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THE RELEVANCE OF PASS-THROUGH EFFECT: SHOULD WE REVISIT MONETARY POLICY REGIME?

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Abstract

This paper aims to examine the relationship between exchange rate changes and domestic prices in DR. Congo, more particularly to measure the level of exchange rate pass-through to inflation from January 2002 to March 2017. Applying a cointegration and using a vector error correction model, the main finding is that a change in exchange rate will affect inflation more than proportionally, the level of pass-through being relatively high. One per cent of currency depreciation increases prices index of 0.38 per cent in the short run. This effect is larger in the long run where the increase in prices index is 1,66%. Furthermore, the adjustment towards equilibrium will take time (12 months and 2 weeks). As main implication, Congolese's monetary authority must, on the one, be careful and closely monitor exchange rate behaviour so as to take a prompt monetary policy action and stem inflation pressure from the external sector by targeted exchange rate market interventions and, on the other, rethink intermediate targets by adopting hybrid targeting : (i) monetary targeting and (ii) implicit and flexible exchange rate targeting.

Keywords: Nominal exchange rate, inflation, pass-through, monetary policy, error-correction model.

JEL Classification : F4, E31, E52, C22

Résumé

Ce papier a pour objectif d'analyser la relation entre le taux de change et les prix domestiques en RD. Congo, plus particulièrement de mesurer le degré du pass-through du taux de change nominal à l'inflation sur la période allant de Janvier 2002 à Mars 2017. En se basant sur l'approche par cointégration avec le modèle à correction d'erreur, la principale conclusion est qu'un changement dans le taux de change affectera l'inflation plus que proportionnellement, le degré du pass-through étant relativement élevé. Une dépréciation de 1% cause une hausse du niveau général des prix de 0,38% à court terme. Cet effet est encore plus large à long terme où la hausse du niveau général des prix est de 1,66%. En outre, l'ajustement vers l'équilibre prendra

Vol. 2, No. 02; 2018

ISSN: 2456-7760

du temps (12 mois et 2 semaines). La principale implication de politique économique découlant de ces résultats est que l'autorité monétaire Congolaise doit, d'une part, être vigilante et suivre de près les mouvements du taux de change afin de poser des actions rapides et de contenir les pressions inflationnistes du secteur extérieur par des interventions ciblées sur le marché des changes et, d'autre part, repenser les objectifs intermédiaires en adoptant un ciblage hybride : (i) objectifs monétaires quantitatifs et (ii) ciblage implicite et souple du taux de change.s

Mots clés : Taux de change nominal, inflation, pass-through, politique monétaire, modèle a correction d'erreur.

Code JEL: F4, E31, E52, C22

1| Introduction

The close relationship between the exchange rate and inflation has long been at the center of macroeconomic debates. The renewed interest in this relationship follows the transition to the floating exchange rate regime which did not play its intended role in balancing the balance of payments; the trade balances of the main trading nations simply did not respond, according to expectations, to appreciations and depreciations of the currency, and the flexibility of the exchange rate did not give monetary policy the autonomy expected as to the Friedman. This has led to an interest in the degree of transmission of nominal exchange rate changes to the general price level, what economic theory calls the "pass-through".

The concept of "pass-through" means the level with which changes in the exchange rate are transmitted to the prices of commercial goods expressed in domestic currency. Goldberg and Knetter (1997) define the exchange rate passthrough as: [the] "percentage change in the local currency importing countries". Similarly, the pass-through of the exchange rate can be defined as the change in the prices of domestic goods in national currency resulting from the 1% change in the exchange rate. Another way, as seen by Mumtazet al. (2006), is to define pass-through as the percentage change in domestic prices of imported goods following a 1% change in the exchange rate between importing and exporting countries. That can statistically be represented as the elasticity of import prices to a change in the exchange rate. The definition can also be extended from import prices to producer and consumer prices, which will eventually affect the general level of prices in the economy. This extension is even more important in the case of countries where the vast majority of goods consumed and intermediate goods entering production are imported.

