asset managers looked at business models, cash flows and debt levels, investors evaluated companies differently during the hyperinflation period. Investors became practical and stopped evaluating companies based on profits or future cash flows. Instead, firms were valued by the assets that they owned such as properties and plants. For investors, plant maintenance became a higher priority than sustaining high levels of production.

Regardless of the evaluation method it was clear that equities were regarded as a safe haven by investors because there was a perception that returns would recover if firms survived the high inflation period. The stock market was therefore a good hedge against hyperinflation. This

is seen in that, in spite of the extreme inflationary fluctuations from 1998 to 2006, the stock market was stable in US dollar terms. For example, from September 1999 to September 2006, the Imara Asset Management equity fund increased by 37 percent in US dollar terms and specifically, from 2001 and 2006, the equity fund doubled (Legat, pers. com. 2020). Clearly, the Zimbabwe Stock Exchange (ZSE) was a store of value for the small segment of the population which invested there, mainly the upper-middle-class.

Even in at the peak of hyperinflation, in May of 2008, the stock market remained a place of refuge for those who could afford to invest and it protected pensions and insurance schemes against hyperinflation. At this stage, tobacco farmers were earning US$4 per kilogram (Cross, pers. coms. 2020). With the exchange rate floating at Z$230 million for US$1, this translated into many millions of Zimbabwean dollars. The only point of caution was that the local currency had to be used quickly before losing its value. As a result, as soon as farmers received their foreign earnings from exports, they directed them into the stock market and kept just enough to purchase inputs for the next season as well as to meet their daily needs. Indeed, the stock market proved to be a store of value and a vehicle of wealth accumulation during the hyperinflation period.

1.2.3 Microeconomic effects

The previous sections have shed light on how hyperinflation occurred, progressed and its effect on investment. It is clear that investment patterns were distorted by the high levels of inflation. Financial investment in interest bearing assets such as bonds decreased, while purchases of equity and property held up. It is also important to explore how the few businesses that survived were coping in this environment. Hyperinflation affected firms through finance, infrastructure and labour. As the nation's economic and political conditions worsened, investor confidence fell with it, and many companies suffered from a lack of financing. In addition, many firms' Foreign Currency Accounts were frozen when the country ran out of foreign reserves. As a result, such companies could not access the foreign earnings from their exports. This had short term impacts is it stopped them from importing inputs needed for production. It also had longer term consequences for production as it precluded, investment in new capital and hindered maintenance of the equipment that they were using. As expected, this negatively affected production and profits for firms.

Apart from the investment aspect, consumption rates were significantly lower due to unemployment and imperfect indexation. This had an adverse effect on the sales volumes of many companies. The Chief Financial Officer of Lafarge Cement, makes it clear that volumes and revenue from cement sales, in real terms, were declining due to currency devaluation

(Matanhire, pers. com. 2020). A similar trend was observed at Total Petroleum, where the volumes of fuel sold decreased by 40 percent between 1999 and 2008 (Mukamura, pers. com.2020). Similarly, the Chief Executive officer of Nyaradzo Funeral Service, (Mataranyika, pers. com. 2020), concluded that the main cause for declining sales volumes in industry was a lack of affordability. Households resorted to basic lifestyles and cut out unnecessary expenditure, accordingly real demand fell and the private sector suffered.

Hyperinflation also had a negative effect on firms' daily operations. At Lafarge, for example, procurement procedures became inefficient because of foreign currency shortages. This resulted in poor maintenance of the company's plant and heavy equipment. In addition, employees complained about the rapid loss of value of their locally denominated salaries due to inflation. As a result, Lafarge resorted to using fuel coupons as a currency to pay employees and creditors. In general, daily productivity was very low as transactions were limited due to fast rising prices. The business lost a number of critical skills as employees migrated to other countries for better employment opportunities. This brain-drain negatively affected product quality and customer satisfaction.

In an attempt to minimize the effects of the inflation persons receiving money tried to effect purchases as soon as possible; one result was the increasing appeal of payments against future delivery. In the case of Lafarge, cement was paid for in advance and customers would be advised when to collect. The prepayments were meant to preserve value, but even this failed once the local currency was no longer accepted. Eventually the company resorted to barter - clients would bring various goods and service in exchange for cement. In some instances, the Lafarge received cars in exchange for cement. Daily operation at Lafarge suffered most in 2007 when the government introduced price controls. Overnight, there were no inputs for production in the formal market. Inefficiency became the norm as permission to review prices, despite the extreme inflation, had to be sought from the government's Ministry of Industry and Commerce.

Total Petroleum tells a similar story of how operations suffered due to the shortage of foreign currency. It became increasingly difficult for them to pay for imported products such as fuel and lubricants. Even the maintenance of petrol stations was nearly impossible due to the liquidity crisis, along with the emigration of the company's skilled engineers.

The situation of firms worsened further in March 2007 when government began to charge an export tax of 32.5 percent of their export proceeds, at the official exchange rate. The real cost

was even greater as the official rate was far below the unofficial de facto rate. However, this did not deter firms from exporting, as this was the only way to earn the foreign currency needed to buy manufacturing inputs. At this point, foreign investors had largely withdrawn their support for local businesses. Despite the export tax and the disruptions some firms, mostly large companies that had economies of scale, continued to earn from exports, were able to sustain production and pay dividends to shareholders. An observation of the market showed growth in sales volumes for the firms that survived, which is counter-intuitive as prices had become inhibitive at this stage. However, this was because the few surviving retail firms were producing cheaper brands which cost them less to make. This along with the formation of syndicates, increased marketing and shorter pay periods were survival strategies that were adopted by firms in response to cash, credit and input shortages during the hyperinflation period (Gumbe and Kaseke, 2011).

Another problem affecting production, especially in the manufacturing sector, was the poorly maintained national infrastructure. As previously mentioned in this account, government progressively failed to maintain and improve the water purification system, electricity supply, road networks and railways. As a result, the transportation of raw materials, the operation of electrically powered manufacturing equipment, as well as hydro-based systems suffered. Again, this had an adverse effect on production, which led to the closure of most of Zimbabwe's industrial sector. According to Gumbe and Kaseke (2011), between 2006 and 2008, capacity utilization of the manufacturing sector decreased from 95 to 31 percent. The estimates in Figure 10, show that recorded gold production decreased from 25 tonnes in 1997 to 2,5 tonnes in 2008. This decline corresponds with the official statistics that show a decrease in gold production, from 11 tonnes in 2006 to 7 tonnes in 2007 (Spiegel, 2015). Unrecorded production, especially from informal operations, may well have risen. In the same decade, the output from coal mines decreased from 5 000 000 tonnes in 1999 to 1 500 000 tonnes in 2008. This quantity produced in 2008 was the lowest since 1947. Figure 11 shows the progressive decline in production based on quantities of coal transported by the National Railways of Zimbabwe from 1999 to 2004.

As mentioned, one common coping mechanism for firms was barter trade; customers paid for services with fuel coupons, building tiles, bricks, cars, and other assets. As an unspoken rule, the functional currency in industry was fuel coupons. These became the unofficially recognised store of value and medium of exchange when foreign currency was still illegal tender.

It is evident that the hyperinflation period had a severe adverse effect on firms, especially around August 2007 when the government fixed prices below the market clearing levels. Businesses could not sell at prices high enough to recover costs. This resulted in shortages of goods in the official market and increasing supply in the parallel market. Once the economy

had effectively moved to the parallel market, it became difficult to quantify inflation. By the end of June 2007, year on year inflation had increased by 22 000 percent according to the ZSE index.

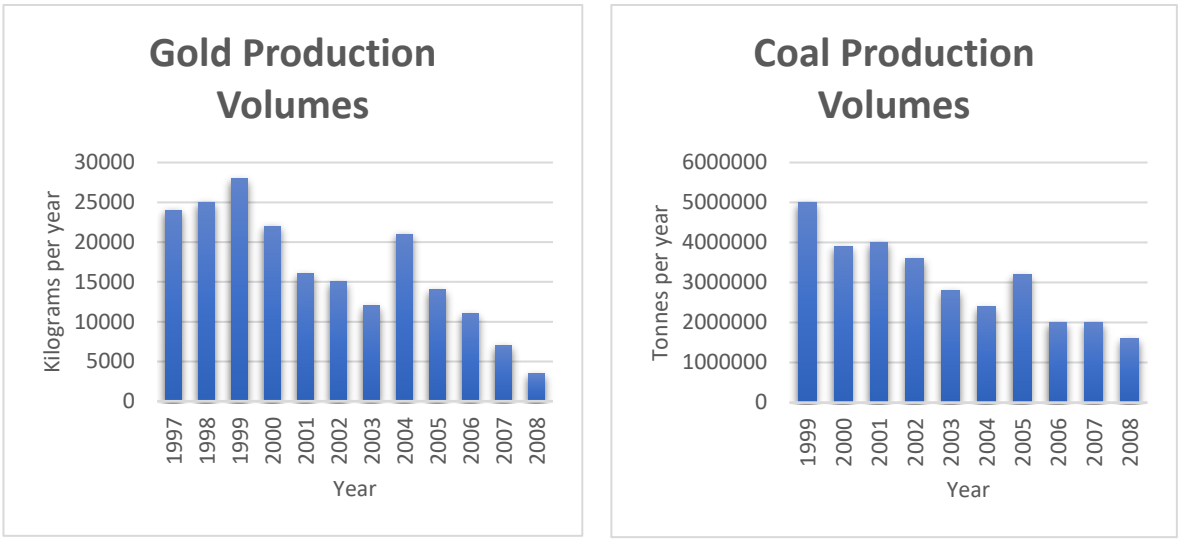


Figure 10: Zimbabwe's mineral production trends, 1997-2008

Source: Robertson Economic Information Services

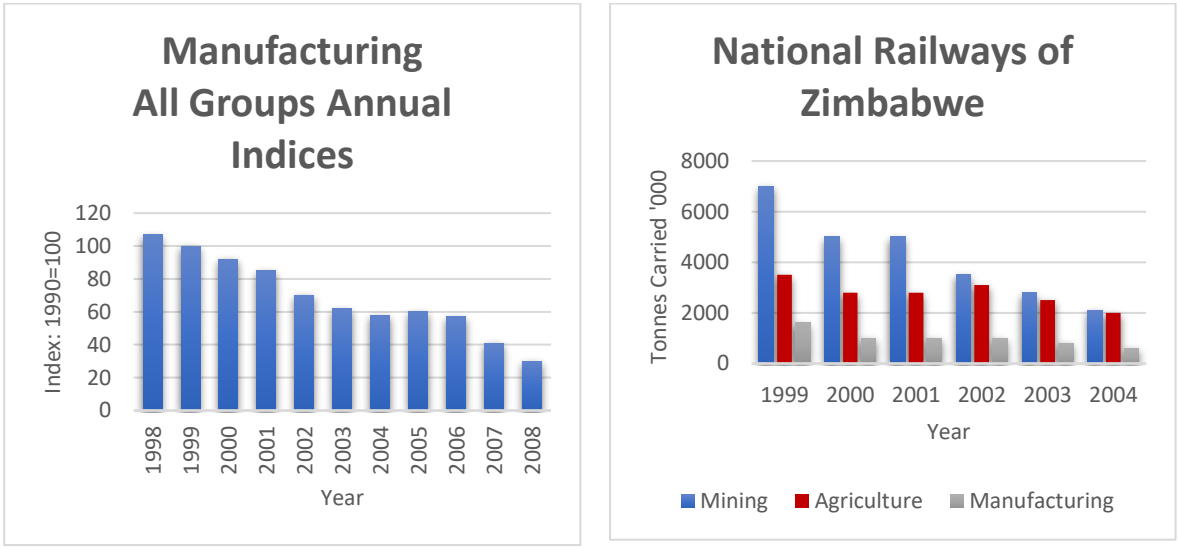


Figure 11: Zimbabwe's overall production trends, 1998-2008

Source: Robertson Economic Information Services

Investor confidence faltered even more after the announcement of the new Indigenization and Economic Empowerment Program (IEEP) in 2010, which required foreign investors to sell 51 percent company ownership to the government (Chigudu, 2019; Chowa and Makuvare, 2013). It is capital intensive businesses that were most negatively affected by this policy, as they tend to rely on foreign direct investment.

In such a hyperinflationary environment, most retail companies could not afford to purchase new stock and pay their overhead expenses. As a result, many employees were sent on unpaid leave. Retailers were no longer able to rely on local manufacturers as production became impractical at the controlled prices. As a result, most retailers chose to import their stock. Approximately 40 percent of retail products were imported. Mawowa and Matongo (2010) show that retailers purchased foreign currency from the roadside traders and then used it to procure imports. They were an integral part of the parallel market.

Over the year 2007, the annualized inflation rate was estimated to be in the range of 500 000 percent to 1 000 000 percent; the official Z$ to US$ exchange rate had increased by 1 100 000 percent; and the stock market had risen by 1 400 000 percent (Robertson, pers. com. 2020). In terms of currency, the largest denomination was now a Z$250 million bill. Importantly, wages were lagging behind the price level; as a result, consumption dropped and poverty was increasing in households. Poverty also increased as a result of unemployment which became a continual problem over the decade. According to Chipika and Malaba (2011), structural unemployment rose from 63 percent in 2003 to 80 percent in 2008. Jobs that were lost in the formal sector, added to the informal sector which was inherited as a part of the colonial dual[7] economy.

As expected, with these high levels of unemployment, household income poverty increased rapidly during the hyperinflation period. In 1995, the Poverty Assessment Study Survey[8] showed that the national poverty headcount ratio, based on the Total Consumption Poverty line, was 42 percent. A follow up study conducted in 2003 showed that the national poverty rate had increased to 63 percent, with at least 50 percent poor households in all of Zimbabwe's 10 provinces[9]. In the same study, ZimSTAT (2003), used per capita income as a measure of living standards and found the national Gini Coefficient of Zimbabwe to be 0.59 and 0.64 in 1995 and 2003 respectively, suggesting that income inequality increased during the economic crisis. Robertson (pers. com. 2020) agrees and in Figure 12 shows that income per person fell below the global poverty line of US$1 a person a day in 2008. Post-dollarization, there was significant improvement.

[7] According to Kanyenze, G., Kondo, T., Chitambara, P., and Martens, J. (2011) in their book, "Beyond the Enclave", the dual economy consists of two sectors. The formal sector is the one where capitalist production occurs and involves less than 20 percent of the nation's labour. Coexisting with the formal, is the informal sector which is based on pre-capitalist activities like subsistence farming and engages the rest of the labour force participants in unproductive labour.

[8] Ministry of Public Service, Labour and Social Welfare, (2006). "ZIMBABWE 2003 Poverty Assessment Study Survey Main Report", MPLSW, FilMAZ, Harare, Zimbabwe.

[9] See Table A2.1 in the appendix.

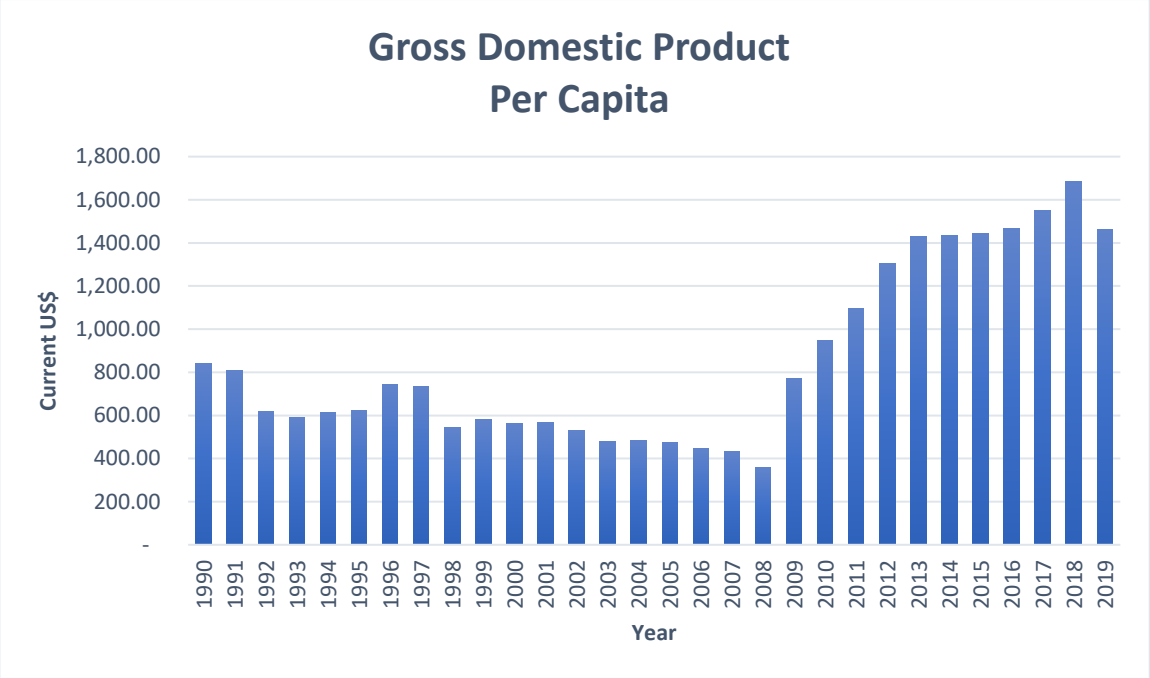


Figure 12: Zimbabwe's GDP per capita trend, 1990 - 2019

Source: World Bank Data Portal

Further information on household wellbeing is provided by Zimbabwe's Scientific Industrial Research and Development Centre (SIRDC) who, through the Food and Nutrition Council, publish the Zimbabwe Food Security and Vulnerability Assessment Report (ZimVAC) annually for rural households and once every three years for urban households. The greater reporting frequency for rural households reflects their higher levels of food insecurity and their 65 percent share of the nation's population. For the purposes of this study, findings from ZimVAC (2002; 2003; 2005; 2006; 2009; 2010) will be used to show the state of households during the period of study. The reports before 2007 give details of the pre-hyperinflation situation, while those after 2008 give information about the post-hyperinflation situation.

The decline in agricultural output during the hyperinflation period, led to a food security crisis in the country. According to ZimVAC (2005), a household is food insecure when its food entitlements, from own crop production and income, are less than its food requirements. This situation results in households not having sufficient food for survival and resorting to coping mechanisms such as cutting out meals or decreasing expenditure in health and education, which is what happened during the economic crisis.

During the year 2002, Zimbabwe suffered a food deficit of 239 000 metric tonnes (Robertson, pers. com. 2020). This scarcity resulted from both the ongoing drought and the land reform program and associated land invasions. The land tenure changes left 496 000 former commercial farm workers requiring food aid. As a result, the total population of food insecure

individuals rose to 7 182 000 between September 2002 and March 2003. These farm workers that were retrenched due to land reform faced deficits of up to 75 percent of their food needs (ZimVAC, 2003).

With this reality, the government planned to import 617 727 MT of cereals. Unfortunately, there was corruption in food distribution with apparent discrepancies between the reported quantities of imports and the volumes of grain that were received in communities (ZimVAC, 2002). Due to the shortages in agricultural output, the parallel market price for maize increased by 167 percent in a year. One kilogram of maize was selling at Z$130. Over the course of the year 2002, the market saw an increase in livestock prices as well. The prices of chicken, goats and cattle increased by 40, 72 and 47 percent respectively. Given the annual inflation rate of 133 percent in 2002, the real prices of livestock during this period are shown in Table 1. Food inflation was high and households that bought food, felt the difference and began selling some assets in order to afford to buy food at the at the higher prices, in an effort to maintain the same levels of consumption. For instance, in 9 out of the 10 provinces in Zimbabwe, households sold more cattle and goats than they had done in previous years, in order to raise money to buy food. This observed rise in demand and prices of livestock was mainly because rainfall was low and Zimbabwe suffered a drought in the year 2002 (Richardson, 2007). Then more livestock was lost due to drought and disease during this time.

Table 1: Changes in real livestock prices, August to December 2002

Animal	August Price (Z$)	December Price (Z$)	Percentage change (%)
Cattle	172.53	253.02	46.66
Goat	19.47	33.51	72.08
Chicken	4.29	6.02	40.53

Source: ZimVAC (2002)

In 72 percent of the communities that were surveyed (ZimVAC, 2002), many in the work force had lost their jobs and remittance flows declined by 96 percent due to the increase in unemployment. Unemployment was highest in urban and commercial farming areas. Most jobs were lost in the urban centres of Harare, Bulawayo, Midlands and Masvingo. On commercial farms, jobs were mainly lost in Mashonaland Central and Mashonaland East. Out of the people who remained employed, 41 percent were employed in government's public works program. In order to meet their expenses, individuals who were officially unemployed sold fruits, insects such as termites, livestock, vegetables and engaged in casual labour. Nonetheless, others were engaging in high risk activities such as prostitution, livestock theft and gold panning. Another common feature of the hyperinflation era, especially in urban areas was the sale of household assets (ZimVAC, 2002).

Food shortages after the land reform and drought season, especially shortages of cereals, led to the consumption of wild foods, some of which are acidic when eaten raw (ZimVAC, 2002). As a result, 70 percent of women reported an increase in the incidence of diarrhoea among children. Some deaths resulted out of this new reality. Zimbabwe's infant mortality rates were the highest in the world at this time. Historically – in the first 20 years of independence – Zimbabwe's death rate has been an average of 10 in every 1,000 individuals a year, but during the hyperinflation period, the official death rate in Zimbabwe was double this amount, as seen in Figure 13. These hyperinflation years were also marked by low life expectancy.

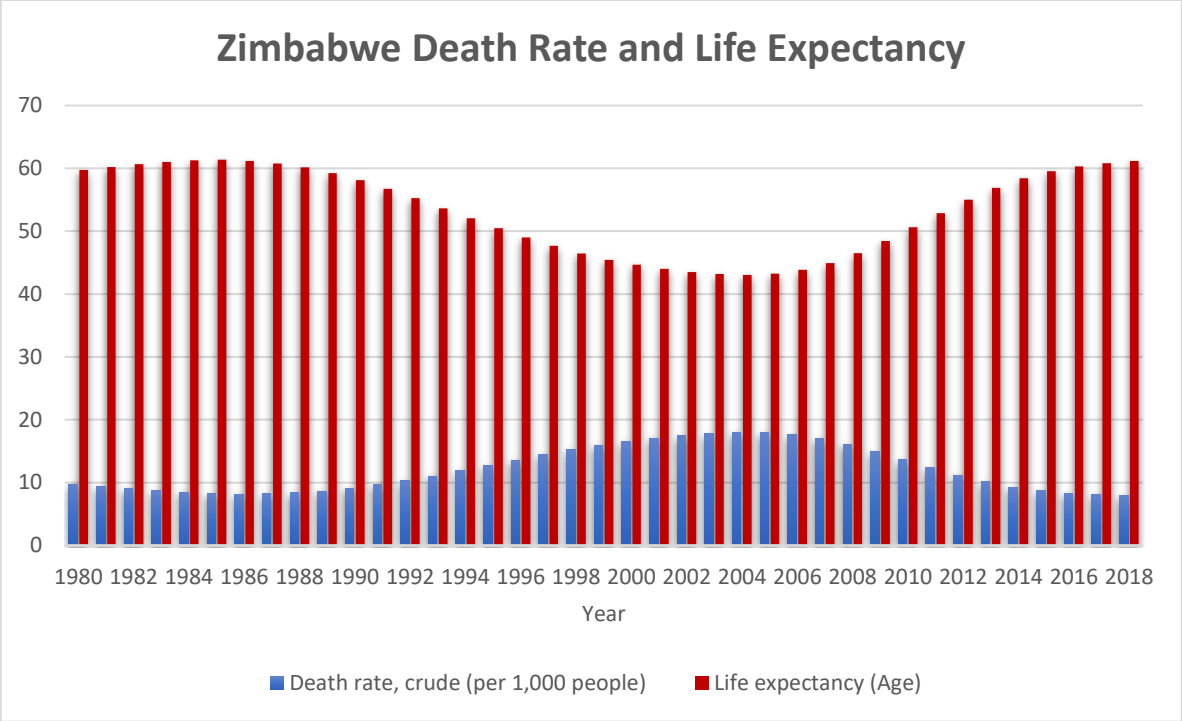


Figure 13: Zimbabwe's death rate and life expectancy trends, 1980 - 2018

Source: World Bank Data Portal

Nonetheless, Cross (pers. com. 2020) claims that the average migrant seems to be sending roughly US$1000 to their family in Zimbabwe every year, though some send back far more. It is quite clear that remittances have been the lifeline of many households in Zimbabwe. Some of the remittances come as goods, but much comes as financial transfers. These are typically lumpy. With the inflation, much of the money has been secured by using it to purchase building materials and consumer durables. The majority of these remittances are directed to rural households and over the years, rural homes have become more modernised as their members working abroad send money and other durable items such as televisions, refrigerators, vehicles, and so on. Figure 14 shows the estimates of total remittance inflows provided by the Reserve Bank of Zimbabwe.

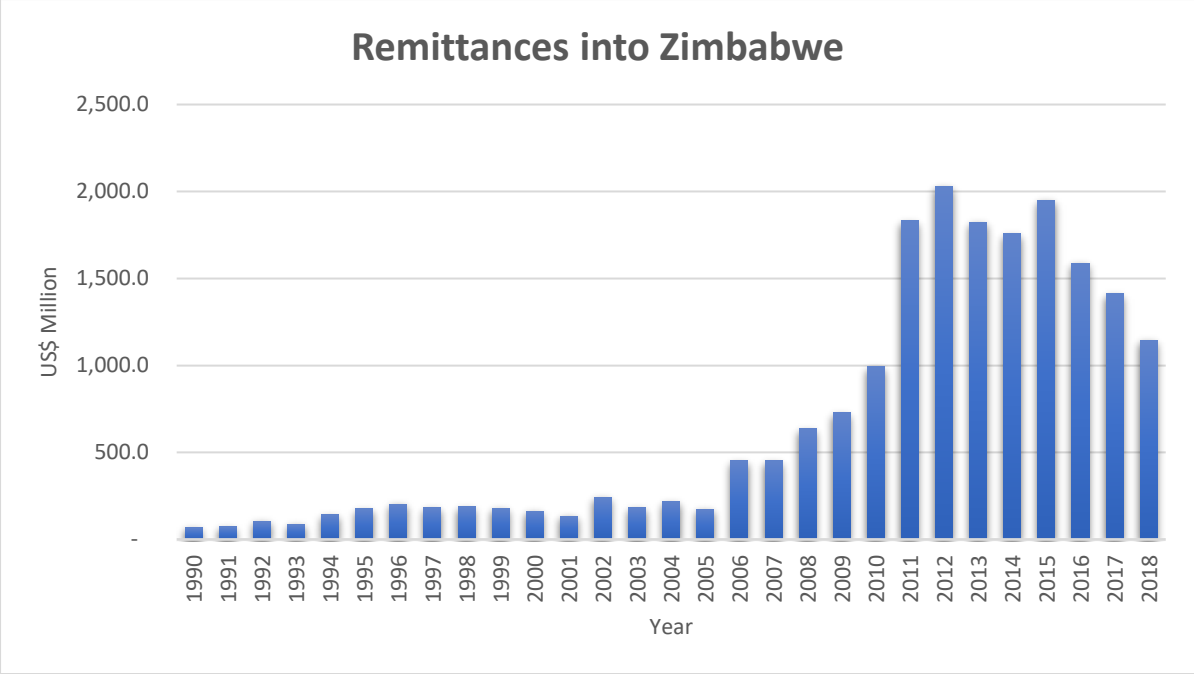


Figure 14: Zimbabwe's foreign currency inflows from Money Transfer Agencies, 1990 – 2018

Source: The Reserve Bank of Zimbabwe

It is evident that recorded remittances increased as the economic crisis worsened, and anecdotal evidence suggests that unrecorded remittances, and remittances in kind did so too; households depended on them for survival. But even with these extra resources coming in, households were cautious with their expenditure as the nature of remittances is unpredictability. This is what makes them different from a salary. In light of this, households employed the coping strategies in Table 2 during the hyperinflation period.

These coping strategies were applied across the country, but were especially evident in urban households. Having little or no land to grow their own food, a greater part of their budget was assigned to food expenditure and they had to find ways of coping with hyperinflation in order to maintain food consumption at the best possible levels. A closer look at the urban demographic shows that 72 percent of the urban population were poor (ZimVAC, 2003). These households typically stayed in squatter camps, backyard shacks and peri urban areas. The most vulnerable and food insecure were households with more than 7 members, and those headed by females and elderly people. Approximately 2.5 million individuals, 64 percent of the urban population, were unable to meet the minimum daily food requirements. Of these, 1,2 million were located in Harare, and another 0.5 million in Bulawayo.

Table 2: Household coping strategies during hyperinflation

Coping Strategy	Proportion of households
Consumption strategies	
Regularly limit food portion sizes	86%
Regularly reduce the number of daily meals	86%
Borrow food	57%
Skip whole days without eating	49%
Consume food from relatives or friends	28%
Purchase food on credit	21%
Income strategies	
Sell all poultry	11%
Sell all assets	9%
Sell all goats	8%
Sell breeding and draft power cattle	6%
Sell land	1%
Expenditure strategies	
Reduce expenditure on healthcare	42%
Reduce expenditure on education	39%
Reduce expenditure on beer	34%

Source: Zimbabwe Food Security and Vulnerability Assessment Report, 2002

Over 60 percent of cereals that were consumed in households were sourced from the parallel market by half of the urban population who could get them. The rest rarely got access to maize and other cereals. The result was that households significantly reduced their dietary intake. In urban areas, only 43 percent of the households ate 3 meals a day. The rest of the urban population ate 2 meals or less. This was the case for both the poor and middle class. The poorer the household, the less protein and more carbohydrates they consumed.

While this was the case in urban areas, out of the sampled rural households in the survey, 36 percent were food insecure (ZimVAC, 2005). Among many contributing factors, 70 percent of the rural household heads mentioned erratic rains and 57 percent complained about price increases as part of the causal factor for food insecurity in 2005. Rural households produced 45 percent of the food that they consumed, while urban households only produced 12 percent of their food. As a result, food insecurity for urban households increased to 33 percent by the end of 2009 while it had decreased to 15 percent for rural households.

Figure 15 shows the income sources for rural households and makes it apparent that they benefited from selling food to urban households. Sales of vegetables, food and cash crops fast became the main source of income as inflation rose. While these sales constituted 37 percent

of income for rural households in 2003, it rose to 54 percent in 2005 and 83 percent in 2009 (ZimVAC, 2003, 2005, 2009). This resonates with Darnton-Hill and Cogill's (2010) view that rural households are at an advantage during times of inflation because they produce their own food to eat and sell to urban households. The graph shows vegetable forming the bulk of food sales and this is very important because ZimVAC (2009) shows that, in an average week, urban households were consuming vegetables for 6 days and animal protein only one day in the week. If 70 percent of their food was purchased, this gave rural households an advantage over urban households in terms of income.

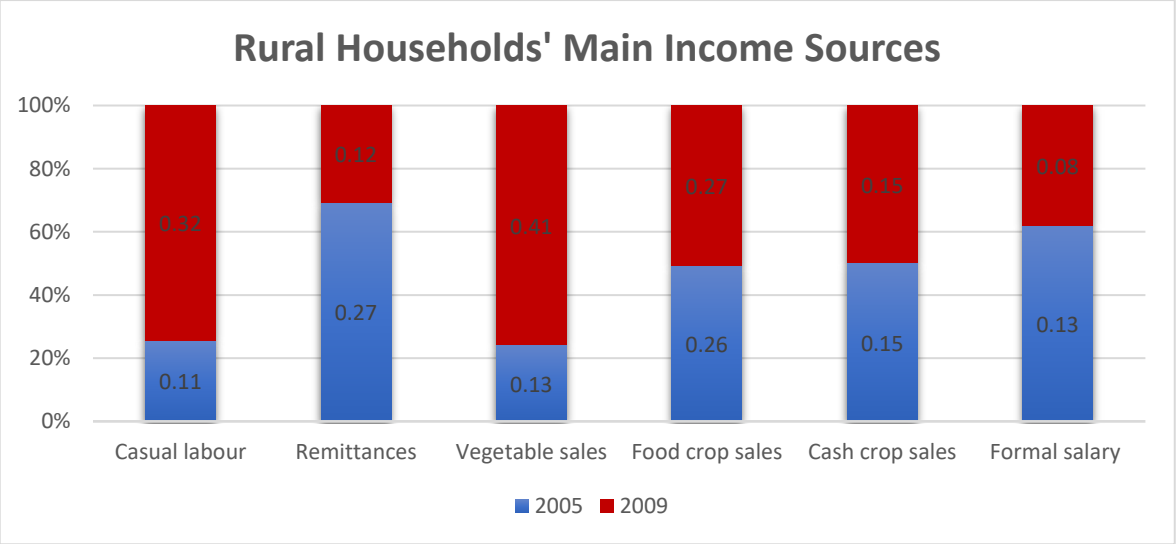


Figure 15: Zimbabwe's rural household income sources, 2005 and 2009

Source: ZimVAC (2005; 2009)

While rural households were self-employed, earning money from producing and selling vegetables, ZimVAC (2009) states that unemployment was 80 percent in the urban areas in 2009. As a result, there was a shortage of income, which hindered households from accessing food. Apart from the loss of employment (therefore income), other shocks which affected urban households' access to food where salary reductions, high food prices, high utility bills, low cash withdrawal limits and the pricing of food in foreign currency which was not available to all (ZimVAC, 2009). As a result, urban households suffered from food insecurity. Figure 16 shows how the eating habits of urban households changed. The proportion of households eating 3 meals a day fell substantially, as most resorted to eating one or two meals in a day. By 2009, only 59 percent of urban households had access to an adequate diet. This reinforces the suggestions regarding coping mechanisms provided in Table 2.

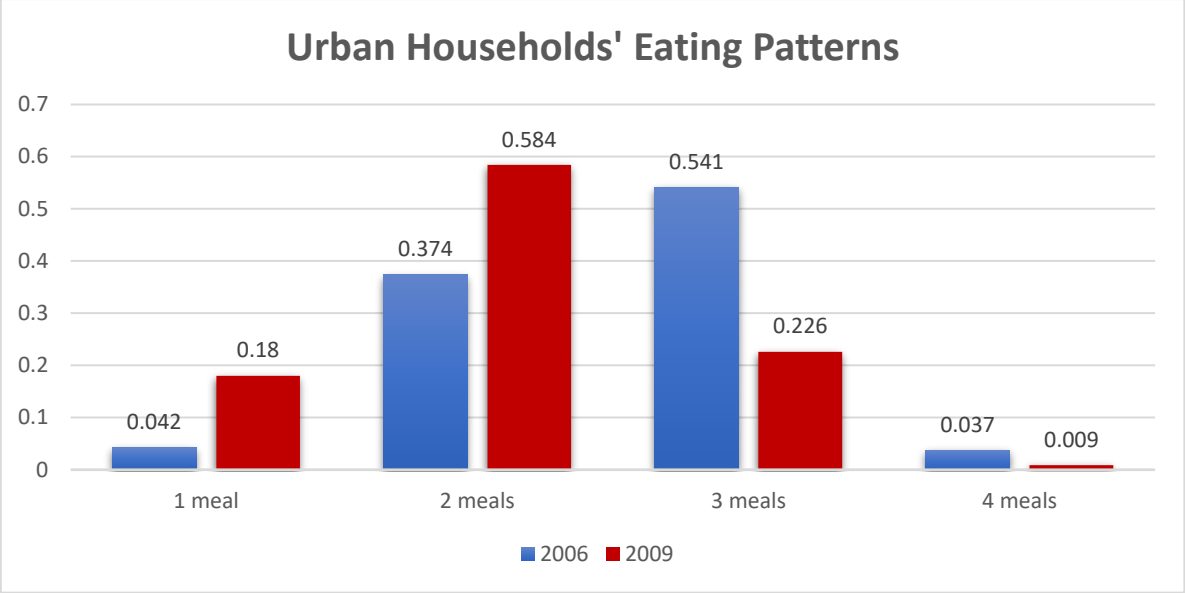


Figure 16: Zimbabwe's daily urban household eating patterns, 2006 and 2009

Source: ZimVAC (2009)

The picture painted in Figure 16 suggests that the impacts of the economic crisis, which was characterised by hyperinflation may extend far beyond the actual period of rising prices. Clearly, urban households did not recover immediately prices stabilised, individuals continued to suffer a lack of income and food. Basing on evidence from other developing countries, the decrease in food quantity and alteration of diet to minimal protein intake most likely affected the health of adults and the growth of children (Ferreira and Schady, 2009).

Apart from changing their diet, another coping mechanism that urban households used was the selling household assets. ZimVAC (2009) shows that 7 percent of urban households sold their livestock in order to buy food. In addition, 31 percent of the households had sold assets in the previous 3 months in order to buy food. Only 6 percent of urban households had purchased assets in the 6-month period prior to the survey. From the total sample of urban households interviewed, 41 percent of food insecure households and 24 percent of food secure households reported the disposal of assets in order to purchase food.

Considering the fact that, 37 percent of transactions in rural areas were conducted through barter trade, there is a high likelihood that, in addition to cash purchases, urban households also traded their physical assets for food, to the benefit of the rural suppliers. Cross (pers. com. 2020) confirms that urban households became dependent on rural households for food during the hyperinflation period. There was a reversal of the flow of resources during this time. Apparently, people in urban areas sold cars, consumer durables, houses, flats, and other assets in order to get cash for food purchases. The problem was that the Zimbabwean dollar was devaluing so fast, that in fact, people sold these assets for foreign exchange rather than local

currency. Many were willing to take discounts because selling assets at a discount in US dollars was better than selling them for their full value in local currency. In 2008, prices were doubling every 3 hours. It was difficult to keep up, so the only way to avoid losing the value of earnings was to trade most of their earnings in for foreign currency or durable assets; either option was a store of value. Then the urban households would keep just enough local currency to buy food and pay for transportation. Unfortunately, the local currency was also unpopular with the farmers as it would depreciate before they could buy seed for the next crop. The result was that many farmers took to saving seed, even though it resulted in yield depression (Leiman and Behar, 2011).

Indeed, rural households told a different story from their urban counterparts in ZimVAC (2009; 2010). Apparently, food insecurity had decreased from 36 percent in 2005 to 18 and 15 percent in 2009 and 2010, respectively. This could be attributed to the 31 percent increase in staple cereal production and the proceeds thereof. As well as the 215 percent increase in vegetable sales. Casual labour income also increased with the greater demand for agricultural produce. While in 2005, the proportion for casual labour among income sources in rural households was 11 percent, ZimVAC (2010) shows that it increased to 32 percent over the 5-year period. With more income from these various sources, it is highly likely that rural households were able to purchase more assets after hyperinflation.

Indeed, ZimVAC (2010) shows that the proportion of income spent on education, loan repayments, agricultural inputs and clothes increased significantly among rural households. In addition, access to improved water sources increased. While only 52 percent of rural households had access to improved water sources in 2005, by 2010, the proportion had increased to 67 percent. Access to improved sanitation, mainly Blair toilets, had improved marginally with an increase from 36 to 40 percent between 2006 and 2010 (ZimVAC, 2010).

On the other hand, sanitation and water supply became dysfunctional in urban areas. ZimVAC (2009) does not quantify the access rates for sanitation in urban Zimbabwe. However, there is mention of infrastructure breakdown which resulted in the cholera outbreak of 2008/9 that claimed approximately 4 600 lives of the 98 000 who fell ill in 60 of the country's 62 districts (World Health Organization, 2008). Causal factors mentioned were the absence of a refuse collection system and purified water, as well as the collapse of the sewage and public health systems; which all occurred progressively during the economic crisis. In support, the World Bank (2013) mention that only 24 percent of urban household sanitation systems were connected to sewer. As a result, the rest of the households use open defecation and often untreated sewers run into water sources. According to the report, water and sanitation systems collapsed because of insufficient treatment chemicals and chronic power shortages which disrupted the pumping and treating process of water.

