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## The Effect of Exchange Rates on Consumer Price Index

**Abstract.** The consumer price index (CPI) is a crucial economic indicator of consumer price inflation, which has an attendance effect on the extent of savings and, hence, on investment capacity. The literature contains different opinions on the relationship between exchange rate and consumer price index; however, given the uniqueness of each country's economic environment, it became apposite to focus the bearing of this paper on the South African economic context. Thus, this paper evaluates the effect of currency exchange rates on the consumer price index in South Africa. Time series data on CPI and exchange rates were drawn from the Fusion Media investment database and were analysed using the OLS regression. For the independent variables exchange rate, which is the Rand price against the Dollar, the authors applied lag-2 given the assumption that exchange rate differences might take up to two months to affect the consumer price index. The authors' assumption draws from the findings of eminent scholars, which indicate that, given sufficient time, changes in domestic prices would fully compensate for exchange rate adjustments. The analysis showed that exchange rate changes significantly and positively affect CPI within the data's boundaries. The findings offer academic and practical implications for understanding the theoretical short-term period effect of the exchange rate on the consumer price index within the South African setting and for practical economic policy application for advanced policies to cushion potential negative effects on savings and investment. The paper provides an agenda for further study of the application of expanded time series to evaluate the effect of currency exchange rates on CPI over a longer period to unravel a theoretical difference between the short-term and long-term implications of exchange rates on CPI.

**Keywords:** consumer price index, exchange rate, savings and investment, inflation, monetary policy.

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## Вплив валютних курсів на індекс споживчих цін

**Анотація.** Індекс споживчих цін (ІСЦ) є ключовим економічним показником інфляції, який впливає на обсяг заощаджень і, отже, на інвестиційну здатність. Науковці висловлюють різні думки щодо зв'язку між валютним курсом та індексом споживчих цін; однак, враховуючи унікальність економічного середовища кожної країни, автори вважають за доцільне зосередити увагу на економічному контексті Південної Африки. Таким чином, у цій статті оцінюється вплив обмінних курсів валют на індекс споживчих цін у Південній Африці. Дані часових рядів щодо ІСЦ та обмінних курсів були взяті з інвестиційної бази даних Fusion Media та проаналізовані за допомогою регресії звичайних найменших квадратів. Для незалежної змінної обмінного курсу,

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якою є ціна ранду по відношенню до долара, автори застосували двомісячний часовий лаг, враховуючи припущення, що курсові різниці можуть вплинути на індекс споживчих цін протягом двох місяців. Припущення авторів базується на висновках відомих учених, які вказують на те, що за достатнього часу зміни внутрішніх цін повністю компенсували б коригування обмінного курсу. Аналіз показав, що обмінний курс значно змінюється та позитивно впливає на ІСЦ в межах даних. Отримані результати є важливими для розуміння теоретичного короткострокового впливу обмінного курсу на індекс споживчих цін у південноафриканському середовищі, а також основою для практичного застосування – розробки економічної політики щодо пом'якшення потенційних негативних наслідків для заощаджень та інвестицій. Стаття визначає напрямки подальших досліджень щодо застосування розширених часових рядів для оцінки впливу валютних курсів на ІСЦ протягом тривалого періоду, щоб оцінити теоретичну різницю між короткостроковими та довгостроковими наслідками впливу обмінних курсів на ІСЦ.

**Ключові слова:** індекс споживчих цін, валютний курс, заощадження та інвестиції, інфляція, монетарна політика.

## INTRODUCTION

Investors and analysts regularly monitor the stock market's success, with a special focus on the Consumer Price Index (CPI). The CPI offers insightful information about how inflationary pressures may impact market patterns, company earnings, and investor sentiment. An economic indicator known as the CPI tracks shifts in the average cost of household purchases of goods and services. It assists in monitoring inflation and illustrates how price fluctuations affect consumers' overall cost of living. Therefore, CPI data is used by governments and central banks to assess the value of the currency, decide on monetary policy, and maintain economic stability (Maunsell, 2023). Given the nature and importance of CPI, it is also an important tool for corporate strategic and investment planning. Thus, CPI is a useful economic indicator for private and public sectors and individuals within and outside of the economy. Hence, research on the link between exchange rate and CPI in a particular economy is important for academic and practitioner applications in their policy and investment planning.