The pass-through is said to be "complete" when an appreciation (or depreciation) in terms of the percentage of a foreign currency causes an increase (or decrease) in an equal percentage of the price of an imported good (valued in the country's currency). destination). Similarly, a "partial or incomplete" pass-through is defined when the price response is less than the percentage given by

Vol. 2, No. 02; 2018

ISSN: 2456-7760

the exchange rate. Empirical evidence has shown that, in an open economy, changes in the exchange rate are, in most cases, transmitted partially and deferred in time to domestic prices.

It is important to measure the degree of pass-through and assess its dynamics, as it is an important element in the formulation of the conduct of monetary policy, especially for import-dependent countries. The climate of high inflation leads the central bank to focus more on the possible effects of changes in the nominal exchange rate than on inflation. In particular, it is concerned about the possible formation of a vicious circle whereby a large depreciation would fuel inflation and increase expectations of higher inflation in the future or an anticipated rise in inflation. This situation tends to generate an inflationary spiral. When the pass-through effect is significant, the exchange rate regime gives even less autonomy to monetary policy and the targeting of intermediate objectives tends to become hybrid and / or flexible (likewise monitor the exchange rate and inflation rate, by implicitly pursuing an undeclared rate target exchange rate to ensure the achievement of the inflation target). The exchange rate seems to be the main channel of transmission of monetary policy. This is particularly the case for countries with high dollarization rates, such as the Democratic Republic of the Congo (DRC).

Indeed, DRC adopted the floating exchange rate regime in 2001 and since the currency has experienced a continuous depreciation involving a reaction to the rise in the price level in an economy highly dependent on imports due to the weakness of domestic production. Nevertheless, between 2010 and 2015, the country experienced relative stability of the exchange rate (around 920 CDF / USD on average) and a low level of inflation (1.4% on average between 2012 and 2015). it turns out that the exchange rate depreciated by 32.2% between the end of 2015 and June 2017 resulting in inflationary pressures (inflation of 25.04% in 2016 and 38.2% in the first quarter of 2017) since the sharp currency depreciation is the servant of high inflation (Reinhart and Rogoff, 2009). This situation follows, on the one hand, an unfavorable international context marked by the low prices of raw materials and sluggish global demand for the products on which the country's exports depend, causing a significant drop in supply. In the economy and, on the other hand, an increase in the money supply, largely driven by the deterioration of the Government's net position.

This situation marks the interest, in a context of strong pressure on the exchange rate and high inflationary pressure, to question the effect of exchange rate variations on the general price level.

The present work is a contribution to the analysis of the pass-through effect in the DRC. The dominant idea is to measure the degree of transmission of exchange rate variations on the change in the general level of prices in this context of macroeconomic instability that is unfavorable to the Congolese economy. Indeed a strong and / or weak degree of pass-through would advocate that exchange rate changes have more / less effect on inflation. This could change the central bank's predictions about the future reaction of inflation, which are decisive for monetary policy tactics.

This work is organized as follows: the second section reviews the literature on the degree of transmission of exchange rate changes on inflation, the third provides a brief overview of the

Vol. 2, No. 02; 2018

ISSN: 2456-7760

relationship between the exchange rate and inflation rate in the DRC, the fourth section discusses the methodological approach used to answer the work problem and finally, the last section presents the results found.

2| Review of the literature

2|1 Transmission channels from the exchange rate to consumer prices

There are two main channels through which the pass-through of the exchange rate is transmitted to consumer prices: direct and indirect channels (Laflèche, 1996). Exchange rate movements can directly affect domestic prices through changes in the prices of imported finished products and imported inputs. Indeed, the appreciation of the currency leads to a decrease in the prices of imported finished goods and inputs. Similarly, the depreciation of the currency leads to higher prices imported finished products, which will have repercussions on consumer prices. The depreciation of the currency also causes higher prices for imported inputs, which increases the marginal cost for producers. Thus, this leads to higher prices for domestic goods.