Chapter 2

Hypothesis and Research Questions

The main hypothesis of this thesis is that Zimbabwe's hyperinflation had consequences for asset poverty, asset inequality and child malnutrition in Zimbabwe; the nature and extent of these impacts provides its subject matter. The empirical chapters, answer the following research questions:
Chapter 3: How did the hyperinflation of 2007 to 2008 affect asset poverty in Zimbabwe?
Chapter 4: How did the hyperinflation of 2007 to 2008 affect asset inequality in Zimbabwe?
Chapter 5: How did the hyperinflation of 2007 to 2008 affect child malnutrition in Zimbabwe?

The Zimbabwe Demographic and Health Surveys (ZDHS 1994, 1999 2005, 2010, 2015) provide much of the data used to address these questions. The first three datasets represent the pre-hyperinflation period, while the last two represent the post-hyperinflation period. Using this nationally representative data, an asset index is created as a proxy for household income. This asset index is the main thread that ties the empirical analyses together.

In the first empirical chapter, the asset index is used to assess changes that occurred in household poverty across the hyperinflation period. Following Sahn and Stifel (2000) and Booysen, Van Der Berg, Burger, Von Maltitz & Du Rand (2008), the 20^{th} and 40^{th} percentiles are used as relative poverty lines. Private asset ownership and public asset access rates before and after hyperinflation are compared. It is expected that asset poverty will increase as was the case with income poverty in other countries that experienced extreme inflation (Cardoso, 1992; Powers, 1995; Datt and Ravallion, 1997; Ravallion, 1998; Romer and Romer, 1998; Agénor, 1998; Easterly and Fischer, 2000; Braumann, 2004; Chaudhry and Chaudhry, 2008). Particular attention is given to urban households because the literature (Dessus, Herrera, & De Hoyos, 2008; Robilliard, Bourguignon, & Robinson, 2001; Suryahadi, Sumarto, & Suharso, 2000; Friedman and Levinsohn, 2002) shows that, during economic crises marked with high inflation, urban households are more negatively affected than their rural counterparts. This chapter contributes to the existing empirical literature by being the first to explore the hyperinflation-poverty link using Zimbabwe DHS data.

In the second empirical chapter, the asset index is used to assess the changes that occurred in asset inequality during hyperinflation. The Gini Coefficient and other measures of inequality are applied to the asset index and compared before and after hyperinflation. This study adds to others which give evidence that a positive correlation exists between inflation and household income inequality (Blinder and Esaki, 1978; Adelman and Fuwa, 1992; Cutler, Katz, Card, & Hall, 1991; Cardoso and Urani, 1995; Bulir, 2001; Fereirra and Litchfield, 2001;

Bittencourt, 2009). The results of this chapter are a key contribution to the literature on the link between hyperinflation and inequality because of the use of a non-monetary measure of inequality and the application to the African context.

In the last empirical chapter, the asset index along with inflation, is used among a number of proximate determinants of child malnutrition in Logistic regression analyses. The main objective is to assess the relationship between inflation and malnutrition. Malnutrition is measured by two indicators – stunting and wasting. Literature (Darton-Hill and Cogill, 2010; Paxson and Schady, 2005; Christian,2010; Kiguel and Liviatan, 1995; Waters, Saadah, & Pradhan, 2003; Block et al., 2004; Stillman and Thomas, 2004; McKenzie, 2006; West and Mehra, 2010; Pelletier, Frongillo, Schroeder, & Habicht, 1995; Black et al., 2008; Brinkman, De Pee, Sanogo, Subran, & Bloem, 2010) shows mixed results for this relationship, as it depends on other socioeconomic factors at individual, household and community level. Nonetheless, it is expected that child malnutrition would increase with inflation because of the prevailing conditions at the time. The aforementioned shortages in electricity, clean water, food and healthcare which were characteristic of the hyperinflation period, are probable contributors to a rise child malnutrition. In addition, the rates of malnutrition would most likely differ among children depending on access rates to various amenities. Hence the chapter ends with an assessment of malnutrition inequality showing the most affected segment of population. This chapter adds to the slim body of literature (Frankenberg, Beegle, Sikoki, & Thomas, 1999; Paxson and Schady, 2005; Waters et al., 2003; Masgrove, 1987; Abel-Smith, 1986) that shows a decline in health during economic crises that are characterized by high inflation. To date, there exists no literature on the link between hyperinflation and child malnutrition in Africa, but especially in Zimbabwe. As a result, this is a significant contribution to that research area.

The lessons of this thesis can be summarised in three key points[10]:

First, that unsustainable external borrowing, coupled with excessive money supply plus corruption, can plunge an economy into a hyperinflationary spiral that is hard to reverse. Zimbabwe's hyperinflation did not just happen; it was a consequence of deliberate actions taken by policy makers.

Second, the people who suffered most were those who had things that are intensely sought after in a modern economy: a decent wage earning job, a mortgage, a bank account, a pension scheme, and easy access to social infrastructure, such as municipal supplies of water and electricity.

[10] My thanks to an anonymous examiner for suggesting these three points.

Third, that Zimbabwean hyperinflation incentivized rural households to accumulate physical assets while forcing their urban counterparts to de-cumulate financial assets. Consequently, and to the surprise of the author, overall asset poverty in the country decreased when inflation was at its peak. This suggests that an anti- inflationary policy applied uniformly in urban and rural areas is unlikely to have the desired welfare effects.

In essence, the best way to protect the coveted urban life is to practice sound macroeconomic policies.

Chapter 3

Household poverty and hyperinflation in Zimbabwe

3.1 Introduction

This empirical study seeks to answer the question: How did household asset poverty change during the hyperinflation period in Zimbabwe? To answer the question, an objective analysis is conducted, and results are explained taking the Zimbabwean context into account. The analysis focusses on shifts in the incidence and severity of poverty between Zimbabwe's pre-hyperinflation and post-hyperinflation periods. As mentioned in the thesis introduction, hyperinflation in Zimbabwe destroyed many people's savings and left some absolutely impoverished. However, the impacts were not felt equally by all. As expected, those who had their savings denominated in Zimbabwe Dollars as cash or in banks and building societies effectively lost everything. Those who held equity quoted on the Zimbabwe Stock Exchange (ZSE) were somewhat better off; a study of share portfolio values in real terms shows that some value was kept; indeed pension/insurance companies like Old Mutual did well (Mpofu and Nyamadzawo, 2016). People holding land, developed property, livestock and real capital assets such as farm machinery or mining equipment merely lost the natural depreciation on them. There have been only two other studies (Larochelle, Alwang, & Taruvinga, 2014) that attempt to compare the impacts of the inflation on the real worth of households, measured by their asset holdings. What distinguishes this study, however, is the use of the ZDHS datasets. Since similar datasets are available for other countries, it becomes possible to compare the results with relatively similar sized economies. This is an issue of real moment, both politically and economically, and a gap that this paper attempts to fill.

The significance of a household's asset base for its well-being has been well-addressed in the global literature. According to Oliver and Shapiro (1990), financial and durable assets are the resources that enable households to move beyond basic needs and to achieve economic mobility. As examples they cite assets such as savings for college or retirement, investments, and real estate. These buffer a household against financial loss and are also a source of economic security and upward mobility. Caner and Wolff (2004) echo this sentiment, stating that assets provide liquidity in times of economic hardship, specifically citing owner-occupied housing as an important part of household wealth. In addition, Rothwell and Robson (2018) say that assets allow for consumption smoothing, increased social engagement and contribute towards social and economic mobility. Carter and Barrett (2006) also argue that the asset-

based approach to poverty analysis sheds light on the persistence of structural poverty in a society; an issue of significance in Zimbabwe.

A household's assets, being a store of wealth over time, provide a stable measure of household well-being. This is especially important in a country like Zimbabwe where the value of money is unstable. Over a 30-year period, the annual inflation rate increased from 15.5 percent in 1990, to 351,410 percent in 2008, declined to 3 percent by 2010 and in mid-2020 is again back above 800 percent (RBZ, 2014). During the hyperinflation, money ceased to be a store of value because it lost its purchasing power within minutes. As stated in the thesis introduction, at the peak of hyperinflation in 2008, prices were being changed hourly, and were doubling every day. Given that wages are the price for labour, they also fluctuated unpredictably, though not as frequently as inflation. The result is that household income and expenditure data over this period are generally unavailable, and where present, they are unreliable and unmeaningful. Financial assets such as pensions, which are beyond the scope of this study, are only addressed tangentially. Their values fluctuated sporadically and meaningful data on them are scarce.

Noting the clear and well-defined impacts of Zimbabwe's hyperinflation on cash, bonds, equities and other financial assets; this paper focusses on its implications for the stock of *durable* assets held by households. These include televisions, radios, refrigerators, vehicles, toilet facilities, water sources, electricity connections, and the construction material of the dwelling. These, and others like them, are used in the standard asset index literature (Sahn and Stifel, 1999; Filmer and Pritchett, 2001). A significant contribution made in this analysis will be the inclusion of assets that are more relevant to rural areas, such as land and livestock. As a robustness check, the analysis is done twice. First with just the 2005 and 2010 datasets that are closest in time to the hyperinflation period, then the analysis is repeated after adding data from 1994 to 2015. The first scenario is shown in the results section of the main paper, while the second has been placed in the appendix. In this study, the chosen assets are useful in revealing certain unexpected consequences of hyperinflation, one of which was enhanced accumulation of household assets as it incentivised them to transform any spare cash into consumer durables or home improvements.

The link between inflation and poverty has been explored in many contexts, but there is a growing consensus that consumption poverty increases with inflation (Cardoso, 1992; Powers, 1995; Datt and Ravallion, 1997; Ravallion, 1998; Romer and Romer, 1998; Agénor, 1998; Easterly and Fischer, 2000; Braumann, 2004; Chaudhry and Chaudhry, 2008). These concur that inflation erodes the purchasing power of money, reducing real incomes and resulting in a decrease in consumption and subsequent increase in consumption poverty. The main assumption is that indexation is imperfect, i.e. wages do not increase as fast as general prices. In Zimbabwe, public sector wages were being reviewed bi-annually, while private sector wages

were reviewed quarterly and at most monthly during hyperinflation, yet inflation was rising hourly (Makochekanwa, 2007). As a result of the lagging wage increments, households experienced loss in real income. In such a case of persistent inflation and loss in real income, the compositions of households' asset portfolios change; equity holdings and real cash balances decreasing while tangible assets increase (Cagan and Lipsey, 1978). Like American households in the 1970s, affluent Zimbabwean households initially flocked to the stock market (Njanike and Mudzura, 2009); however, at the peak of hyperinflation, the common stock failed to be an adequate means of hedging against inflation because financial assets depreciated in real terms (Ben, 2016). Hyperinflation theory (Kiguel, 1989) suggests that real money balances decline below steady state during times of hyperinflation. In essence, households respond to rising inflation and negative real interest rates, by spending while they can. On receiving income from labour or investments, they immediately move into real assets, such as the consumer durables used in this analysis. Taylor (1974) describes this hedging mechanism by acquiring assets as, a form of saving during times of uncertainty. Saving by purchasing durables can have profound implications for economic growth. As savings are withdrawn from bank accounts and channelled into durables, liquidity in the banking sector declines and corporate investment dwindles.

The implications of inflation for poverty have also been studied in Zimbabwe by Stoeffler, Alwang, Mills, & Taruvinga (2016), who measured the multidimensional poverty index[11] (MPI) from 2001 to 2008 and found a 22 percent increase in multidimensional poverty from 2001 to 2007, followed by a 16 percent decrease as the economy recovered post-2008. The MPI used by Stoeffler et al., (2016) included education, health, employment, while the assets that represented living standards were access to water and electricity, as well as sanitation type. Amongst rural households, land, livestock and farm equipment were also included. Using polychoric principal components analysis Larochelle et al., (2014) noted a similar pattern and found that poverty worsened during the hyperinflation. In their analysis, the value of durable goods formed part of total household consumption, which included food, education, health, along with other goods and services. What distinguishes this analysis from the aforementioned studies is that it identifies periods 'before', and 'after' hyperinflation, and captures the changes in poverty between them. Like Stoeffler et al., (2016) this study recognises rural households through the inclusion of assets such as livestock, but has opted to use Uncentered Principal Components Analysis to create the asset index.

[11] According to Alkire and Santos (2010, p7), "The MPI is an index of acute multidimensional poverty. It reflects deprivations in very rudimentary services and core human functionings…"

In this study, the asset index relies on data from the ZDHS waves of 2005 and 2010. Variables reflecting ownership of assets and access to services are used to generate an index, which is a proxy for asset wealth. Asset ownership rates and cumulative density functions are analysed in order to quantify the changes in asset wealth during the hyperinflation period. These changes in asset wealth give a direct indication of the shifts in asset poverty, which are further assessed using the conventional poverty measures.

Prices having been so unstable; a non-monetary measure was imperative; benchmarks expressed in cash terms would be meaningless in a hyperinflationary context such as Zimbabwe's. The asset index was the most suitable measure allowing for the comparison of household welfare over time. Sahn and Stifel (2003) explored the uses of alternative welfare measures using data from 10 relatively stable economies, with less extreme inflation than Zimbabwe's. Their findings suggested that asset indices are acceptable predictors of household economic welfare and can outperform conventional indicators such as income or expenditure, which may be subject to error due to recall bias and unreliable price deflators - which are especially likely if (as in Zimbabwe) there have been rapid and uneven changes in inflation.

The absence of any measure of debt or liquid assets from the index built for this study is conspicuous. Although authors such as Haveman and Wolff (2004) used them when examining asset poverty, both were wiped out, first by the hyperinflation and then by the replacement of the Zimbabwe Dollar. Durable assets and access to key public services remained the only viable measure of household welfare over time in Zimbabwe.

3.2 Review of related literature

According to Deaton (2003), "What happens to poverty depends on what happens to the distribution of income and consumption." Grootaert (1983) had suggested that, "Households can be ranked on the basis of their total expenditures (appropriately deflated), while income and assets are the key variables necessary to analyse the sources of varying levels of welfare." Both seem to suggest a logical division of the literature into two segments. The first consists of monetary measures such as income and consumption, while the second uses non-monetary measures of welfare such as assets.

In the first group which measures flows of welfare, money is the common denominator. Income, for example, includes salaries, wages, grants and any other proceeds from productive activities. Consumption measurements are based on household expenditure. They show the value of durable and perishable goods and services, consumed by a household in a given period of time, whether home produced or obtained from the formal or the informal sector. Due to

this level of inclusivity, consumption expenditure is the better measure in developing countries where many households produce their own food (Blundell and Preston, 1998; Cutler and Katz, 1992; Deaton, 2016; Meyer and Sullivan, 2003, 2004, 2008, 2011, 2013; and Poterba, 1989). Such food as is produced and consumed at home would be excluded from purchases made using income. However, once the quantity of home-produced food is known, its value at market prices can be estimated and added to income. Apart from inclusivity, measurement error is likely to be lower for consumption than for income which is more likely to be over- or under-reported.

While income and consumption are common measures of household welfare, they can be problematic in developing country contexts. First, developing countries are often characterised by high levels of unemployment. As a result, many households do not have consistent income. Second, where household earnings are generated in the informal sector (as is common in LDCs including Zimbabwe) the income is rarely regular and pay slips are not available for verification during data collection. Third, where households produce food for sale, the resulting income is seasonal. These three factors contribute to recall bias amongst respondents. Errors are prone to happen. Although income and consumption are the most commonly used measures, neither would have been a viable welfare measure during Zimbabwe's hyperinflation because the attendant price volatility would have made measuring the real values of either impossible.

Unfortunately, in Zimbabwe, both income and consumption were unreliable measures of household welfare during the hyperinflation period. Not only because of the aforementioned sources of measurement error, but also due to price distortions arising from the extreme inflation. The prices of goods and services were changing rapidly and unpredictably, making any form of standardization meaningless. Accordingly, in order to measure household welfare while avoiding price related complexities, uses an asset index. Asset indices falls in the broader class of welfare indices, which are used as proxy measures of household welfare in cases where income and consumption variables are either unreliable or unavailable (Bollen, Glanville, & Stecklov, 2002; Booysen et al., 2008; Filmer and Pritchett, 2001; Kolenikov and Angels, 2009; Larochelle et al, 2014; Montgomery, Gragnolati, Burke, & Paredes, 2000; Moser and Felton, 2007; Sahn and Stifel, 2000, 2003; Wall and Johnston, 2008).

According to O'Donnell et al., (2007) there are three main methods used when constructing welfare indexes; this study uses a variant of the third. Welfare indices can be constructed by predicting consumption, using arbitrary weights or using Principal Components Analysis (PCA).

When constructing a welfare index by predicting consumption, one dataset (typically from an earlier time period) will include a consumption variable, while the other does not. A regression is computed using the old consumption data and the coefficient estimates are used as weights for a welfare index in the more recent dataset. Such a welfare index would include indicators of welfare such as durable assets, as well as determinants of consumption such as education status (Coady, Grosh, & Hoddinott, 2004; Grosh and Baker, 1995).

In the case where a welfare index is computed using an arbitrary approach, this is done by adding up asset ownership variables and assigning equal weights (Montgomery et al., 2000; Morris, Carletto, Hoddinott, & Christiaensen, 2000).

To construct a welfare index using Factor and Principal Components Analyses, a weighted combination of assets is constructed, but this time, the weights are not arbitrary. Instead, they are assigned by statistical techniques applied to the particular dataset in use (Galbraith, Moustaki, Bartholomew, & Steele, 2002). Nonetheless, the choice of variables is arbitrary, and depends on the asset variables that are available in the dataset. The approach uses a combination of indicator variables to represent 'welfare', which is unobserved in the absence of consumption and income. Filmer and Scott (2008) show that Factor Analysis and Principal Components Analysis produce indices that are highly correlated with each other and that yield similar rankings for households. The index is a linear combination of asset variables; the model for it can be seen in equation (1) of the methodology section below.

The asset index is the first of many uncorrelated linear combinations of asset variables. Each combination produces weights that show variation in the data. The first linear combination, which gives the asset index, is called the principal component. The most appropriate PCA format will depend on the nature of the data. According to Adbi and Valentin (2007), when the asset variables are continuous, Principal Components Analysis (PCA) is the most suitable method. On the other hand, when the asset variables are ordinal, Multiple Correspondence Analysis (MCA) is preferred (Larochelle et al, 2014). When some of the asset variables are categorical in nature Kolenikov and Angles (2009) suggested polychoric PCA (p-PCA).

An alternative to the PCA indices is Factor Analysis (FA). The aforementioned linear combinations are much fewer when the FA method is used. As a result, the FA method yields a much smaller covariance matrix to influence the weights in the first combination (Sahn and Stifel, 2003).

There are shortcomings visible in the household welfare literature concerning Africa. One reason is the lack of reliable income and consumption data. The few authors who have written about household welfare in Africa have opted to use welfare indexes (Booysen et al., 2008; Rustein and Johnson (2004); Sahn and Stifel, 2003). Second, with the exception of Larochelle et al (2014), there is little on changes in household welfare in hyperinflationary environments despite the distortionary effects of hyperinflation on household welfare. Third, the welfare measures used have tended to be biased in favour of urban households, typically containing assets used in urban households. Even though 60 percent of Africa's population is rural (United Nations Population Division, 2018), the best that has been done to accommodate rural households has been to add variables for poor sanitation and basic water.

This study addresses the first and second shortcomings by analysing changes in household welfare in Zimbabwe; the only African country that has experienced hyperinflation. By using the specific years covered in the study, another coincidental contribution is that this is the first time that an asset index is created and used in an analysis for Zimbabwe using the 2005 and 2010 ZDHS datasets. The existing empirical studies have used Zimbabwe DHS data from 1988, 1994 and 1999 (Booysen et al., 2008; Sahn and Stifel., 2000). As a means of addressing the third shortcoming, this study uses Uncentered Principal Components Analysis (UCPA). According to Wittenberg and Leibbrandt (2017), this is the most suitable method for creating an asset index if the majority of households are rural. This is because all assets are assigned weights with positive values, even rural assets which are often deemed inferior and would be assigned negative values by the conventional welfare index methods listed above. To further represent rural households, land, livestock and cellular phones are included in the asset index. These assets are common in rural households which constitute 65 percent of the Zimbabwean population. In summary, this empirical study of the changes in household welfare and poverty during Zimbabwe's first hyperinflation makes these four contributions to existing literature.

3.3 Methodology

This study uses a technique of asset poverty measurement like that used by Sahn and Stifel (2000). The analysis uses ZDHS data from the years 2005 and 2010 i.e. just before and just after the hyperinflation. Because inflation was already very high in 2005, a robustness check is then performed by extending the pre- and post- inflation periods, using data over the 20-year period 1994 – 2015.

The method has four steps. First, an asset index is generated for each economic period. Second, the summary statistics for the asset index and asset variables, are compared between the two economic periods. Third, the cumulative density functions for the asset index in each

of the two periods are compared. Fourth, an analysis of asset poverty is performed by computing the poverty headcount and poverty gap indices (FGT 0 and 1[12]). The results for the two economic eras are then compared. All calculations are first conducted on a national level, and then after disaggregation between the rural and urban sectors.

Deriving the asset index

The asset index is a linear combination of the household assets listed in the data section. Indexation makes the asset and access variables comparable so that they can be combined to capture household wealth. Banerjee's (2010) technique of Uncentered Principal Components Analysis (UCPCA) is adopted to create the asset index. This varies slightly from the Principal Components Analysis (PCA) of Filmer and Pritchett (2001); it is more relevant to the Zimbabwean context, which is 65 percent rural, because it gives positive values to rural assets such as Blair[13] toilets. As Wittenburg and Leibbrandt (2017) explain, the difference is due to the standardization method. In an UCPCA index, unlike a standard PCA index, the asset variables are divided by the mean. In the case of binary variables that are used in the index, they are divided by the probability of owning the asset. This method places the entire index in the positive orthant, and there are no assets with negative coefficient values. This reflects an underlying assumption that all assets add value to a household, including those assets, typically found in rural areas, even though these may be perceived to be inferior to assets more prevalent in urban areas. For example, the Blair toilet, which is often seen to have less value than the flush toilet. While people are pleased to have one in the rural areas, it is frowned upon in urban areas; yet it is still better than having a conventional pit latrine or no toilet at all. With the UCPCA index, both flush and Blair toilets are given positive coefficient values. Another advantage of this index is that it can be used to measure inequality. Like conventional PCA, this method precludes the arbitrary application of weights as the resultant weights are based on the asset data. Imposing equal weights would conceal the actual value of the assets in relation to household wealth, which is the latent variable. The structural equation of the asset index is:

$$W_i = \omega_1 a_{i1} + \cdots + \omega_k a_{ik} \quad (1)$$

Here, W_i is the asset index for households i=1…N; the a_{ik}'s denotes the k=1…K assets and ω's represents weights[14]. The weights that emerged upon creating the wealth index with the ZDHS

[12] Foster, J. E., Greer, J., & Thorbecke, E. (1984) "A class of decomposable poverty indices."

[13] A Blair toilet is a ventilated cement lined improved pit toilet with a chimney and fly trap which connects the pit to outside air. See: http://www.csir.co.za/Built_environment/santechcentre/docs/Blair_info_sheet.pdf . Blair toilets are the common substitute for flush toilets among households in Zimbabwe, where piped water is rarely available. They are designed to prevent the contamination of ground water by human sewage while keeping house flies from leaving the latrine (Root, 2001).

[14] See Table A2.2 in the Appendix

data are shown in Table A1.1. These are coefficients showing the relationship between the respective asset and the latent variable – wealth. It would not be prudent to use asset prices as weights in an economy like Zimbabwe's, where market prices have been so badly distorted.

UCPCA is also used to derive weights for the construction of the asset index. The common factor which explains most of the variation in asset ownership is wealth (θ_i). The assets are related to wealth in a linear manner:

$$a_{ik} = \rho_k \theta_i + u_{ik} \quad (2)$$

The relationship between the asset and wealth component is computed as a correlation coefficient. Wealth and other common factors (latent variables) are derived from the pattern of correlation between the assets. The common factors, other than wealth, which also determine variation in the assets, are contained in the uniqueness element. The correlation matrix is derived from the original asset variables but once the assets are standardized, the result is a covariance matrix, the eigenvalues being used as the weights for the asset index in equation 1. The less common assets thus receive greater weights.

The following assumptions are made in the construction of the asset index:

A1 – Households are distributed independently and identically (iid) . (3)

A2 – Error zero mean: $\mathrm{E}(u_i|\theta_i) = 0$ (4)

A3 – Constant variance of error: $V(u_i) = Diag^{Kx1}\{\sigma_1^2, \dots, \sigma_k^2\}$ (5)

Once the asset index is created, the mean asset index, which represents average wealth, is then compared between the pre-hyperinflation and hyperinflation periods.

Poverty Profile

Next, the asset index is used to measure the poverty. Two relative poverty lines are used in the analysis. Following Filmer and Scott (2008), the 20th percentile of the asset index distribution is used as the lower poverty line, which is the mark of extreme poverty, in the pre-hyperinflation period. Then, following Sahn and Stifel (2000), the 40th percentile of the pre-hyperinflation asset index distribution is used as the upper poverty line. Based on these two poverty lines, the pre-hyperinflation and hyperinflation poverty headcounts and gaps are measured. It is worth emphasising that these poverty lines are based on the asset index distribution of the pre-hyperinflation (or base) period and they remain fixed for comparison with the asset index distribution of the post-hyperinflation period. These calculations are done at a national level then decomposed into two sub-pools, one for rural and the other for urban households. Poverty is measured for the combined dataset as well as for each wave and separately for rural and urban households. The results will be valid, even though this is not a

panel study, because the repeated cross-sections that are used in this analysis are nationally representative.

The Foster-Greer-Thorbecke (1984) poverty measures are represented by the following equation:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{N}(\frac{G_i}{z})\hat{}\alpha \quad (6)$$

The poverty headcount index P_0 which is calculated when $\alpha = 0$ is a measure of the proportion of a population that is poor.

$$P_0 = \frac{1}{N}\sum_{i=1}^{N} I\,(W_i < z) \quad (7)$$

If a household's asset index score W_i is below the poverty line z, then the indicator function $I(.)$ will be equal to 1, showing that the household is poor.

Apart from the headcount index P_0 , the poverty gap G_i is also computed.

$$G_i = (z - y_i)I(y_i < z) \quad (8)$$

The poverty gap applies to poor households. It is the difference between the poverty line and a household's actual asset index score. Each household is assigned a poverty gap score, with non-poor households getting $G_i = 0$, by virtue of the indicator function, as they are situated above the poverty line z . The average of the poverty gap scores in the poverty gap index P_1:

$$P_1 = \frac{1}{N}\sum_{i=1}^{N}(\frac{G_i}{z}) \quad (9)$$

The next step is to apply standard tests of wealth dominance in order to compare the asset wealth index distributions over time and assess the direction and magnitude of the change in poverty between the pre-hyperinflation and hyperinflation periods.

3.4 Data

The ZDHS (1994, 1999, 2005, 2010, 2015) datasets used to quantify the impact of hyperinflation on household welfare and poverty, are compiled at regular intervals by the Zimbabwe Central Statistics Office (ZimSTAT), with sponsorship from the United States Agency for International Development (USAID). A major advantage of the ZDHS data is that they are standardised and can therefore be used in an intertemporal analysis and results can be compared for different time periods. These datasets are used in all empirical chapters of this thesis.

A preliminary assessment of the asset ownership and poverty rates was conducted using a pooled cross section of nationally representative ZDHS datasets from 2005 to 2010. These datasets represented 19,041 households; 9,285 surveyed in 2005 and 9,756 in 2010. They represent a population size of 12.08 million and 12.7 million in 2005 and 2010 (United Nations,

Department of Economic and Social Affairs, Population Division, 2019). Both waves of data were nationally representative, in the respective years. The unit of analysis for this study is the household. In both datasets, the majority of households are rural. Rural areas provided 67.09 percent of the households in the 2005 dataset, and 65.92 percent of households in the 2010 dataset. The standard ZDHS survey consists of the household, female and male adult members, children and service availability questionnaires. These cover a wide array of topics which include demography, fertility, childhood mortality, maternal health, nutrition, AIDS and STDs. In this chapter and the next, only data from the household questionnaire are used.

The household samples are stratified over two stages. The first stage is the stratification between urban and rural, with equal probability. The second stage is stratification by land use. The four land use categories are communal land, large scale farming, small-scale farming, and resettlement areas. The primary sampling unit is the enumeration area (EA). The 395 EAs that were sampled throughout the years of analysis were determined in the 1992 population census. The main limitation is that the data does not include income or expenditure information, which would have been ideal benchmarks for an asset index. However, this USAID derived data is believed to be robust, having already been used in academic studies (Sahn and Stifel,2000; Alkire and Santos, 2010).

The ZDHS datasets provide high quality detailed information about household characteristics. The data include the assets owned by each household and the public services available to it. The asset and access variables which are common among all five datasets are used in constructing the asset index. Following Filmer and Pritchett (2001), the asset variables are split into five categories. The first group consists of binary variables for the ownership of movable durable assets such as radio, television, refrigerator, bicycle, motorized vehicle, livestock and cellular phones. The second category has an energy binary variable for whether or not a household uses electricity when cooking. Here, 1= improved energy (electricity) and 0= Paraffin, coal, charcoal, wood or straw. Third is the dwelling quality category which has binary variables for floor quality. Where 1= improved floor (vinyl strips, ceramic tiles, cement or carpet) and 0= earth or sand floors. Fourth is the water and sanitation category with the binary variables for access to water and toilet type. For the improved water variable, 1= piped or borehole water, while 0= well, spring, rain, tank or surface water. For the improved toilet variable, 1= flush or Blair toilet and 0= pit latrine or no toilet. The final category is the binary variable for the ownership of agricultural land.

The poverty analysis uses two main asset categories, public and private[15]. The main reason for splitting the assets into these two categories is that ownership of the private asset does not automatically imply full utility because, in some cases, there may be limited access to the requisite public assets. For instance, while a household may have flush toilet, deriving full utility from it requires reliable access to water (which tended to fail in many areas of Zimbabwe during the country's economic collapse).

3.5 Descriptive overview

In this section, changes in the rates of ownership of assets as well as use of key public services during the hyperinflation period are computed. Percentage as well as percentage point changes are included in the tables to give a clear picture of the magnitude of shifts in asset ownership. Typically, percentage changes would be large when changes occur off a low base i.e. where very few households had use of a particular asset in the initial period. The t-statistics are included to show whether the change in ownership between the two periods was significant (a t-statistic of 1.96 or more indicating that the change was statistically significant at 95% confidence interval). Information on the changes that occurred in terms of ownership of private assets is shown is shown in tables 3 and 4. Table 3 shows the summary statistics for rural households, while Table 4 does the same for urban households.

The mean values for the asset index show that the average rural household had less asset wealth than the average urban household. This was true in 2005 before hyperinflation and in 2010 after hyperinflation. However, between the two periods, the direction of change was different for the two sectors. While asset wealth significantly increased for rural households during the hyperinflation period, their urban counterparts experienced a decrease.

Two reasons seem likely. First, remittances which were sent in cash and kind from household members abroad during the economic crisis. As indicated by Cross (pers. com. 2020), the majority of remittances went to rural households. Second, proceeds from the sale and barter of farm produce, particularly grains and vegetables, continued to accrue to rural households. Both factors would have contributed to the increase in asset wealth for rural households. On the other hand, there were two main reasons for the decrease in asset wealth for urban households. First, the selling of private assets in order to buy food and other basic necessities. Second, the deterioration in the provision of public services such as water and electricity in many urban centres. This will become more evident in the data below.

[15] The public assets group consists of improved energy used for cooking, which in this case is electricity and improved drinking water sources, in particular piped and borehole water. The private assets are radio, television, refrigerator, bicycle, vehicle, land, livestock, cellular phones, improved floor and improved toilet.

As seen in the results section, during hyperinflation, private assets increased for rural households much more than they did for urban households. This is true of televisions, refrigerators, motorized vehicles, cellular phones, toilet facilities and floor materials. Among the three private asset classes that decreased in rural households, only one was statistically significant – land. The decrease in land ownership may have been due to the land reform program, which mainly affected commercial farms and the households supported by them. As a result, some rural households, especially those in commercial farming areas were dispossessed of their land, while urban households given land migrated back to rural areas did not get title (Rugube and Chambati, 2001). Though many more households had land, few had legal ownership of it. While there was a notable increase in the ownership of selected private assets among rural households, these households were starting from a very low base and in most cases, the new ownership rates after hyperinflation were still lower than those in the urban areas. This is especially true for the electrically powered assets such as refrigerators and televisions.

Table 3: Private asset ownership summary statistics, rural households

Rural households	Pre-Hyperinflation	Post-Hyperinflation	Percentage Point Change	t-statistic
		Mean		
Asset Index	1.29	1.69	0.39	10.43
Radio	0.33	0.32	-0.01	1.59
Television	0.10	0.16	0.05	9.05
Refrigerator	0.03	0.04	0.01	2.33
Bicycle	0.24	0.24	-0.00	0.10
Vehicle	0.02	0.03	0.01	2.19
Livestock	0.80	0.81	0.01	0.87
Land	0.88	0.79	-0.09	14.25
Cellphone	0.03	0.46	0.43	64.88
Improved Toilet	0.03	0.04	0.01	3.31
Improved Floor	0.50	0.56	0.05	5.96

Note: Sample size (N)= 19,041 households; 9,285 surveyed in 2005 and 9,756 in 2010.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

An interesting point of similarity between urban and rural households is the significantly large increase in the ownership of cellular phones[16]. This would partly explain why the ownership of radios decreased; cellular phones have become good radio substitutes. Figure A1 in the

[16] Cellular telephones were introduced to Zimbabwe in 1997 and demand grew when 3G technology was introduced. This coincided with the era of high inflation. Econet Wireless (https://www.econet.co.zw/about-us/history), which is the largest provider, indicates that its subscription grew from 140,000 in 2003 to 640,000 in 2008, and then to 8.02 million in 2011, up to 11.4 million in 2018. The rapid expansion came after inflation and it confirms the increase seen in tables 3 and 4.

appendix shows the growth rate in cellular phone subscriptions in Zimbabwe over during this time. As the public and household telephone systems stopped working, cellular phone usage gained traction in Zimbabwe. With the arrival of 3G systems, the cellular phones came with music and media streaming functions which became substitutes for conventional radios. As many working adults in the formal sector became unemployed and resorted to informal sector activities, cellular phones became a necessary means to link themselves to suppliers and to customers. This theme is further developed by Kanyenze, Kondo, Chitambara, & Martens, (2011) who noted that the informal economy was further stimulated during the hyperinflation period as wages lost value and workers had to supplement their incomes. This was especially the case in the public sector, mainly in hospitals and schools. It is these teachers and doctors, in both rural and urban sectors, who were using the cellular phones for business transactions.

The increased ownership of electrical assets in rural areas may be explained by the increase in use of electricity shown in Table 5. While there were new connections in rural growth points, electricity delivery was unreliable. It seems likely, therefore, that the increase is largely due to remittances. This increase is most likely due to remittances from household members who remitted money for solar installation. While there is no data for these variables in 2005, the 2010 ZDHS dataset shows that 24.6 and 13.82 percent of rural households were using solar and generator energy, respectively. Some of these solar home systems were installed by families using their own incomes, but approximately 85,000 of these had been installed by the government between 1993 and 1998 (Mapako and Afrane-Okese, 2002).

There was increased connection to grid electricity due to the implementation of the Rural Electrification Fund Act of 2001 which had the objective of making electricity accessible to all rural households (Munjeri, 2002). Spearheaded by the Rural Electrification Agency, the goal was to connect 9,906 rural institutions to the national electric grid between 2002 and 2005. Indeed, under this program, rural electrification increased as Dube (2003) reports that on a monthly basis, 100 rural business and government centres (known as growth points) were being electrified. As of June 2005, 3,992 rural institutions had been connected to the electric grid; among these were 901 growth points, 944 primary schools, 593 irrigation systems and other institutions (Mangwengwende, 2005). Mapako and Prasad (2007) in a more focused study of the effect of the rural electrification program on growth points reveal that they rural areas benefited by connecting to electricity. For instance, they show that only 2.5 percent of businesses were using electricity before the program, and this proportion increased to 30 percent after the program. Naturally this would imply that neighbouring households would also benefit. In their sample, the use of refrigerators increased from 2.5 to 12 percent and that of stoves increased from 0 to 2 percent. This confirms the increase in the use of electricity.

In this particular analysis, rural households are seen to have acquired 52.27 percent more televisions – coming off the very low base of 10 percent ownership, while urban households experienced a much lower increase of 7.42 percent – though the majority already owned televisions. While the proportion of rural households owning refrigerators increased by 25.13 percent, that of urban households decreased by 3.38 percent. Ownership of bicycles decreased by 0.32 among rural households, but fell even faster, by 30.21 percent, among urban households. As the ownership of motorized vehicles (cars and trucks) increased by 27.30 percent for rural households, urban households experienced a 0.18 percent decrease.

Urban households lost many of their private assets - those easiest assets to sell in order to compensate for lost earnings. As indicated in the ZimVAC (2009) report, urban households faced serious financial challenges in purchasing basic household necessities. Urban families that had a surplus needed to safeguard it against inflation. Another reason for the increase in assets in rural areas is that some urban families invested in improving their rural homes as a way of hedging against inflation. Almost all private assets seemed to have done better in rural areas than urban ones.

Regardless of these declines in asset ownership, there were four assets whose ownership increased for urban households. These were televisions, cellular phones, livestock and land. The increase in televisions would most likely be attributable to remittances, especially in high density areas, where many households did not have televisions previously. Buying televisions was also a way of storing the value of extra cash holdings in households. Larochelle, et al., (2014) suggest that the increased holdings of land and livestock were mainly due to the land reform program. The households that gained from this program, got land and the animals that were on it. These households were among the 91,000 families that the government intended to resettle on 5 million hectares of land. However, in actuality, Dore (2009) shows that 145,775 households were settled on 2,288 A1 farms as peasant farmers. These farms covered 4,137,085 hectares of arable land. Some of the urban households that gained ownership of land became commercial farmers, under the A2 scheme. A total of 16, 386 households were given these A2 farms, covering up to 2,681,642 hectares of land. A majority of the new land users were urban households. This reflects the reality of dual residence that is typical of many Zimbabwean households that live in town and own rural assets.

Apart from gains in the agricultural sector, in terms of land and the livestock on it, urban households experienced loss in asset wealth. Urban households fared worse than rural households in this regard. This was not only the case for portable private assets but even in terms of sanitation and dwelling quality. Urban households also experienced a decrease in usage of public assets. As seen in Table 5 below, there was a significant decrease in the proportion of households that used improved energy (electricity) to cook. As the electrical

infrastructure collapsed and power shortages ensued, urban households resorted to cooking with wood and paraffin. The same was true with water as urban households resorted to borehole or well water, in the absence of reliable piped water. These results correspond with the ZimVAC (2009) report that the water system in urban areas collapsed during the hyperinflation period. Boreholes and wells were sunk as substitutes for piped water that was no longer being supplied by municipalities. This was necessitated by the deteriorating macroeconomic situation and the foreign exchange shortage which led to shortages of water treatment chemicals and the neglect of water treatment plants[17].