There are mixed research and results in the existing literature. Some researchers have focused on the effect of CPI on exchange rates (ATFX, 2023), whilst others study the impact of exchange rates on CPI (Hüfner & Schröder, 2002). Yet, others dwell on a causality study of the variables (Usupbeyli & Ucak, 2020). ATFX (2023) highlighted that CPI may affect the dollar's value positively or negatively if published CPI data from the Bureau of Labor Statistics exceeds or falls below the market predictions of CPI. For instance, Hüfner and Schröder (2002) studied how changes in exchange rates affected consumer prices in the euro region. They used vector error correction models to calculate the pass-through effect in Germany, France, Italy, the Netherlands, and Spain. In order to reflect the entire euro area, they computed a weighted average of the results for each country using the weights of the Harmonized Index of Consumer Prices (HICP). Their results show that a 10 percent decline in the euro's nominal effective exchange rate index after a year corresponds to a 0.4 percent increase in the HICP. The adjustment of consumer prices is fully realized within three years, with an overall effect of 0.8 percent.

In another study, Usupbeyli and Ucak (2020) investigate how changes in currency rates – more especially those in the US dollar affect Turkey's producer pricing index (PPI) and consumer price index (CPI). The results show cointegration between the series, which suggests a sustained link. Furthermore, a unidirectional association is found between exchange rates and PPI, but a bidirectional causality is seen between CPI and exchange rates. However, exchange rates and PPI do not appear to be causally related. Moreover, examining the short-term correlation between exchange rates and CPI suggests that a decline in Turkish exchange rates results in a rise in CPI.

Given the uniqueness of every economy, understanding the unique relationship between the exchange rate (ER) and consumer price index (CPI) for each economy becomes imperative, especially for South Africa, which has a high-level population living in poverty (Plagerson, 2023). The insight from this analysis has more decision benefits that pervade financial, marketing, business management, economic policy, and investment strategies couched on proactivity. For instance, if CPI is seen to be affected by exchange rate fluctuations, this affects investors, given that CPI, which drives the purchasing ability of workers, also diminishes the amount of savings that could be used for investment. For example, a rising exchange rate may warn the citizens of an impending ripple in the CPI with an attendant corrosion ripple on savings. Therefore, this paper aims to evaluate the impact of exchange rates on the consumer price index (CPI).

The next section of the paper provides a conceptual review; the subsequent sections present the method and results from the analysis. The last section of the paper concludes and provides recommendations.

## THEORETICAL BACKGROUND

### The Concept of Consumer Price Index (CPI)

In many countries, controlling inflation lies with the Central Bank. So, the Central Bank needs to have a high degree of foresight because curbing inflation takes a long time. Thus, the Central Bank must continue to anticipate when inflation will likely rise. Therefore, policymakers rely more on inflation forecasts to determine where prices will be in the future and appropriate policy actions to take

(Cecchetti et al., 2000). While CPI is generally regarded as a measure of inflation, various economists have argued that it is not the only best tool for measuring inflation and considering policy issues (Johnson, 1999).

Economists rely on the CPI figure to determine price changes in the individual cost of living (Baldwin, 2018). Thus, a cost of living index (COLI) measures the changes in amounts consumers may need to spend over time to reach a certain standard of living. For example, living in town may cost a certain amount of South African rand a year compared to a lower or higher amount in another city; it may be calculated by PayScale's calculator (Ullman, 2019). As such, while the CPI measures the average prices consumers pay over time, the COLI measures the price of the same basket of goods and services in different geographic locations (CNN, 2020).

The purchasing power parity rates help to determine the geographic differences in the cost of living. That is, as the cost of goods and services increases, the buying power of the national currency decreases. Thus, growth in the cost of living must be measured correctly because it is the measurement that is closely considered when major decisions relating to monetary setting, salary adjustments and operations of capital and monetary markets are considered (Podpiera, 2003).

There are various discourses on how CPI impacts the cost of living. Various analysts indicate numerous imperfections in the CPI as a measure of the cost of living. Some have claimed that, amongst other concerns, the consumer price index overstates the true rate of increase in the cost of living (Shapiro & Wilcox, 1996). This view is evaluated based on the two sources of biases.