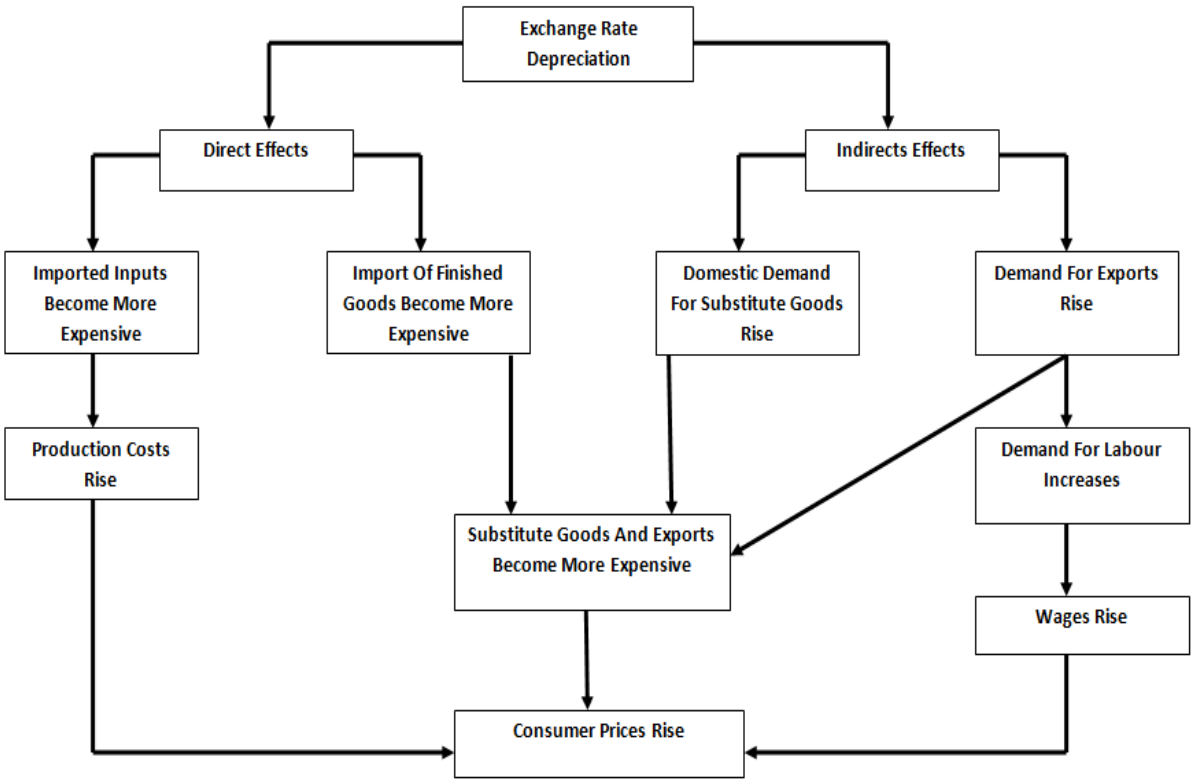
On the other hand, the indirect effect of the exchange rate on domestic prices appears when the currency depreciates, the prices of domestic goods become relatively cheaper for non-residents, all other things being equal. This can lead to increased exports and an increase in aggregate demand implying an increase in domestic prices. Increasing demand for domestic products also leads to an increase in labor demand and, perhaps, wage increases which in turn will be reflected in prices.

The graph below provides an illustration of the pass-through transmission mechanism.