Table 4: Private asset ownership summary statistics, urban households

Urban Households	Pre-Hyperinflation	Post-Hyperinflation	Percentage Point Change	t-statistic
		Mean		
Asset Index	5.96	5.94	-0.02	0.23
Radio	0.78	0.50	-0.28	24.54
Television	0.71	0.76	0.05	4.73
Refrigerator	0.49	0.47	-0.02	1.33
Bicycle	0.29	0.20	-0.09	8.17
Vehicle	0.15	0.15	-0.00	0.03
Livestock	0.22	0.30	0.08	7.40
Land	0.26	0.28	0.03	2.32
Cellphone	0.35	0.90	0.55	55.83
Improved Toilet	0.94	0.90	-0.04	5.87
Improved Floor	0.99	0.98	-0.02	5.99

Note: Sample size (N)= 19,041 households; 9,285 surveyed in 2005 and 9,756 in 2010.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

Table 5: Public asset usage summary statistics, urban households

Urban Households	Pre-hyperinflation	Post-hyperinflation	Percentage point change	t-statistic
		Mean		
Improved Energy	0.89	0.77	-0.12	11.87
Improved Water	0.98	0.93	-0.04	8.58

Note: Sample size (N)= 19,041 households; 9,285 surveyed in 2005 and 9,756 in 2010.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

Table 6 below shows that prior to hyperinflation, very few rural households had used piped water; those who had typically being situated on irrigation schemes with public taps on their premises. These also became dysfunctional after the land reform program which affected the

[17] See http://mg.co.za/article/2004-09-10-sewage-seeps-into-harare-water-supply

maintenance of irrigation systems. As a result, rural households that previously used improved water sources were left with no choice but to use well and surface water.

On the other hand, there was a one percentage point increase in the use of electricity in rural areas. Because of the low base, this translates to a 25 percent increase in the proportion of households that used electricity in rural areas across the hyperinflation years. This finding is like other studies (Larochelle et al, 2014; Stoeffler et al., 2016).

Table 6: Public asset usage summary statistics, rural households

Rural Households	Pre-hyperinflation	Pre-hyperinflation	Percentage point change	t-statistic
	Mean			
Improved Energy	0.04	0.05	0.01	4.12
Improved Water	0.51	0.49	-0.02	2.33

Note: Sample size (N)= 19,041 households; 9,285 surveyed in 2005 and 9,756 in 2010.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

The limited use of piped water that is seen in tables 4 and 5 resulted in a decline in the quality of sanitation facilities nationwide. It is evident that sanitation facilities were negatively affected by local government's poor delivery of piped and communal tap water. The toilet types represent the quality of sanitation available for use in a household. Households with pit latrines and no toilet facilities were assigned a zero in the Improved toilet variable. While those with flush and Blair toilets were assigned a value of one. Table 2 shows that though there was a 34.99 percent increase in the use of improved toilets among rural households, it was just a small 1 percentage point increase from 3 to 4 percent. On the other hand, Table 3 shows that there was a 4.16 percent decrease among urban households using improved toilet facilities. The direct implication is that over 95 percent of rural households continued to use pit latrines and the bush, while more urban households fell into this category of poor toilet facilities during the hyperinflation period. Overall, the use of inferior toilet facilities increased more among urban households. This finding corresponds with the World Bank (2013) statistics, showing that 76 percent of urban households were not connected to the sewer system by the time hyperinflation ended. This sanitation problem was largely a consequence of the decline in piped water provision in the urban areas during the hyperinflation period. While the urban squatter settlements might be contributing to this increased number of poor toilet facilities, it would not have been significant because this analysis covers the period soon after urban squatters had been cleared during the 'Operation Murambatsvina[18]' campaign (Potts, 2006). In general, the theme of worsening asset ownership levels in urban areas continues across the entire asset register.

[18] The expulsion from cities of informal traders and households dwelling in squatter camps and illegal shelters.

3.6 Poverty changes during hyperinflation

As mentioned earlier, an asset index can be used to indicate poverty. Following Easterly and Fisher (2000), poverty is measured at given relative poverty lines. To show the impact that hyperinflation had on household poverty levels, a comparison is made between the pre-hyperinflation and post-hyperinflation periods. Table 6, shows changes in the incidence of poverty. The asset index scores at the 20^{th} and 40^{th} percentile marks of the 2005 datasets are used as the poverty lines in this analysis. In so doing, it is possible to compare the two datasets objectively. The 20^{th} percentile is the lower poverty line which shows the households that are extremely poor, while the 40^{th} percentile is the upper poverty line, demarcating the households that are poor from the rest. These poverty lines are applied to the asset index that was created specifically in this study which includes the assets that are listed in tables 2 to 5 only. Also, as explained in the methodology section, P_0 is the poverty headcount index which shows the fraction of the sample that is poor. On the other hand, P_1 is the poverty gap index which shows the average amount of asset wealth needed for the poor households to reach the upper poverty line and cease to be technically poor.

On a national level, before hyperinflation, 18 percent of the households were extremely poor, with asset index scores below the lower poverty line. At the same time, 46 percent of Zimbabwean households were below the upper poverty line. The analysis yielded unexpected results: the proportions of households below the poverty lines did not rise but fell markedly by the end of the inflation. They decreased by 27 percent during the hyperinflation period. One reason for this is the rural/urban divide and the very different impacts of the inflation in the countryside. Approximately 98 percent of Zimbabwe's poorest 40 percent of households live in rural Zimbabwe (DHS, 1994, 1999, 2005, 2010, 2015). The increase in asset holdings by rural households therefore translates immediately into decreased poverty at a national level.

Despite these changes, the incidence of poverty remains high amongst rural households. While there was a 31 percent decrease in extreme poverty among rural households, the headcount rate of 26 percent remains high and statistically significant. When using the upper poverty line, pre-hyperinflation 69 percent of the rural households lacked private assets and public services. Post-hyperinflation the poverty rate using the upper poverty line decreased to 47 percent of households, while the extreme rural poverty headcount fell to 18 percent. Even though poverty declined, it was still high among rural households and poverty reduction efforts, particularly the provision of public assets, need to target rural households.

Prior to the inflation, poverty ranges had shown little change. Booysen et al., (2008) who measured poverty using the ZDHS datasets of 1988, 1994 and 1999, found that 37.1 percent of rural households and 0.4 percent for urban households were asset poor. Their variables

were slightly different, and the index formation method was the Multiple Correspondence Analysis, but they concurred with this analysis that water and sanitation standards had declined in Zimbabwe. These small changes are not surprising as asset poverty is likely to change far less than consumption/income poverty due to frictions associated with accumulating and decumulating assets.

Using the lower poverty line, this study shows that the poverty rate in urban areas was less than 5 percent across the hyperinflation years. However, poverty increased by 50.78 percent, which was statistically significant. Yet another statistically significant change was the 87.24 percent increase in urban poverty, using the upper poverty line. Such magnitudes of increase are extreme, yet not surprising in the hyperinflationary environment where annual inflation reached 231 million percent in July 2008.

As a robustness check, these results are compared with the changes in the already existing DHS wealth index which Rustein and Johnson (2004) constructed using a Principle Components Analysis with similar consumer durables (The outcome is the same whether using the 20th or the 40th percentile as the poverty line). For the DHS wealth index, when using the lower poverty line, results show that during hyperinflation national and rural poverty decreased by 0.82 and 2.35 percent respectively, while urban poverty increased by 2.39 percent. The result of decreased rural poverty and increased urban poverty is the same with both indices. It is evident that these are small changes, which is reasonable since the measure is based on illiquid durable assets. In this period little was added, but similarly, little was lost. It was liquid assets and cash denominated assets that were most often wiped out by the hyperinflation.

Table 7: Shifts in poverty during the hyperinflation period – Lower Poverty Line Estimates

Poverty Line:	20th Percentile in 2005			
National	**2005**	**2010**	**Change (%)**	**Percentage point change**
p0	0.1767 (0.00)	0.1289 (0.00)	-27.05	-0.05
p1	0.0827 (0.00)	0.0659 (0.00)	-20.28	-0.01
Rural	**2005**	**2010**	**Change (%)**	**Percentage point change**
p0	0.2584 (0.01)	0.1781 (0.01)	-31.08	-0.08
p1	0.1195 (0.00)	0.0874 (0.00)	-26.87	-0.03
Urban	**2005**	**2010**	**Change (%)**	**Percentage point change**
p0	0.0214 (0.00)	0.0322 (0.00)	50.78	0.01
p1	0.0129 (0.00)	0.0239 (0.00)	84.67	0.01

Notes: P-values in parentheses.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

Table 8: Shifts in poverty during the hyperinflation period – Upper Poverty Line Estimates

Poverty Line:	40th Percentile in 2005			
National	2005	2010	Change (%)	Percentage point change
p0	0.4648 (0.01)	0.3372 (0.01)	-27.47	-0.12
p1	0.2342 (0.00)	0.1679 (0.00)	-28.30	-0.06
Rural	2005	2010	Change (%)	Percentage point change
p0	0.6904 (0.01)	0.4743 (0.01)	-31.30	-0.22
p1	0.3465 (0.00)	0.2356 (0.00)	-32.01	-0.11
Urban	2005	2010	Change (%)	Percentage point change
p0	0.0361 (0.00)	0.0677 (0.01)	87.24	0.03
p1	0.0208 (0.00)	0.0350 (0.00)	68.22	0.01

Notes: P-values in parentheses.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

In addition to changes in the poverty headcount levels, the changes in the depth of poverty are also worth noting. Using the absence of illiquid assets as an indicator of poverty, tables 7 and 8 above also show the changes in the poverty gap. Between the pre-hyperinflation and post-hyperinflation periods there was a decrease in the severity of poverty at a national level. The extreme poverty gap decreased by 1 percentage point and when using the upper poverty line, the poverty gap decreased by 6 percentage points. Rural households also experienced a decline in the severity of poverty between the pre and post hyperinflation periods. Using the 20^{th} and the 40^{th} percentile poverty lines, the rural poverty gap decreased by 3 and 11 percentage points, respectively. Yet the opposite was true for the poor in urban areas of Zimbabwe, who fell much further below the poverty lines. The severity of poverty increased by 1 percentage point for the bottom 2 quintiles. This means that households that were on the poverty line were found 68% below it, post hyperinflation.

The commercial farmers, large scale and small, suffered from price controls on the farm produce which they sold to milling companies. They were paid less than market value and, as a result of the hyperinflation, the earnings they received were unable to cover the cost of seed for the following season. As a coping mechanism, saved seed, despite the risk of yield depression, replaced purchased hybrid seed. Farmers would store some seed from their harvest and sell the rest of the surplus (Leiman and Behar, 2011). The proceeds were then converted into durable assets in order to store value. Apart from the typical consumer durables

such as radios, the rural households bought items to develop the home. Hence, we see an increase in boreholes and improved toilet systems.

These findings resonate with Brimmer (1971) who found that rural households in the United States of America in a milder inflationary environment, during the Vietnam war, experienced significant outmigration. As a result, the households that remained in the rural farming communities enjoyed more income, as food remained a major component of household budgets across the country. In Zimbabwe too there was extensive outmigration during the economic crisis. According to UNICEF (2013), the crude net out-migration from Zimbabwe between 2005 and 2010 was -12.41 percent. On the other hand, over the same 5-year period, the population grew by 5.13 percent. People were leaving the country at a higher rate than they were being replaced. The estimated number of emigrants between 1999 and 2010 was 4 million (UNICEF, 2013). The exact number that left the rural areas is difficult to quantify as many entered neighbouring countries illegally. In addition, ZimVAC (2007) shows that a substantial amount of internal return-migration occurred as urban households, who constituted 37 percent of internal migrants, moved back to rural areas in search of farming land. These households transferred many of their private assets from the urban to the rural setting. They are also likely to have purchased more assets using the proceeds of their agricultural output. This return migration may explain the increased number of pit toilets in use by rural households; these are likely to have been dug by the returnees as they settled into rural areas. The use of poor toilet facilities was a small sacrifice because the flush toilets in the urban areas were no longer working. This discomfort was outweighed by the ability to own and use land for crops and livestock, both for subsistence and for sale.

Remittances from international emigrants would also have contributed to the accumulation of assets. Unfortunately, there is no accurate record of the remittances that flowed into Zimbabwe over the years. One reason is that the Zimbabwean diaspora is suspicious of the government and of official channels of remitting money. Also, the official rate of exchange was not nearly as good as the parallel market rate. As a result, instead of sending money through commercial banks and the RBZ, migrants send money and goods back home through informal channels including returning relatives and friends, or unofficial money carriers on busses and aeroplanes (Thebe, 2011). Nonetheless, ZimSTAT (2012) estimates that remittances contributed 5.3 percent to total annual household income. The value of remittances recorded officially was US$319 million per year. ZimSTAT (2012) suggested that in 2012 the rural areas were receiving average annual cash transfers of US$454 per household from relatives who had migrated to urban areas within Zimbabwe or those who had gone abroad.

In the urban areas, unemployment levels increased significantly as the formal sector contracted during the hyperinflation period. All sectors in the formal economy suffered negative growth and rising unemployment during the inflationary years. In addition to hyperinflation, which eroded the value of incomes and demotivated workers, the failure of property rights during the haphazard land reform program had a significantly negative effect on the agricultural and mining sectors which were inextricably linked to urban commerce and industry. Unemployment rose further with the closure of local businesses which had been net creditors and whose credit book lost value with the rising prices. Household income was therefore affected by both hyperinflation and unemployment. The resulting tendency to dis-saving meant that, private asset ownership and usage decreased among urban households. These economic declines, combined with accelerating inflation, meant that civic rates and taxes lagged behind prices, and reduced the real incomes of municipalities. These fiscal challenges, and the outmigration of skilled labour, accelerated the decline in infrastructure which negatively affected the delivery of public services such as water and electricity to urban households.

3.7 Conclusion

The objective of this chapter was to analyse the changes in household welfare and poverty during Zimbabwe's hyperinflation period which began in March 2007 and ended in December of 2008. The analysis was conducted using data from the Zimbabwe Demographic and Health Surveys. In particular, the 2005 dataset is used to represent the pre-hyperinflation period, while the 2010 dataset is used to represent the post-hyperinflation period. The analysis shows that, despite the collapse of the economy, the currency and of formal employment, there was an increase in households' non-financial assets. Since the bulk of the poor had few savings in the form of cash and other financial assets, and since most of them resided in rural areas, this meant that the overall wealth of many poor households rose, and asset poverty decreased.

Looking at specific assets, in the introduction to this thesis, it was made clear that cash savings were destroyed during the hyperinflation period, and money lost its function as a store of value. The result was that households which found themselves with cash immediately bought their basic necessities and converted the rest to assets, in particular consumer durables, such as cellular phones, televisions and refrigerators. The results reveal this phenomenon of increased asset holdings in both the descriptive statistics as well as the poverty analysis. It is noteworthy that the increase in asset holdings was greater in magnitude and significance among rural households. Rural households most likely had more assets because they earned more cash from selling the food that they produced on their land. On the contrary, urban households sold their assets in order to buy food and basic necessities. In some cases, there

was barter trade as assets were traded for food, again shifting asset wealth from urban to rural households. These results are not surprising as similar trends of increased urban poverty due to hyperinflation had been noted in Indonesia and China (Aaberge and Zhu, 2001; Frankenberg et al., 1999; Waters et al., 2003)

Public assets were also affected during the hyperinflation period. In rural areas where there was little infrastructure for water and electricity, there was a minimal upward change during the hyperinflation period. However, in urban areas water, sanitation and electricity infrastructure collapsed during this time. As national income declined, the maintenance of systems suffered to the degree that many urban households lost their ability to use electricity for cooking along with piped water for flushing toilets and other household activities.

Due to this dynamic nature of the majority of households, who are located in rural areas, gaining durable assets through barter trade and remittances; while on the other hand, the urban households lost financial and durable assets, as well as utility of public services, overall asset poverty decreased.

Chapter 4

Household Inequality and Hyperinflation in Zimbabwe

4.1 Introduction

The previous chapter showed that Zimbabwe's hyperinflation affected urban and rural households very differently; the asset holdings of urban households tended to decline, while those of rural households tended to rise. The reasons for these changes will now be explored in greater detail. It is important to stress, however, that the changes may not have followed from the hyperinflation entirely; its ending, and the dollarization that ended it, may have also had effects. This issue was identified by Bulir (2001) who claims that, "The positive impact of price stability on income distribution is nonlinear – the reduction in inflation from hyperinflation levels significantly lowers income inequality, while further reduction toward a very low level of inflation seems to bring about negligible gains in the Gini coefficient." The same two datasets from the previous chapter are used in this analysis, 2005 representing the pre-hyperinflation period and 2010 representing the post-hyperinflation period. *A priori*, a decrease in inequality is expected as hyperinflation had ended by 2010.

In addition to assessing the direction of change in the asset wealth distribution, which represents household welfare, this chapter has a second objective, to determine the factors that contributed to inequality during the hyperinflation. This will be done using an inequality decomposition analysis which is based on Shorrocks's (1982) model. In so doing this study contributes to the body of empirical literature on decompositions by using a non-money metric welfare measure, applying the methodology to ZDHS data and doing so in a hyperinflationary developing country context.

This study uses the asset holdings of a household, and its usage of public services, as a proxy for its welfare, and investigates the changes in these assets and services over the hyperinflation period. At this juncture, it is important to stress that the asset index is a *proxy* for household *welfare*, it is not a *measure of wealth*. As shown in the previous chapter, the ownership of durable assets increased as inflation prompted households to convert their cash (or liquid) savings into consumer durables. Thus, one reason for increased number of improved floors was that households were incentivised to store their wealth in building materials. Indeed, as outlined in the thesis introduction, there was a surge in construction of homes during Zimbabwe's hyperinflation, as this was a means of hedging against inflation.

Of course, not everyone was able to save (by purchasing durable assets) and each household's capacity to do so affected its ranking in the welfare distribution. Inflation's effect on inequality matters.

Previous studies have tended to analyse inequalities across household incomes. However, as explained in the previous chapter, the asset index is the welfare indicator of choice in this study because shifts in households' real incomes during the period of hyperinflation were captured as changes in their holdings of durable assets. At a time when the value of money fluctuated rapidly and many households earned little or no income, asset holdings became a more reliable indicator of household welfare.

Historically Zimbabwe has suffered chronic inequality that seemed to be growing as the economy imploded and inflation rose. ZimSTAT (2003)[19], used per capita income as a measure of living standards and found Gini Coefficients of 0.59 and 0.64 in 1995 and 2003 respectively. They found a difference in inequality after comparing rural and urban households as well as the gender of the main income earner in a household. Geographic region was also seen to affect inequality in Zimbabwe as there existed a gap especially amongst the urban elite and the other 65 percent of the nation's citizens residing in the rural areas. There is now little commerce outside the two central business districts of Harare and Bulawayo, yet these cities house only 20 percent of the population. An analysis of the 2003 Poverty Assessment Study Survey shows[20] higher inequality levels for households in rural provinces than their urban counterparts. For example, while inequality is 0.54 in Bulawayo, which consists of urban households, the Gini coefficient for Masvingo, a rural province, is 0.62. The inequality levels *within* rural provinces tend to be higher than the inequality levels *between* districts because of the diversity of professions. These areas often house commercial farmers, a few professionals who service the community, such as nurses and teachers, while most of the population consists of casual agricultural workers. As a result, the earnings gap is much wider. The inequality gap by location is more evident when comparing poverty levels. The poverty headcount ratio for Bulawayo (which is mainly urban) in 2003 was 56.9 percent whilst that of Masvingo (a fairly typical rural province) was 68.5 percent. This difference in poverty levels shows that overall income was distributed unequally in Zimbabwe in 2003, with mean household incomes being higher in urban areas than in rural ones. urban provinces consisting of households that have higher incomes compared to their rural counterparts.

[19]ZimSTAT, (2003). "Poverty Assessment Study Survey 2003 Main Report"

[20] See Table A1, in appendix.

Gender may also be a factor: when inequality among male headed households was compared to that of female headed households, the Gini coefficient for the former was 0.63 and that of the latter was 0.60 (ZimSTAT, 2003). Both values show high levels of inequality. More light can be shed by the poverty headcount ratios, as they show the level of unequal distribution of income by gender. Using the national income poverty line, at 68.48 percent, the poverty headcount ratio among female headed households was higher than the 60.25 percent for male headed households. This confirms the assertions of Malaba (2006) whose analysis suggested that historically, poverty has been more prevalent among female headed households. Female headed households are also less likely to be affluent; UNICEF Zimbabwe (2016) has 24 percent of male headed households in the top quintile of the wealth distribution, compared to 18 percent of female headed households.

4.2 Review of related literature

As Lerman and Yatzhaki (1985) stated, "How economic trends and government policies affect the distribution of income is a central topic in economic and policy analysis." This study analyses the effect hyperinflation on inequality using a theoretical model based on Shorrocks's (1982). This decomposes household income into factor components and determines how each contributes to total income inequality. The factor components are sources of income, such as transfer payments, wage earnings, investment income and others. As households acquire different allocations of each component, they differ from each other and the distribution of income becomes unequal. The decomposition analysis then reveals each factor component's contribution to overall income inequality in a society.

While a number of studies have used factor components to investigate changes in income inequality, only a few did so in high inflation environments (Cardoso, 1992; Urani, 1993; Neri, 1995; Fereirra and Litchfield, 2001; Fereirra, Leite, & Litchfield, 2008). These authors cited six reasons for changes in inequality during hyperinflation. First, perfect indexation is rarely a reality but there is better indexation for the rich since part of their income comes from indexed financial assets. Second, inflation reduces disposable income, which wipes out the savings of the middle class and pushes them below the poverty line. The result is a wider income gap and higher poverty rates. Third, inflation disadvantages all income earners as it causes oscillations in income, making consumption smoothing difficult. This is especially true of vulnerable households that do not have safety nets. The Brazilian data shows that variations in inflation and unemployment explain 30% or more of all variation in inequality. The authors conclude that recessions worsen income distribution because of the effect on unemployment, with unskilled workers being the first to lose their jobs. Inflation thus affects poor, and often-unskilled labourers, mainly through declines in real wages. Fourth, location matters. For

example, in Brazil, the urban population is three times richer than the rural population. Not only is there inequality between the locations but within the poor areas, inequality levels are high. Similar results were expected in Zimbabwe because inflation has a weaker effect on households able to produce their own food, and in so doing avoid food inflation. Much like in brazil, in Zimbabwe, a household's position in the income distribution, post hyperinflation was dependent on how much of their budget went to food and how much they were able to save in the form of assets. Fifth, the ability for a household to defend its wealth in inflationary times increases with income. Richer households can buy durable assets and these too can provide opportunities. For example, refrigerators, by allowing for storage of perishable goods, also enable consumption smoothing. On the other hand, households that do not earn income or experience a decline in income during inflationary times suffer more. Sixth, households with access to transfer payments suffer less and this is dependent on the state of national finances which are usually low during times of high inflation. It is expected that this is a key determinant of inequality in Zimbabwe, given the history of high remittance inflows (Bracking and Sachikonye, 2010).

Another group of literature exists (Powers, 1995; Datt and Ravallion, 1997; Ravallion, 1998; Romer and Romer, 1998; Agénor, 1998; Easterly and Fischer, 2000; Braumann, 2004; Chaudhry and Chaudhry, 2008; Dessus et al., 2008; Robilliard et al., 2001; Suryahadi et al., 2000, Friedman and Levinsohn, 2002; Blinder and Esaki, 1978; Blejer and Guerrero, 1990; Cutler et al., 1991; Adelman and Fuwa, 1992; Bulir and Gulde, 1995; Bulir, 2001; Bittencourt, 2009; Barros, Corseuil, Mendonca, & Reis, 2015; Cardoso and Urani, 1995; Kane and Morrisett, 1993) which employs methodologies other than decompositions to examine the relationship between inflation and inequality. Many of these are time-series analyses and most find that inequality increases with inflation. However, in most contexts there was slow, steady, and predictable inflation. This differs from the case of Zimbabwe which was marked by rapid and accelerating hyperinflation. This is the case from Malaysia where inflation was 4.44 percent to Brazil where cumulative inflation between 1983 to 1994 was 2659 percent. They generally found evidence of a widening income gap with the middle class largely unaffected by inflation, but the income share of the highest quintile increased, while the share of the lowest quintile decreased. This was because the rich could protect their income in indexed assets such as equities, land, physical capital and foreign currency, while the incomes of the poor did not keep pace with the price level, leading to lower levels of consumption and higher poverty. This relationship also applied to in cross-country analyses, as inflation negatively affected lower income countries that have less sophisticated financial markets. The poor were also affected because they lost their jobs first, hence their real income. While this is the case in developing countries, Romer and Romer (1999) show that inflation benefits the poor in developed countries as it cancels out their nominal debt.

While these studies all showed inflation leading to higher levels of inequality, with the exception of Brazil, they were all based on moderate and predictable inflation. There are very few studies of the relationship between hyperinflation and inequality. Moreover, the literature has deficiencies. First, with the exception of the studies on Brazil, it does not explore shifts in inequality in hyperinflationary environments. This is peculiar considering the distortionary effects of hyperinflation. Second, it focusses on income rather than wealth; the existing literature analyses changes in income inequality with a few studies based on non-monetary measures of inequality.

This chapter addresses these shortcomings by conducting a decomposition analysis using data from Zimbabwe, where hyperinflation peaked at 231 million percent in July of 2008. A static decomposition following the modified model of Shorrocks (1982) by Lerman and Yatzhaki (1985) is applied to the asset index which was created in the previous chapter. The index contains assets (factor components) in two groups, private and public. The study will reveal which of these contributed the most to the inequality experienced during Zimbabwe's hyperinflation period.

This is a significant contribution because in cases of high and persistent inflation, real incomes decline significantly and most households move away from cash to asset holdings in order to preserve their wealth. The limited income in households is usually stored in financial and durable assets. It is therefore important to assess the changes in asset inequality and the contributing factors. Previous inequality studies that were conducted for Zimbabwe, without using income, include the Gender Inequality Index (GII) in the United Nations Development Program (2013). The dimensions of the GII are reproductive health, economic activity and empowerment. The Oxford Poverty and Human Development Initiative (2015) constructs a multidimensional poverty index and then measures inequality of the index using the positive multiple of variance method, adopted from Alkire and Seth (2014). Both cross-sectional studies concluded that Zimbabwe has high levels of inequality. However, their work was mainly descriptive, without a decomposition analysis included. Similarly, in its national household surveys, ZimSTAT constructs poverty profiles but the inequality sections tend to be skeletal and only construct an income Gini Coefficient. This paper adds to the literature by examining the inflation-inequality relationship in the African context and contributes to Zimbabwe's literature by giving an in-depth inter-temporal assessment of inequality, through the decomposition.

4.3 Methodology

As was done in the preceding poverty paper, a weighted index of asset variables is computed to represent household welfare. The index consists of households' private assets (ownership of a radio, television, refrigerator, vehicle, cellular phones, livestock, land, floor type in dwelling; toilet type in dwelling) and public assets (energy source for cooking and water sources). While this index includes asset variables that are representative of both urban and rural households, it leaves out financial assets, which would have revealed more inequality in urban areas. The rich held more financial assets that lost value during hyperinflation. On the other hand, the poor rarely possessed financial assets, but owned the consumer durables listed above. These asset variables are from the pooled ZHDS datasets of 2005 and 2010. it is worth noting that the year 2005 was characterized by sustained high and rising inflation and can be considered a part of the onset of hyperinflation, which technically occurred in 2007 and 2009. On the other hand, the year 2010 came right after the dollarization policy was implemented in February of 2009 (Noko, 2011). By then the domestic currency had been replaced by the US Dollar. Excluded from the analysis is information on the debt that leverages the household's wealth base. Given this background knowledge, it becomes apparent that the changes in asset inequality that occurred at the same time as hyperinflation, in this paper, only refer to tangible asset wealth, not income, liabilities, loans, or financial assets.

Following Wittenburg and Leibbrandt (2017), the asset index created in the previous chapter, using Uncentered Principal Components Analysis, is applied to the Gini coefficient formula. The Gini Coefficient measures the extent to which the actual asset wealth distribution deviates from a perfectly equal distribution. This index allows for direct comparison of two populations with different asset index distributions, regardless of their size. As a result, we use the Gini to compare inequality among households across Zimbabwe's ten different provinces. The structural model for the Gini is:

$$G'(W) = \left[1 - \Sigma_{i=1}^{n} \left(\frac{2\tau_i - 1}{n^2}\right)\right] w_i \qquad (10)$$

$G'$is the multidimensional Gini index which is based on Wi,for i=1…. N households. Wi is the wealth indicator constructed by taking a weighted average of household assets and characteristics. This is the general Kolm (1977) inequality index formula which measures the distance between the mean welfare level and the equally-distributed-equivalent-welfare. Significantly different here, the multidimensional Gini uses the first eigen vector (which is positive), hence the weights have to be non-negative. As a result, Wi distribution is in the realm of non-negative real numbers. If this distribution of wealth indicators Wi is equal, then, $G'(W) = 0$.

Dividing the assets by their means makes the Gini *scale independent* (the axiom of ratio scale invariance), which is a necessary condition so that the inequality level is not altered by population size. The second axiom that this inequality measure satisfies is *mean independence*, in other words, doubling the asset ownership across the distribution does not affect rank. A third is *symmetry* which implies that the inequality measure is not altered by other attributes of households in the sample. This means that, if two households were to swap identical assets, there would be no change in the measured inequality. A fourth is the axiom of *statistical testability*; the quality which enables assessment of changes in the inequality index over time. A fifth is the *continuity axiom* i.e. the inequality index is continuous because it is a direct mapping of a continuous asset / wealth index onto the non-negative orthant. The sixth axion is the 'weak uniform Pigou-Dalton Majorization', an extension of the *Pigou-Dalton Transfer Sensitivity* axiom which postulates that a transfer of wealth from the rich to the poor should decrease inequality (and vice versa). The index also satisfies the axioms of '*weighted attributes under unidirectional comonotonicity*' and the *correlation increasing majorization* axioms. Finally, dividing by the mean ensures that Weymark's (1981) basic axioms of *monotonicity* and *ordering* are satisfied as well.

The Gini Coefficient when represented by the Lorenz Curve which shows the cumulative asset wealth owned by all the population up to each percentile. The 45-degree line depicts an equal society, where each percent of the population owns the same proportion of asset wealth. The further the Lorenz Curve lies from the 45-degree line, the more unequal the distribution of asset wealth. Nonetheless, a variety of different Lorenz curves can give the same Gini coefficient as the Gini is not sensitive to the slope of the Lorenz curve at different points, only to the relative area beneath it. This limitation is addressed by General Entropy Indices (GE) (Shorroks, 1980). These GE indices, with values from zero to infinity, meet the required axioms and have the added advantage of being decomposable measures of inequality.

The general entropy formula is given by:

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)} \left[\frac{1}{N} \sum_{i=1}^{N} \left(\frac{w_i}{\bar{w}}\right)^{\alpha} - 1\right] \quad (11)$$

Where $\bar{w}$ is the mean asset index (average income, normally).

The values of GE measures vary between 0 and infinity. Zero represents an equal distribution, while higher values represent higher levels of inequality. The parameter $\alpha \in [0,1]$ is the weight given to distances between the wealth levels of households in the wealth distribution. When alpha equals zero, the measure is sensitive to changes in the lower tail and when alpha equals one, the measure is sensitive to changes in the upper tail. As a result, the magnitudes of GE (0) and GE (1) show the section of the wealth distribution where the greatest change occurred.

GE (1) is Theil's T index with the following formula:

$$GE(1) = \frac{1}{N} \sum_{i=1}^{N} \left(\frac{w_i}{\bar{w}}\right) \ln\left(\frac{w_i}{\bar{w}}\right) \quad (12)$$

On the other hand, GE (0) is Theil's L index with the following formula:

$$GE(0) = \frac{1}{N} \sum_{i=1}^{N} ln\left(\frac{\bar{w}}{w_i}\right) \quad (13)$$

These formulae are used to measure the changes asset inequality of Zimbabwean households in the hyperinflationary period. These will be applied on a national level and then disaggregated by gender (male or female), geo-type (urban or rural), and province. The levels of asset inequality within and between these categories will also be determined.

The analysis ends with a decomposition of asset inequality by source. Following Lerman and Yatzhaki (1985), the overall Gini is decomposed by asset type. In so doing, it is possible to show the contribution of the various assets towards overall asset inequality. The overall Gini shown above is, in this case, a summation of the products of the Gini correlation, the relative Gini component of an asset and the asset's share of total wealth as seen in equation 15:

$$G_0 = \sum_{k=1}^{K} S_k \, G_k R_k \quad (14)$$

Here, k is a component of household wealth, in this case, an asset; R_k is the Gini correlation between asset k and total asset wealth; G_k is the relative Gini for asset k and S_k is asset k's share of total wealth. Thus, the source's marginal effect relative to the overall Gini is:

$$\frac{\frac{dG}{de}}{G_0} = \frac{S_k G_k R_k}{G_0} - S_k \quad (15)$$

The decomposition reveals four main findings. First is the share of a particular asset in overall asset wealth. Second, is the disparity within asset groups. Third, it shows the correlation between an asset and total household wealth and finally, the effect of a change in an asset on total asset inequality. While the full decomposition is reported in the appendix, a summary table of private and public assets is shown and explained in the results section.

4.4 Asset inequality changes during hyperinflation

This section explains the inequality measures obtained from the ZDHS datasets. Zimbabwe had highly unequal ownership of assets both before and after hyperinflation. Table 9 and Figure 17 show that the average asset Gini Coefficient (Gini, henceforth) values lay above 0.5 between 2005 and 2010. Evidently, on a national scale, asset inequality decreased over the five-year period, with the exception of the urban areas where there was an increase. As alluded to in the introduction, the period of Zimbabwe's hyperinflation occurred between 2005 and 2010, specifically, from March 2007 to December 2008 (Hanke and Kwok, 2009)[21]. As a result, the changes in asset inequality from 2005 to 2010, at the national and disaggregated levels described in the methodology are the focus of this analysis; the pre-hyperinflation period is represented by the 2005 data, while the post-hyperinflation period is represented by the 2010 data.

The asset Lorenz curves before and after this five-year period appear in Figure 17. They show that, on a national level, wealth inequality decreased across the hyperinflation period. The red (post-hyperinflation) curve is unambiguously closer to the 45-degree line of equality, albeit statistically insignificant, as shown by the test statistics. The results in tables 9 and 10, below, correspond to this graph and show a 6.65 percent decrease in the national adjusted Gini across the hyperinflation period. In like manner, the mean logarithmic deviation (GE (0)) decreased by 13.88 percent, while the Theil Index (GE (1)) decreased by 13.80 percent during that time. Each of these indicates that asset inequality declined.

In a literal sense, this means that the distribution of private and public assets among households changed over the hyperinflation period. In Table 11, it is evident that prior to hyperinflation, the top twenty percent of the Zimbabwean society, which consisted of urban households, held approximately 63 percent of the asset wealth, while the remaining 37 percent of wealth was shared among the bottom 80 percent of households. However, after hyperinflation, the top quintile held 5 percent less of overall asset wealth as gains were made by households in the middle class. Generally, households in urban areas held a greater share of wealth as they used electricity and thus owned electric appliances. These households also used piped water and flush toilets. Very few rural households have these types of assets. The few rural households with piped water and flush toilets on their dwellings use borehole water. What rural households have, which most urban households do not possess are agricultural land and farm animals.

[21]Source: file:///C:/Users/FloraKurasha/Desktop/School/Hanke%20Inflation%20paperr.pdf

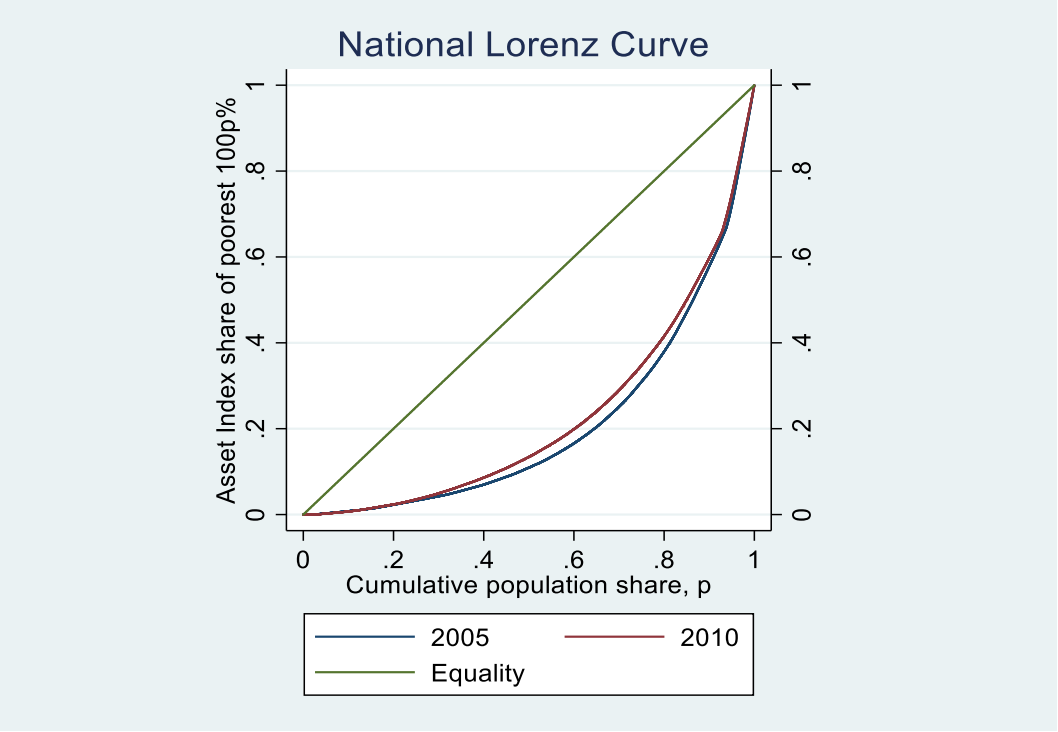


Figure 17: National Lorenz Curve

Source: Own calculations, Zimbabwe Demographic and Health Surveys

Table 9: Changes in Inequality

National	Pre-hyperinflation	Post-hyperinflation	Proportional Percentage Change
Gini	0.58	0.54	-6.65
GE (0)	0.66	0.57	-13.88
GE (1)	0.60	0.52	-13.80
Rural			
Gini	0.51	0.51	-1.54
GE (0)	0.46	0.46	0.78
GE (1)	0.56	0.50	-10.49
Urban			
Gini	0.36	0.37	1.88
GE (0)	0.24	0.25	7.09
GE (1)	0.23	0.24	3.34
Male			
Gini	0.57	0.53	-5.69
GE (0)	0.64	0.55	-13.58
GE (1)	0.56	0.50	-10.85
Female			
Gini	0.59	0.55	-6.68
GE (0)	0.66	0.59	-10.52
GE (1)	0.64	0.54	-15.99

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005 – 2010

Table 10: Changes in the Gini Coefficient

	Gini	P-values	95% Confidence Interval		t-statistic
National					
2005	0.5822	0.0031	0.5762	0.5882	
2010	0.5435	0.0031	0.5373	0.5496	0.4915
Rural					
2005	0.5139	0.0077	0.4988	0.5289	
2010	0.5060	0.0067	0.4928	0.5191	0.0658
Urban					
2005	0.3647	0.0043	0.3563	0.3730	
2010	0.3716	0.0046	0.3626	0.3805	0.0731
Male Head					
2005	0.5670	0.0038	0.5596	0.5743	
2010	0.5347	0.0042	0.5265	0.5430	0.3611
Female Head					
2005	0.5929	0.0051	0.5828	0.6029	
2010	0.5532	0.0047	0.5441	0.5624	0.4010

Note: Total observations = 19,576 households. N=9820 in 2005. N=9756 in 2010.

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005 – 2010

However, as seen in tables 3 and 4, in the previous chapter, the distribution of agricultural land, farm animals and cellular phones changed significantly over the hyperinflation period. The direction of changes in these productive assets contributed to the decrease in asset inequality. For instance, ownership of cellular phones which are used by households to communicate and often to arrange trade logistics, increased by 55 percentage points among urban households; from 35 to 90 percent. Similarly, there was a 43-percentage point increase in the usage of cellular phones among rural households; from 3 to 46 percent over the 5-year period. As a result, rural households which started from a very low base, moved at a faster pace in accessing technology and could use these mobile telephones for income generation through business transactions. In this period, rural households grew and sold vegetables to urban areas and they used mobile telephones to access these markets. As rural household earnings increased, they bought more assets and inequality decreased. This was more so the case when financial transactions were replaced by barter trade due to the loss of value of money (Makochekanwa, 2009). It became normal for urban households to trade in assets in exchange for food.