The first bias emanates from the mismanagement of price indices that are generated when a new assortment of goods is in the market and also when the quality of the existing goods in the market changes, thus resulting in a shift of shopping patterns towards lower-priced stores (Podpiera, 2003). The second bias is referred to as the substitution bias, which is triggered by a lack of sensitivity to the CPI substitution effect induced by price changes (Ibid). Therefore, it is critical that the CPI be measured correctly because there are adverse consequences, particularly when decision-makers are making fiscal policy considerations. When CPI is not correctly managed, it may affect citizens, such as social security benefits, pension benefits, tax brackets, personal exemptions, and related issues (Shapiro & Wilcox, 1996).

Furthermore, the CPI has implications for developing and implementing several government policies, including fiscal, monetary and other measures of economic performance such as productivity and GDP (Shapiro & Wilcox, 1996). There is a general theoretical outlook indicating that fiscal and monetary policies are instruments of economic stabilization. There are contending views on the efficacy of these policy instruments and their effect on the national economy. Some economic analysts argue that while fiscal and monetary policies are important tools, their effectiveness depends on various conditions in the national economy (Marfán, 2005; Spiegel, 2006).

Conversely, others argue that these policy instruments are ineffective in all countries. In comparing various empirical literature, some economists indicate that the effects of monetary policy on economic activity, in contrast to that of fiscal policy, have received less attention (Afonso & Sousa, 2012; Spiegel, 2006).

Monetary policy has both its strengths and limitations. Some economists argue that monetary policy can be used effectively to restrain an overheating economy versus expanding an economy in a recession state. For example, monetary policy has proved ineffective in stimulating growth in economies experiencing deflation. In particular, this was observed in the United States of America's economy, specifically during the years 2001-2003, when the reduction of the interest did little to stimulate investment in the economy; however, it was able to cause households to refinance their mortgage (Stiglitz, 2003).

### **Previous Studies on Exchange Rate (ER) and Consumer Price Index (CPI)**

A thorough examination of the empirical literature on the impact of exchange rate variations on consumer prices in Australia throughout the inflation-targeting period was carried out by Chung et al. (2011). According to their research, the pass-through impact is generally quite small but is more noticeable and swifter for manufactured goods – especially those that are imported. Additionally, their analysis indicates that within the past ten years, fluctuations in exchange rates have had a quicker impact on retail pricing for this class of highly transferable commodities. Analysis of ER and CPI conducted by McFarlane (2002) looks at the link that has changed over the past twelve years between prices in Jamaica and the exchange rate. The results imply that the exchange rate pass-through is “complete” in the long run. However, it has been noted that the pass-through has slowed down recently, partly because of increased competition and the implementation of a stricter framework for monetary policy. However, it is crucial to remember that exchange rate changes still significantly influence pricing and inflationary expectations.

In order to examine the connection between exchange rate pass-through and the average inflation rates in China, Australia, and India, Saha and Zhang (2013) undertook a quantitative study. Using a structural VAR model, they looked at the exchange rate pass-through from 1990 to 2011. The results of the impulse responses indicate that the rising domestic prices in China and India are mostly unaffected by exchange rates.

Some other research sought to check for causality interactions between ER and CPI; hence, Zhu (2012) used the Granger Causality test to investigate the relationship between changes in the consumer price index (CPI) and exchange rate variations in China. The study focused on three major trading partners for China: the US, the EU, and Japan. The study's conclusions show a causal connection between shifts in the US dollar and Japanese yen relative to the Chinese yuan and shifts in the country's consumer price index. Nevertheless, there is no proof that consumer price index variations may cause

exchange rate changes. This finding differs from the causality results in Turkey by Usupbeyli and Ucak (2020), which found a unidirectional association between exchange rates and PPI. However, a bidirectional causality is seen between CPI and exchange rates. Still, in further search for causality, Rauf and Rashid (2019) investigated the relationships between real exchange rate volatility (VRER), interest rate volatility (VINT), consumer price volatility (VCPI), and industrial output volatility (VLMI) in their study. They used a multivariate Granger causality model with monthly data from January 1988 to December 2017. The findings demonstrated the bidirectional causal relationship between VRER and both VLMI and VINT. Conversely, a unidirectional Granger causality between VLMI and VCPI, VINT and VLMI, and VCPI and VRER was noted.

The related literature with different findings indicates that the effect of exchange rates on CPI may differ from country to country and from region to region. Hence, this paper looks at this important economic and business concept in South Africa.