Chart 2.1. Channels of transmission of a depreciation of the currency to consumer prices

Vol. 2, No. 02; 2018

ISSN: 2456-7760



Source: Adapted from Laflèche (1996)

2|2 The determinants of pass-through

The degree of pass-through is influenced by the following factors:

• The inflationary environment: the analysis is macroeconomic and the focus is on the credibility and effectiveness of monetary policy in maintaining a low inflation rate which leads firms to anticipate the non-persistence of any negative shock of the exchange rate on inflation and therefore they do not directly affect the exchange rate effect. Taylor (2000) was one of the first to explicitly formulate the hypothesis that the

The move to low inflation has reduced the degree of transmission of exchange rate movements to domestic prices.

• The exchange rate regime: in a flexible exchange rate regime, a low transmission of exchange rate movements to prices can help stabilize output and inflation. Devereux (2001) shows that in a small open economy with a high degree of transmission of exchange rate movements to prices, the trade-off between the volatility of output (or consumption) and the volatility of inflation is pronounced. whatever the monetary policy rule. A policy that seeks to stabilize production leads

Vol. 2, No. 02; 2018

ISSN: 2456-7760

to high volatility in the exchange rate and, as a result, marked volatility in inflation. But if exchange rate changes only slowly affect inflation, this arbitrage is much less pronounced.

• Other factors: the real exchange rate (in case of overvaluation of the domestic currency), economic activity (recession period), nominal rigidities and slow adjustment of consumer prices may make domestic prices less responsive changes in the exchange rate, the structure and degree of competition in the goods markets, the balance of payments imbalance, etc.

2|3 Empirical Review

Abundant literature exists on the relationship between the exchange rate and prices, most empirical studies, focused on developed countries, have found a low and decreasing level of pass-through since the 1990s (de Bandt and Razifindrabe, 2014).

McCarthy (1999) examines the pass-through of the exchange rate and import prices on domestic prices for several industrialized economies (United States, Japan, Germany, France, United Kingdom, Belgium, the Netherlands, Sweden and Switzerland) using a VAR model. He observes that the estimated impulse response and variance decomposition after the post-BrettonWoods period indicates that the effect of external factors on domestic inflation is very modest in most of the countries examined, including the United States.

De Bandt and al. (2007) study the question of the short- and long-term impact of exchange rate movements on import prices in the euro area countries. By using cointegration on panel data, they find that the appreciation phase of the euro makes it possible to find a long-term relationship between the exchange rate and import prices.

Bouakez and Rebei (2008) use a dynamic general equilibrium structural model to estimate the degree of pass-through in Canada. They find that the impact of changes in the exchange rate on Canadian import prices has remained fairly stable, but that their effect on consumer prices has declined in recent years. Simulations show that, this reduction is largely due to the change in the monetary policy regime.

An L. and Wang J. (2011) estimate exchange rate pass-through at import, production and consumption prices for 9 OECD countries using an SVAR model. They find that the pass-through of the exchange rate is less than unity in the short and long run. Of the three price indices, the pass-through is higher for import prices and lower for consumer prices. In addition, a greater degree of pass-through is found in small economies, having a large import share, a more persistent exchange rate, a more volatile monetary policy and a high inflation rate.

Wattanakoon P. (2013) examines the degree to which the exchange rate affects domestic prices for the case of Thailand over the period 2000-2011, using a standard Engle-Granger model. The main result is that, inevitably, a change in the exchange rate will affect inflation incompletely. It finds a degree of pass-through equal to 0.02% in the short term and 0.4% in the long term. This low degree of pass-through, particularly in the short term, may be explained by the government's non-accommodative reaction to inflation in order to preserve purchasing power.

Vol. 2, No. 02; 2018

ISSN: 2456-7760

Ponomarev and al. (2014) estimate the short- and long-run effect of exchange rate pass-through on prices in Russia over the period 2000-2012, using an error-correction model. The results show that the pass-through effect is incomplete and statistically significant in the short and medium term and the degree of pass-through corresponds more to the case of emerging countries. In addition, the results show an asymmetric pass-through effect for all price indices used implying that a depreciation leads to an increase in prices but that an appreciation does not lead to a drop in prices.