The ownership of land favoured urban households. While land ownership decreased by 9 percentage points for rural households, from 88 to 79 percent ownership rate; it increased by 3 percentage points for urban households, from 26 to 29 percent. As stated in the introductory chapter, the increase in use of agricultural land was largely a result of the government's land reform program. Moyo (2011) shows that 6,214 farms covering 10 million hectares were distributed to 168,671 households. Hence, the number of owners did not essentially change, but more families had access to the land. The ZHDS data does not allow for a clear distinction between households that got mere access to land and those that received title deeds to their new plots of land. However, Matondi and Dekker (2011) explain that the land was given to new occupants in the form of long-term leases from government. The actual proportion of households that were given the formal lease documents is unknown. However, urban households that gained access to land tended not to make permanent improvements to the land because in essence, it is owned by the government. The reality on the ground is that land was transferred from large and medium scale commercial farmers into the hands of many small-scale farmers.

During this transition, there was an 8-percentage point increase in the quantity of farm animals owned by urban households; from 22 to 30 percent of households owning livestock. The change for rural households was an insignificant increase of 1 percentage point; from 80 to 81 percent. As a result of these changes urban and rural households began to resemble each other more. While urban households acquired more land and animals, yet at the same time losing access to piped water and electricity; rural households acquired more electronic appliances such as cellular phones, both types of change contributing to the general decrease in inequality.

Table 11: Asset indices pre- and post-hyperinflation by quintile share

Quintile shares	Pre-hyperinflation	Post-hyperinflation	Proportional Percentage Change
	0.02	0.02	5.72
Quintile 1	(0.00)	(0.00)	
	0.05	0.06	34.34
Quintile 2	(0.00)	(0.00)	
	0.09	0.11	20.71
Quintile 3	(0.00)	(0.00)	
	0.21	0.22	5.59
Quintile 4	(0.00)	(0.00)	
	0.63	0.58	-7.76
Quintile 5	(0.00)	(0.00)	

Note: Standard errors in parentheses

Source: Own calculations, Zimbabwe Demographic and Health Surveys

In this study, only a few assets found in the ZDHS dataset are used to proxy overall wealth as well as household welfare. Using this approach, the top quintile, which had held 63 percent of national asset wealth, lost more than 7 percent of it during the hyperinflation period. On the contrary, there was a 5.72 percent increase in the bottom quintile. However, all other cohorts experienced an increase in assets with the lower middle class (20^{th} to 60^{th} percent) being the most positively affected. Households between the 20^{th} and 80^{th} percentile experienced a cumulative increase of 60.64 percent in the share of asset wealth that they held.

Though financial assets are not included in the asset index, they were being similarly affected by hyperinflation. For instance, cash holdings lost their value entirely, first through the inflation and then through dollarization. The IMF (2005, 2009, 2011) shows that broad money (M2) as a percentage of GDP decreased from 31 percent in 2004 to 14 percent in 2009, with a slight increase to 18.5 percent in 2010, they omit the reality that all local currency was rendered worthless by dollarization. What the hyperinflation did not destroy, the cure of it did.

Further evidence is provided in Old Mutual[22] annual reports which reveal that the quantity of registered shareholdings in the company decreased significantly during the hyperinflation year of 2008. The Old Mutual shares held by Zimbabweans (mostly urban dwellers and commercial farmers) decreased by 22 percent between 2005 and 2010. A closer look at the data, seen in Table 12, reveals that the shares were increasing from 2005 to 2008 and then there was a 32 percent decline in 2008. Njanike and Mudzura (2009) show that the increase in general ownership of shares in the Zimbabwe Stock Exchange (ZSE) during the hyperinflation period was a form of saving as households made an effort to hedge against inflation. However, in the year 2008 the stock market collapsed and these financial assets owned by households in the top quintiles succumbed to hyperinflation. In actuality, the ZSE stopped operating at the end of 2008 and resumed in February 2009 in the fully dollarized market (Ben, 2016).

Table 12: Annual Changes in Old Mutual Shares

	Proportional Percentage changes (%)				
	2005 to 2006	2006 to 2007	2007 to 2008	2008 to 2009	2009 to 2010
Total Shares	4.68	7.07	14.22	-32.80	-9.37
Number of Holders	-1.13	4.39	6.25	-0.27	-2.88
Percentage of global stock	-22.34	7.19	14.02	-33.16	-11.20

Source: Old Mutual (2005, 2006, 2007, 2008, 2009, 2010) Annual Report and Accounts

[22] Old Mutual is the largest life insurance and pension company in Zimbabwe. It holds shares as a 'nominee' on behalf of beneficial owners.

This loss of wealth in the top quintile, (primarily urban households), coupled with the wealth gain in the lowest quintile explains most of the narrowing in the asset wealth gap. This decrease in the wealth gap can be further quantified using a Palma Index[23]. Calculations show that prior to hyperinflation, the Palma Index was 6.95 and became 6.63, post-hyperinflation. The result is a 4.63 percent decrease in asset inequality.

Table 13, allows for a closer look at the changes in wealth ownership in the top quintile of the asset index distribution (80th to 100th percentile). The greatest loss was incurred by the top 5 percent of the wealth distribution. This segment of the wealth distribution primarily consists of urban households, hence much of this loss seems connected to the decline in public assets, such as electricity and piped water. It is also very likely that these households sold some private assets in order to buy food and other basic necessities during the hyperinflation period. Nonetheless, a closer look at the data shows that some households in the top 3 percent were able to substitute electricity with generators and water with boreholes.

Table 13: Percentile share changes of Asset Index distribution

Percentile cohort	Pre-hyperinflation	Post-hyperinflation	Proportional Percentage Change
	0.37	0.42	13.00
0-80	(0.00)	(0.00)	
	0.20	0.18	-7.26
80-90	(0.00)	(0.00)	
	0.14	0.14	-3.31
90-95	(0.00)	(0.00)	
	0.11	0.10	-10.54
95-97	(0.00)	(0.00)	
	0.11	0.10	-10.45
97-99	(0.00)	(0.00)	
	0.06	0.05	-9.98
99-100	(0.00)	(0.00)	

Note: Standard errors in parentheses

Source: Own calculations, Zimbabwe Demographic and Health Surveys

As highlighted in the introduction, income and wealth in Zimbabwe have long been distributed unequally among households, with key influences having included location and gender. This background informs the disaggregation of asset inequality that is seen in Table 9. Evidently, asset wealth is unequally distributed. The decrease in inequality among rural households and

[23] The Palma Index is the ratio of the income share of the top 10 percent to that of the bottom forty percent. $PI = {}^{w_{10}}/_{w_{40}}$

the increase in urban areas makes sense given that the quintile analysis has shown that the top twenty percent of the asset wealth distribution lost ownership of more assets. As the majority sold durable assets or lost use of public assets, very few households were able to substitute piped water with boreholes, or electricity with generators. As a result, the wealth gap widened. The story is different for the rural households that form the majority of the bottom 80 percent of the population that experience a decrease in asset inequality. As more rural households used remittances and agricultural proceeds to acquire consumer durables, inequality decreased in the rural areas. Figure 18 shows that whilst asset inequality increased for urban households during the hyperinflation period, it decreased for rural households, as depicted by the respective shifts of the post-hyperinflation Lorenz curve. The shift for urban households was larger, but both were not statistically significant.

Apart from the rural or urban location, the gender of the household head was also a factor influencing the impact of inflation and the household's ability to recover from it. For male headed households, asset inequality declined by 5.69 percent, from 0.57 to 0.53 during hyperinflation. A decrease of 6.68 percent is seen among female headed households which had a Gini of 0.59 before hyperinflation and then 0.55 after hyperinflation. Figure 19 depicts these asset inequality changes by gender. The post-hyperinflation curves for both male- and female-headed households' contract towards the line of equality.

A further intertemporal analysis of asset inequality is conducted for the subgroups of location (rural/urban), gender and province. For all three decompositions in Table 14, the total value for the Theil index before hyperinflation was 0.60 and after hyperinflation was 0.52. This difference amounted to a decrease of 13.80 percent. These values correspond with the national Theil Index values in Table 9. For all three decompositions, 'within group' inequality was the main source of asset inequality in the years both before and after the hyperinflation. However, the between group component accounted for the change in inequality over time. For instance, the between residential sector component constituted 27 percent of total inequality before hyperinflation and dropped to 18 percent after hyperinflation. On the other hand, the within group component shows very little change over the hyperinflation period. It is therefore apparent that the observed downward trend in total inequality for households' asset wealth during this period is almost entirely due to the decrease in the between group effect. A similar trend is observed in the gender and provincial decompositions. The between group component accounted for much of the decrease in asset inequality.

Table 14: Asset Inequality within and between sub-groups

Urban/Rural	Pre-hyperinflation	Post-hyperinflation	Proportional Percentage Change
Within-Group component	0.33	0.34	2.66
	55%	*65%*	
Between-Group component	0.27	0.18	-33.59
	45%	*35%*	
Total Inequality (Theil T)	0.60	0.52	-13.80
	100%	*100%*	
Male/Female			
Within-Group component	0.59	0.52	-11.77
	97%	*100%*	
Between-Group component	0.02	0.00	-92.06
	3%	*0%*	
Total Inequality (Theil T)	0.60	0.52	-13.80
	100%	*100%*	
Provincial			
Within-Group component	0.45	0.40	-10.73
	75%	*78%*	
Between-Group component	0.15	0.11	-23.26
	25%	*22%*	
Total Inequality (Theil T)	0.60	0.52	-13.80
	100%	*100%*	

Source: Own calculations, Zimbabwe Demographic and Health Surveys

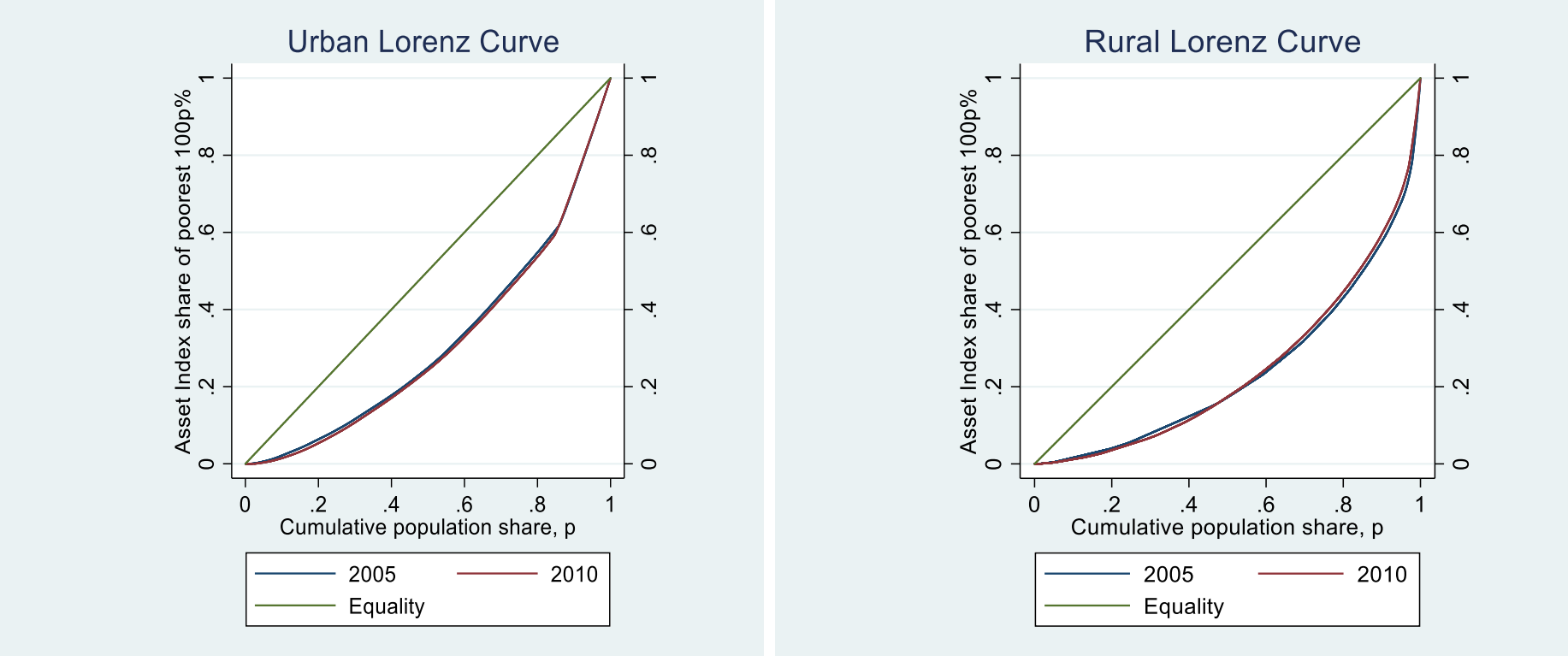
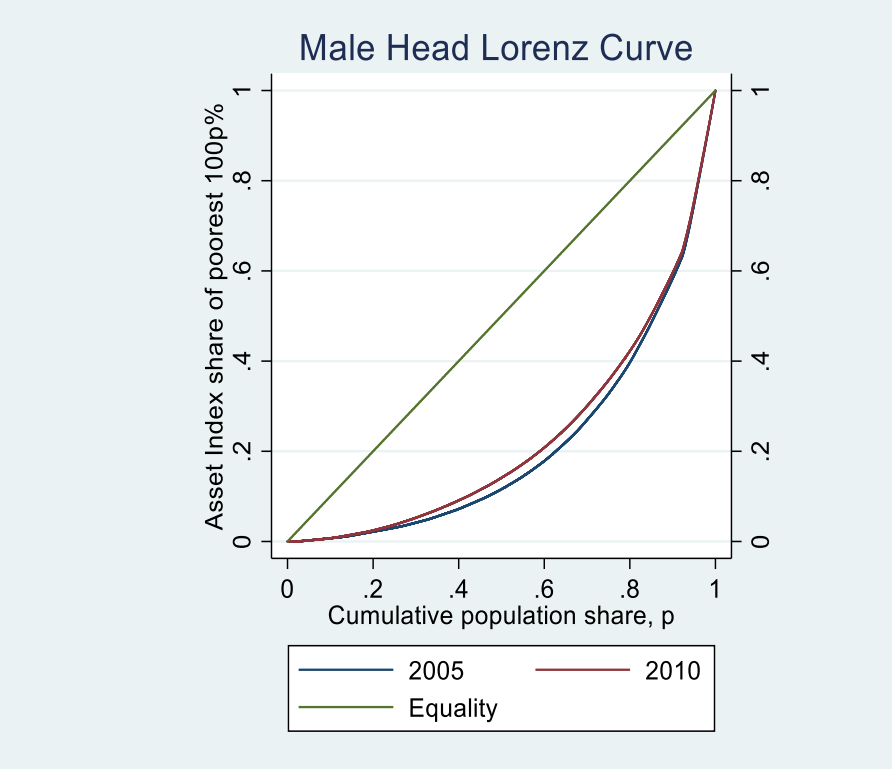


Figure 18: Urban and Rural Lorenz Curves, 2005 and 2010

Source: Own calculations, Zimbabwe Demographic and Health Surveys



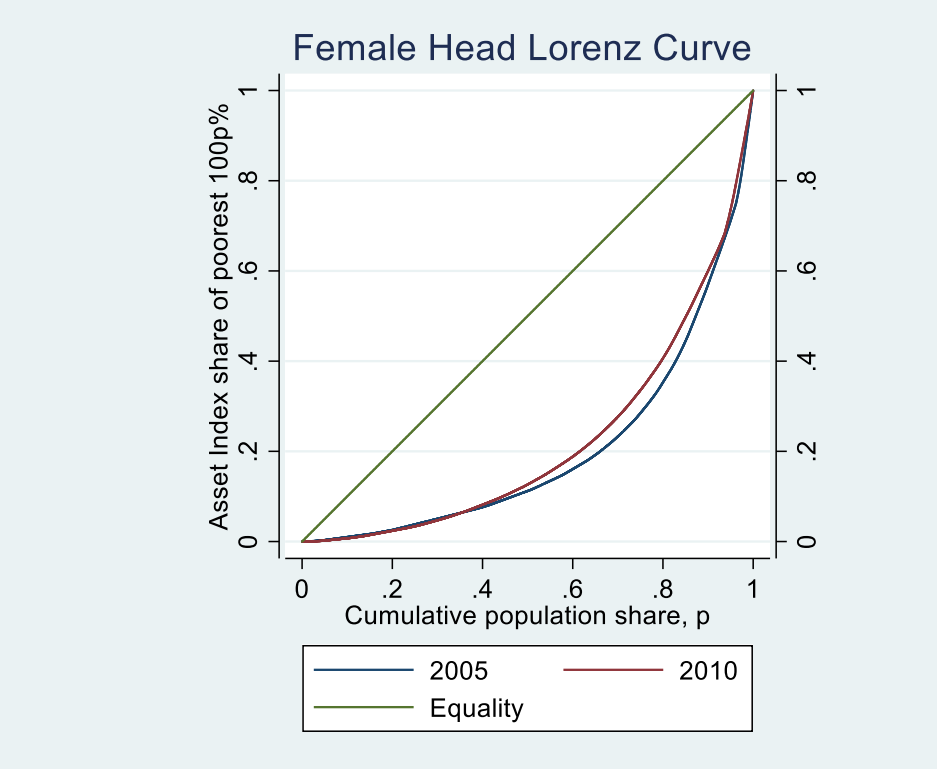


Figure 19: Intertemporal Lorenz Curves, by household head gender

Source: Own calculations, Zimbabwe Demographic and Health Surveys

What were the sources of these shifts? Table 15, shows the national level changes in the variables used to construct the asset index. These show a significant decrease in use of public assets, especially electricity and piped water (hereby represented by the 'improved energy' and 'improved water' variables). For example, the use of electricity decreased by 11 percentage points in urban areas. Prior to hyperinflation, 89 percent of urban households used electricity to cook. Over the five-year period of hyperinflation, many lost the ability to use electricity and only 78 percent were using it for cooking in 2010, after hyperinflation ended. By 2010, the Zimbabwe Electricity Supply Authority (ZESA) was supplying limited quantities of electricity and most households were experiencing load shedding. According to Kaseke, N. (2013), "Firms and households experienced power failures about five times a week, each lasting an average of four hours." This shortage in electricity supply, particularly in urban areas contributed to the increase in urban inequality because most households reverted to candles for illumination and wood for cooking, while very few were able to afford generators and solar systems. While one would expect a decrease in inequality since the urban rich were losing services that the poor never had, the observed increase in inequality, though not statistically significant, was due to the fact that very few urban households gained assets during this period when the majority were experiencing loss.

While this was the case in urban areas, the opposite was true in rural areas where the use of electricity increased off a low base, by 1 percentage point (or 42 percent). This was a statistically significant change given that only 4 percent of rural households used electricity for cooking prior to hyperinflation. The increase was most likely due to electricity connections to rural town centres, locally known as growth points. Indeed, this change in the availability of electricity resulted in a redistribution of household welfare. The dominant substitutes for electricity were firewood and gas. The smoke from backyard fireplaces that replaced internal electric stoves became a common sight in urban cities like Harare and Bulawayo. As the economic crisis worsened, urban areas began to resemble rural areas.

The decline in supply of treated municipality water was met by an increase in the use of alternative water sources, such as boreholes, wells and rivers (surface water). In rural areas, the use of safe drinking water (piped, communal tap, boreholes and protected wells) decreased from 51 to 49 percent, while urban households witnessed a decrease from 98 to 93 percent. In both urban and rural areas, the main substitute was underground water. Those who could afford it, dug wells or sank boreholes. So, while only 1 percent of the urban population had boreholes, prior to hyperinflation, by the end of the period, 11 percent were using borehole water. Due to the

significant decline in safe drinking water, the effectiveness of waterborne sanitation also decreased. Urban households moved from using flush toilets (represented by the 'improved toilet' variable) to using pit toilets, while others opted for open defecation, especially in squatter camps. Results in the previous chapter showed a 4 percent decrease in the use of flush toilets. Before hyperinflation, 94 percent of urban households used flush toilets, but by the end of the period, only 90 percent could use their flush toilets.

The decline in the provision of basic services such as water and electricity partly explains the increase in inequality within urban areas where few households, in affluent neighbourhoods, could afford to dig boreholes when water infrastructure collapsed. Few too could afford the diesel generators needed to power the borehole pumps in order to have piped water in their homes. The majority of urban households, found in high density areas, bore the brunt of the collapse in electricity and water infrastructure. As a result, many resorted to shallow well and surface water, as well as pit toilets and open defecation. As the households that previously had use of public and private assets lost them, and only a few managed to maintain their assets, urban inequality increased. Another possible contributor to this widening gap would have been remittances, as the few households with members living outside the country and making substantial earnings were often receiving gifts in the form of assets or cash to purchase assets. Bracking and Sachikonye (2006) show that only 7 percent of cash remittances were consumer durables such as those found in the asset index of this study. Most of the money was used to buy food and fund transportation. Hence the increase in inequality between the few who received these goods and the majority who suffered the loss of assets.

In the rural areas, asset inequality decreased between rural households. In terms of sanitation, there was a 1 percentage point increase in the proportion of rural households using improved toilets (flush and Blair); from 3 to 4 percent. However, a large proportion of rural households, along with urban households who moved back to rural areas during the hyperinflation still struggled to access basic services, and the proportion of households using pit toilets more than doubled. The proportion of rural households using pit toilets increased from 19 to 34 percent between 2005 and 2010; while that of urban households increased from 9 to 26 percent.

Table 15: Aggregate asset ownership changes

National	Pre-Hyperinflation	Post-Hyperinflation	Percentage point change	t-statistic
Radio	0.48	0.38	-0.10	14.03
Television	0.30	0.36	0.06	8.88
Refrigerator	0.18	0.19	0.00	0.83
Bicycle	0.26	0.23	-0.03	4.79
Vehicle	0.06	0.07	0.01	1.50
Livestock	0.61	0.63	0.02	3.51
Land	0.67	0.61	-0.06	8.69
Cellphone	0.13	0.61	0.48	77.66
Improved Toilet	0.33	0.34	0.01	0.74
Improved Floor	0.67	0.70	0.03	5.07
Improved Energy	0.32	0.30	-0.02	2.89
Improved Water	0.66	0.64	-0.02	3.38

Source: Own calculations, Zimbabwe Demographic and Health Surveys

When the table above is decomposed by location, it becomes apparent that the drivers of inequality were different for rural and urban households. See Table 16 where changes show how 'within group' inequality contributed the most to asset inequality changes during the hyperinflation period. As for public assets, the percentage point changes by location paint a picture of inequality by location during the hyperinflation period. While electricity usage increased marginally, from 4 to 5 percent, among rural households, it decreased for urban households; going down from 89 to 78 percent. Provision of piped water fell in both, but the proportionate fall amongst urban households was double that of rural households. The results are further substantiated by the significant increase in the use of alternative water sources for both rural and urban households.

As previously mentioned, the decay of water infrastructure negatively affected sanitation and caused some households to change the toilet types used. The proportion of rural households with improved toilet facilities increased, while the opposite happened among urban households. The use of Blair toilets decreased in both cases, especially in rural areas. On the other hand, pit latrine usage increased for both rural and urban households. One plausible explanation is that households dug pit latrines as contingency measures while they waited for the flush toilet systems to work again; as and when piped water would be reintroduced to dwellings. More disturbing was the increase in the number of households that reported having no designated toilet facility in the dwelling. While in 2005, only 9.29 percent of urban households claimed not to have toilet facilities, the proportion had increased to 50.88 percent by 2010. An implication of this movement away

from the flush and Blair toilets was an increased likelihood of ground-water contamination, and hence of diarrhoea among children in urban households. The data reveals that the proportion of children with diarrhoea in urban areas increased from 19 percent in 2005 to 30 percent in 2010. The opposite was true in rural areas where there was a marginal decrease from 30 to 29 percent. Again, this is evidence of the narrowing gap in inequality, as the rate of infection in urban households reached similar levels to rural households.

Table 16: Contrast of asset ownership shifts, by location[6]

Pre and Post Hyperinflation Percentage Point Changes		
Variables	Rural	Urban
Private Assets		
	-0.01	-0.28***
Radio	(1.59)	(24.54)
	0.05***	0.05***
Television	(9.05)	(4.73)
	0.01***	-0.02
Refrigerator	(2.33)	(1.33)
	0.00	-0.09***
Bicycle	(0.10)	(8.17)
	0.01***	0.00
Vehicle	(2.19)	(0.03)
	0.01	0.08***
Livestock	(0.87)	(7.40)
	-0.09***	0.03***
Land	(14.25)	(2.32)
	0.43***	0.55***
Cellphone	(64.88)	(55.83)
	0.01***	-0.04***
Improved Toilet	(3.31)	(5.87)
	0.05***	-0.02***
Improved Floor	(5.96)	(5.99)
Public Assets		
	0.01***	-0.11***
Improved Energy	(4.12)	(11.87)
	-0.02***	-0.04***
Improved Water	(2.33)	(8.58)

Notes: *** shows statistically significant changes. Estimates are statistically different if t-statistics>1.96 in parentheses.
Source: Own calculations, Zimbabwe Demographic and Health Surveys

The increased proportion of pit toilets in rural areas may also be a consequence of urban-rural migration. Between 2005 and 2010, there was an increase of 1.38 percent in the rural population, while there was a decrease of 2.67 percent in the urban population. Three reasons stand out: First, in the year 2005 there was *Operation Murambatsvina*, the expulsion from cities of informal traders and households dwelling in squatter camps and illegal shelters. Second, with the rising inflation rates the cost of living in urban areas rose faster than household incomes, without alternative means of support some households moved back to their rural homesteads where they could grow their own food and avoid purchasing it. Third, some urban households were given land in the land resettlement program. So, they moved to the rural areas as well. Whatever the reason for their move, households arriving at a new location would need to dig a temporary toilet facility while constructing permanent residence and ablution facilities.

It is worth noting that in urban areas, when the water system stopped working, many households began to share toilet facilities. The ZDHS data shows that the percentage of shared ablution facilities increased from 34.4 to 48.7 percent during the hyperinflation period.

Inequality was not only seen in household use of public assets, such as water, sanitation and electricity but also in the private assets that were used by households. Looking at Table 16, the first point of note is the significant decline in the ownership of radios and bicycles among urban households in contrast to the insignificant changes in these assets, among rural households. This may reflect the sale of movable assets to obtain basic necessities. For example, bicycles may have been used in barter trade in exchange for food from rural households. Also, some just got old or broke down and did not get fixed because spare parts, including tyres, were difficult to get. There is also a high probability that the radios were replaced by cellular phones which can connect to radio stations.

In contrast to urban areas, ownership of private assets – televisions, refrigerators, vehicles and cellular phones increased among rural households. This increase was also a contributor to the decrease in inequality in rural areas as certain households moved up in the asset index distribution. Inequality would have decreased within the rural sector because of the drastic increases in these private assets, especially the productive ones like cellular phones, as they no longer belonged to a small minority. Though, there is little data-based proof, anecdotal experience points to remittances as the source of these increased private assets in rural households. According to Cross (pers. com. 2020), “Much of the money that is remitted into Zimbabwe goes to rural families and some of that money goes to rural homes. You can drive through rural/communal areas and you can see some decent houses with television aerials on the roof,

solar panels and all that sort of thing." It is reasonable to assume that remittances have largely contributed to the improvement in the construction material for dwellings indicated by the increase in the proportion of cement, wooden and tiled floors among rural households.

While the results above are for decompositions by location and gender, the analysis now concludes with a decomposition of inequality, by source. Using the same asset index derived from the ZDHS data, tables 17 and 18, below, show the results of the decomposition before and after hyperinflation. These results show the magnitude of the assets' absolute and relative contributions to total household wealth and the inequality thereof. While the contribution of the assets to total wealth are revealed by the weights in Table A2.2, in this section, the focus is on the contribution of each asset to overall inequality. Prior to hyperinflation, private assets constituted 79 percent of the asset wealth distribution and contributed 74.3 percent to inequality. On the other hand, the share of public assets in the asset index was 21 percent and they increased inequality by 25.7 percent. After hyperinflation, private assets constituted 82.1 percent of the asset wealth distribution and contributed 76.5 percent to inequality. By then, the share of public assets in the asset index was 17.9 percent and they increased inequality by 23.5 percent. Evidently, the decrease in inequality on a national level was mainly attributable to the increase in private assets among poor households.

Table 17: Decomposition of asset inequality, by elements of asset index – Pre-hyperinflation

Sources	Asset wealth share	Gini correlation	Gini index	Absolute contribution	Relative contribution
			Private Assets		
Radio	0.102	0.813	0.250	0.203	0.150
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Television	0.066	0.923	0.213	0.197	0.145
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Refrigerator	0.039	0.936	0.149	0.140	0.103
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
Bicycle	0.053	0.479	0.187	0.090	0.066
	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
Vehicle	0.014	0.851	0.060	0.051	0.038
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Livestock	0.128	-0.233	0.240	-0.056	-0.041
	(0.00)	(0.02)	(0.00)	(0.01)	(0.00)

Land	0.143	-0.390	0.221	-0.086	-0.064
	(0.00)	(0.03)	(0.00)	(0.01)	(0.01)
Cellular	0.029	0.904	0.118	0.107	0.079
phone	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
Improved	0.073	0.863	0.225	0.194	0.144
toilet	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Improved	0.145	0.773	0.216	0.167	0.123
floor	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
			Public Assets		
Improved	0.069	0.893	0.219	0.196	0.144
energy	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Improved	0.141	0.683	0.224	0.153	0.113
water	(0.00)	(0.02)	(0.01)	(0.01)	(0.00)
Total	1.000			1.354	1.000
	(0.00)			(0.02)	(0.00)

Note: Standard errors in parentheses.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

Table 18: Decomposition of asset inequality, by elements of asset index – Post-hyperinflation

Sources	Asset wealth share	Gini correlation	Gini index	Absolute contribution	Relative contribution
			Private Assets		
Radio	0.075	0.596	0.235	0.140	0.102
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Television	0.072	0.887	0.231	0.204	0.149
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Refrigerator	0.036	0.894	0.149	0.133	0.097
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
Bicycle	0.044	0.406	0.174	0.071	0.051
	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
Vehicle	0.014	0.809	0.066	0.054	0.039
	(0.00)	(0.02)	(0.01)	(0.00)	(0.00)
Livestock	0.127	-0.120	0.231	-0.028	-0.020
	(0.00)	(0.02)	(0.00)	(0.01)	(0.00)
Land	0.126	-0.169	0.232	-0.039	-0.029

	(0.00)	(0.03)	(0.00)	(0.01)	(0.01)
Cellular	0.122	0.798	0.236	0.189	0.137
phone	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Improved	0.064	0.817	0.219	0.179	0.131
toilet	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Improved	0.141	0.722	0.206	0.149	0.108
floor	(0.00)	(0.02)	(0.01)	(0.01)	(0.00)
			Public Assets		
Improved	0.057	0.871	0.204	0.178	0.130
energy	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
Improved	0.122	0.611	0.237	0.145	0.105
water	(0.00)	(0.02)	(0.00)	(0.01)	(0.00)
Total	1.000			1.373	1.000
	(0.00)			(0.02)	(0.00)

Note: Standard errors in parentheses.

Source: Own calculations, Zimbabwe Demographic and Health Surveys

The third column shows the Gini correlation R_k from equation 5 above. These values show the correlation that exists between the particular asset and the entire asset index. The average Gini correlation for private assets decreased by 4.7 percent, while that of public assets decreased by 5.96 percent. The average Gini for private assets before and after hyperinflation was 0.19 and 0.15, respectively. While for public assets, the average Gini coefficient 0.22 both before and after hyperinflation. This confirms the earlier observation that the decrease in inequality that occurred on a national level, during hyperinflation is mainly attributable to the change in inequality among private assets.

Ultimately, this shows that increased ownership of private assets resulted in a decrease in asset inequality. As seen in the previous chapter, many of these increases accrued to poor (rural) households, decreasing the asset wealth gap. The increase in private asset holdings of rural households were largely funded by crop sales and remittances. These rural households constitute 98 percent of the bottom two quintiles of the asset wealth distribution. They also experienced a marginal increase in the use of public assets as remittances enabled them to connect their homes to the electric grid. On the other hand, urban households, which were largely located in the top three quintiles of the wealth distribution, experienced significant losses in use of public assets when national infrastructure collapsed and their private asset portfolio did not improve due to the

decrease in real wages. The inflation forced urban households to redirect their income and increase proportions of their budgets to food expenditure because they did not produce their own food.

4.5 Conclusion

There seems little doubt that Zimbabwe's hyperinflation affected the distribution of household welfare. At a national level, and in rural areas, inequality in asset holdings decreased; but in urban areas it rose. An initial decomposition reveals that the observed inequality levels were mainly found within subgroups. However, the observed decrease in inequality was due to inequality between subgroups. In this case study, the observed increase in inequality was within the urban areas and the observed decrease was within the rural areas. A further decomposition by asset wealth source revealed that private assets contributed the most to the observed inequality levels. A household's ranking in the asset index distribution was largely determined by ownership of private assets.

As shown in the results above, households responded differently to hyperinflation. Many, especially in rural areas converted their cash savings into assets, as a means of storing value. Hence the observed increase in private assets. However, differences were apparent in the type of assets. For instance, households that could afford more, went beyond the purchase of electric appliances to renovating existing houses, building new houses, installing solar systems, installing boreholes and in some rare cases, acquiring electric generators. In addition, while some households bought new assets, others sold the assets that they had. In general, rural households were acquiring assets using proceeds from food production. On the other hand, urban households were disposing of their assets in exchange for food and other basic necessities. This was made clear not only in the asset register used to create the asset index, but also in the reduction in the number of shares held in Old Mutual, which mainly apply to urban households. This reflects the reality that households in the formal economy suffered most from hyperinflation, while the opposite was true for those who were self-sufficient. This explains the existence of inequality in asset wealth, and especially the observed increase in inequality among urban households during hyperinflation.

Tables 9 and 10 show that asset inequality increased among urban households and decreased among rural households. Indeed, the erosion of the urban asset base was an equalizing factor, as it contributed to the overall decrease in inequality on a national level.

While most assets included in the asset index were contributing to inequality, this was not the case for land and livestock. Access to land and livestock resulted in a reduction in inequality because they are productive in nature. Arable land would be used to grow crops for sale and the earnings would improve household welfare. As this happened for more households, inequality would decline. Animals were also used in the food production process, as they were either sold as food or used to cultivate crops. Either way, they were useful in improving household welfare and reducing inequality. Since these land and livestock were mainly found in rural areas, they reduced inequality among these households, while urban households suffered more inequality during the hyperinflation period. Productive private assets are therefore part of the solution to the problem of inequality, especially in the presence of hyperinflation.

With the current release of micro-level data by ZimSTAT, further research can be conducted on the topic. Potentially an analysis of variance could be conducted, which includes variables that measure the state of political instability during the hyperinflation period. A worthwhile addition would be the inclusion of financial assets in the asset index.

Chapter 5

Child nutrition and hyperinflation in Zimbabwe

5.1 Introduction

The previous chapter showed that Zimbabwe's period of hyperinflation was accompanied by changes in the distribution of asset wealth across households. While the whole nation was affected by the economic conditions prevailing during hyperinflation, urban households suffered more. In particular, the asset holdings [which are taken to proxy household welfare] of urban households decreased significantly, while in rural areas they tended to rise. Since rural households tended to be poorer, the result was a reduction in overall asset inequality. Major contributors to the changes in asset inequality were the transfer of land and livestock to some urban households that relocated to rural areas during the land reform program; the acquisition of private assets by rural households using agricultural proceeds and remittances; the disposal of private assets by urban households in order to buy food and other basic necessities; and finally, the deterioration (especially in towns and cities) of public assets, with growing shortages of electricity and piped water, and with sanitation facilities becoming increasingly dysfunctional.

While these results give a good picture of what happened on a household level, they omit the effects of hyperinflation on children. This chapter focuses on the changes that occurred in child nutrition levels and the factors contributing to these changes amongst children under the age of 5. The hypothesis is that the disparity in child health widened during Zimbabwe's hyperinflation period, and that children under the age of five – the typical victims of a dilapidated healthcare system – were especially vulnerable to malnutrition due to the economic crisis. As a means to examine the hypothesis, a multivariate Logistic regression analysis based on the proximate determinants analytical framework is conducted (Mosely and Chen, 1984).

This study contributes to an existing body of literature on the relationship between economic crises and child health (Frankenberg, et al., 1999; Strauss and Thomas, 1998), in particular to the use of nutrition as a measure of health (Waters, et al., 2003; Stillman and Thomas, 2004). The literature on the relationship between hyperinflation and malnutrition (Darnton-Hill and Cogill, 2010; Paxson and Schady, 2005; Christian, 2010) is noticeably thin, especially in the African context, a gap that this paper endeavours to fill, using the peculiar case study of Zimbabwe, a Sub-Saharan African country that recently experienced the highest levels of inflation recorded in Africa.

In Zimbabwe, the combination of political instability and poor economic policy led to hyperinflation and a significant slowdown in overall productivity. These conditions resulted in income loss, inadequate food production and a collapse of infrastructure which included the water and sanitation systems. Households that were affected by the increase in food prices and the reduction in food production experienced food shortages. Over the 20-year period under study, droughts occasionally contributed to food inflation. However, as Mazvimavi (2010) shows, there were only 3 droughts during this period, in 2002, 2012 and 2015; none of which coincided with the peak of the hyperinflation (2007 to 2008). Another potential contributing factor to food inflation could have been foot and mouth disease amongst cattle, which makes movement of livestock difficult. However, even this seems unlikely to have been a concern; the disease was not unusually prevalent and there were only 5 recorded cases during the hyperinflation period[24]. Clearly food inflation during this time was not the result of natural causes, but was indeed linked to the general price increases occasioned by poor economic policies. As mentioned in chapter 1, the two main coping mechanisms adopted by the public were to reduce the number of meals and to consume an undiversified diet, with very little meat protein.

In addition to the food shortages, most of Zimbabwe's urban households lost use of clean piped water and few were able to replace municipal supplies with private boreholes. The country had become accustomed to clean piped water, safe for drinking and washing, and available for use in flush toilets. Its absence encouraged the spread of diseases such as Cholera and Diarrhoea. ZimVAC (2009) mentions that sanitation and water supply became dysfunctional in urban areas. The infrastructure breakdown resulted in the cholera outbreak of 2008/9 that claimed approximately 4 600 lives of the 98 000 who fell ill in 60 of the country's 62 districts (World Health Organization, 2008). Causal factors mentioned were the absence of a refuse collection system and purified water, as well as the collapse of the sewage and public health systems; which all occurred progressively during the economic crisis. The World Bank (2013) mention that only 24 percent of urban household sanitation systems were connected to sewer. Most of the remaining households use open defecation or pit latrines, and untreated sewers often run into water sources. According to the report, water and sanitation systems collapsed because of insufficient treatment chemicals and chronic power shortages which disrupted the pumping and treating of water. As a result, when water was supplied to dwellings, it was contaminated contaminated and unfit for drinking.

[24] See https://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/statusdetail

Although the directions of causality are sometimes ambiguous, a priori, a positive relationship is expected between the rate of inflation and the incidence of malnutrition amongst children (Paxson and Schady, 2005). Since malnutrition can be caused by both disease and shortage of food, the likely drivers would be inflation's effects access to food, to clean water, to efficient sanitation and to modern healthcare. Following Blackley et al., (2004), Figure 20 hypothesizes a transmission mechanism between hyperinflation and child nutrition.