**RESEARCH METHOD**

The paper applies a quantitative approach and uses the South African Consumer Price Index (CPI) and exchange rate data for 2020 and 2021. The monthly exchange rate data were collected from Fusion Media (2023), namely the USD/ZAR – US Dollar South African Rand. In addition, the monthly data on CIP were collected from Fusion Media (2022) – the South Africa Consumer Price Index (CPI) YoY. The data were analysed using OLS regression with the aid of Gretl econometric and statistics software.

The OLS regression model is the following:

$$Y = \alpha + \beta X + \epsilon$$

Where:

Y = dependent variable being the consumer price index (CPI);

$\alpha$  = constant or intercept;

$\beta$  = the beta, regression coefficient, slope or gradient, measuring the degree of change in Y when X changes by 1;

X = independent variable being the exchange rate (ER);

$\epsilon$  = error term which accounts for unknown independent variables not included (omitted) in the regression model

For the independent variables exchange rate, which is the Rand price against the Dollar, the authors applied lag-2 given the assumption that exchange rate differences might take up to two months to affect the consumer price index. The authors’ assumption draws from the findings of eminent scholars, which indicate that “given sufficient time, exchange rate adjustments would be fully compensated for by changes in domestic prices” (Kreinin, 1977, p.2).

**RESULTS**

Findings from the OLS regression analysis in Table 1 show that at an alpha level of 0.05(5%), the probability value P-value is 0.01293, far below the alpha level, indicating a high significance level. Thus, this shows that given a two-month lag, a change in the exchange rate may positively influence the change in the consumer price index (given the positive coefficient of RandPrice\_2 in Table 1). The regression coefficient of 1.60539 indicates that a unit increase in the South African currency rate may impact a 1.6 unit increase in the consumer price index. This result seems to support the earlier result in Türkiye, where changes in the exchange rate were found to cause an increase in the consumer price index (Usupbeyli & Ucak, 2020; Hüfner & Schröder, 2002). Similarly, Nuhu (2021) found a positive and significant effect of the nominal exchange rate on the consumer price index. This implies that providing economic and financial policies that may cushion the exchange rate volatility could catalyse a favourable effect on domestic prices, which is direly needed for the economic good of the citizens.

Table 2 presents White’s test for heteroskedasticity, the Doornik-Hansen test for normality and the Breusch-Godfrey test for autocorrelation. Adkins (2006) highlights the computational robustness of the Doornik-Hansen test for normality over the Jacque Bera test. Given that the p-values are above the alpha value, the null hypotheses could not be rejected for the three tests. This indicates that the data contains no heteroskedasticity and autocorrelation, and errors are normally distributed.

Figure 1 shows the QQ plot showing the closeness of the residuals.

Table 1. **Model 2: OLS, using observations 2020:01-2021:12 (T = 24)**  
**Dependent variable: CPI\_YOY\_**

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-17.0048	9.31051	-1.8264	0.08276	*
RandPrice_2	1.60539	0.588295	2.7289	0.01293	**
Mean-dependent var:	8.318182	S.D-dependent var:		4.063617	
Sum of squared resid:	252.6874	S.E: regression:		3.554486	
R squared:	0.271317	Adjusted: R-squared		0.234883	
F(1, 20):	7.446780	P-value(F)		0.012933	
Log. likelihood:	-58.06886	Akaike criterion:		120.1377	
Schwarz criterion:	122.3198	Hannan-Quinn:		120.6518	
Rho:	0.309217	Durbin-Watson:		1.176808	

Source: authors’ OLS analysis output.

Result in equation:

$$\hat{CPI\_YOY\_} = -17.0 + 1.61 * RandPrice\_2$$

(9.31) (0.588)

T = 22, R-squared = 0.271

(standard errors in parentheses)

Table 2. Tests for Regression Assumptions

Doornik-Hansen test for normality:

Testing for the normality of residuals assumption

H0- hypothesis: there is normal distribution of error

T-statistic: Chi-square(2) = 5.70355

p-value = 0.0577418

Heteroskedasticity testing – the White's test:

H0 hypothesis: there is no presence of heteroskedasticity

T-statistic: LM = 2.4797

p-value = P(Chi-Square(2) > 2.4797) = 0.289428

Autocorrelation test: the Breusch-Godfrey test:

LM testing for presence of autocorrelation using up to order 12

H0 hypothesis: autocorrelation is not present

T-statistic: LMF = 0.761413

p-value = P(F(12,8) > 0.761413) = 0.676673

Source: authors' OLS analysis output.