Since the 2000s, exchange rate pass-through studies have been extended to developing economies, particularly in sub-Saharan Africa. However, the results tend to be mixed despite the fact that many of them suggest a low pass-through degree (Jouini and Barhoumi, 2008).

Choudhri and Hakura (2001) study a sample of 71 countries, including emerging and developing economies, and confirm the existence of a strong correlation between exchange rate pass-through and a highly inflationary environment. They find zero elasticity of exchange rate pass-through to inflation in Bahrain, Singapore, Canada and Finland. For the countries of Sub-Saharan Africa, they find an exchange rate pass-through of 0.09 for Kenya, 0.14 for Ghana, 0.02 for South Africa, 0.06 for Zimbabwe, 0.16 for Burkina Faso and no one for Tunisia and Ethiopia.

Zouheir A. and IM Sghaier (2012), analyze the relationship between the nominal exchange rate and prices in the conduct of monetary policy in Tunisia and Morocco, using the methods of Edwards (2006) and Gerlach and Gerlach-Kristen (2006). Two results result from econometric tests: First, there is no evidence of a statistically significant change in the nominal exchange rate at prices. Referring to Edwards' approach in Tunisia and Morocco, the nominal exchange rate is not a tool for adjusting the inflationary effects of shocks. Second, changes in the nominal exchange rate are not a source of disruption to the ultimate goal of controlling inflation, pursued by the Tunisian and Moroccan authorities.

Mordi NO and Adebiyi A. (2012) use a DSGE model to estimate the pass-through effect of the Nigerian exchange rate using quarterly data for the period 1980-1998. In the short term, they find a positive and significant response of inflation to a shock on the exchange rate. The pass-through is incomplete and its coefficient is low. This low degree of pass-through is attributed, in part, to low, stable and predictable inflation resulting from improved credibility of monetary policy.

Loloh W. (2014), estimates the impact of pass-through of exchange rate movements on domestic prices in Ghana over the period 1994-2012, using a recursive VAR. The results show that the effect of a nominal exchange rate shock on domestic prices is incomplete, generally modest and fades between 18 and 24 months, but this effect is felt the most during the first 12 months. In general, the impact of an exchange rate shock on the consumer price index is lower than on the prices of non-food goods. In addition, evidence is found in favor of Taylor's assumption that the pass-through of the exchange rate is positively correlated with the level of inflation.

On the other hand, some empirical results have demonstrated the existence of a relatively high pass-through in the economies of sub-Saharan Africa.

Vol. 2, No. 02; 2018

ISSN: 2456-7760

Kiptui and al. (2005), examine the relationship between the exchange rate and the price level in Kenya over the period 1972-2002, using a VAR model. They find a large elasticity of exchange rate pass-through to inflation accounting for 46% of the variance of inflation during the period.

Razafimahefa (2012) examines pass-through in the economies of sub-Saharan Africa. The results show that for the Eastern and Southern African Common Market (COMESA) economies with a high level of inflation, pass-through is 25% to 50% higher than in the economies of the world. the West African Monetary Zone (WAMZ), the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC), where the level of inflation is low.

Bangura M. and al. (2012), use a Structural VAR model for Sierra Leone's economy to estimate the pass-through of the exchange rate to consumer prices. The model takes into account the key features of the economy, including its heavy reliance on foreign capital inflows in the context of monetary targeting. The results show that the pass-through of the exchange rate is incomplete, significant and high (reaching almost 50%). This suggests that the depreciation of the exchange rate is an important source of inflation in Sierra Leone.

Luyinduladio M. (2012) examines for the case of the Democratic Republic of Congo the pass-through over the period 2002-2007. Using a VAR model, it establishes the relationship between the reactions of the general index of consumer prices and the price index of gasoline following the innovations of the exchange rate. The results of the empirical analysis show that exchange rate innovations lead to a strong response on the consumer price index (accounting for 52% of its variance) and the gasoline price index (accounting for 11%). % of its variance) during the period.