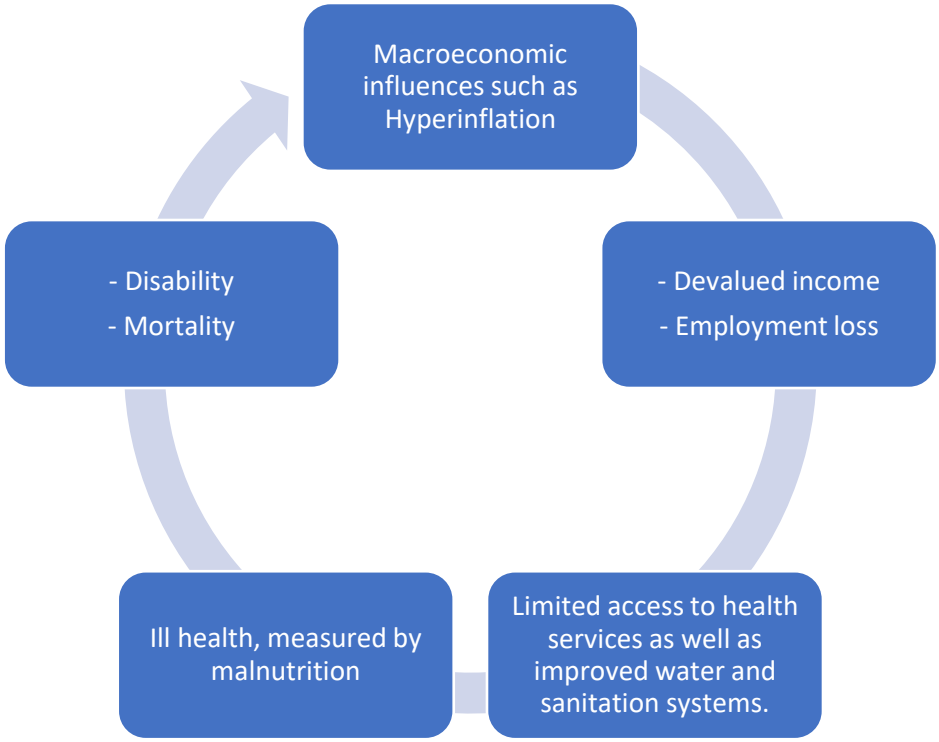


Figure 20: Socioeconomic position and risk factor pathways to health

Source: Blackley et al., (2004). "Assessing the distribution of health risks by socioeconomic position at national and local levels."

As macroeconomic conditions affect households differently, so they have differential effects on the health levels of children in them. As a result, macroeconomic shocks often have unequal impacts on child health. Cutler et al., (2002) suggest that economic crises marked by hyperinflation affect child health through three main channels.

- First, child health is affected by declining private expenditure on medical care and nutrition. As prices rise and the average family income (and wealth) decreases due to job loss and a decline in purchasing power, households spend less on medical care and a balanced diet.
- Second, as a means to counter household income loss, children join the labour force. Some working conditions can have an adverse effect on these weaker younger household members.

- Third, macroeconomic crises marked by hyperinflation often result in a decline in public sector expenditure on healthcare. Generally, public health facilities suffer a lack of maintenance and eventual destruction. Not only are the super structures of hospitals and clinics dilapidated, but their functionality suffers because of the failure of other public resources, such as water and electricity.

In Zimbabwe, the first and third scenarios certainly transpired. However, dangerous child labour was not prevalent. Instead, the common means of supplementing lost income was the sale of household assets. In addition, the hyperinflation period was accompanied by structural changes in the healthcare system. Medical personnel migrated to countries that offered them better earnings and working conditions. According to the Zimbabwe Ministry of Health and Child Welfare, (2010), at the peak of hyperinflation in 2008, the country was operating at 31 percent capacity for doctors, 39 percent for nurses and 20 percent for midwives. The availability of drugs fell to 29 percent and vital hospital items, which should have been at 100 percent, were at 22 percent capacity. The majority of the medical equipment in hospitals was either obsolete or non-functional. In terms of public health expenditure, the per capita budget allocation towards healthcare was US$7 in 2008, down from US$9 in 2005 and US$21 in 2000. This was significantly below the recommended minimum of the World Health Organisation (WHO henceforth), which is US$34 per year (Sambo, Kirigia, & Orem, 2013).

This situation led to escalating mortality rates. The World Health Organization (2009) shows that the mortality rate for children under the age of 5 was 85/1000 in 2006, which was higher than the global rate of 71/1000. This was the highest it had been since the catastrophic drought year of 1992, when the rate was 77/1000. On the other hand, Zimbabwe's infant (children 2 years old and younger) mortality rate was 790/100000 live births at the peak of hyperinflation. This was much higher than the global mean of 191/100000 and the Africa region mean of 425/100000 at the same time. Not only were children dying, but so too were their mothers. Todd, Ray, Madzimbamuto, & Sanders, (2010) show that the maternal mortality rate in the year 2007 was 725/100000, which was a large increase from the 168/100000 recorded in 1990. Overall life expectancy, which had been 62 years in 1990, declined to 43 years in 2006. This is not unexpected, given that there were 1.6 doctors and 7.2 nurses left to service 10,000 citizens in 2010 (Zimbabwe Ministry of Health and Child Welfare, 2010). Approximately 18,000 healthcare personnel had emigrated between 1998 and 2008. The result was that children were being born into a society where their chances of both short- and long-term survival were low.

Figure 21 reveals how child mortality fluctuated over the years. As stated in chapter 1, Zimbabwe achieved majority rule in 1980. The graph shows the state of child mortality thenceforth. The

graph shows high mortality rates at the beginning of this period. This was due to a combination of factors such as the war of liberation, limited health infrastructure in the rural areas where the majority of the population was located and the drought of 1982 which resulted in low food production. These mortality rates decreased soon afterwards as rainfall patterns recovered, economic sanctions were lifted and as the government invested more in primary and preventative healthcare, especially at district level across the country. Public health expenditure increased by 94 percent in real terms during the first decade of Zimbabwe's independence and this improved health in households. For instance, Kanyenze et al., (2011) suggest that, because of the increase in child immunization from 25 to 80 percent between 1980 and 1988, child malnutrition decreased from 22 to 12 percent; and infant mortality declined from 90 to 53 deaths per 1000 live births. This explains the significant drop in all measures of mortality rates of children seen in Figure 21.

In the decade 1990 - 2000, however, Zimbabwe's child mortality rates began to rise steadily. A number of factors may explain this.

One was the decline in the quality and availability of primary healthcare in rural areas due to the decrease in government expenditure as part of the cost-recovery scheme under the Economic Structural Adjustment Programme (ESAP). While in 1991 public health expenditure constituting 6.2 percent of the national budget, by 1996 this had decreased to 4.2 percent. With a less equipped health system due to minimal funding, survival rates of children declined. Apart from the austerity measures that were necessitated by the stagnant economy and ESAP, the drought of 1992 negatively affected national income, leaving even less money available for investment in the health sector. While the contingency plan was for hospitals to retain user fees for internal use, these were insufficient to meet the health department's needs. So, the financially constrained health system of the second decade of independence failed to meet prenatal and postnatal health care needs, leading to higher rates of child mortality.

A second reason for the increase in child mortality rates during this decade was the emergence of the HIV and AIDS pandemic around the year 1997. This added to the disease burden and children born of victims often died in infancy because of late diagnosis of the parents and insufficient protective measures for unborn children and neonates from the virus.

A third reason for the increase in child mortality was that many health centres in remote areas, were supported by missionaries and farmers. These were significantly disrupted by the land invasions which began in 1997. The compound effect of these last two reasons is visible in the graph, as a peak in child mortality in 1997. The health sector experienced a storm as both the HIV

pandemic and the land invasions were unexpected and only in later years were mitigating measures put in place.

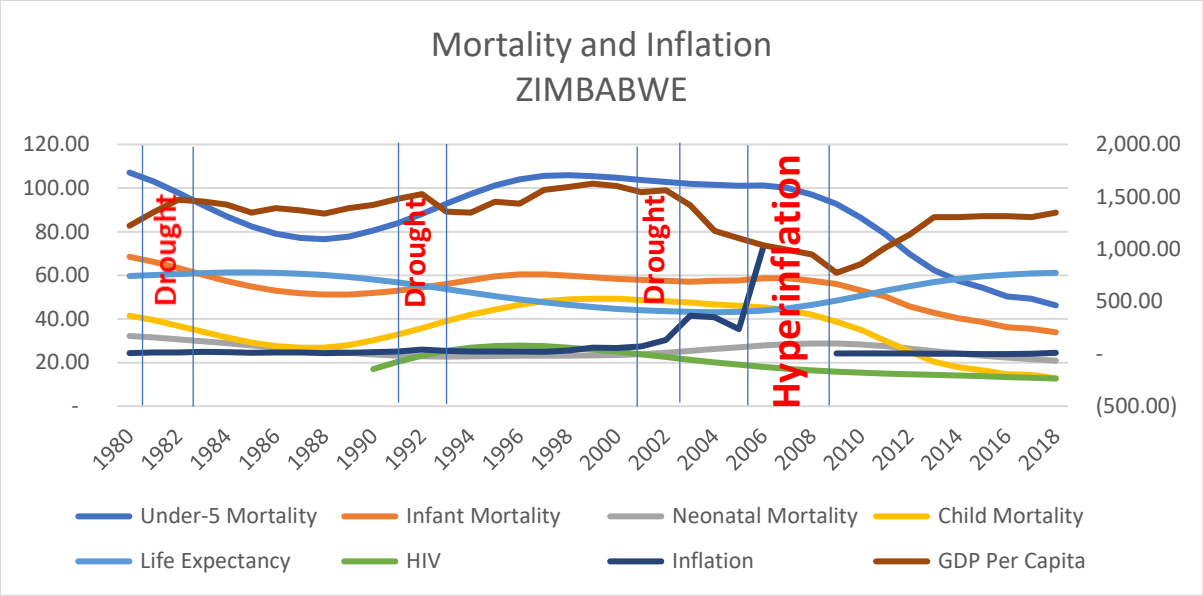


Figure 21: Zimbabwe's Child Mortality and Inflation trends, 1980 - 2018

Source: World Bank, United Nations

It is evident in the diagram above that the situation did not improve as child mortality rates remained high in the 3rd decade of the independent Zimbabwe. Basically, there was a plateau, followed by a subsequent peak in 2007 and 2008. The high rates of child mortality seen in this period resulted from a combination of factors. Leading these was political instability: it led the government to adopt a number of populist policies including the encouragement of the land invasions that destroyed the agricultural sector and much of the economy; repeatedly printing money in order to finance a budget deficit largely based on payment of gratuities to war veterans, purchases of armaments and munitions for the Congolese war and other quasi-fiscal activities (IMF, 2001). These encouraged capital flight which left Zimbabwe's economy with little money to maintain the health care system. As a result, children died young from a lack of vaccines and medicines as well as a shortage of hospital personnel and equipment.

Related to the fiscal shortfall was failure to invest in the maintenance of the water and sanitation systems. Without clean water and flush toilet systems, Zimbabwe experienced a cholera epidemic. In the short period between August 2008 and September 2009, 98,309 individuals were infected and 4,300 died (Kanyenze et al., 2011). The death rate affected both adults and children, hence the peak in all measures of mortality in Figure 21.

The third reason was inflation. Unlike the previous decades where child mortality rates would oscillate, during this crisis period, the high death rates of children were sustained until the inflation was solved by dollarization in 2009. The steeply rising prices negatively affected the resources of the households in which the children were being born and raised. Income levels of parents were declining in real terms, and gradually private healthcare unaffordable while public healthcare was increasingly unavailable. In addition, clean water and sanitation systems were not available; the number of health personnel declined; vaccine and medicine supplies became scarce and unaffordable. At the height of hyperinflation, even food became a struggle for many to attain. Hence, child health declined and mortality increased, as a result of poor diet, a lack of medicines and infrequent health check-ups.

A simple correlation is not evidence of causality. The multitude of factors that drove prices up may also have been impacting directly on child health. For example, low rainfall affecting the yield of maize would simultaneously cause hunger and higher prices. However, while data constraints do not allow for the determination of a causal relationship, this pre-post comparative analysis and the subsequent regression analysis do help explain some of the changes in child nutrition and its distribution during the hyperinflation period.

Malnutrition is a state of deficient nutrition caused by either poor diet or repeated infections (De Onis, Blossner, Borghi, Morris, & Frongillo (2004). Malnutrition is commonly found in children who live in areas with low food production due to economic conditions, poor climate or overpopulation. Indicators of childhood malnutrition are obtained using combinations of body measurements and age. These are relevant because the response of a child's body to inadequate food intake or disease is to stop or slow down growth. The most common of these measures are *stunting* and *wasting*. These indicators are based on reference curves for healthy children which were determined by the WHO (1995a). In terms of these measures, children are considered malnourished when their z-scores for either of these measures fall more than -2 standard deviations below the international reference median.

Stunting occurs when a child is unusually short for its age. This is often due to repeated illness or poor nutrition during the first two years of life, which leaves lingering effects thereafter. It is an indicator of chronic malnutrition, due to *sustained* food deprivation and disease.

Wasting is marked by a low weight-for-height score. It describes significant weight loss, due to a recent famine or severe disease in the recent past. Wasting indicates acute recent malnutrition.

Figure 22 shows that the prevalence of stunting and wasting increased over the years of high and hyper-inflation and then decreased after the hyperinflation ended, when dollarization was implemented. The period of economic crisis was accompanied by growing crises in child health. These are believed to have continued until 2009, however, due to a lack of annual data, the analysis is based on 5-year intervals and significant information is lost in between. The graph shows a decrease in wasting and stunting in the post-inflationary period that followed dollarization in 2009; a period of economic revival when food and health care were more affordable and accessible.

Table 19 shows the stunting prevalence rates for children aged 5 years and younger, in Africa and on a global level (World Health Organisation, 2010). On both a global and regional level, malnutrition decreased. Though more detailed analysis is provided in the results section, it is worth noting that the malnutrition levels in Zimbabwe, during the hyperinflation period were below the regional average, yet above the global average rates. Data on a global and regional level were not available for wasting. However, the 2017 estimates, noted below the table, are within the same range as the Zimbabwean prevalence rates for wasting.

Table 19: Global and regional trends for malnutrition in children 5 years and younger

	2005	2010	Percentage Change (%)
Global			
Stunting	0.295	0.261	-11.5254
Africa			
Stunting	0.399	0.372	-6.76692

Source: Global Health Observatory data repository of the World Health Organisation.
Notes: No values were available for wasting in 2005 and 2010, however, the regional average for 2017 was 7 percent, while the global average was 7.5 percent.

The pre-post analysis used in the table above is similar to the methodology that will be employed for Zimbabwe, with the structural shift being the hyperinflation period that occurred from year 2007 to 2008. A further disaggregation will be conducted in order to reveal the role of location (rural or urban), child's gender and asset wealth rank of their households.

Currie et al., (2009) identify child age, gender, family affluence, parent's education, country health patterns, communication with parents, positive peer relations, and supportive school environment as common sources of variations in child health. This analysis will use factors relevant to the Zimbabwean context, along with the household's asset index as a measure of living standards. Initially, one might expect that a hyperinflationary economic crisis would have an unambiguously negative impact on child nutrition. The results of this study show, however, that

the relationship is far more nuanced. A closer reading of the literature suggests that this outcome should not have been surprising.

5.2 Review of related literature

The existing literature on health effects of economic crises marked by high inflation shows mixed results. Zimbabwe is not the first country to face this problem and among existing case studies, there are profound variations. It is therefore worth surveying the experiences of other countries during periods of economic crisis, to see how child heath, in particular nutrition, was impacted. In Peru, Paxson and Schady (2005) found no significant changes in food consumption patterns during the economic crisis. Between 1986 and 1990, inflation increased from 86 percent to 7,500 percent in Peru (Kiguel and Liviatan, 1995). When real GDP per capita reached its lowest in 1988, infant mortality increased significantly. At this point, both private and public healthcare expenditure had declined significantly. Public health expenditure decreased by 58 percent and its share of the state budget declined from 4.3 percent of the national budget in 1985 to 3 percent in 1990. Not only were medical supplies expensive, but the real earnings of health workers had decreased significantly, leading to repeated strikes and large-scale loss of medical personnel. The result was very poor healthcare across the nation of Peru, to the extent that 50 percent of births occurred at home between 1988 and 1990. When Peru's hyperinflation period ended in 1991, infant mortality had risen.

Paxson and Schady (2005) comment that, during Peru's hyperinflation, when GDP decreased by 30 percent and real wages declined by 80 percent, cheaper staple foods – mainly starch – replaced proteins, dairy, and vegetables. Children were at risk of malnutrition through illness because the number of households that purchased medicine dropped by 50 percent. On the other hand, the authors show that households purchased more durable goods to protect income against hyperinflation. During the crisis, both food and medication prices became inhibitive, however it was poor healthcare that became the main avenue through which child health suffered.

Approximately a decade after the Latin American crisis, the 1997 to 1998 East Asian Economic Crisis had significant negative effects on the urban population of Indonesia (Waters et al., 2003). At the time, Indonesia's annual inflation rose to 58 percent and food prices increased at a rate of 80 percent. The crisis came unexpectedly; it was an exogenous shock, effectively a knock-on effect after the devaluation of the Thai Bhat. The health sector was negatively affected as medicine and medical treatment became more costly as input costs rose. As the value of money decreased, healthcare's share of household budgets fell. As a result, anaemia and vitamin A deficiency

increased among mothers and children under the age of 5. Wasting increased among mothers. Importantly, however, child malnutrition levels did not increase. In fact, overall child malnutrition decreased from 32.6 to 28.5 percent between 1995 and 1999. The percentage of children who were stunted and underweight also fell. The reason why child malnutrition decreased, while food and overall inflation increased might be that adults decreased their own nutritional intake in order to feed children in their households. While this explains why malnutrition did not worsen among children, it still does not clarify why it decreased. Could it be that families cut down on junk (non-nutritious) food? Or perhaps they narrowed down their budgets to mainly just food expenditure?

It is worth noting that the effect of the crisis was different in Thailand where the economic contagion had originated, but where households had access to good public healthcare. The nation's insurance schemes, such as the Voluntary Health card were useful to households. As a result, child malnutrition did not increase. However, the macroeconomic shock was felt by mothers and children at the micronutrient level. According to Block et al., (2004) haemoglobin concentration levels declined for both mothers and children. However, overall child malnutrition, proxied by wasting, remained unaffected.

Further evidence of the far-reaching consequences of the 1997 East Asian crisis was provided by Stillman and Thomas (2004), who show that, during the related Ruble crisis the following year, the Russian economy contracted by 25 percent and food expenditure decreased at the same rate. As the value of real individual incomes decreased, per capita expenditure declined by 20 percent. The result was a decrease in protein and fat intake in Russian households. Nonetheless, calorie intake did not decline significantly during the crisis because households increased staple food consumption. Similarly, McKenzie (2006) shows that households' energy intake was maintained during the Peso crisis in Mexico. This is mainly because households replaced milk, meat and fruit with staple foods. Consumer durables were used as a smoothing mechanism, either through the sale of or the reduction in the purchase of assets.

The impact of the Asian economic crisis on child health and nutrition was also assessed by Bhutta, Bawany, Feroze, & Rizvi (2008). Their study showed that food prices in Indonesia increased by as much as 300 times, while in Laos, they were 10 times the pre-crisis levels. The analysis revealed that, despite the price rises, child malnutrition did not change significantly in Laos and actually decreased in the Philippines and Indonesia. Overall, among these Asian economies, including Thailand, there was a minimal and insignificant increase in wasting among children under the age of 5. However, the same age group experienced a decrease in stunting and mortality, especially in rural areas. West and Mehra's (2010) study the effects of the 1998 financial crisis on the

Indonesian reported that Indonesia's GDP per capita declined by approximately 40 percent. However, they point out that in addition to the Asian contagion, it was also affected by cyclones, by an El Niño event, and by political unrest. The weather extremes led to food shortages which resulted in a significant increase food inflation. The most negatively impacted demographic were urban households who consumed less protein and vitamin A-rich food sources as they could no longer afford animal source foods and fruits. The results included increases in night blindness and anaemia.

Approximately a decade after the Asian economic crisis came the world food crisis of 2008. Christian (2010) chronicles how during this time, there was a 24 percent increase in the prices of staple foods such as sugar, rice and corn. Oil prices increased by 87 percent and dairy by 58 percent. On a global scale, this led to an overall increase in food insecurity, a decrease in nutrition and an increase in starvation-related deaths. Young children under the age of 5 were not spared from this reality as the mortality rates of under-5s around the world tend to be highest in the poorest quintile, with 55 percent of deaths typically resulting from malnutrition (Pelletier et al., 1995). Malnutrition, due to a lack of food, often led to infectious diseases. Wasting and stunting were responsible for causing the largest disease burden. This study of 9 different countries revealed that approximately 21 percent of deaths of children under 5 were due to restricted intrauterine growth, stunting and wasting. As the prevalence of malnutrition increased, the child mortality rate followed suit. In this global study, Christian (2010) estimates an 8 to 16 percent increase in wasting and a 3 to 7 percent increase in stunting in Asia. At the same time, child mortality in Sub-Saharan Africa was expected to increase by 3 to 15 percent. The main contributing factor being a decrease in micronutrient intake. The specific micronutrients that were expected to decrease among children on a global scale were Zinc, by 4.4 percent and vitamin A by 6.5 percent. The latter alone would result in a 23 to 30 percent increase in child mortality risk (Black et al., 2008) while the former would increase the risks of pneumonia, stunting and diarrhoea.

A closer look at the East Asian and Pacific regions, reveals significant increases in child malnutrition rates during this crisis of 2008. This was more so the case for urban households that did not grow their own food and instead relied on food purchases (Darnton-Hill and Cogill 2010). While rural households have the advantage that they can grow their own food and collect fruits and vegetables from the wild, urban households rely on food purchases. Economic pressures mean that many urban households end up selling assets, taking loans and reducing non-food expenditures in order to survive. In such circumstances, the trend seen among the urban-poor during the crisis was that animal-based foodstuffs were the first to be excluded from the diet. As

a result, household members experienced protein and micronutrient deficiencies as they ate less fish, milk, vegetables, eggs, meat and fruits. The new diets consisted largely of fats and carbohydrates i.e. staple foods. As the crisis worsened, households coped by reducing the size and frequency of meals, for adults first, then children. For example, in Indonesia, the effects of the food crisis were mainly felt by mothers. Wasting increased among women due to food shortages. A similar story of a rise in food insecurity during the global crisis is told by Sophal (2011) who shows that food shortages increased in Cambodia. Food prices there increased by 36.8 percent between 2007 and 2008, suggesting that 70 percent of the budget of the poorest 40 percent had been distorted. As a result, 50 percent of the poor households decreased their food intake during the crisis.

While most literature has shown these negative effects that were being experienced on the demand side, Brinkman et al., (2010) do the same and then go further to show how the crisis affected the suppliers of food. According to the authors, the 2008 global economic crisis resulted in general price increases, and as such, food price inflation. This was a welcome advantage to farmers who earned more profit from food production. Non-farm households that were dependent on food expenditure struggled to keep up with the food price increases and resorted to coping by either selling assets or stopping children from going to school. These were the consumption smoothing mechanisms on the demand side. In Burundi, for instance, 83 percent of households complained about the 40 percent rise in the price of staple foods during the global economic crisis. Similarly, in Ethiopia where staple food prices increased by between 100 and 180 percent, the proportion of food insecure households increased, especially in urban areas. In Guinea, 29 percent of urban households ate less frequently and 87 percent ate smaller meals. In Uganda, food prices increased by 10 percent, leading to fewer food purchases until 50 percent of food came from own production.

With these effects of the food crisis having been observed in other contexts, it is reasonable to ask whether there was spill over effects into Zimbabwe. Might the global crisis have been a contributing exogenous factor to Zimbabwe's economic crisis, given that they occurred simultaneously? Or were Zimbabwe's food shortages solely an internal problem?

This survey of global literature has shown that, during various economic crises, the risk of food insecurity tended to increase with inflation, even though the incidence of malnutrition varied by context. While most of the available empirical evidence shows that malnutrition and mortality increase with economic crises, their impacts may be felt asymmetrically. Quite often, during crises, women are described as forgoing their own meals to ensure food for their children. In such cases,

child malnutrition does not increase significantly. However, maternal malnutrition does, leading to low birth weight for neonates. However, it is more common that as real household incomes decline, households reduce dietary diversity, micronutrient and energy intake. In addition, as the deficiency in micronutrients increases, children became more susceptible to infections and suffer from poor growth and slow cognitive development. Even if caloric intake is undiminished, the likelihood of child stunting and wasting increases when food inflation forces households to decrease proteins and micronutrients. The remainder of the chapter analyses the changes that happened in child nutrition levels in Zimbabwe's history, paying particular interest to the hyperinflationary period.

5.3 Methodology

This chapter is a study of changes in child nutrition from 1994 to 2015, with a keen interest on the hyperinflation period. The nationally representative ZDHS 1994, 1999, 2005, 2010 and 2015 datasets are used in this analysis. In addition to the household data used in previous chapters, this analysis, specifically utilizes the women's datasets which carry health information for 28,254 children (14,246 girls and 14,608 boys) who were under the age of 5 at the time of the surveys. The ZDHS women's datasets contain information on adult women, household characteristics, birth history as well as pre- and post-natal data for up to 6 children under 5 years of age. This includes vaccination and health care information (Demographic and Health Surveys, 1994, 1999, 2005, 2010, 2015). National aggregates for inflation[25], remittances[26], annual rainfall[27] and maize yield[28] are also included in the analysis.

The analysis begins with a descriptive section showing the prevailing rates of child malnutrition and the changes that occurred during hyperinflation. This is important since high levels of malnutrition, specifically stunting and wasting, signal problems with general child health. Stunting (extremely low height-for-age) reflects cumulative growth deficits, i.e. ongoing chronic malnutrition. It shows past growth failure, due to prolonged food deprivation and/or sustained illness (World Health Organization, 2006; Akombi et al.2017). Wasting (extremely low "weight-for-height) describes a child's current nutritional status i.e. acute malnutrition due to recent food

[25] Robertson, J., personal communication, January 9, 2020.

[26] The Reserve Bank of Zimbabwe (2018). "Zimbabwe's foreign currency inflows from Money Transfer Agencies"

[27] Centre for Hydrometeorology and Remote Sensing (2020). Data Portal. Retrieved from http://chrsdata.eng.uci.edu/

[28] Food and Agricultural Organization of the United Nations (2020). FAOSTAT. Retrieved from http://www.fao.org/faostat/en/#data/QC

deprivation or illness (World Health Organization, 1999). For both measures, the malnourished child is located two or more standard deviations below the reference median. The ZHDS stunting and wasting variables are calculated using the World Health Organization (2006) Child Growth Standards. The descriptive and regression analyses for malnutrition use simple binary variables for stunting and wasting. These variables show the proportion of children who are stunted and wasted, without specifying the extent for each child.

After computing and comparing the malnutrition prevalence rates, the next stage involves multivariate regression analyses to establish whether inflation and other variables are significantly related to the rates of stunting and wasting amongst children. As mentioned earlier, correlation is no proof of causality, however, the implicit presumption being tested is that inflation leads to changes in household asset wealth, which in turn impact diet and healthcare and thence child health. This hypothesis is tested through the application of the *proximate determinants framework* of Mosley and Chen (1984), which was influenced by Palloni (1981) and Schultz (1979). The specific technique used is a multivariate Logistic regression analysis based on the following theoretical model:

$$P\left(Y_i = \frac{1}{x_i}\right) = \emptyset(x\beta) \qquad (16)$$

The dependent variables are stunting and wasting, which are non-specific measures of child health (Cole and Parkin, 1977; Mata, 1978). The subscript i in equation 16 refers to the individual child. In this case, the objective is to measure the probability that a child is malnourished (stunted or wasted) depending on the following proximate determinants which have an influence on the risk of morbidity and eventually lead to stunting and wasting:

1. Maternal factors - M_i
    i. Mother's height
    ii. Number of children born to mother
    iii. Duration of breastfeeding, in months
2. Environmental contamination - E_i
    i. Child had fever in the last 2 weeks
    ii. Child had diarrhoea in the last 2 weeks
    iii. Household has electricity
    iv. Household has piped or borehole water
    v. Household has a flush or Blair toilet
3. Nutrition deficiency - N_i
    i. Child ate food made from local grain in the last 24 hours
    ii. Child ate food made from local tuber in the last 24 hours

iii. Child ate eggs, fish or poultry in the last 24 hours
iv. Child ate beef, pork or lamb in the last 24 hours
v. Child ate pumpkin, carrot or squash in the last 24 hours
vi. Child ate dark green leafy vegetables in the last 24 hours

4. Personal illness control - P_i
   i. Child received BCG vaccination
   ii. Child received DPT vaccinations
   iii. Child received Polio vaccinations
   iv. Child received Measles vaccination
   v. Mother visited a doctor for prenatal health reviews
5. Socioeconomic factors - S_i
   i. Mother's education level – None, Primary, Secondary, Tertiary
   ii. Mother's employment status – Employed or not
   iii. Frequency of household visits to a health centre in the last 24 months
   iv. Asset index score for household (measured between XX and YY).
   v. Log of national annual aggregate for remittances
   vi. National annual rainfall
   vii. Log of national annual yield of maize
   viii. Log of annual inflation rate

The resulting empirical model is as follows:

$$y_{ij} = \emptyset_j + \sum_{i=1}^{3} \beta i\, M_i + \sum_{i=1}^{5} \varphi i\, E_i + \sum_{i=1}^{6} \partial i\, N_i + \sum_{i=1}^{5} \gamma i\, P_i + \sum_{i=1}^{8} \delta i\, S_i + \vartheta_j \qquad (17)$$

Here, the subscripts ij in equation 17 refer to the individual child i in household j. This equation measures the level of malnutrition based on the proximate determinants. In the final section of the analysis concentration indices are constructed. These show the levels of malnutrition inequality during the years covered by the study. The concentration index and concentration curve quantify, "the degree of income-related inequality in a specific health variable" (Lambert and Aronson, 1993; Kakwani, Wagstaff, & Van Doorslaer, 1997; and Wagstaff, Paci, & Van Doorslaer, 1991). The concentration index is always defined in reference to the concentration curve. On the x-axis of the concentration curve is the cumulative percentage of the sampled households ranked from poorest to richest. The y-axis is a plot of the cumulative percentage of the health variable that corresponds to each cumulative percentage of the distribution of the living standards variable. In this analysis, the X axis uses the asset index which was constructed in chapter 2. The health variables are stunting and wasting, which are also proxies for ill-health.

If the concentration curve $L(p)$ lies on the diagonal, there is no inequality in malnutrition. This means that, when households are ranked by asset holdings, the same proportion of children are

found to be malnourished in each quintile. However, if $L(p)$ is above the diagonal, there exists inequality in malnutrition, with children from poor households being more disadvantaged. In other words, ill-health is concentrated among the poor. On the other hand, if $L(p)$ were to lie below the diagonal, the malnutrition levels amongst children would be greater in wealthy households. The further $L(p)$ is from the diagonal, the greater the degree of health inequality. It is from these concentration curves that the numerical measure – concentration index (C) – of health inequality is derived. C is twice the area between $L(p)$ and the diagonal. $C = 0$ when $L(p)$overlaps with the diagonal. $C < 0$ when $L(p)$ lies above the diagonal and $C > 0$, $L(p)$ is found below the diagonal. Kakwani et al., (1997) gives the concentration index formula as:

$$C = \frac{2}{n\mu}\sum_{i=1}^{n} y_i R_i - 1 \qquad (18)$$

Where $n =$ sample size; $y_i =$ malnutrition indicator for child i; $R_i =$ relative rank in the wealth distribution for child i, $\mu = \frac{1}{n}\sum_{i=1}^{n} y_i$ is the mean level of malnutrition. In this context, where an asset index is used to represent living standards, the rank of the child in the wealth distribution is derived from the continuous factor score used in the creation of the wealth index. The concentration curve below illustrates the situation immediately prior to the hyperinflation:

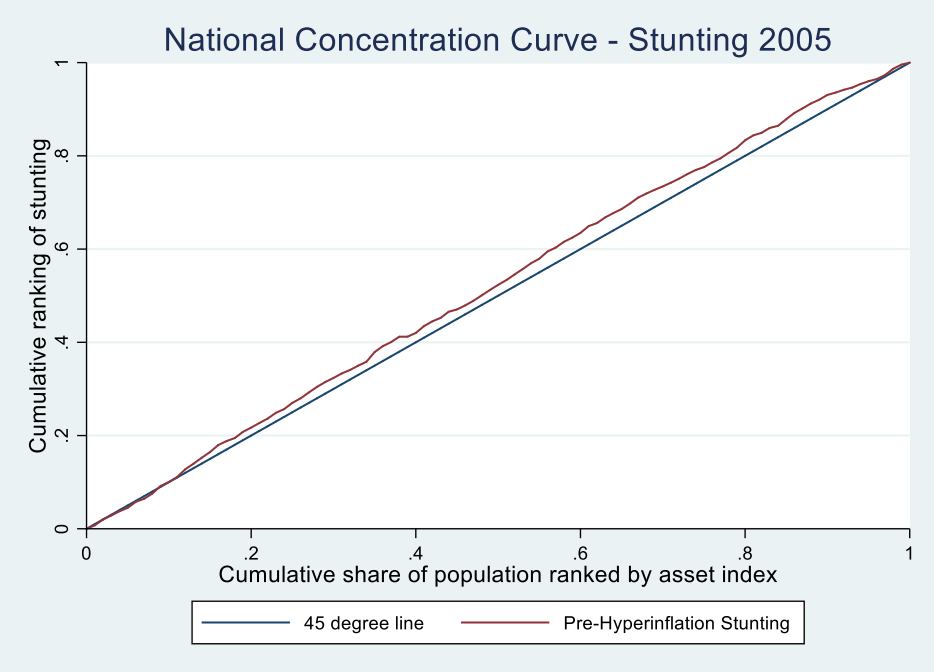


Figure 22: National Concentration Curve for Stunted Children, 2005

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005

5.4 Results

As seen in the thesis introduction, as well as in Figure 26 at the beginning of this chapter, the onset of Zimbabwe's hyperinflation period was really the year 2003 when annual inflation first ran above 350 percent. This is when rapid general price increases became the norm and this continued into the years of the technical hyperinflation – 2007 and 2008. Nonetheless, as shown in the thesis introduction, the economy was in trouble much earlier on. As a result, accessing good medical care and a balanced diet was already difficult in the early years of this millennium. It is therefore no surprise that stunting and wasting were on the rise from as early as 1999 onwards, as seen in Figures 22 and 23. While the years in the graphs show a rise in malnutrition up to 2006, supplementary data[29] shows that this upward trend continued until 2009 when hyperinflation ended due to dollarization. Thereafter as the economy improved and prices decreased, the purchasing power of real incomes also increased. As a result, healthcare and food was more accessible to households resulting in a decrease in child malnutrition.

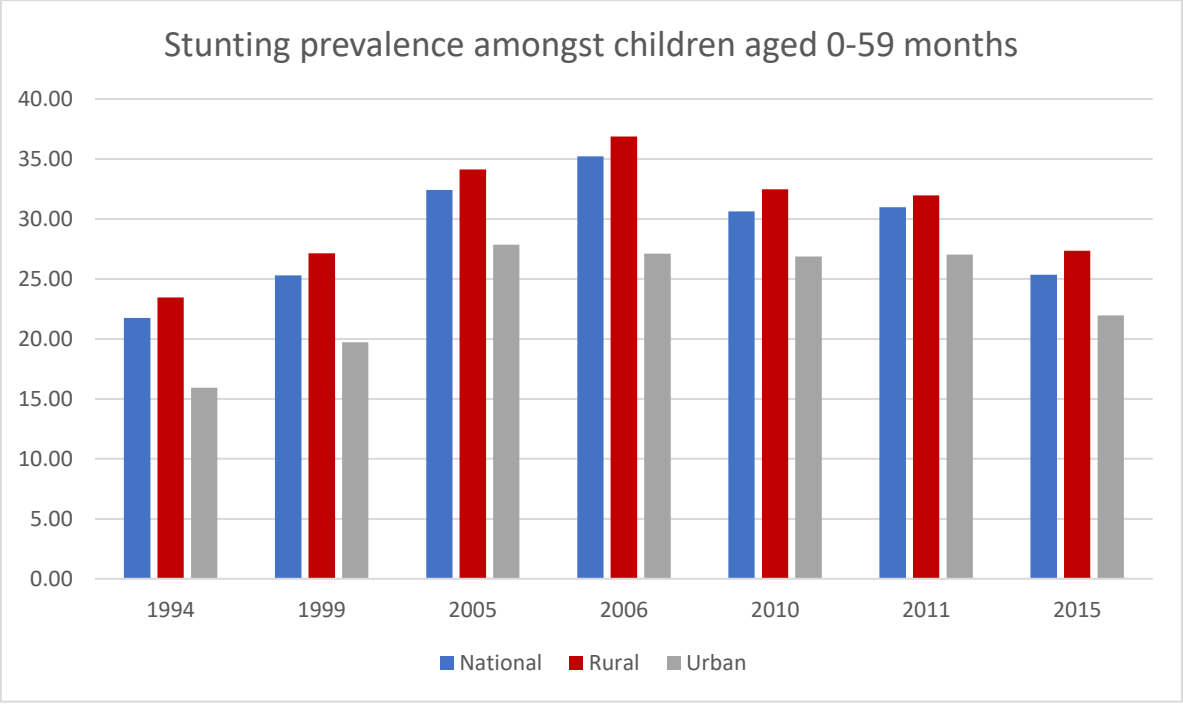


Figure 23: Zimbabwe's child stunting prevalence rates, 1994 – 2015

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

[29] World Bank (2010). UNICEF, WHO, World Bank: Joint child malnutrition estimates (JME). Retrieved from https://data.worldbank.org/indicator/SH.STA.STNT.ZS?locations=ZW

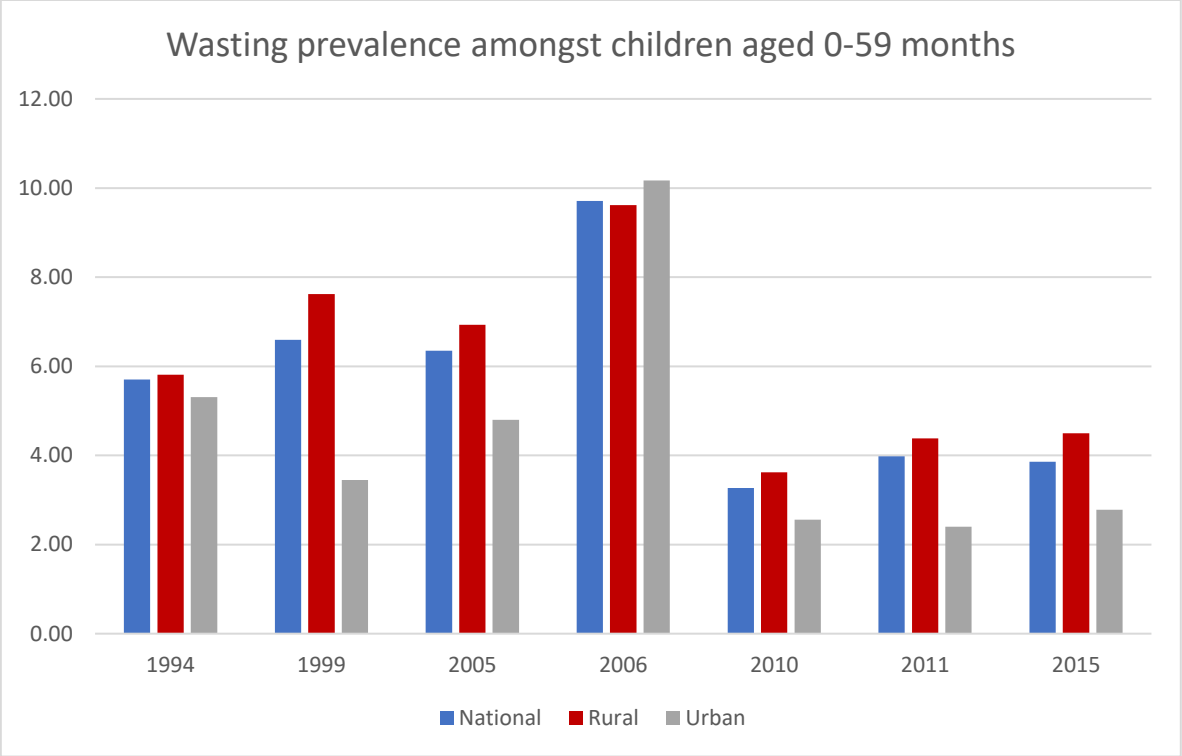


Figure 24: Zimbabwe's child wasting prevalence rates, 1994 – 2015

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

It is worth noting that the change in malnutrition rates after hyperinflation was more drastic in the case of wasting than stunting. This is expected since wasting is indicative of the immediate effects of a famine on children's weight. It is a good signal of the rate of recovery from starvation and infections that characterize economic crises. Zimbabwe was no exception, as the graph for wasting shows a sharp decline between 2006 and 2010. Due to this structural break of the technical hyperinflation from the year 2007 to 2008, the data can be split into two groups, with the years before 2007 being labelled as pre-hyperinflation years and the years after 2008 being labelled as post-hyperinflation years. Upon making this demarcation, Table 20 shows the overall picture. Its causes being cumulative, the high rate of stunting only changed slightly after hyperinflation, but wasting decreased significantly. For both stunting and wasting, prevalence rates were generally higher in rural areas and among male children, than they were in urban areas and among female children. These numbers show malnutrition before and after the hyperinflation period, allowing the inference that the change owed something to the hyperinflation that occurred in-the interim.