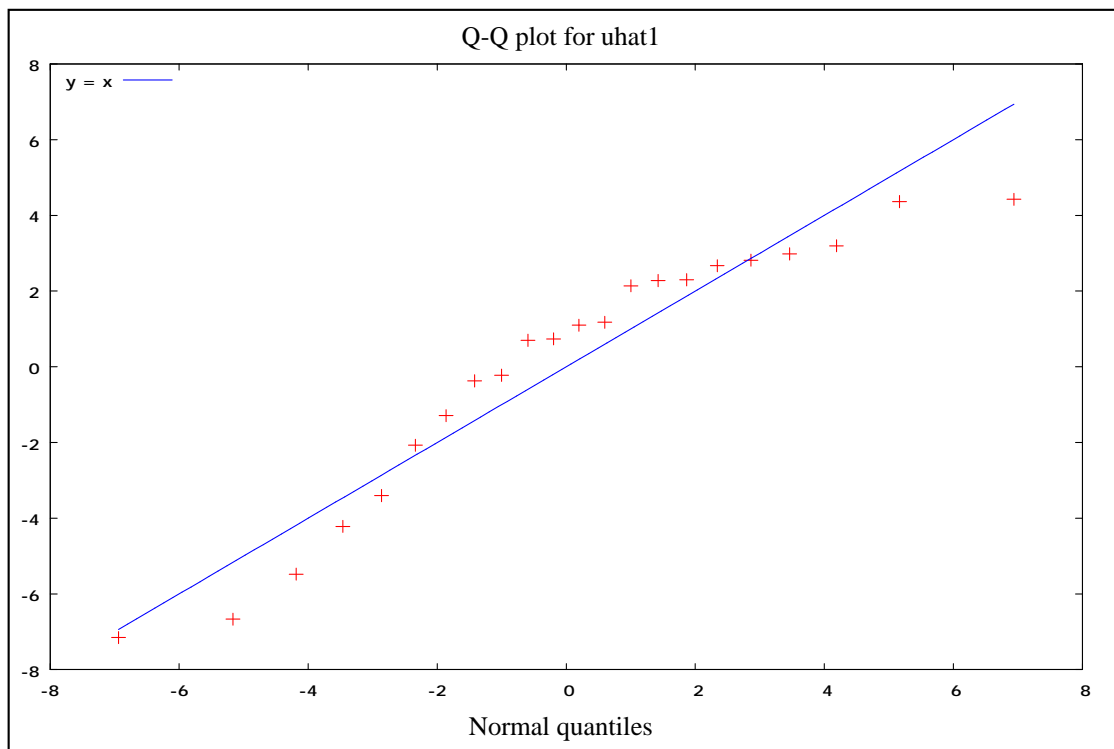


Figure 1. QQ Plot

Source: graph from authors' OLS analysis output.

**CONCLUSION**

The consumer price index plays an important economic indicator function in several ways that range from guidance for investment planning, economic and government policy, etcetera. The literature contains different opinions on the relationship between exchange

rate and consumer price index, however, given the uniqueness of each country's economic environment, it became apposite to focus the bearing of this paper on the South African economic context. Hence the paper used the exchange rate and CPI data for South Africa to examine the complex relationship.

Using a time series data of twenty-four months guided by the OLS regression, the findings show that changes in the price of South African currency may have a positive and highly significant effect on the consumer price index at a P-value of less than 0.05 alpha value at least within the short-time period of twenty-four months. This result is of theoretical and practical significance to academics and practitioners. Theoretically, it shows that within a short-time period of twenty-four months, exchange rate may influence an increase in CPI, hence economic policy makers may provide an advanced fiscal impact-

cushioning policies to reduce the adverse effects on savings and investment, and importantly on the livelihoods of low-income citizens.

Given the limited time-series coverage of twenty-four months, the paper recommends further study application of expanded time series to evaluate the effect of exchange on CPI over a longer period. Such expanded time series may provide more theoretical information on long-term effect of currency exchange rate on the consumer price index within the South African economic environment.

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