Table 20: Malnutrition prevalence rates, pre and post hyperinflation

	Pre-hyperinflation	Post-hyperinflation	Percentage change (%)	t- statistic
National				
Stunting	27.70	27.89	0.69	0.25
Wasting	6.57	3.74	-43.07	7.79
Rural				
Stunting	29.41	29.79	1.29	0.42
Wasting	7.11	4.25	-40.23	6.31
Urban				
Stunting	22.34	23.91	7.03	1.18
Wasting	4.89	2.67	-45.40	3.80
Male child				
Stunting	29.57	31.07	5.07	1.41
Wasting	7.43	4.04	-45.63	6.28
Female child				
Stunting	25.82	24.67	-4.45	1.13
Wasting	5.71	3.43	-39.93	4.67

Note: T-statistic > 1.96 is statistically significant.

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005 – 2010

The next table shows the malnutrition prevalence rates by asset wealth quintile. Over the 20-year period under study, both stunting and wasting were most prevalent among households in the bottom 40 percent of the asset index distribution - Quintiles 1 and 2. This is the poorest segment of the Zimbabwean society, with the majority of these households being in rural areas. Stunting and wasting are also high in the 4th quintile which mainly comprises poor urban households. The lowest levels of malnutrition are seen in the wealthiest quintile of the asset index distribution, which mainly consists of affluent urban households. For this wealthy segment of society, the change in malnutrition after hyperinflation was negligible, albeit positive as there was a decline in both stunting and wasting. The significant changes were declines in malnutrition rates among households in the 4th quintile. In addition, there was a significant decrease in wasting amongst children of households in the bottom 40 percent of the asset index distribution.

The high rates of wasting and stunting among the urban poor are expected because this is the group with the least ability to produce its own food directly, but also the one whose wage income

is under threat the most. The previous chapters have shown that these urban households experienced the greatest increase in asset poverty during hyperinflation. The decrease in resources, would have been a constraining factor from accessing healthcare. These are also the same households that suffered most from food inflation, dysfunctional sanitation systems, as well as electricity and water shortages.

Table 21: Shifts in the quintile distribution of malnourished children

	Pre-hyperinflation	Post-hyperinflation	Percentage change (%)	t- statistic
			Stunting	
Quintile 1	37.48	35.89	-4.24	0.66
Quintile 2	29.52	31.67	7.28	0.94
Quintile 3	33.94	29.15	-14.11	1.97
Quintile 4	34.06	27.95	-17.94	2.22
Quintile 5	27.61	26.85	-2.75	0.24
			Wasting	
Quintile 1	8.84	3.58	-59.50	4.36
Quintile 2	7.41	4.30	-41.97	2.70
Quintile 3	6.06	4.18	-31.02	1.65
Quintile 4	7.13	2.59	-63.67	3.63
Quintile 5	4.56	2.55	-44.08	1.55

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

There were certainly the high rates of wasting and stunting among children in poor rural households and it seems likely that these reflected decreased access to healthcare, especially during the hyperinflation period. On average, 57 percent of rural households visited a health facility in 1994. This number had declined to 30 percent in 2006 and gradually recovered after hyperinflation. As Figure 24 shows, the story was not much different for urban households over the years. However, a stark difference is seen in Figures 25 and 26 which show that, while the proportion of women who consulted with health personnel for prenatal medical care was low for all households, it was especially so for women in rural households during the hyperinflation years of 2005 and 2006. Figure 25 drives the point home by showing a sharp decline in the percentage of women who visited nurses for prenatal care between 2006 and 2010. It is evidence that the hyperinflation years of 2007 and 2008 affected access to prenatal care and likely had negative

consequences on child health. Healthcare only recovered to its original level after a decade. But even after hyperinflation, very few women in rural areas had their pregnancies attended to by doctors.

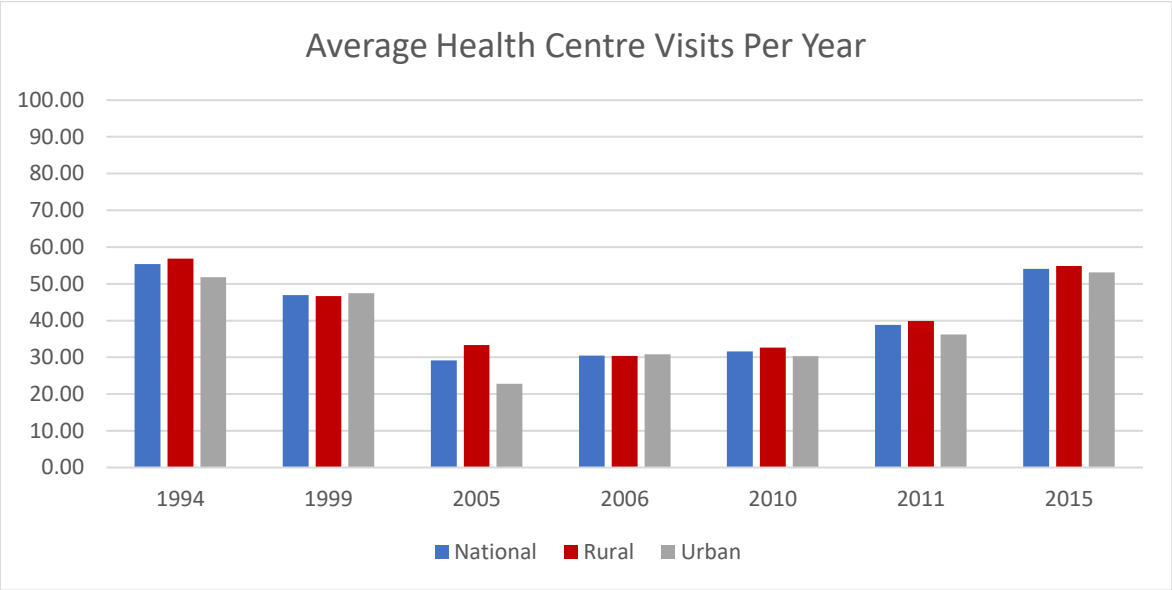


Figure 25: Proportion of households visiting health centres

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

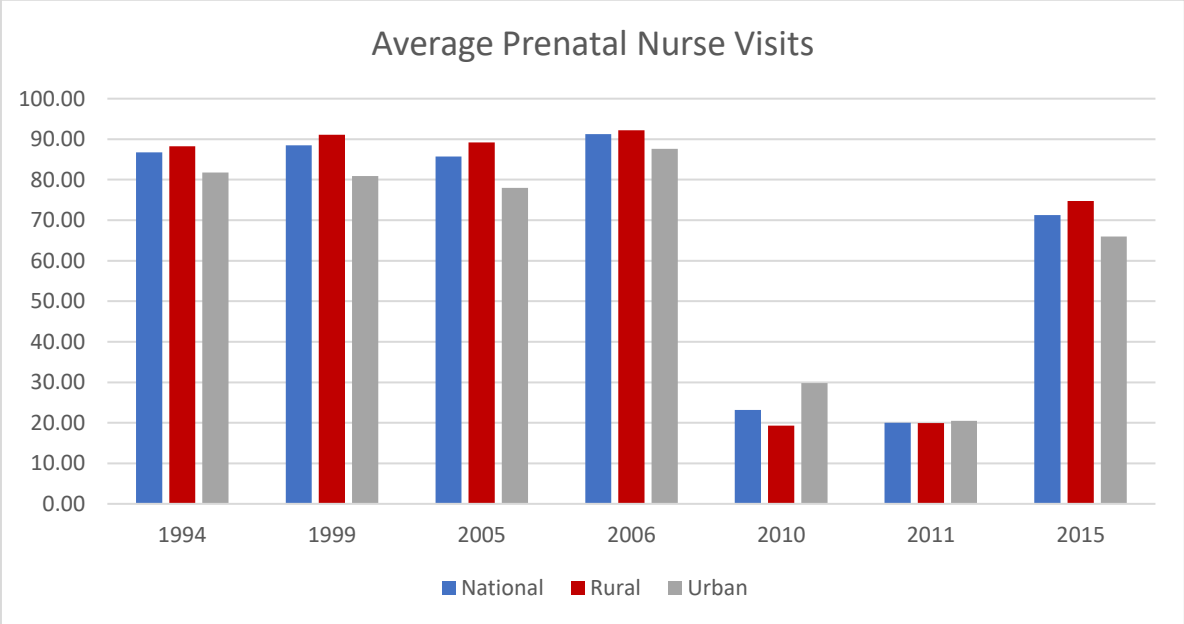


Figure 26: Proportion of women consulting with nurses for prenatal care

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

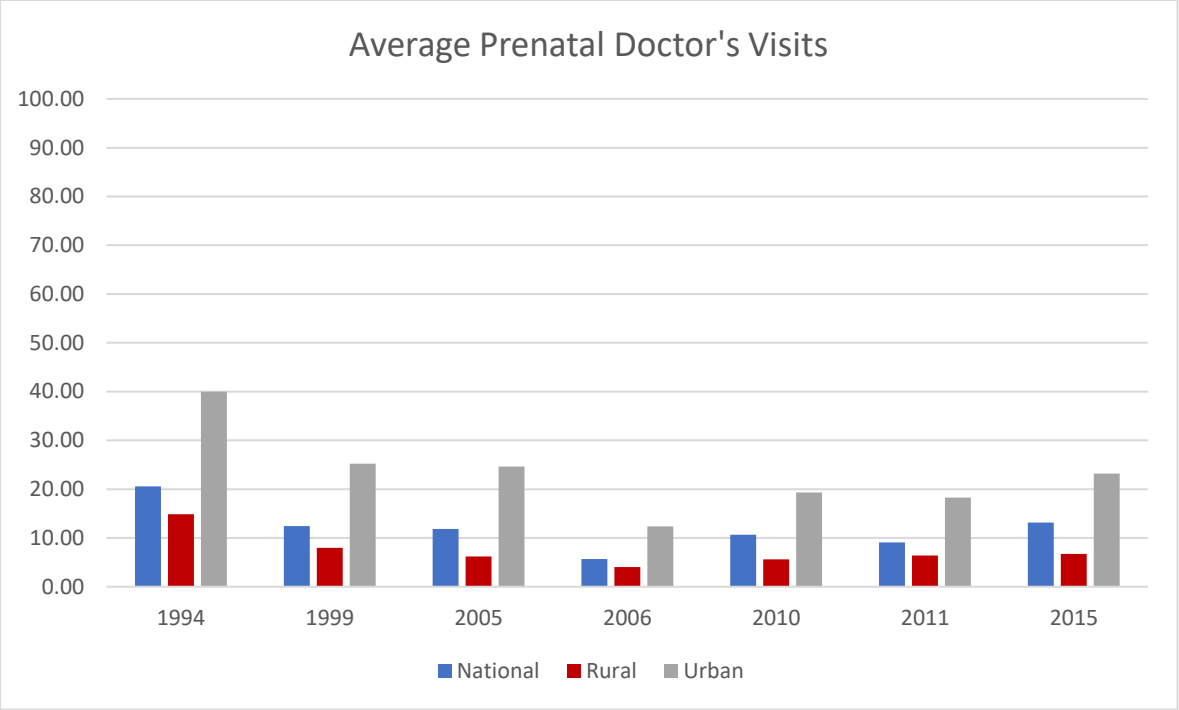


Figure 27: Proportion of women consulting with doctors for prenatal care

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

Once the children were born, they were generally immunized at the same rate, regardless of location – rural or urban. However, Figure 27 makes it apparent that the rates of immunization dropped during the hyperinflation period. From the year 1999 to 2006, the ZDHS show a steady decline in immunization for BCG, DPT, Polio and Measles. Recovery only occurred after hyperinflation. Rural households lagged behind in all cases and this would have contributed to the higher malnutrition rates that are observed in the bottom quintiles.

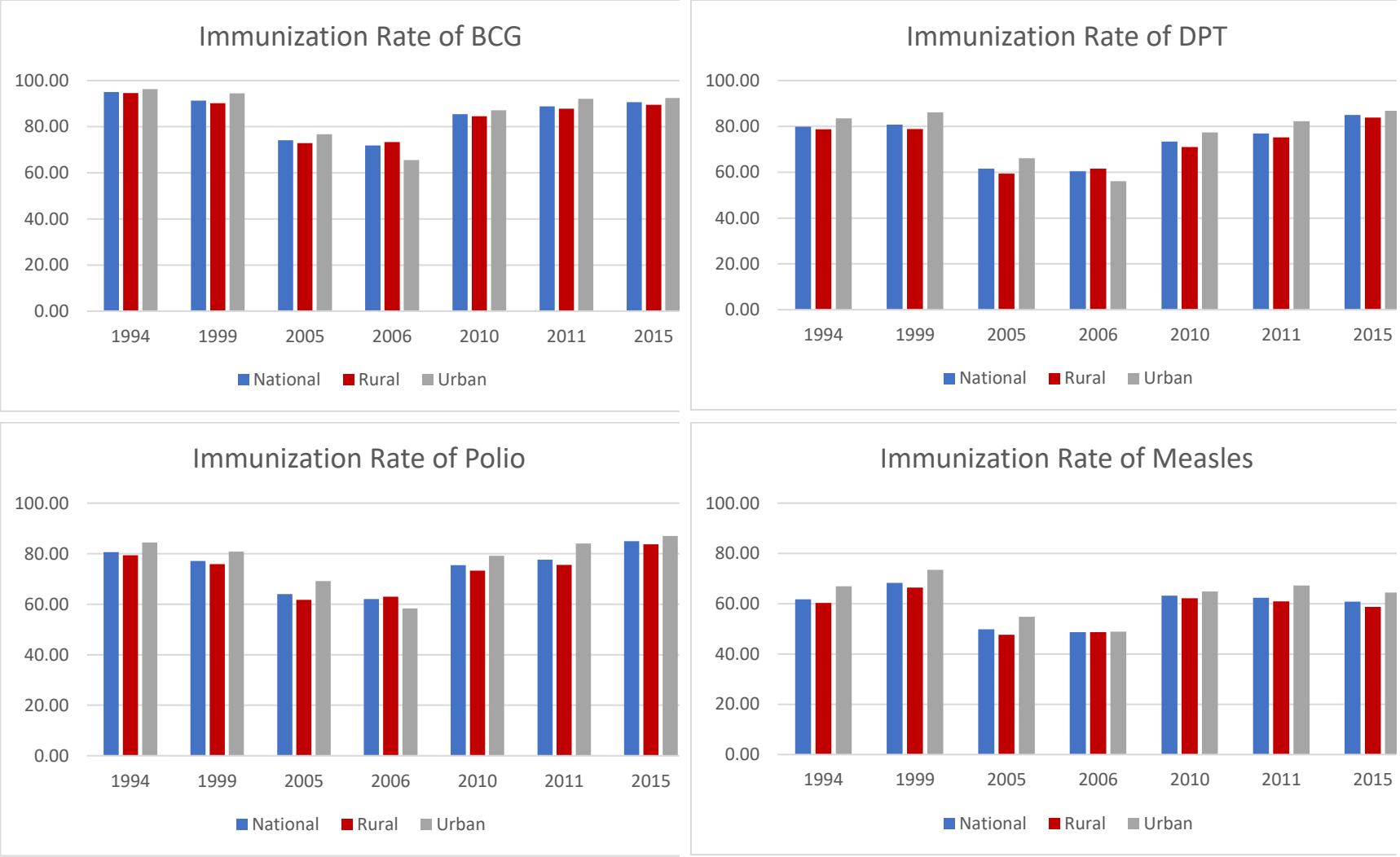


Figure 28: Proportion of immunized children

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

An additional factor contributing to malnutrition among children in rural households is poor access to safe drinking water – piped into the dwelling, communal tap, protected well and borehole water. Figure 28 makes this constraint very apparent. The national average is pulled down by low access in rural areas. While the proportion of households using water from these four protected sources increased in the early years, it eventually plateaued slightly above 50 percent. Though in actuality, rain water, that is collected in closed containers would have been safer to drink than the piped water in cities such as Harare which increasingly became contaminated (Maponga, 2013). Be that as it may, the data shows that half of the households in rural Zimbabwe have been drinking contaminated water and thus risking the health of their children. The harsh reality is that over these 20 years, only 2.5 percent of rural households have used piped water, while a meagre 4.6 percent use communal tap water.

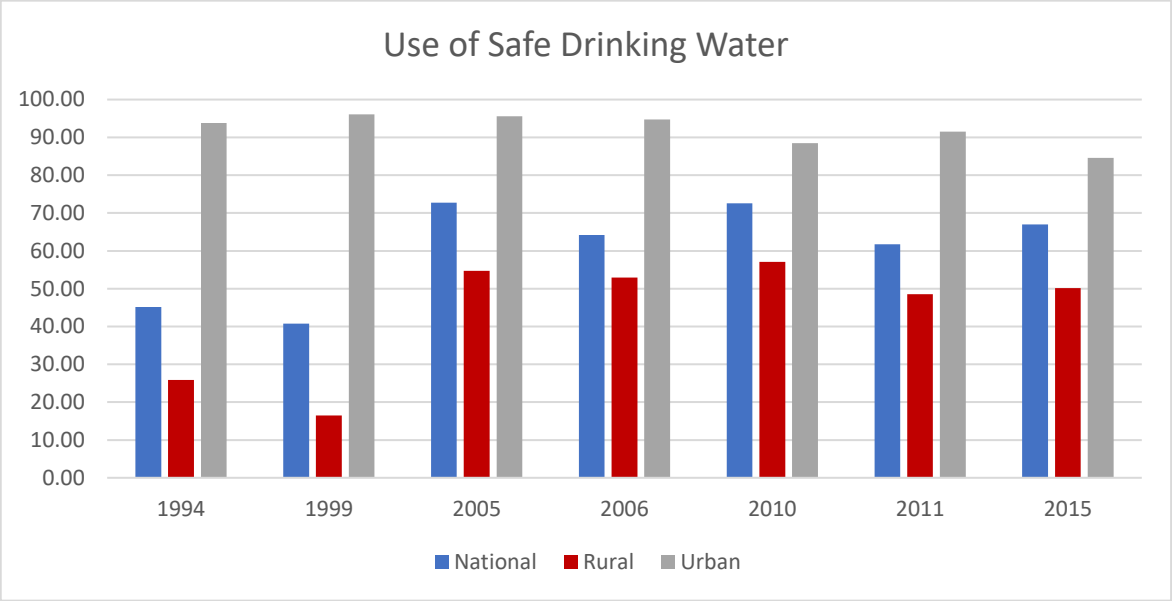


Figure 29: Proportion of households using safe water

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

This inability to use piped water also constrains the rural households from being able to use flush toilets. Only 3.8 percent of rural households have flush toilets in their homes, 22 percent use Blair toilets, which are lined pits covered by a cement slab, importantly they have a fly trap in a vertical flue so they minimize the health risks and other externalities associated with pit latrines. 22 percent of the rural population use external toilets in the form of pits dug in the backyard. The remaining 55 percent of rural households have no toilet facilities. This raises the likelihood of environmental contamination, which is a risk factor to child health.

While the rural sanitation infrastructure is virtually non-existent, the urban infrastructure has become increasingly dysfunctional over the years. The reality is that many households that own flush toilets found them inoperable during the hyperinflation period. As explained earlier, the Zimbabwean government failed to invest in the maintenance of the fresh water and waste-water purification infrastructures during the economic crisis, and households suffered real consequences such as the Cholera pandemic of 2008 (Mason, 2009). Figure 29 shows the decline in the use of flush toilets from the year 1999 onwards. The sharpest decrease is seen during the hyperinflation years, from 2005 to 2010.

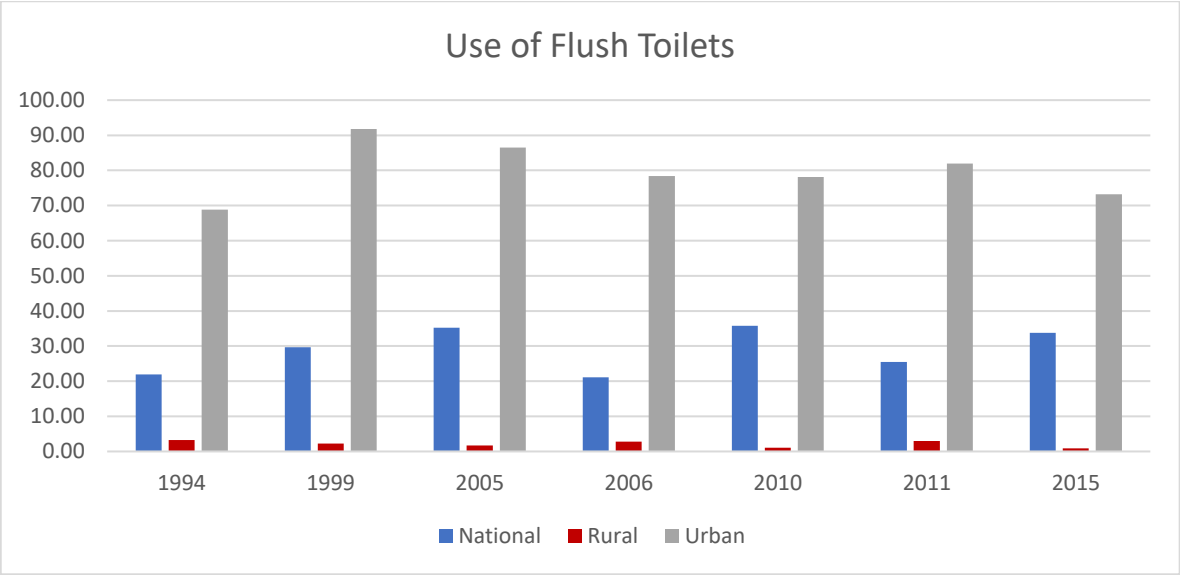


Figure 30: Proportion of households using flush toilets

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

The final prominent factor related to the malnutrition of children was diet. As highlighted in the thesis introduction as well as the literature review of this chapter, a common coping mechanism among households during the hyperinflation period was to alter their diet. Generally, in response to price increases, households either reduced meal frequency, meal quantity or meal diversity. In many cases, it was a combination. Urban households tended to suffer more from food inflation because they had to purchase most of their food. In contrast, rural households coped better because the majority produced their own food while others sent members to do agricultural work in order to earn money to purchase food (ZimVAC, 2009). The differences in dietary diversity are seen in Figures 30 and 31; these were constructed from responses given by mothers about the food groups consumed by their children in a 24-hour day.

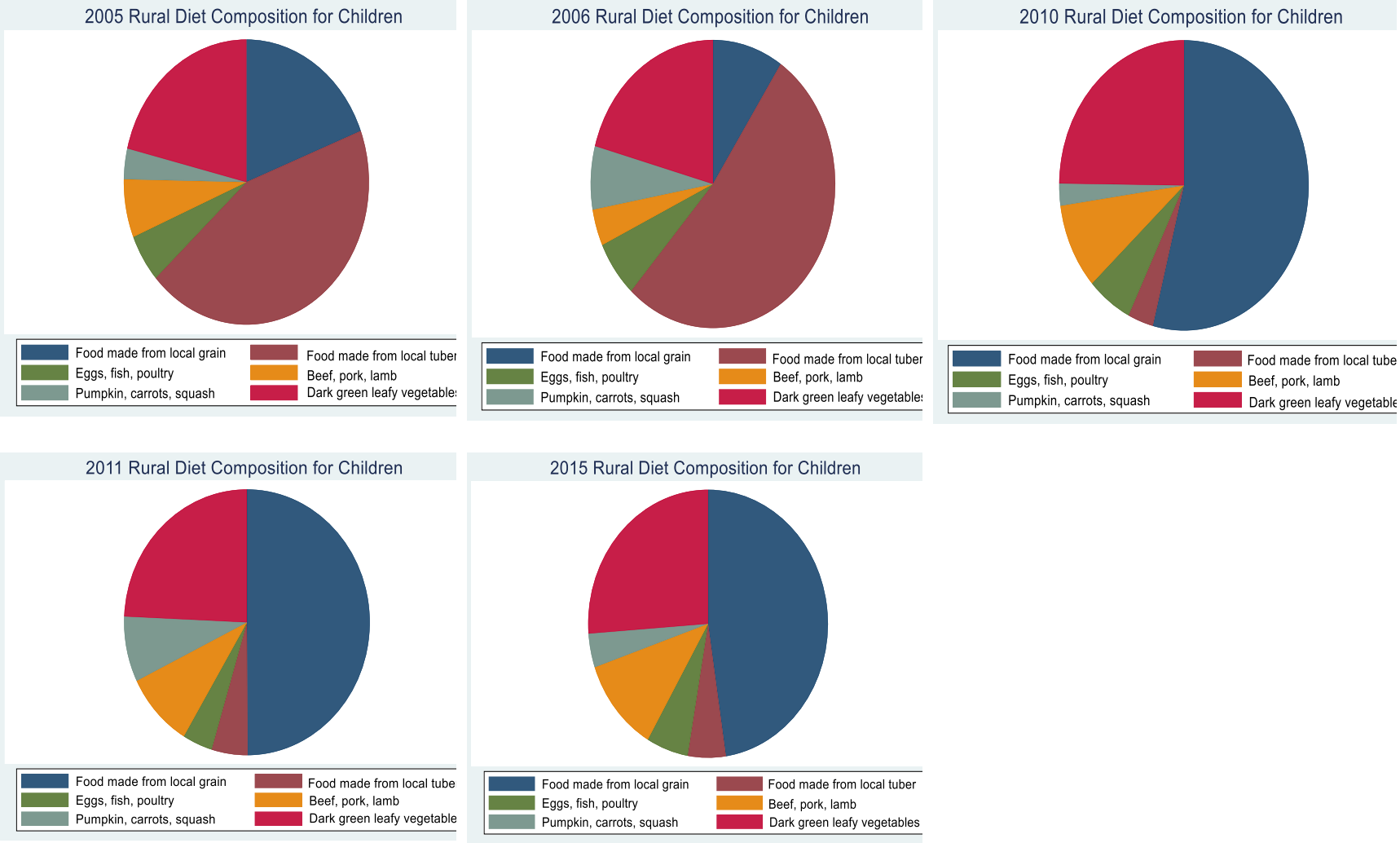


Figure 31: Diet composition for rural children in Zimbabwe

Note: The 1994 and 1999 data sets do not have comparable variables.

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005 – 2015

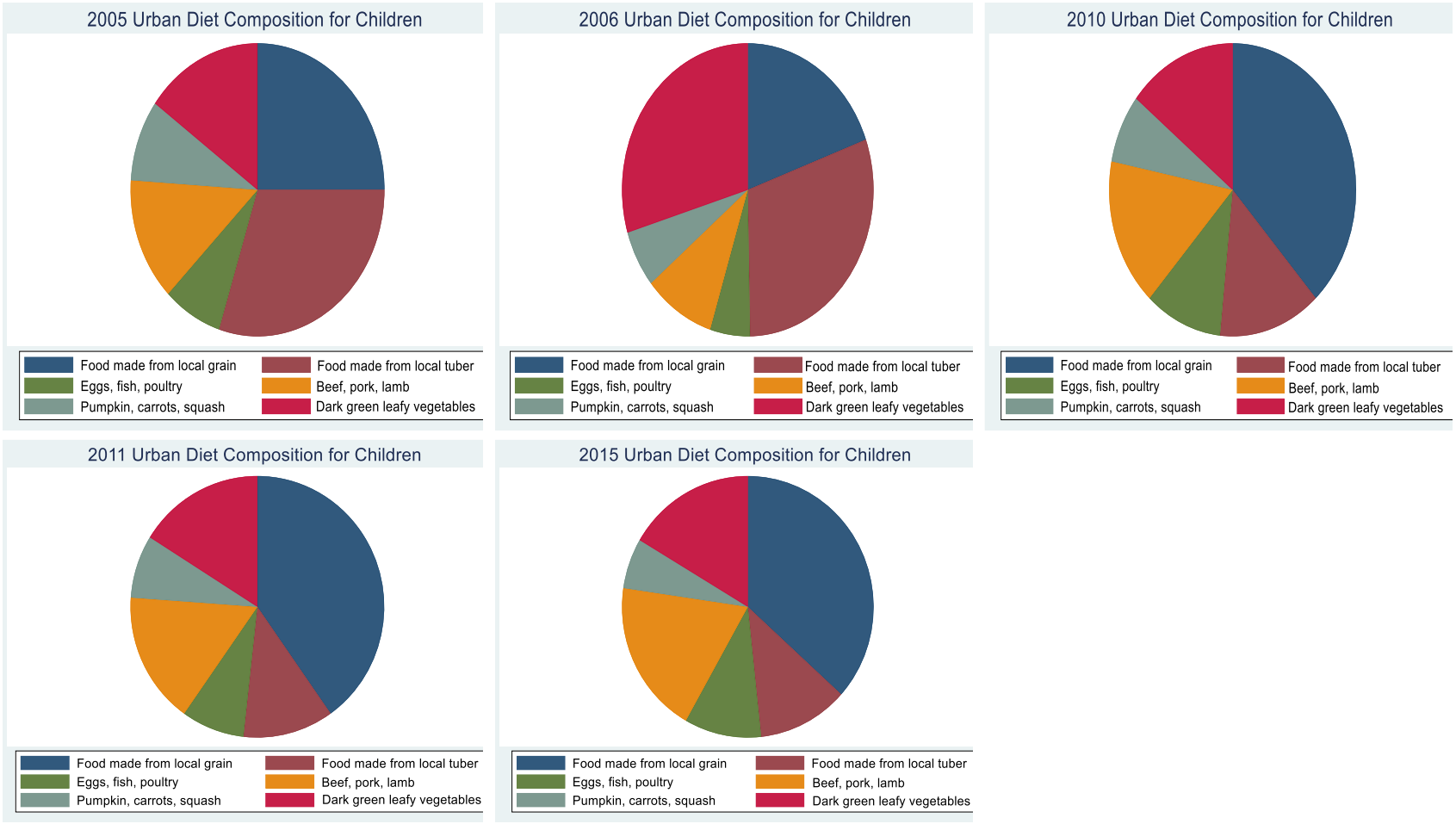


Figure 32: Diet composition for urban children in Zimbabwe

Note: The 1994 and 1999 data sets do not have comparable variables.

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005 – 2015

Looking at the pie charts for the years at the onset of hyperinflation – 2005 and 2006, children from both rural and urban households consumed very little protein in the form of poultry and meat. Their meals mainly consisted of vegetables and carbohydrates. By 2006, protein comprised less than 25 percent of children's daily diet. At this point, green vegetables and pumpkins made up a third of the diet of urban children while over 50 percent consisted of carbohydrates in the form of grain and tubers. The urban diet was less balanced than the rural diet during hyperinflation. However, this changed noticeably after hyperinflation when urban children consumed a more diverse diet with increased proportions of protein.

Clearly a variety of factors contributed to the levels of malnutrition that are observed in the data. Acute malnutrition in the form of wasting increased during hyperinflation and later decreased after dollarization. A similar pattern in observed for the indicators of morbidity – fever and diarrhoea. Both increased during hyperinflation and decreased when it ended. There is an obvious correlation and it is highly likely that diarrhoea cases were exacerbated by the failures of functional piped clean water and flush toilet systems in urban areas. On the other hand, instances of fever. which is indicative of infection, may have increased due to the decreased access to vaccines, infrequent health centre visits, limited protein consumption, and the ingestion of food cooked incompletely due to electricity shortages seen in Figure 32.

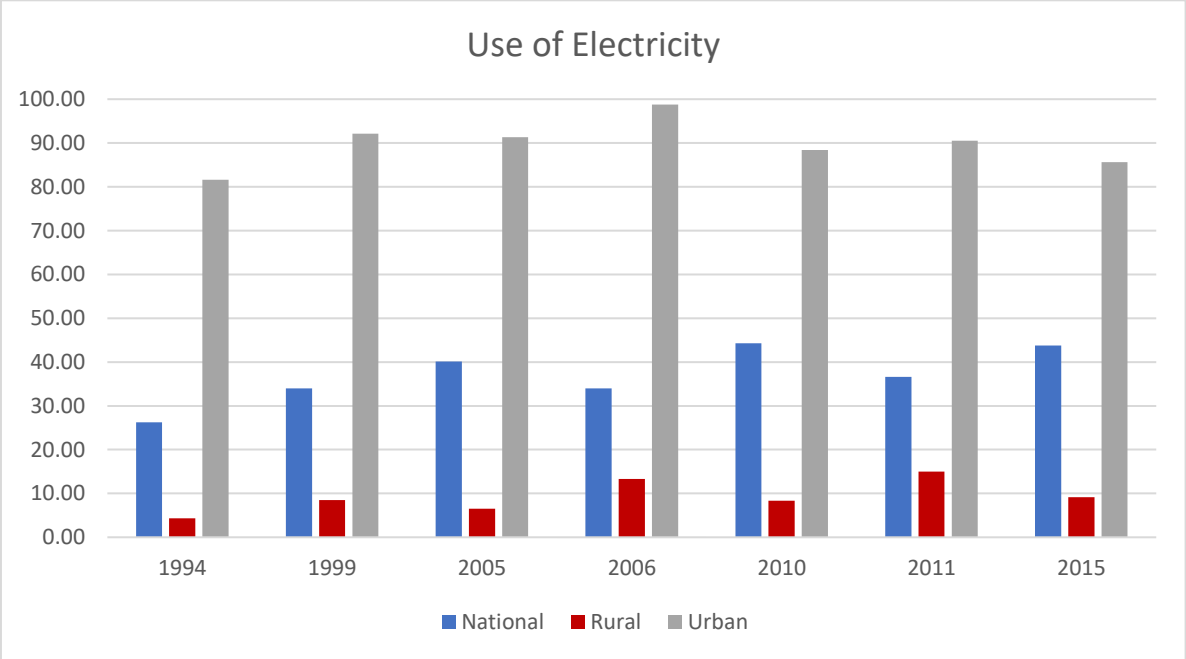


Figure 33: Proportion of households using electricity

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

While the descriptive statistics have shown likely correlates with malnutrition, the regressions below give more clarity on the most crucial variables which are likely to have influenced changes in stunting and wasting.

Table 22: Individual, household and community level factors of children aged 0-59 months

Variables	Mean	Standard Deviation
Stunted	0.28	0.45
Wasted	0.05	0.22
Child Age	4.28	4.82
Child Age Squared	41.58	91.25
Female Child	0.49	0.50
Household size	5.68	2.87
Number of children in household	1.01	0.99
Healthcare Visits	0.43	0.50
Mother's education	0.95	0.21
Months of breastfeeding	12.79	7.49
Mother's height (cm)	159.18	65.99
Asset Index	2.70	6.36
Improved Toilet	0.51	0.50
Safe Water	0.60	0.49
Electricity	0.38	0.48
BCG	0.86	0.34
DPT	0.76	0.43
Log Remittances	6.25	1.13
Log Inflation	2.64	2.21
Log Maize Yield	16.09	0.37

Notes: Sources for remittances, inflation, maize yield and rainfall in end notes. The data is for the years 1994 to 2015.

Table 22 contains the summary statistics of the covariates used in the econometric analysis. The average for stunted children in Zimbabwe over the 20-year period is 28 percent, while that of wasting is 5 percent. This corresponds with the results in Table 20 showing that the prevalence rates are in similar ranges. The average age is 4.3 months, which is rather worrisome given that the study includes children up to 5 years of age. This might be an indicator of infant mortality which averaged 54.77 percent over the 20 years (World Bank, 2015). The household size variables are representative of the Zimbabwean society which does not have extremely large families and also lost members to migration over the years. The mean for health care visits shows that over half the population can go for a year without receiving medical attention. Another problematic factor are the immunization rates which are less than 1. Maternal variables show that 95 percent of the women have at least primary level education, are of average height and they breastfeed

their children for an average of 12 months. The safe water, electricity and improved toilet averages point to infrastructure problems. The averages for the log of remittances and inflation show that quite a lot of money flowed into the country as inflation increased. On the other hand, the maize yield average shows high productivity over the years, though it later tapered down. In tables 23 and 24 below, the results of the Logistic regressions are shown.

Table 23: Multivariate Analysis of Wasting (Weight-for-height index)

Variables	Odds ratio	95% CI	P>z
Dependent Variable: Wasting			
Gender of Child			
Male	1		
Female	0.764***	(0.65, 0.89)	0.001
Mother's education			
None	1		
Educated	0.824**	(0.72, 0.94)	0.005
Household size	0.980	(0.95, 1.01)	0.181
Electricity			
No electricity	1		
Electricity	0.672***	(0.52, 0.87)	0.003
Toilet			
Basic Toilet	1		
Improved Toilet	0.943	(0.77, 1.15)	0.566
Water			
Unsafe Water	1		
Safe Water	0.921	(0.77, 1.10)	0.359
Log Remittances	1.094	(0.92, 1.29)	0.297
Log Inflation	1.143***	(1.03, 1.26)	0.008
Log Maize Yield	1.268	(0.64, 2.49)	0.492

Notes: 1) Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; z-scores in last column.
2) $Pseudo\ R^2$ = 0.012; p-value=0.0000; $X^2\ (19)$=144.67. 3) Observations=12,949. 4) Remittance values are derived from the Reserve Bank of Zimbabwe as shown in Figure 14. For this analysis, values for the years corresponding to the household data are used. 5) Inflation values are derived from the Reserve Bank of Zimbabwe as shown in Figure 1. For this analysis, values for the years corresponding to the household data are used. 6) Maize yield values are derived from the Food and Agriculture Organization as shown in Figure 5. For this analysis, values for the years corresponding to the household data are used.

Among the determinants of wasting, the first significant variable and a 99 percent confidence interval was child's gender. The odds that a female child is wasted are 23.6 percent lower than for

a male child. This result corresponds with the descriptive statistics in Table 20 which show a lower prevalence rate of wasting among girls than boys. Prior to hyperinflation, the prevalence rate for wasting among boys was 23 percent more than girls, and it was 15 percent more after hyperinflation. Given that the mean of wasting is 5 percent, that implies that many more boys suffered from wasted than girls, during the hyperinflation period. It is indeed the expected result as a similar finding was made by Awoyemi and Abaniwonda (2019) in Nigeria. They find that wasting is 9.8 percent higher among boys than girls. So, while the pattern is the same, the difference in wasting by gender was greater in Zimbabwe, which is indicative of the severity of the consequences of hyperinflation on malnutrition.

The next significant determinant for wasting is the level of education attained by the mother of the child. The odds of wasting are 17.6 percent less for children with educated mothers than those without. This is the expected result given that educated mothers are more likely to make more informed decisions in prenatal, delivery and postnatal care. For instance, an educated mother will most likely apply the latest knowledge in treating their child's illnesses, feeding them, immunizing them and so forth (Mosley, 1983).

Household size is also a significant determinant of wasting, with each additional household member decreasing the odds of wasting among children by 2 percent. This signals an important aspect of economic crises. In a situation of hyperinflation like the one that was experienced in Zimbabwe where real income declined, the value of each working household member increases as their financial contributions assist in consumption smoothing. In addition, access to electricity significantly influenced the chances of wasting among children. The odds that a child from a household with electricity will be wasted were 32.8 percent less than a child in a household without electricity. This is the expected result as electricity is useful in the sterilization of utensils, preparation of hot meals, boiling of water, and the refrigeration of food; all which prevent infections in young children (Mosely and Chen, 1984).

While the other household level variables changed in the expected direction, they were not statistically significant. On a country level, the variable that was statistically significant from zero in terms of its effect on wasting was inflation. The odds of wasting increased in Zimbabwean children by 0.03 percent with each extra percentage increase in inflation. This means that in 2007 when the annual inflation rate was 6,724 percent, the chances of being wasted were 2 percent.

These results were relatively similar to those of stunting. However, in the ensuing discourse, it shall become apparent that the prevalence rate of stunting was affected by more long-term variables. Much like it was with wasting, the regression results in the table below show both inflation and remittances increasing the odds of stunting among children. It makes sense that the two variables move together because remittances increased during the hyperinflation period and have often been termed the lifeline of Zimbabwean households (Von Burgsdorff, 2012). The odds of stunting increased in children by 0.02 percent increase in inflation and by 0.04 percent increase in remittances. It is worth noting that the odds are lower for stunting that they are for wasting. This is because stunting is a long-term condition that outlasted the hyperinflation famine and was necessitated by many other factors, mainly at the household and individual levels.

For similar arguments as in wasting, the odds of stunting were 23.5 percent lower for female children than their male counterparts. Nonetheless, the other two significant socio-demographic characteristics were child's age and household wealth. Results show that the odds of stunting among children increased with age, albeit at a decreasing rate over time. Household wealth also mattered as each extra unit increase in the asset index was associated with a 0.2 percent decrease in the likelihood of stunting. A similar finding to Martorell and Young (2012) who show the role of household wealth in reducing stunting. Apart from wealth, household size was significant, as each extra household member resulted in a 0.1 percent reduction in the odds of stunting among children. Even though larger households seemed advantageous to children, as they number of children in the household increased, the chances of stunting followed suit. The regression shows that each extra child increased the odds of stunting by 17.6 percent. This confirms the previous assertion that the adult working household members were the helpful ones in preventing stunting.

Apart from demographic factors, healthcare proved to be important in determining the likelihood of stunting among children. It appears that if a household had visited a health centre in the last 24 months, the children were 10.7 percent less likely to be stunted. This is the expected result as access to healthcare is often associated with lower levels of stunting (Aoun, Matsuda, & Sekiyama, 2015). In addition, the odds of being stunted were 35.9 percent lower for a child given the BCG vaccine, that one who had not been immunized. has 0.23 less probability of being stunted. However, the odds that a child who receives all shots of DPT will be stunted are 34.8 percent higher than one who has not been vaccinated. While the earlier result is expected, the latter is an anomaly. However, Prendergast (2015) shows that the effect of DPT vaccines vary in child population, depending on geographical location, as children born in harvest season respond

differently to those who are not. This potentially applies to Zimbabwe too, as it is an agricultural society.

Table 24: Multivariate Analysis of Stunting (Height-for-age index)

Variables	Odds ratio	95% CI	P>z
Dependent Variable: Stunting			
Gender of Child			
Male	1		
Female	0.765***	(0.68, 0.85)	0.000
Age of Child			
Child Age	2.023***	(1.67, 2.46)	0.000
Child Age Squared	0.828***	(0.79, 0.86)	0.000
Household size	0.999	(0.97, 1.02)	0.924
Number of children in household	1.176***	(1.09, 1.27)	0.000
Health visits in a year	0.893	(0.80, 1.00)	0.047
Months of breastfeeding	1.050***	(1.04, 1.06)	0.000
Mother's height	0.993***	(0.99, 1.00)	0.000
Asset index	0.998	(0.99, 1.01)	0.720
BCG vaccine			
None	1		
Vaccinated	0.641***	(0.50, 0.82)	0.001
DPT vaccine			
None	1		
Vaccinated	1.348	(1.08, 1.68)	0.008
Log Remittances	1.246***	(1.15, 1.35)	0.000
Log Inflation	1.133***	(1.09, 1.18)	0.000

Notes: 1) Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; z-scores in last column.
2) $Pseudo\ R^2$ = 0.090; p-value=0.0000; $X^2\ (23)$=682.14. 3) Observations=8,066. 4) Remittance values are derived from the Reserve Bank of Zimbabwe as shown in Figure 14. For this analysis, values for the years corresponding to the household data are used. 5) Inflation values are derived from the Reserve Bank of Zimbabwe as shown in Figure 1. For this analysis, values for the years corresponding to the household data are used.

There were also some significant maternal factors in the regression. First, each unit increase in the mother's height was associated with a 0.7 percent decrease in the likelihood of stunting in their child. Second, each extra month of breast feeding increased the likelihood of stunting in the child

by 5 percent. This was an unexpected result. However, Syeda, Agho, Wilson, Maheshwari & Raza, (2020) shows that prolonged breastfeeding has an adverse impact on child nutrition. In Zimbabwe, it is possible that the 2.85 percent of mothers who breastfed their children past 24 months did so to supplement solid food during the hyperinflation period.

Now that the regression output has revealed the variables that are strongly related with malnutrition, it is reasonable to assume a varied effect of these socioeconomic indicators, depending on each households' endowments. This chapter will therefore end with an assessment of inequality levels in child malnutrition. Table 25 shows that stunting and wasting have been disproportionately distributed over the 20-year period under study. With all values of the concentration index being negative, it is apparent that children from poor households are suffering more from malnutrition that the rest of the child population. While this trend had improved between 1994 and 2005, inequality in stunting and wasting increased from 2006 onwards during the peak of hyperinflation and only declined after dollarization in 2010.

Table 25: Child malnutrition inequality in Zimbabwe, from pre to post-hyperinflation

STUNTING	National		Rural		Urban	
	Concentration Index	P-value	Concentration Index	P-value	Concentration Index	P-value
1994	-0.10	0.00	-0.02	0.52	-0.28	0.00
1999	-0.11	0.00	-0.08	0.00	-0.10	0.04
2005	-0.02	0.25	0.01	0.48	-0.02	0.52
2006	-0.08	0.03	-0.05	0.23	-0.14	0.10
2010	-0.06	0.00	-0.03	0.23	-0.04	0.06
2011	-0.05	0.10	-0.03	0.27	-0.04	0.51
2015	-0.09	0.00	-0.06	0.00	-0.14	0.00
WASTING	National		Rural		Urban	
	Concentration Index	P-value	Concentration Index	P-value	Concentration Index	P-value
1994	-0.13	0.03	-0.16	0.04	-0.20	0.16
1999	-0.12	0.01	-0.01	0.83	-0.26	0.12
2005	-0.09	0.09	-0.05	0.32	-0.02	0.89
2006	-0.07	0.36	-0.04	0.63	-0.26	0.00
2010	-0.07	0.25	-0.01	0.94	-0.15	0.13
2011	-0.04	0.52	-0.06	0.54	0.37	0.13
2015	-0.16	0.00	-0.16	0.01	0.01	0.90

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

It appears that the urban poor were significantly affected during hyperinflation. The children in poor rural households appeared to suffer from wasting in 2015, long afterwards. Both cases are most likely due to food shortages. While food inflation affected diet for urban households in 2005 and 2006, the 2012 and 2015 drought seasons most likely affected diet for rural households in the time interval between 2010 and 2015 (Mazvimavi, pers. com. 2020). A similar trend was observed by Alderman, Hoddinott, & Kinsey, (2006) for children who lived through the drought of 1982 to 1984. The graphs in Figure 33 give a clear picture of the progression of child health inequality over time.

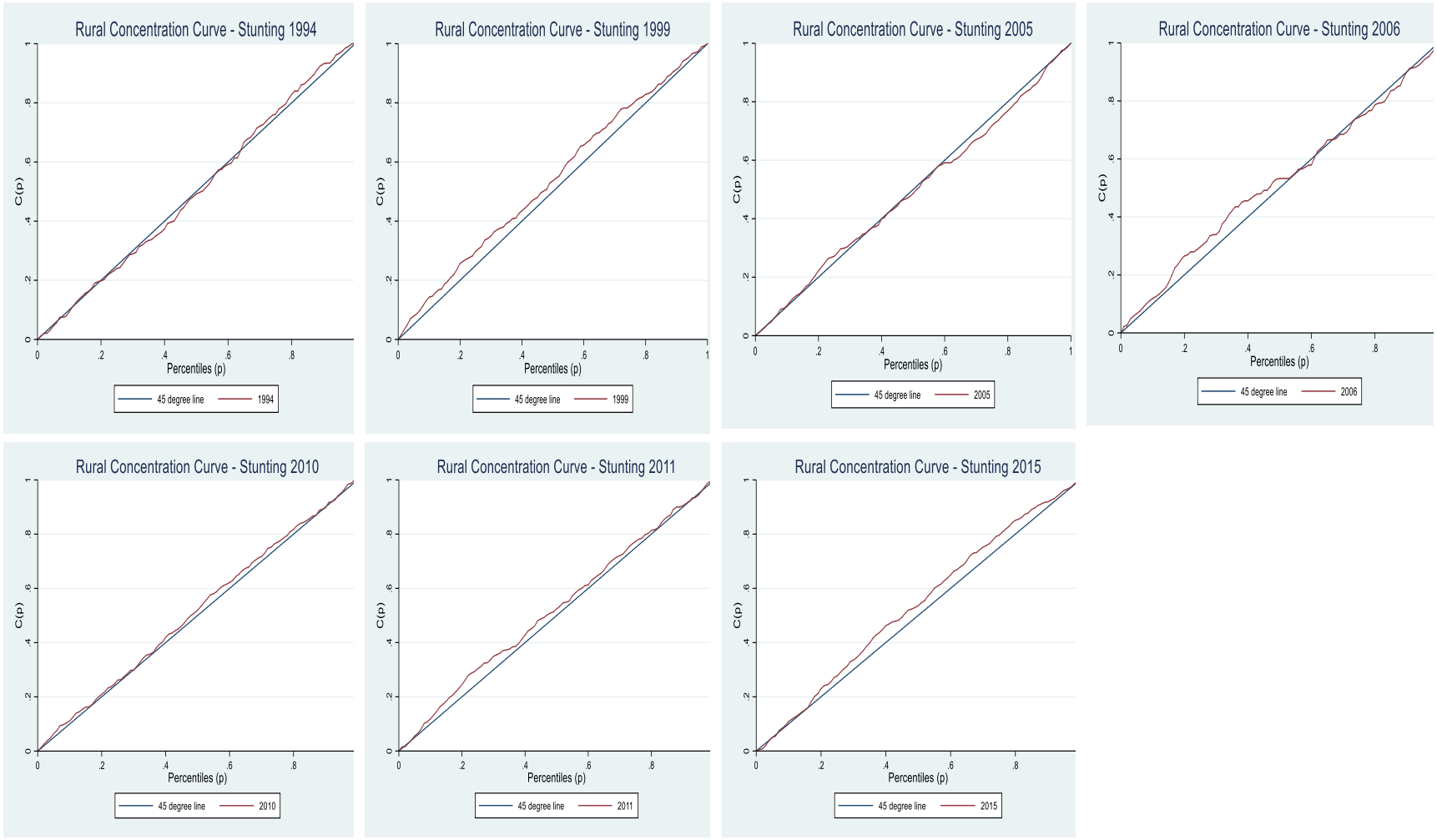


Figure 34a: Rural Concentration Curve for Stunted Children, 1994 – 2015

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

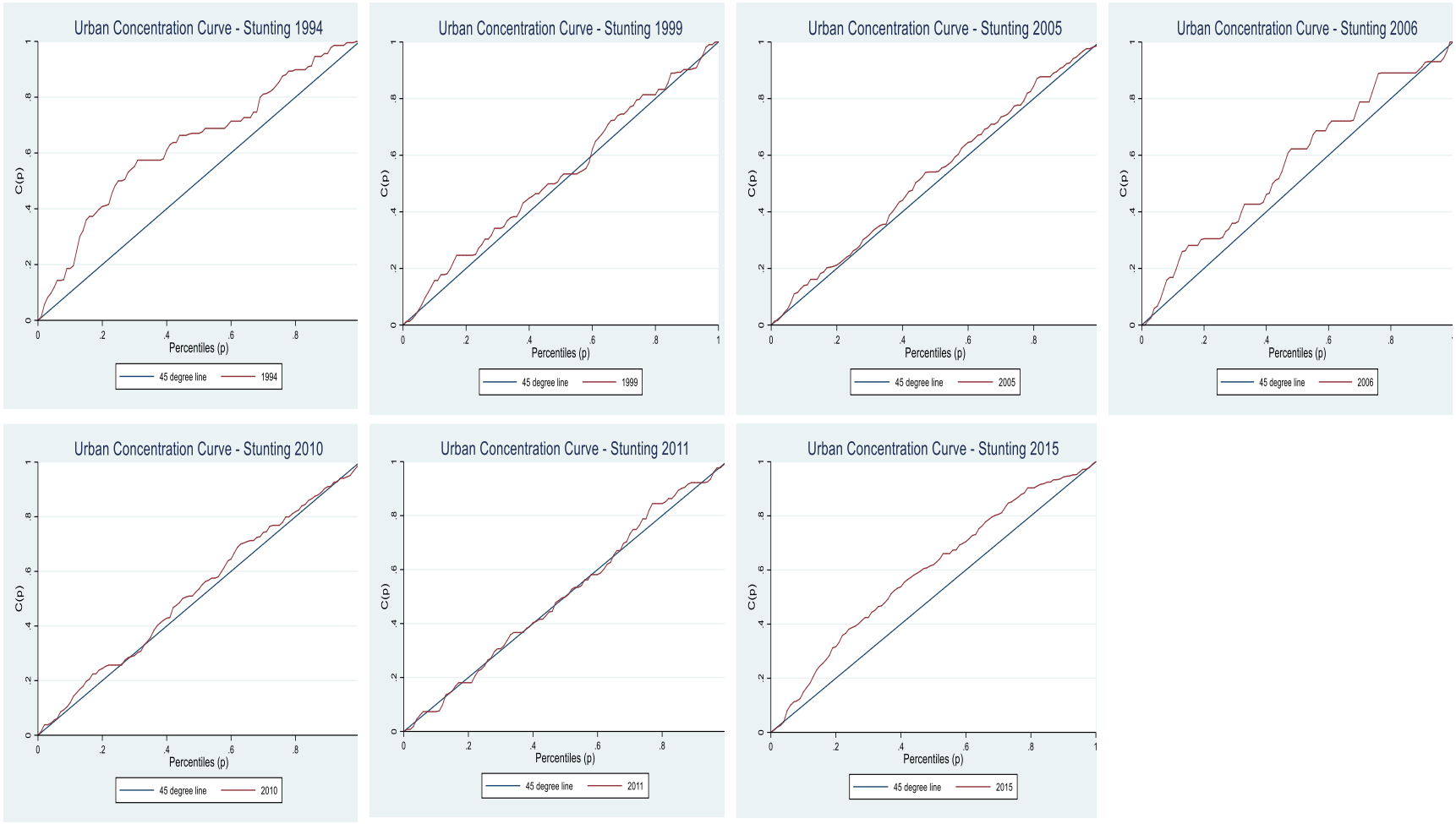


Figure 34b: Urban Concentration Curve for Stunted Children, 1994 – 2015

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

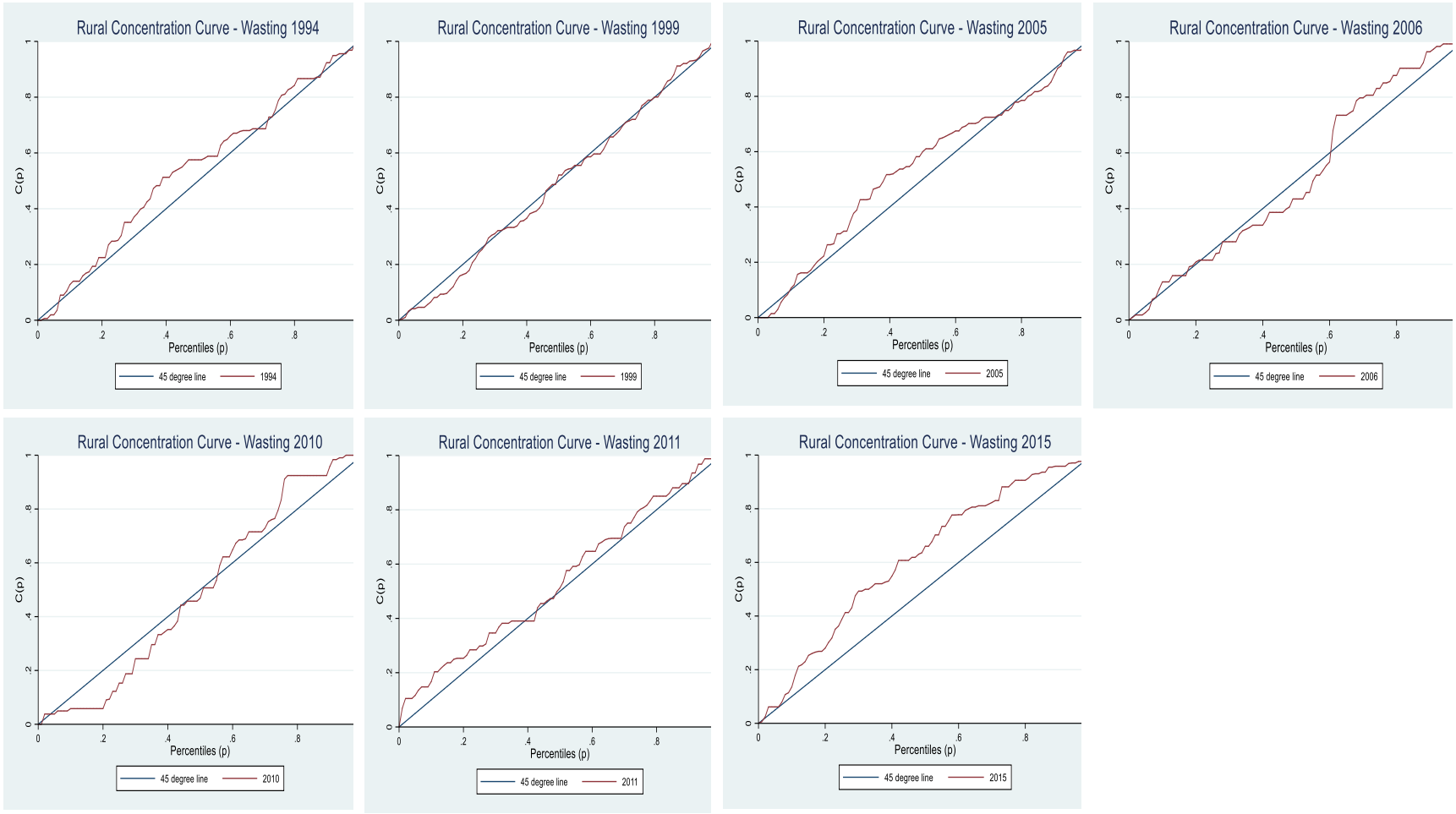


Figure 34c: Rural Concentration Curve for Wasted Children, 1994 – 2015

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

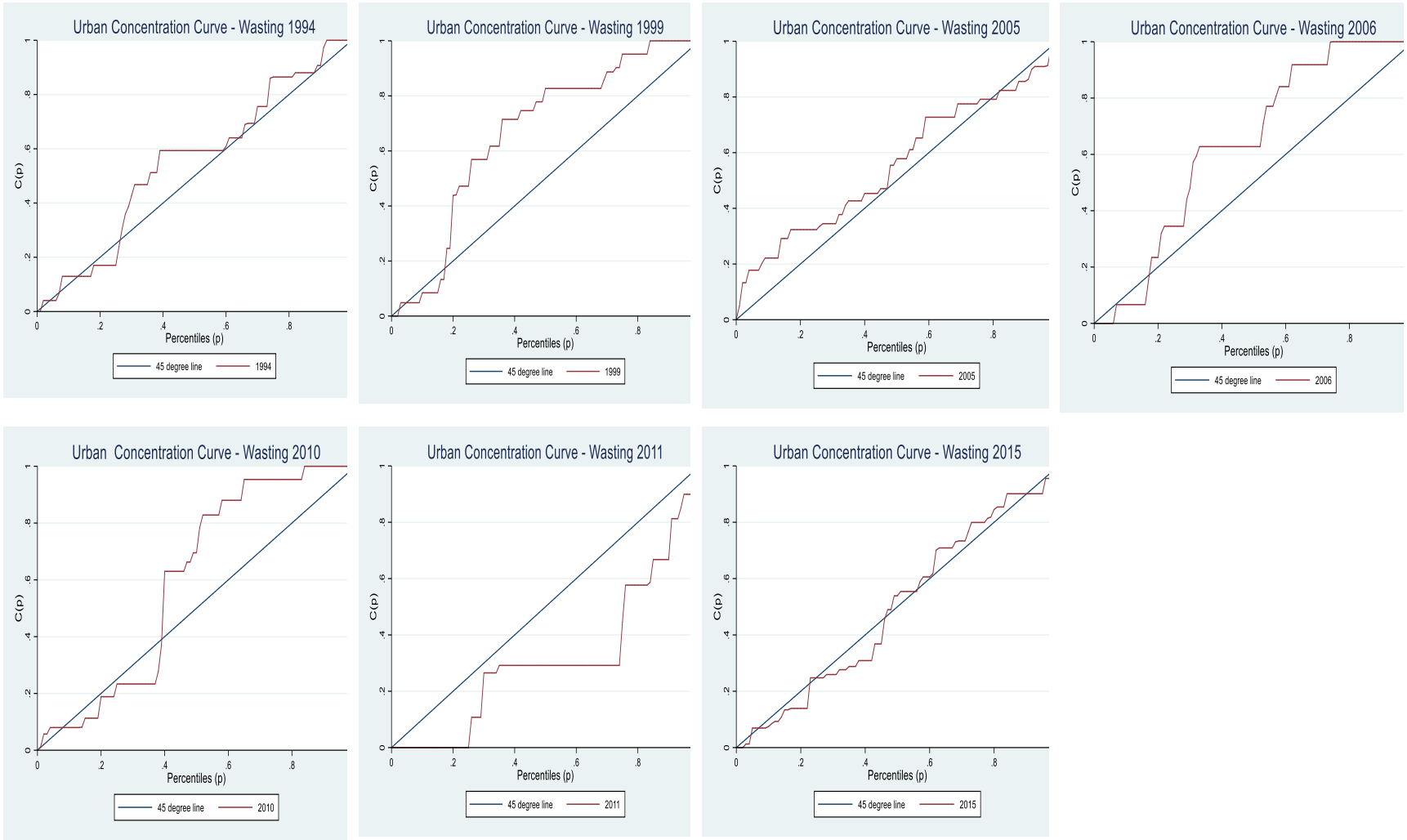


Figure 34d: Urban Concentration Curve for Wasted Children, 1994 – 2015

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015

5.6 Conclusion

The objectives of this chapter were to show the relationship between hyperinflation and child malnutrition in Zimbabwean. This was achieved through a multi-step process of analysis. First, child malnutrition measures were created using anthropometric data – height and weight – of the 28,254 children below the age of five in the ZHDS datasets from 1994 to 2015. The resulting measures capture ill-health. In particular, 'stunting' was used to measure chronic (long-term) malnutrition, while 'wasting' was used to measure acute (short-term) malnutrition.

The second step in the analysis was to assess the prevalence of ill-health using these malnutrition measures. This was done on a national scale, as well as for urban and rural households. A further disaggregation was made for child gender. The results show that malnutrition is more prevalent in rural households and among male children. While malnutrition increased during the hyperinflation period, post-hyperinflation only wasting decreased significantly. The third step was a quintile analysis which gave more information of how malnutrition levels changed in different parts of the asset wealth distribution. The fourth step involves Logistic regression analyses which revealed factors that were strongly correlated with child malnutrition. The fifth and final step was designed to show child malnutrition inequality and in so doing reveal policy targets.

The graphs in Figures 27 and 28 made it apparent that both wasting and stunting were at their highest in 2006, which was the onset of hyperinflation. Supplementary data from the World Bank which is cited in the results section shows that stunting continued to rise through the hyperinflation period and only decreased after dollarization in 2009. This confirms that the harsh economic condition resulted in an increase in child malnutrition. The prevalence rate of stunting decreased after hyperinflation, in both rural and urban areas. However, the rate was higher among children in rural households. This in itself is an indication of inequality in child health, dependent on location. The prevalence rate also varied across the gender of children, as male children suffered more from stunting than girls of the same age. The quintile analysis shows that the highest proportions of malnourishment were among rural households in the bottom 40 percent of the asset index distribution, as well as in the 4^{th} quintile where the urban poor are located. The observed levels of stunting inequality were mainly a result of unequal access to healthcare which is here quantified by hospital visits, during and after pregnancy as well as vaccines. Access to theses was strongly related to household welfare, measured by the asset index as well as the mother's level of education.

Nonetheless, the effects of hyperinflation were mainly seen through the drastic changes in the prevalence rate of wasting among children. Unlike stunting which did not change significantly after hyperinflation, wasting decreased by an average of 43 percent. This shows that wasting was the form of malnutrition that was mainly affected by the hyperinflation conditions. It is a reasonable finding given the acute nature of wasting, which is mainly necessitated by food shortages and repeated infections during famines.

While a comparison between rural and urban shows higher prevalence rates of malnutrition in rural areas, changes within the urban areas were more significant. Much like stunting, wasting did not affect all children in the country. Significantly more urban children suffered from wasting, than did children in rural households, especially boys. Fewer children from rural households were wasted because their households had access to land and livestock for the production of food and maintenance of a good diet. This was not the case in urban areas where households typically purchase food yet prices were very high due to hyperinflation. As a result, many urban households traded assets for food, and even then, could not afford to maintain a balanced diet. They coped by eating fewer meals with little to no protein. This resulted in wasting among children.

Another contributing factor to wasting during the hyperinflation period, more so in urban areas, were repeated infections. This was due to a significant decline in the use of improved water sources such as piped water into dwellings and communal taps. Many urban households resorted to digging unprotected wells or using rain water, both with high probability of contamination. This is the water that the majority of children in urban households were drinking, hence the upsurge in diarrhoea during and after hyperinflation. Due to the dysfunctional water systems, urban households were not able to use the flush toilets within their dwellings, with many resorting to the use of pit toilets which increased the probability for environmental contamination. This also contributed to the increase in repeated infections among children in urban households, during and after hyperinflation. These various factors resulted in wasting being unequally distributed among children in Zimbabwe.

The regression results revealed that indeed inflation is significantly correlated with child malnutrition. Both wasting and stunting increased with inflation and wasting more so. Other significant determinants of malnutrition are child gender, with girls suffering less. Electricity is negatively related with malnutrition as access leads to less wasting and stunting. Educated and taller mothers fared better during harsh economic times as their children were less likely to be

wasted. Asset wealth also mattered as more of it reduced the likelihood of stunting. This confirms the long-term nature of asset holdings in reducing poor health. Also significant was household size as children from larger households had a lower chance of being wasted, most likely because these households had more income earners to procure food and fund medical care. Another covariate with long term effects was use of health centres, which significantly reduced the likelihood of stunting. Finally, more rain and maize yields decreased chances of wasting. Which confirms the fact that wasting is an indicator of famine.

In conclusion, these findings are relevant in the formation of policy. First, is the obvious reminder that inflation management is vital in order to maintain stable and affordable prices for households. In so doing the purchasing power of real income is preserved enabling access to food, vaccines, electricity, water and other inputs necessary for the production of child health. Second, developing Zimbabwe's agriculture sector is vital in order to avoid food shortages and to earn national income that can be used for investments in infrastructure such as electricity and health centres. So, investing in agricultural infrastructure such as irrigation is also important as it removes dependence on rain and ensure adequate production even during drought years. Third, national policy should ensure the education and feeding of women as mothers of strong physical stature as well as those who are well educated do better at preventing malnutrition in their children.

Chapter 6

Thesis Conclusion

This thesis set out to analyse the effect of hyperinflation on household welfare by assessing changes in asset poverty, asset inequality and child malnutrition in Zimbabwe, identified using data from the five-yearly Zimbabwe Demographic and Health Surveys (ZDHS). The 'March 2007 to December 2008' period of hyperinflation was used as a structural break; the pre-hyperinflation period being represented by the 1994, 1999 and 2005 data sets, while the post-hyperinflation period is represented by the 2010 and 2015 sets.

The first two empirical chapters focused on household wealth measured in terms of physical assets and key services, many of them being things needed to meet Maslow's basic physiological needs. A key and unexpected result emerged: overall poverty and inequality appeared to decrease during hyperinflation. The finding that poverty in Zimbabwe decreased during the period of hyperinflation is surprising. Nonetheless, it is convincingly justified by the evidence that inflation encouraged accumulation of physical assets (especially livestock and buildings) in rural areas. The finding that poverty decreased rests on the application of an asset index as a welfare measure, rather than, say, income or consumption. A closer analysis revealed that the outcome was mainly driven by the inflation's effects on the rural poor who form the majority of Zimbabwe's population (65 percent). These households, who tended to be poorer than their urban counterparts, were insulated from the formal economy by their subsistence lifestyles.

First, since they produced their own food, they did not have to drastically change their diet due to high food prices. In contrast, meal frequency and diversity were directly affected in urban areas where households had to purchase most of their food.

Second, following the collapse of formal agriculture due to the farm invasions, most rural household members were engaged in intermittent work on farms, with only a few having formal non-agricultural employment such as teaching. As a result, when many urban Zimbabweans lost jobs and experienced loss in real income due to hyperinflation, those in rural areas were less affected. Working in the agricultural sector was not only advantageous because of the availability of free food or the avoidance of unemployment; it became a source of asset accumulation for

rural households. As food grew increasingly expensive in the formal market, urban households resorted to sourcing foodstuffs, especially vegetables and maize meal, directly from the rural households, paying for them with cash or durable assets. Due to the hyper-inflation, rural households would quickly convert the cash into durable assets in order to store the value of their money. So, either directly (through barter trade) or indirectly, rural households accumulated private assets, while urban households decumulated asset wealth. This was also the case with financial assets, which lost value at the peak of the hyperinflation. In the rural areas, the convention of saving through livestock and grain stores was already established. Prior to the inflation, people in urban areas had much of their savings in financial assets such as pensions, bank and building society accounts and the post office savings bank. With the exception of equities traded on the ZSE, the inflation effectively destroyed the financial savings of (typically urban) Zimbabweans.

Third, rural households did not suffer the loss of services experienced by urban households who, as municipalities lost real income, lost access to public assets such as piped water, flush toilets and electricity. Urban households were battered by the hyperinflation as they lost in every way. Due to these three reasons, the asset wealth gap decreased. The cash income, financial assets, consumer durables and public assets that had formerly distinguished urban households from rural ones, simply disappeared.

Sadly, the hyperinflation also had a negative effect on the health of Zimbabwean children. The final empirical chapter shows that measures of child nutrition – especially wasting – worsened significantly during the hyperinflation period. Despite good rains during this period, the lag between earnings and product prices during the hyperinflation meant that food was increasingly unaffordable and this necessitated a change in the diets of children, especially among urban households. Proportions of protein decreased, and the typical urban diet increasingly consisted of starch and vegetables. In addition to diversity, the quantity of food consumed was also compromised and meal frequencies decreased for net buyers. Child health also suffered due to the rise in prices for general medical and prenatal consultations, as well as vaccines. The lack of medication, coupled with a contaminated water system and dysfunctional sanitation resulted in increased rates of diarrhoea and fever. These repeated infections, along with poor diet, contributed to weight loss and ultimately wasting among many children. The situation worsened as inflation rose, but children in households with electricity and educated mothers who received

remittances were less likely to be wasted. The fact that wasting decreased significantly after dollarization further emphasizes the real negative effects of hyperinflation on child health.

As Zimbabwe enters its second hyperinflation in twelve years, my hope is that this thesis will be read by a policy maker who cares about the people of Zimbabwe. Political power requires the support of the majority. In Zimbabwe, that majority reside in the rural areas. As has been shown, the rural poor seem to have marginally benefitted from the inflation. Perhaps it is not surprising that the government has been so willing to replicate its old inflationary policies. However, the last hyperinflation was accompanied by a grand destruction of wealth for those in the formal economy and the health of children in the nation's town and cities. The survival of durable assets at the expense of financial assets shows the asymmetric impact of hyperinflation. Despite the narrowing gap between rich and poor, there are no winners when prices rise uncontrollably (as they are doing once again), and we risk losing the health of another generation to malnutrition. The current generation of aspirant entrepreneurs is unable to start and grow viable businesses because inflation is again destroying their savings. Without business, general output suffers and the country descends further into a cycle of poverty.

The solution is a government that people trust to serve their interests. Not one that accumulates debt and funds its activities by increasing money supply. Without such a government and such trust, confidence in local currency will continue to falter and inflation will not cease. The vicious cycle of inflation has been persistent in Zimbabwe because citizens do not trust the local currency and will convert it into foreign currency or consumer durables as fast as they can. The result is a high velocity of cash circulating in the economy which, coupled with inflationary expectations, further fuels inflation. In the process, Zimbabwe has become a nation which consists of households that live from hand to mouth, keeping just enough cash to live on, and instead of saving money in an unreliable financial system, quickly convert it to consumer durables which do not yield interest and cannot be easily sold to make profit. Effectively, this is how business has died – Adam Smith, (1776, ch 14,) saw savings as the foundation of capital accumulation and subsequent growth. However, the capacity to save productively is being destroyed. Households now find themselves with fixed and unproductive capital, and without circulating capital that can be used to yield profit. The few firms that try to brave it out cannot compete on a global level because of dysfunctional infrastructure which compromises quality and quantity of output. Until Zimbabwe's government stops trying to inflate away their debt, the economy will not grow and poverty will become a hallmark of our society.

Bibliography

Aaberge, R., & Zhu, Y. (2001). The pattern of household savings during a hyperinflation: the case of urban China in the late 1980s. *Review of Income and Wealth*, *47*(2), 181-202.

Abdi, H., & Valentin, D. (2007). Multiple correspondence analysis. *Encyclopedia of measurement and statistics*, *2*(4), 651-657.

Abel-Smith, B. (1986). The world economic crisis. Part 1: Repercussions on health. *Health Policy and Planning*, *1*(3), 202-213.

Adelman, I., & Fuwa, N. (1992). Income Inequality and Development during the 1980s. *Indian Economic Review*, *27*, 329-345.

Agénor, P. R. (1998). Stabilization Policies, Poverty and the Labor Market: Analytical Issues and Empirical Evidence. *EDI, World Bank, Washington, DC December*.

Akombi, B. J., Agho, K. E., Merom, D., Renzaho, A. M., & Hall, J. J. (2017). Child malnutrition in sub-Saharan Africa: A meta-analysis of demographic and health surveys (2006-2016). *PloS one*, *12*(5).

Alderman, H., Hoddinott, J., & Kinsey, B. (2006). Long term consequences of early childhood malnutrition. *Oxford economic papers*, *58*(3), 450-474.

Alkire, S., & Santos, M. E. (2010). Acute multidimensional poverty: A new index for developing countries. *United Nations development programme human development report office background paper*, (2010/11).

Alkire, S., & Seth, S. (2014). Measuring and decomposing inequality among multidimensionally poor using ordinal data: a counting approach. *Oxford Poverty & Human Development Initiative (OPHI)*. Retrieved from: https://ora.ox.ac.uk/objects/uuid:49111ca0-d178-4d75-b8e8-1bc40aef5b16/download_file?file_format=pdf&safe_filename=OPHIWP068.pdf&type_of_work=Working+paper . Date retrieved: October 2014.

Aoun, N., Matsuda, H., & Sekiyama, M. (2015). Geographical accessibility to healthcare and malnutrition in Rwanda. *Social science & medicine*, *130*, 135-145.

Awoyemi, B. O., & Abaniwonda, I. M. (2019). The prevalence and socioeconomic determinants of malnutrition among under-five children in Ekiti state, Nigeria. *African Journal of Health, Nursing and Midwifery, 2, (2), 1-14.*

Ball, R. J. (1969). *Inflation: selected readings* (Vol. 32). P. Doyle (Ed.). Penguin books.

Banerjee, A. K. (2010). A multidimensional Gini index. *Mathematical Social Sciences*, *60*(2), 87-93.

Barros, R. P. D., Corseuil, C., Mendonça, R., & Reis, M. C. (2015). Poverty, inequality and macroeconomic instability.

Ben, M. (2016). *the Effect of Dollarization on the Performance of the Zimbabwe Stock Exchange* (Doctoral dissertation).

Bhutta, Z. A., Bawany, F. A., Feroze, A., & Rizvi, A. (2008). The impact of the food and economic crisis on child health and nutrition. In *UNICEF conference, New York: UNICEF*.

Bittencourt, M. (2009). Macroeconomic performance and inequality: Brazil, 1983–94. *The Developing Economies*, *47*(1), 30-52.

Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., De Onis, M., Ezzati, M., ... & Maternal and Child Undernutrition Study Group. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *The lancet*, *371*(9608), 243-260.

Blakely, T., Hales, S., Prüss-Üstün, A., Campbell-Lendrum, D. H., Corvalán, C. F., Woodward, A., & World Health Organization. (2004). *Poverty: assessing the distribution of health risks by socioeconomic position at national and local levels*. World Health Organization.

Blejer, M. I., & Guerrero, I. (1990). The impact of macroeconomic policies on income distribution: an empirical study of the Philippines. *The Review of Economics and Statistics*, 414-423.

Blinder, A. S., & Esaki, H. Y. (1978). Macroeconomic activity and income distribution in the post-war United States. *The Review of Economics and Statistics*, 604-609.

Block, S. A., Kiess, L., Webb, P., Kosen, S., Moench-Pfanner, R., Bloem, M. W., & Timmer, C. P. (2004). Macro shocks and micro outcomes: child nutrition during Indonesia's crisis. *Economics & Human Biology*, *2*(1), 21-44.

Bloomberg (2020, June 16). Zimbabwe's inflation rate hits 785.55%. *BusinessTech*. Retrieved from: https://businesstech.co.za/news/trending/408053/zimbabwes-inflation-rate-hits-785-55/. Date retrieved: June 2020.

Blundell, R., & Preston, I. (1998). Consumption inequality and income uncertainty. *The Quarterly Journal of Economics*, *113*(2), 603-640.

Bollen, K. A., Glanville, J. L., & Stecklov, G. (2002). Economic status proxies in studies of fertility in developing countries: Does the measure matter?. *Population Studies*, *56*(1), 81-96.

Bond, P. (1998). *Uneven Zimbabwe: a study of finance, development, and underdevelopment*. Africa World Press.

Booysen, F., Van Der Berg, S., Burger, R., Von Maltitz, M., & Du Rand, G. (2008). Using an asset index to assess trends in poverty in seven Sub-Saharan African countries. *World Development*, *36*(6), 1113-1130.

Bracking, S., & Sachikonye, L. (2006). Remittances, poverty reduction and the informalisation of household wellbeing in Zimbabwe.

Bracking, S., & Sachikonye, L. (2010). Migrant remittances and household wellbeing in urban Zimbabwe. *International Migration*, *48*(5), 203-227.

Braumann, B. (2004). High inflation and real wages. *IMF Staff Papers*, *51*(1), 123-147.

Brimmer, A. F. (1971). Inflation and income distribution in the United States. *The Review of Economics Statistic*, 37-48.

Brinkman, H. J., De Pee, S., Sanogo, I., Subran, L., & Bloem, M. W. (2010). High food prices and the global financial crisis have reduced access to nutritious food and worsened nutritional status and health. *The Journal of nutrition*, *140*(1), 153S-161S.

Bulir, M. A., & Gulde, M. A. M. (1995). *Inflation and Income Distribution: Further Evidenceon Empirical Links*. International Monetary Fund.

Bulíř, A. (2001). Income inequality: does inflation matter?. *IMF Staff papers*, *48*(1), 139-159.

Cagan, P. (1956). The monetary dynamics of hyperinflation. *Studies in the Quantity Theory of Money*, ed. M. Friedman, Chicago: University of Chicago Press.

Cagan, P., & Lipsey, R. E. (1978). The financial effects of inflation. *NBER Books*.

Caner, A., & Wolff, E. N. (2004). Asset poverty in the United States, 1984–99: Evidence from the panel study of income dynamics. *Review of income and Wealth*, *50*(4), 493-518.

Capie, F. (1986, January). Conditions in which very rapid inflation has appeared. In *Carnegie-Rochester Conference Series on Public Policy* (Vol. 24, pp. 115-168). North-Holland.

Cardoso, E. (1992). *Inflation and poverty* (No. w4006). National Bureau of Economic Research.

Cardoso, E., & Urani, A. (1995). Inflation and unemployment as determinants of inequality in Brazil: the 1980s. In *Reform, recovery, and growth: Latin America and the Middle East* (pp. 151-176). University of Chicago Press.

Carter, M. R., & Barrett, C. B. (2006). The economics of poverty traps and persistent poverty: An asset-based approach. *The Journal of Development Studies*, *42*(2), 178-199.

Centre for Hydrometeorology and Remote Sensing (2020). Data Portal. Retrieved from http://chrsdata.eng.uci.edu/

Chaudhry, A., & Chaudhry, T. T. (2008). The effects of rising food and fuel costs in Pakistan. *The Lahore Journal of Economics, Special Edition*, 117-138.

Chigudu, D. (2019). Can Zimbabwe do better? Indigenisation and redistributive policies to improve economic performance. *Ubuntu: Journal of Conflict Transformation*, *8*(1), 9-28.

Chipika, J. & Malaba, J. (2011). Research on the impact of the introduction of the multicurrency system / dollarization on selected rural communities in Zimbabwe.

Chowa, T., & Mukuvare, M. (2013). An analysis of Zimbabwe's Indigenisation and Economic Empowerment Programme (IEEP) as an economic development approach. *Journal of economics*, *1*(2), 2-18.

Christian, P. (2010). Impact of the economic crisis and increase in food prices on child mortality: exploring nutritional pathways. *The Journal of Nutrition*, *140*(1), 177S-181S.

Coady, D., Grosh, M., & Hoddinott, J. (2004). Targeting outcomes redux. *The World Bank Research Observer*, *19*(1), 61-85.

Cole, T. J., & Parkin, J. M. (1977). Infection and its effect on the growth of young children: a comparison of The Gambia and Uganda. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *71*(3), 196-198.

Cukierman, A., Edwards, S., & Tabellini, G. (1989). *Seigniorage and political instability* (No. w3199). National Bureau of Economic Research.

Currie, C., Zanotti, C., Morgan, A., Currie, D., De Looze, M., Roberts, C., ... & Barnekow, V. (2009). Social determinants of health and well-being among young people. *Health Behaviour in School-aged Children (HBSC) study: international report from the*, *2010*, 271.

Cutler, D. M., Katz, L. F., Card, D., & Hall, R. E. (1991). Macroeconomic performance and the disadvantaged. *Brookings papers on economic activity*, *1991*(2), 1-74.

Cutler, D. M., & Katz, L. F. (1992). *Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980s* (No. w3964). National Bureau of Economic Research.

Cutler, D. M. (2002). Health care and the public sector. *Handbook of public economics*, *4*, 2143-2243.

Darnton-Hill, I., & Cogill, B. (2010). Maternal and young child nutrition adversely affected by external shocks such as increasing global food prices. *The Journal of nutrition*, *140*(1), 162S-169S.

Datt, G., & Ravallion, M. (1997). *Why have some Indian states performed better than others at reducing rural poverty?* (No. 583-2016-39704).

Deaton, A. (2003). Household surveys, consumption, and the measurement of poverty. *Economic Systems Research*, *15*(2), 135-159.

Deaton, A. (2016). Measuring and understanding behavior, welfare, and poverty. *American Economic Review*, *106*(6), 1221-43.

Demographic and Health Surveys (1994, 1999, 2005, 2010, 2015). Zimbabwe, Standard DHS. Zimbabwe National Statistics Agency. Retrieved from https://dhsprogram.com/data/ . Date retrieved: 2015.

De Onis, M., Blössner, M., Borghi, E., Morris, R., & Frongillo, E. A. (2004). Methodology for estimating regional and global trends of child malnutrition. *International journal of epidemiology*, *33*(6), 1260-1270.

Dessus, S., Herrera, S., & De Hoyos, R. (2008). The impact of food inflation on urban poverty and its monetary cost: some back-of-the-envelope calculations. *Agricultural Economics*, *39*, 417-429.

Doré, D. (2009). *The Recovery and Transformation of Zimbabwe's Communal Areas* (Vol. 4). UNDP Zimbabwe.

Dornbusch, R. (1992). Lessons from experiences with high inflation. *The World Bank Economic Review*, *6*(1), 13-31.

Dube, I. (2003). Impact of energy subsidies on energy consumption and supply in Zimbabwe. Do the urban poor really benefit? *Energy Policy*, *31*(15), 1635-1645.

Easterly, W., & Fisher, S. (2000). *Inflation and the Poor, World Bank, Country Economics Department*. Working Paper 2335, Washington DC.

Ferreira, F. H., & Litchfield, J. A. (2001). Education or inflation?: the micro and macroeconomics of the Brazilian income distribution during 1981-1995. *Cuadernos de economía*, *38*(114), 209-238.

Ferreira, F. H., Leite, P. G., & Litchfield, J. A. (2008). The rise and fall of Brazilian inequality: 1981–2004. *Macroeconomic Dynamics*, *12*(S2), 199-230.

Ferreira, F. H., & Schady, N. (2009). Aggregate economic shocks, child schooling, and child health. *The World Bank Research Observer*, *24*(2), 147-181.

Filmer, D., & Pritchett, L. H. (2001). Estimating wealth effects without expenditure data—or tears: an application to educational enrolments in states of India. *Demography*, *38*(1), 115-132.

Filmer, D., & Scott, K. (2008). *Assessing asset indices*. The World Bank.

Fischer, S., Hall, R. E., & Taylor, J. B. (1981). Relative shocks, relative price variability, and inflation. *Brookings Papers on Economic Activity*, *1981*(2), 381-441.

Food and Agricultural Organization of the United Nations (2020). FAOSTAT. Retrieved from http://www.fao.org/faostat/en/#data/QC . Date retrieved: June 2020.

Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica: journal of the econometric society*, 761-766.

Frankenberg, E., Beegle, K., Sikoki, B., & Thomas, D. (1999). Health, family planning and well-being in Indonesia during an economic crisis: early results from the Indonesian family life survey. *RAND Labor and Population Program Working Paper Series 99*, *6*.

Friedman, I. S. (1987). *Toward world prosperity: reshaping the global money system*. Lexington Books.

Friedman, J., & Levinsohn, J. (2002). The distributional impacts of Indonesia's financial crisis on household welfare: A “rapid response” methodology. *The World Bank Economic Review*, *16*(3), 397-423.

Galbraith, J. I., Moustaki, I., Bartholomew, D. J., & Steele, F. (2002). *The analysis and interpretation of multivariate data for social scientists*. Crc Press.

Grootaert, C. (1983). The conceptual basis of measures of household welfare and their implied survey data requirements. *Review of Income and Wealth*, *29*(1), 1-21.

Grosh, M. E., & Baker, J. L. (1995). *Proxy means tests for targeting social programs: simulations and speculation*. The World Bank.

Gumbe, S., & Kaseke, N. (2011). Manufacturing firms and hyperinflation-survival options: the case of Zimbabwe manufacturers (2005-2008). *Journal of Management and Marketing Research*, *7*, 1.

Haggard, S., & Kaufman, R. R. (Eds.). (2018). *The politics of economic adjustment: international constraints, distributive conflicts and the state*. Princeton University Press.

Hanke, S. H., & Kwok, A. K. (2009). On the measurement of Zimbabwe's hyperinflation. *Cato J.*, *29*, 353.

Haveman, R., & Wolff, E. N. (2004). The concept and measurement of asset poverty: Levels, trends and composition for the US, 1983–2001. *The Journal of Economic Inequality*, *2*(2), 145-169.

International Monetary Fund (2001). Zimbabwe: 2000 Article IV Consultation. Country Report No. 01/05.

International Monetary Fund (2009). Zimbabwe: 2009 Article IV Consultation. Country Report No. 09/139.

Jevons, W. S. (1882). MARRIED WOMEN IN FACTORIES. *The Contemporary review, 1866-1900*, *41*, 37-53.

Jones, T., Campaign, J. D., Mutasa, C., Brynildsen, O., Bond, P., Rehbein, K., ... & Dykes, T. (2011). Uncovering Zimbabwe's debt. *Jubilee Debt Campaign*.

Kakwani, N., Wagstaff, A., & Van Doorslaer, E. (1997). Socioeconomic inequalities in health: measurement, computation, and statistical inference. *Journal of econometrics*, *77*(1), 87-103.

Kane, C. T., & Morisset, J. (1993). *Who would vote for inflation in Brazil?: an integrated framework approach to inflation and income distribution* (Vol. 1183). World Bank Publications.

Kanyenze, G., Kondo, T., Chitambara, P., and Martens, J. (2011). "Beyond the Enclave", LEDRIZ, Weaver Press, Harare, Zimbabwe.

Kaseke, N. (2013). Emergence of electricity crisis in Zimbabwe reform response and cost implications. *Journal of Business management and social sciences research*, *2*(10).

Keynes, J.M. (1923). Notes for the Lecture to the National Liberal Club. *Reprinted in Collected Writings of John Maynard Keynes*, Vol. XIX, Macmillan, London

Kiguel, M. A. (1989). Budget deficits, stability, and the monetary dynamics of hyperinflation. *Journal of Money, Credit and Banking*, *21*(2), 148-157.

Kiguel, M. A., & Liviatan, N. (1995). Stopping three big inflations: Argentina, Brazil, and Peru. In *Reform, recovery, and growth: Latin America and the Middle East* (pp. 369-414). University of Chicago Press.

Kolenikov, S., & Angeles, G. (2009). Socioeconomic status measurement with discrete proxy variables: Is principal component analysis a reliable answer?. *Review of Income and Wealth*, *55*(1), 128-165.

Kolm, S. C. (1977). Multidimensional egalitarianisms. *The Quarterly Journal of Economics*, 1-13.

Lambert, P. J., & Aronson, J. R. (1993). Inequality decomposition analysis and the Gini coefficient revisited. *The Economic Journal*, *103*(420), 1221-1227.

Larochelle, C., Alwang, J., & Taruvinga, N. (2014). Inter-temporal changes in well-being during conditions of hyperinflation: evidence from Zimbabwe. *Journal of African Economies*, *23*(2), 225-256.

Leiman, A., & Behar, A. (2011). A green revolution betrayed? Seed technology and small-scale maize farmers in Zimbabwe. *Development Southern Africa*, *28*(4), 445-460.

Lerman, R. I., & Yitzhaki, S. (1985). Income inequality effects by income source: A new approach and applications to the United States. *The review of economics and statistics*, 151-156.

Leo, B., & Moss, T. J. (2009). Moving Mugabe's Mountain: Zimbabwe's Path to Arrears Clearance and Debt Relief. *Center for Global Development Working Paper*, (190).

Lucas Jr, R. E. (1972). Expectations and the Neutrality of Money. *Journal of economic theory*, *4*(2), 103-124.

Makochekanwa, A. (2007). A dynamic enquiry into the causes of hyperinflation in Zimbabwe.

Makochekanwa, A. (2009). Clothed in rags by hyperinflation: the case of Zimbabwe.

Malaba, J. (2006, December). Poverty measurement and gender: Zimbabwe's experience. In *Inter-Agency and Expert Group Meeting on the Development of Gender Statistics* (pp. 12-14).

Mangwengwende, E. S. (2005). Increasing Electricity Access While Ensuring Financial Viability: A Perspective from the African Electricity Industry". *Population (million)*, *13*, 13-3.

Mapako, M. C., & Afrane-Okese, Y. (2002, April). Experiences and lessons in the implementation of solar home systems from Zimbabwe. In *Conference Proceedings, DUEE, Cape Technicon, Cape Town, South Africa*.

Mapako, M., & Prasad, G. (2007). Rural electrification in Zimbabwe reduces poverty by targeting income-generating activities.

Maponga, B. A., Chirundu, D., Gombe, N. T., Tshimanga, M., Shambira, G., & Takundwa, L. (2013). Risk factors for contracting watery diarrhoea in Kadoma City, Zimbabwe, 2011: a case control study. *BMC infectious diseases*, *13*(1), 567.

Martorell, R., & Young, M. F. (2012). Patterns of stunting and wasting: potential explanatory factors. *Advances in Nutrition*, *3*(2), 227-233.

Mason, P. R. (2009). Zimbabwe experiences the worst epidemic of cholera in Africa. *The Journal of Infection in Developing Countries*, *3*(02), 148-151.

Mata, L. (1978). Breast-feeding: main promoter of infant health. *The American journal of clinical nutrition*, *31*(11), 2058-2065.

Matondi, P. B., & Dekker, M. (2011). Land rights and tenure security in Zimbabwe's post fast track Land Reform Programme. *A Synthesis report for LandAc. Project ID WS*, *320005*(3).

Mawowa, S., & Matongo, A. (2010). Inside Zimbabwe's roadside currency trade: the 'World Bank'of Bulawayo. *Journal of Southern African Studies*, *36*(2), 319-337.

Mayer, T. (1980). David Hume and monetarism. *The Quarterly Journal of Economics*, *95*(1), 89-101.

Mazvimavi, D. (2010). Investigating changes over time of annual rainfall in Zimbabwe. *Hydrology and Earth System Sciences*, *14*(12), 2671.

McGee, R. W. (1989). The economic thought of David Hume. *Hume Studies*, *15*(1), 184-204.

McKenzie, D. J. (2006). The consumer response to the Mexican peso crisis. *Economic Development and cultural change*, *55*(1), 139-172.

Meyer, B. D., & Sullivan, J. X. (2003). *Measuring the well-being of the poor using income and consumption* (No. w9760). National Bureau of Economic Research.

Meyer, B. D., & Sullivan, J. X. (2004). The effects of welfare and tax reform: the material well-being of single mothers in the 1980s and 1990s. *Journal of public economics*, *88*(7-8), 1387-1420.

Meyer, B. D., & Sullivan, J. X. (2008). Changes in the consumption, income, and well-being of single mother headed families. *American Economic Review*, *98*(5), 2221-41.

Meyer, B. D., & Sullivan, J. X. (2011). Further results on measuring the well-being of the poor using income and consumption. *Canadian Journal of Economics/Revue canadienne d'économique*, *44*(1), 52-87.

Meyer, B. D., & Sullivan, J. X. (2013). Consumption and income inequality and the great recession. *American Economic Review*, *103*(3), 178-83.

Ministry of Public Service, Labour and Social Welfare, (2006). "ZIMBABWE 2003 Poverty Assessment Study Survey Main Report", MPLSW, FilMAZ, Harare, Zimbabwe.

Montgomery, M. R., Gragnolati, M., Burke, K. A., & Paredes, E. (2000). Measuring living standards with proxy variables. *Demography*, *37*(2), 155-174.

Morris, S. S., Carletto, C., Hoddinott, J., & Christiaensen, L. J. (2000). Validity of rapid estimates of household wealth and income for health surveys in rural Africa. *Journal of Epidemiology & Community Health*, *54*(5), 381-387.

Moser, C., & Felton, A. (2007). Intergenerational asset accumulation and poverty reduction in Guayaquil Ecuador (1978–2004). *Reducing global poverty: The case for asset accumulation*, 15-50.

Mosley, W. H. (1983). *Will Primary Health Care Reduce Infant and Child Mortality?: A Critique of Some Current Strategies, with Special Reference to Africa and Asia*. International Union for the Scientific Study of Population.

Mosley, W. H., & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and development review*, *10*, 25-45.

Moyo, S. (2011). Three decades of agrarian reform in Zimbabwe. *Journal of Peasant Studies*, *38*(3), 493-531.

Mpofu, S., & Nyamadzawo, J. (2016). Operations, Regulation, and Practices of the Zimbabwe Stock Exchange during the Hyperinflationary Period, 2000–08. *Economic Management in a Hyperinflationary Environment: The Political Economy of Zimbabwe, 1980-2008*, 157.

Musgrove, P. (1987). The economic crisis and its impact on health and health care in Latin America and the Caribbean. *International Journal of Health Services*, *17*(3), 411-441.

Munjeri, K. (2002). Sustainability indicators for Zimbabwe's energy sector. In *the Sustainable Energy Watch Indicators*. Helio International Paris.

Ndlela, D. (2010). "Towards a Sustainable and Holistic Debt Strategy for Zimbabwe." Unpublished Mimeo

Neri, M. (1995). On the measurement of real wages in high inflation. *Research and economic planning*, *25*(3), 497-525.

Njanike, P. K., & Mudzura, M. (2009). Factors Influencing the Zimbabwe Stock Exchange Performance (2002-2007). *OF THE UNIVERSITY OF PETROŞANI∼ECONOMICS∼*, *9*(2), 161-172.

Noko, J. (2011). Dollarization: the case of Zimbabwe. *Cato J.*, *31*, 339.

O'Donnell, O., Van Doorslaer, E., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Akkazieva, B., ... & Huq, M. N. (2008). Who pays for health care in Asia?. *Journal of health economics*, *27*(2), 460-475.

Old Mutual (2005, 2006, 2007, 2008, 2009, 2010) Annual Report and Accounts

Oliver, M. L., & Shapiro, T. M. (1990). Wealth of a nation: A reassessment of asset inequality in America shows at least one third of households are asset-poor. *American Journal of Economics and Sociology*, *49*(2), 129-151.

Palloni, A. (1981). Mortality in Latin America: emerging patterns. *Population and development review*, 623-649.

Paxson, C., & Schady, N. (2005). Child health and economic crisis in Peru. *The World bank economic review*, *19*(2), 203-223.

Pelletier, D. L., Frongillo Jr, E. A., Schroeder, D. G., & Habicht, J. P. (1995). The effects of malnutrition on child mortality in developing countries. *Bulletin of the World Health Organization*, *73*(4), 443.

Pigou, A. C. (1917). The value of money. *The Quarterly Journal of Economics*, *32*(1), 38-65.

Poterba, J. M. (1989). *Lifetime incidence and the distributional burden of excise taxes* (No. w2833). National Bureau of Economic Research.

Potts, D. (2006). 'Restoring order'? Operation Murambatsvina and the urban crisis in Zimbabwe. *Journal of Southern African Studies*, *32*(2), 273-291.

Poverty, O., & Human Development Initiative. (2015). Zimbabwe Country Briefing, Multidimensional Poverty Index Data Bank.

Powers, E. T. (1995). Inflation, unemployment, and poverty revisited. *Economic Review-Federal Reserve Bank of Cleveland*, *31*, 2-13.

Prendergast, A. J. (2015). Malnutrition and vaccination in developing countries. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *370*(1671), 20140141.

Ravallion, M. (1998). Reform, food prices and poverty in India. *Economic and Political Weekly*, 29-36.

Reserve Bank of Zimbabwe, (2014, October 30). Statistics: Inflation Rates. Retrieved from: http://www.rbz.co.zw/about/inflation.asp . Date retrieved: October 2014.

Richardson, C. J. (2007). How much did droughts matter? Linking rainfall and GDP growth in Zimbabwe. *African Affairs*, *106*(424), 463-478.

Robilliard, A. S., Bourguignon, F., & Robinson, S. (2001). Crisis and income distribution: A micro-macro model for Indonesia.

Romer, C. D., & Romer, D. H. (1998). *Monetary policy and the well-being of the poor* (No. w6793). National bureau of economic research.

Rothwell, D., & Robson, J. (2018). The prevalence and composition of asset poverty in Canada: 1999, 2005, and 2012. *International Journal of Social Welfare*, *27*(1), 17-27.

Rugube, L., & Chambati, W. (2001). Land redistribution in Zimbabwe: Five census surveys of farmland transactions, 1996-2000. *BASIS Management Entity, Land Tenure Center, University of Wisconsin-Madison, WI*.

Rustein, S. O., & Johnson, K. (2004). The DHS wealth index. DHS comparative reports no. 6. *Calverton: ORC Macro*.

Sahn, D. E., & Stifel, D. C. (2000). Poverty comparisons over time and across countries in Africa. *World development*, *28*(12), 2123-2155.

Sahn, D. E., & Stifel, D. (2003). Exploring alternative measures of welfare in the absence of expenditure data. *Review of income and wealth*, *49*(4), 463-489.

Sambo, L. G., Kirigia, J. M., & Orem, J. N. (2013). Health financing in the African Region: 2000–2009 data analysis. *International archives of medicine*, *6*(1), 10.

Sargent, T. J., & Wallace, N. (1975). " Rational" expectations, the optimal monetary instrument, and the optimal money supply rule. *Journal of political economy*, *83*(2), 241-254.

Schultz, T. P. (1979). *Interpretation of Relations Among Morality, Economics of the Household, and the Health Environment* (No. 318). Center Discussion Paper.

Shoko, J. (2013, February 20). Zimbabwe war veterans demand compensation. *TheAfricaReport*. Retrieved from: https://www.theafricareport.com/6037/zimbabwe-war-veterans-demand-compensation/

Shorrocks, A. F. (1982). Inequality decomposition by factor components. *Econometrica: Journal of the Econometric Society*, 193-211.

Shorrocks, A. F. (1980). The class of additively decomposable inequality measures. *Econometrica: Journal of the Econometric Society*, 613-625.

Siklos, P. L. (1990). The Transition from Hyperinflation to Price Stability: Further Evidence. *Eastern Economic Journal*, *16*(1), 65-69.

Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations: Volume One. London: printed for W. Strahan; and T. Cadell, 1776.

Sophal, C. (2011). The impact of high food prices on food security in Cambodia. *Development in Practice, 21(4/5), 718-731.*

Spiegel, S. J. (2015). Shifting formalization policies and recentralizing power: The case of Zimbabwe's artisanal gold mining sector. *Society & Natural Resources*, *28*(5), 543-558.

Stifel, D., Sahn, D., & Younger, S. (1999). *Inter-temporal changes in welfare: Preliminary results from nine African countries*. Ithaca: Cornell University.

Stillman, S., & Thomas, D. (2004). The effect of economic crises on nutritional status: evidence from Russia.

Stoeffler, Q., Alwang, J., Mills, B., & Taruvinga, N. (2016). Multidimensional poverty in crisis: Lessons from Zimbabwe. *The journal of development studies*, *52*(3), 428-446. Retrieved from: https://www.tandfonline.com/doi/pdf/10.1080/00220388.2015.1087511?casa_token=TJe7YAIPaGsAAAAA%3Aeh9tJ_L3Mo5-bl7A4-gI4LLKZkKvHsRqRli0FWOaTOSmDrkuB8U8mpnb3Dv0oIzWHhjYTCpufR4_KNs& . Date retrieved: October 2017.

Strauss, J., & Thomas, D. (1998). Health, nutrition, and economic development. *Journal of economic literature*, *36*(2), 766-817.

Suryahadi, A., Sumarto, S., & Suharso, Y. (2000). *The Evolution of Poverty during the Crisis in Indonesia, 1996 99*. The World Bank.

Syeda, B., Agho, K., Wilson, L., Maheshwari, G. K., & Raza, M. Q. (2020). Relationship between breastfeeding duration and undernutrition conditions among children aged 0–3 Years in Pakistan. *International Journal of Pediatrics and Adolescent Medicine*. Retrieved from: https://reader.elsevier.com/reader/sd/pii/S2352646720300065?token=B7038808602946456E9BEF4CE920713BB3A80000B1049D4863841B54925FF3BD9D6E83E6A42691DB25742E340F96C694&originRegion=eu-west-1&originCreation=20210425085006 . Date retrieved: July 2020.

Taylor, J. (1974). *Unemployment and wage inflation with special reference to Britain and the USA*. Longman Publishing Group.

Thebe, V. (2011). From South Africa with love: the malayisha system and Ndebele households' quest for livelihood reconstruction in south-western Zimbabwe. *The Journal of Modern African Studies*, *49*(4), 647-670.

Todd, C., Ray, S., Madzimbamuto, F., & Sanders, D. (2010). What is the way forward for health in Zimbabwe?. *The Lancet*, *375*(9714), 606-609. Retrieved from: https://www.thelancet.com/action/showPdf?pii=S0140-6736%2809%2961498-7 . Date retrieved: July 2020.

UNICEF (2013). "Migration Profiles: Zimbabwe". *International Organization of Migration*. Retrieved from: https://publications.iom.int/system/files/pdf/mp_zimbabwe_2018.pdf . Date retrieved: July 2020.

UNICEF Zimbabwe (2016). "Extended Analysis of Multiple Indicator Cluster Survey (MICS) 2014: A Story of Inequality and Inequity in Zimbabwe Harare" UNICEF.

United Nations Department of Economic and Social Affairs, Population Division. (2019). World Population Prospects 2019: Data Booklet (ST/ESA/SER. A/424).

United Nations (2020). Food and Agriculture Organization. [Maize]. Retrieved from: http://www.fao.org/faostat/en/#data/QC . Date retrieved: June 2020.

United Nations Population Division. (2018). World Urbanization Prospects: The 2018 Revision.

United Nations Development Program (2013). "Zimbabwe: HDI values and rank changes in the 2013 Human Development Report". Human Development Report, 2013. UNDP, New York, USA.

Urani, A. (1993). Inflation and Unemployment as Determinants of the Level and Distribution of Labor Income in Metropolitan Brazil; 1982-1992. *IPEA Seminars Series*, (04/93).

Von Burgsdorff, D. (2012). Strangling the lifeline: An analysis of remittance flows from South Africa to Zimbabwe. *PASSOP Report, Cape Town*.

Wagstaff, A., Paci, P., & Van Doorslaer, E. (1991). On the measurement of inequalities in health. *Social science & medicine*, *33*(5), 545-557.

Wall, M., & Johnston, D. (2008). Counting heads or counting televisions: Can asset-based measures of welfare assist policy-makers in Russia?. *Journal of Human Development*, *9*(1), 131-147.

Waters, H., Saadah, F., & Pradhan, M. (2003). The impact of the 1997–98 East Asian economic crisis on health and health care in Indonesia. *Health policy and planning*, *18*(2), 172-181.

West Jr, K. P., & Mehra, S. (2010). Vitamin A intake and status in populations facing economic stress. *The Journal of nutrition*, *140*(1), 201S-207S.

Weymark, J. A. (1981). Generalized Gini inequality indices. *Mathematical Social Sciences*, *1*(4), 409-430.

Wittenberg, M., & Leibbrandt, M. (2017). Measuring inequality by asset indices: A general approach with application to South Africa. *Review of Income and Wealth*, *63*(4), 706-730. Date retrieved: August 2017.

World Bank (2015). UNICEF, WHO, World Bank: Joint child malnutrition estimates (JME). Retrieved from https://data.worldbank.org/indicator/SH.STA.STNT.ZS?locations=ZW

World Bank (2013). Water and Sanitation Program: End of Year Report, Fiscal Year 2013. Date retrieved: August 2019.

World Bank (2013). The Zimbabwe Water Forum: Zimbabwe Urban Water Tariff Study – Policy Note 6. Retrieved from: http://documents1.worldbank.org/curated/en/164151468196755260/pdf/103624-BRI-P126703-PUBLIC-ZWF-6-Tariff-Study-Sep-2013.pdf Date retrieved: August 2019.

World Health Organization. (1999). *Management of severe malnutrition: a manual for physicians and other senior health workers*. World Health Organization.

World Health Organization. (2006). *WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development*. World Health Organization.

World Health Organization. (2008). Global task force on cholera control. Cholera country profile: Zimbabwe. 19 December 2008. *World Health Organization, Geneva, Switzerland. http://www. who. int/cholera/countries/ZimbabweCountryProfile2008. pdf*. Date retrieved: August 2019.

World Health Organization. (2009). World health statistics 2008. Geneva: WHO; 2008.

Zimbabwe Ministry of Health and Child Welfare (2010). Human Resources for Health information sheet, 2010.

ZimSTAT, (2003). "Poverty Assessment Study Survey 2003 Main Report", Zimbabwe National Statistics Agency. Harare, Zimbabwe: ZIMSTAT.

ZimSTAT, (2012). "Poverty Income Consumption and Expenditure Survey 2011/12", Zimbabwe National Statistics Agency. Harare, Zimbabwe: ZIMSTAT.

ZimVAC (2002). Zimbabwe Emergency Food Security and Vulnerability Assessment Report. Harare, Zimbabwe. Retrieved from https://sarpn.org/documents/d0000173/P164-ZIMVAC%20Dec%202002%20Report.pdf . Date retrieved: August 2014.

ZimVAC (2003). Zimbabwe Emergency Food Security and Vulnerability Assessment – April 2003. Harare, Zimbabwe.
Retrieved from https://sarpn.org/documents/d0000470/Zimbabwe_VAC_April2003.pdf .
Date retrieved: August 2014.

ZimVAC (2003). Zimbabwe Urban Areas Food Security and Vulnerability Assessment – September 2003. Harare, Zimbabwe. Retrieved from https://reliefweb.int/report/zimbabwe/zimbabwe-urban-areas-food-security-and-vulnerability-assessment-sep-2003 . Date retrieved: August 2014.

ZimVAC (2005). Zimbabwe Rural Areas Food Security and Vulnerability Assessment – June 2005 Report. Harare, Zimbabwe. Retrieved from: http://fnc.org.zw/wp-content/uploads/2019/01/2005-Zimbabwe-VAC-Annual-Assessment-November.pdf . Date retrieved: August 2014.

ZimVAC (2006). Zimbabwe Report Rural Food Security and Vulnerability Assessment – Report No. 6 – May, 2006. Harare, Zimbabwe. Retrieved from: http://fnc.org.zw/wp-content/uploads/2019/01/2006-Final-Report-Zimvac-2006-Rural-Assement.pdf . Date retrieved: August 2014.

ZimVAC (2009). ZimVac Rural Household Livelihoods Survey – Report No. 11, October 2009. Harare, Zimbabwe. Retrieved from: http://fnc.org.zw/wp-content/uploads/2019/01/2009-ZimVac-Rural-Household-Livelihoods-Survey-October-2009-Report.pdf . Date retrieved: August 2014.

ZimVAC (2009). Zimbabwe Vulnerability Assessment Committee Urban Food Security Assessment –. January 2009 National Report. Harare, Zimbabwe. Retrieved from https://documents.wfp.org/stellent/groups/public/documents/ena/wfp197654.pdf . Date retrieved: August 2014.

ZimVAC (2010). Zimbabwe Vulnerability Assessment Committee (ZimVac) Rural Livelihoods Assessment. Harare, Zimbabwe. Retrieved from: http://fnc.org.zw/wp-content/uploads/2019/01/2010-ZimVac-Rural-Livelihoods-Assessment.pdf . Date retrieved: August 2014.

Appendix 1 – For Chapter 3

Results for the analysis for data starting in 1994 and ending in 2015

Table A1.1: Private asset ownership summary statistics, urban households

Urban Households	Pre-hyperinflation	Post-hyperinflation	Percentage Change (%)	Percentage point change	t-statistic
Radio	0.74	0.47	-36.83	-27.30	34.57
Television	0.58	0.76	31.66	18.20	23.60
Refrigerator	0.39	0.56	44.79	17.40	21.13
Bicycle	0.24	0.19	-22.88	-5.6	8.12
Vehicle	0.15	0.21	41.53	6.1	9.56
Surface Water	0.00	0.01	302.71	0.8	5.83
Well Water	0.01	0.07	426.05	5.7	16.76
Borehole Water	0.01	0.11	1,338.68	10.20	25.85
Earth Floor	0.01	0.01	23.96	0.3	1.43
Wood Floor	0.03	0.03	12.40	0.3	1.19
Tiled Floor	0.03	0.10	255.20	6.5	16.52
Carpet Floor	0.06	0.02	-65.60	-4.4	12.96
Cement Floor	0.87	0.84	-3.21	-2.8	4.70
Flush Toilet	0.95	0.90	-4.73	-4.5	10.08
Blair Toilet	0.03	0.02	-33.70	-0.9	3.68
Pit Toilet	0.02	0.05	176.91	3.4	10.77
No Toilet	0.01	0.03	397.11	2.1	9.97

Source: Own calculations, Zimbabwe Demographic and Health Surveys

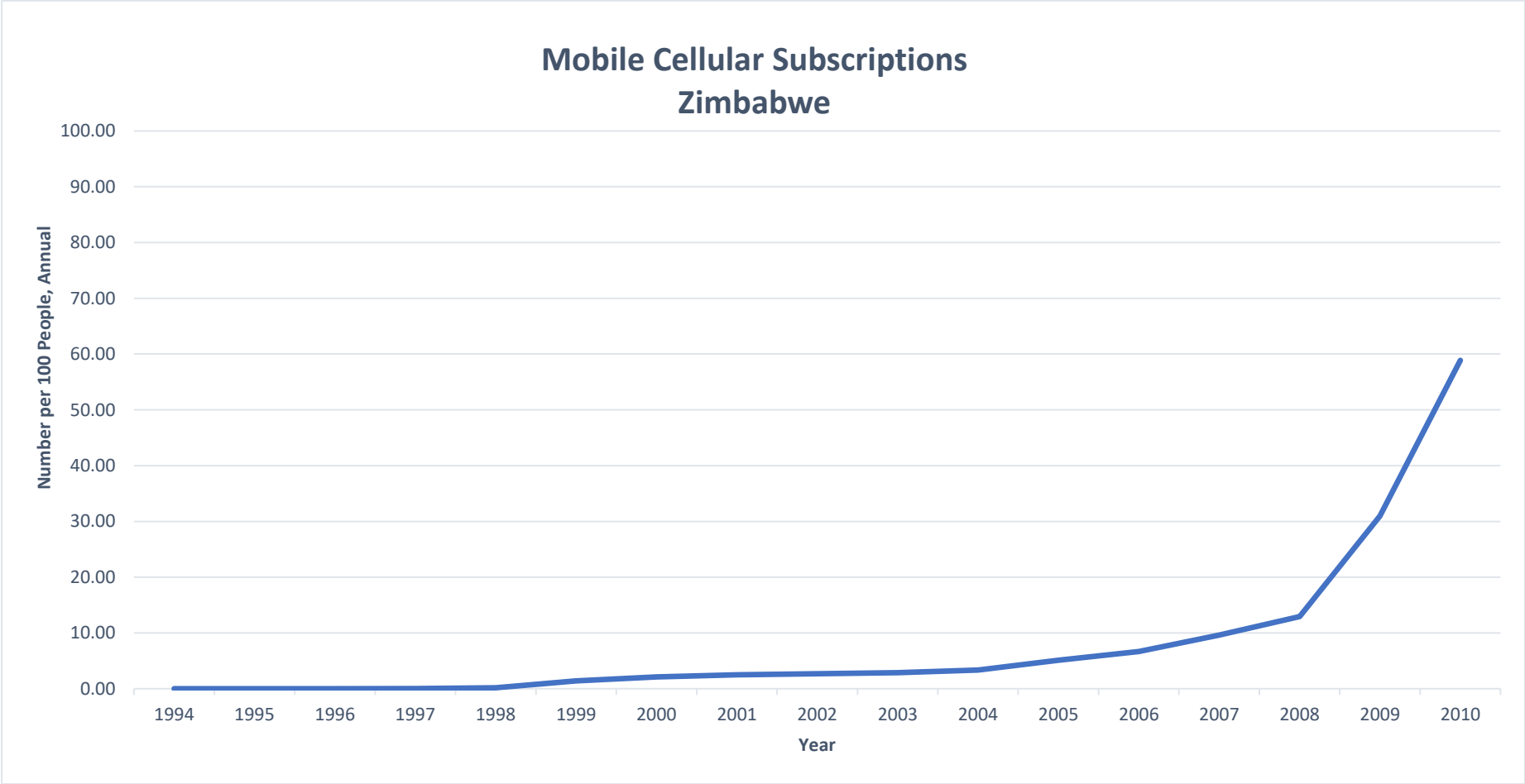


Figure A1: Zimbabwe's mobile phone subscriptions, 1994 – 2010

Source: Federal Reserve Bank of St. Louis https://fred.stlouisfed.org/series/ITCELSETSP2ZW

Appendix 2 – For Chapter 4

Results for the analysis for data starting in 1994 and ending in 2015

Table A2.1: Asset Inequality, by province: UCPC Index, Zimbabwe 2005 – 2010

	Population Share	Wealth Share	Mean Wealth	Gini Coefficient	Theil T GE (0)	Theil L GE (1)
Manicaland						
2005	0.12558	0.10967	1.17433	0.90193	2.2161	2.9553
2010	0.14718	0.08753	1.22058	0.89832	2.1494	2.9637
Mashonaland Central						
2005	0.10335	0.02594	0.33756	0.76502	1.2263	1.9158
2010	0.09122	0.15444	3.47458	0.93757	3.1087	2.8719
Mashonaland East						
2005	0.09845	0.06138	0.83841	0.86837	1.8947	2.6857
2010	0.10685	0.04515	0.86728	0.88473	1.9835	2.6831
Mashonaland West						
2005	0.09955	0.0531	0.71725	0.78018	1.4454	1.9957
2010	0.11043	0.0391	0.72673	0.79104	1.4333	2.0051
Matebeleland North						
2005	0.06644	0.02923	0.59152	0.89316	2.1245	2.5622
2010	0.05077	0.01087	0.43956	0.81849	1.5965	2.2387
Matebeleland South						
2005	0.05079	0.02365	0.62626	0.82705	1.6075	2.3223
2010	0.05234	0.01748	0.68542	0.86554	1.8072	2.8481
Midlands						
2005	0.13656	0.10859	1.06935	0.87604	2.0794	2.643
2010	0.11815	0.05897	1.02435	0.86766	1.9711	2.5705
Masvingo						
2005	0.11493	0.0474	0.55464	0.87985	1.9284	3.1591
2010	0.10923	0.0932	1.75116	0.94582	2.9443	3.3541
Harare						
2005	0.13452	0.37222	3.72094	0.79333	1.3451	1.8919
2010	0.16033	0.36677	4.69477	0.82917	1.6381	1.8616
Bulawayo						
2005	0.06982	0.16882	3.25161	0.72352	1.0055	1.5269
2010	0.0535	0.12648	4.8518	0.7884	1.3158	1.6895

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 2005 – 2010

Table A2.2: Asset index weights

	Pre-hyperinflation	Post-hyperinflation
Radio	0.0163	0.0302
Television	0.0255	0.0436
Refrigerator	0.0385	0.0690
Bicycle	0.0079	0.0229
Vehicle	0.0571	0.0990
Surface Water	0.0004	0.0100
Well Water	0.0010	0.0055
Borehole Water	0.0018	0.0090
Earth Floor	0.0003	0.0021
Wood Floor	0.9950	0.1687
Tiled Floor	0.0219	0.0533
Carpet Floor	0.0108	0.9711
Cement Floor	0.0024	0.0067
Flush Toilet	0.0238	0.0469
Blair Toilet	0.0024	0.0085
Pit Toilet	0.0006	0.0047
No Toilet	0.0010	0.0027
Electricity	0.0224	0.0430
Piped Water	0.0225	0.0437
Communal Tap	0.0038	0.0187

Source: Own calculations, Zimbabwe Demographic and Health Surveys, 1994 – 2015