Lariau and al. (2016), estimate pass-through in Angola and Nigeria. Although both countries share the same dependence on oil exports, the results found differ. For Angola, the degree of pass-through of the exchange rate at prices is high in the long run, although it has declined in recent years reflecting the process of de-dollarization of the economy. For Nigeria, on the other hand, there is no stable long-term relationship between the exchange rate and prices, and changes in the exchange rate do not have a significant pass-through effect on inflation. Nevertheless, the pass-through effect on underlying inflation is significant.

3| Brief overview of the exchange rate and inflation relationship in the DRC

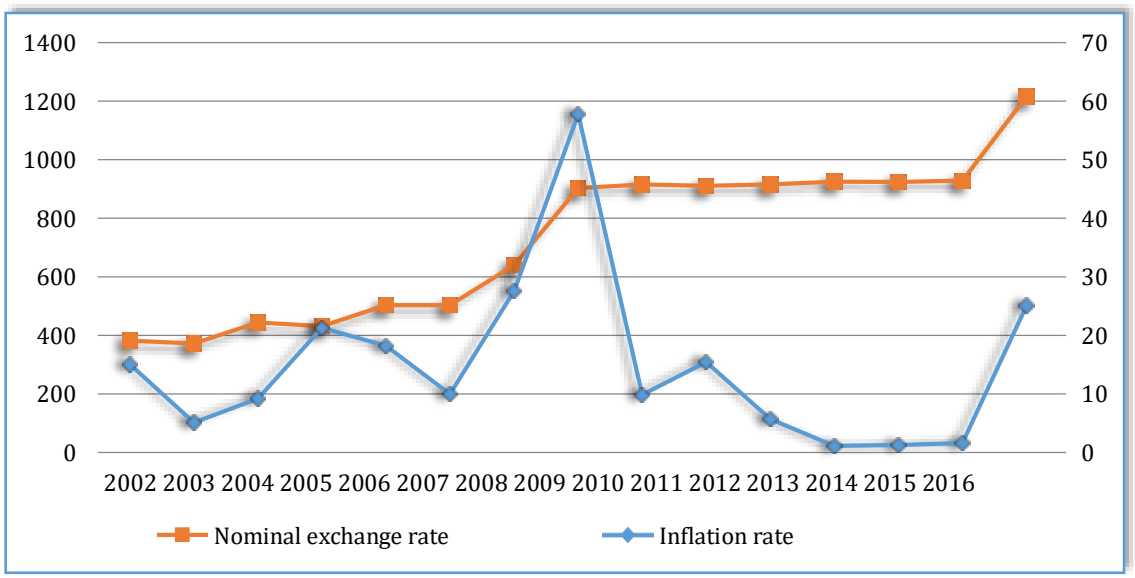
Since 2001, the monetary policy of the Central Bank of Congo has undergone significant structural changes aimed at improving its efficiency. These reforms mainly concerned the design and operational frameworks as well as the monetary policy monitoring mechanism. These changes have particularly concerned the reform of foreign exchange regulations.

In order to eliminate the distortions prevailing in the foreign exchange market, which destabilized the local currency, the floating exchange rate regime was adopted and the exchange rate regulations were liberalized in 2001. These measures, supported by a reform of the fiscal policy, have significantly reduced the rate of currency depreciation.

Vol. 2, No. 02; 2018

ISSN: 2456-7760

Chart 3.1. Evolution of the nominal exchange rate (CDF / USD) and inflation in the DRC from 2002 to 2016



Source: Central Bank of the Congo

As shown in Figure 3.1, the depreciation was the long-term nominal exchange rate trend. However, this long-term depreciation did not occur on a regular basis but in a gradual process, with stabilization phases of the exchange rate followed by depreciations. The implication of this depreciation trend for the pass-through of the exchange rate at domestic prices is that the latter would increase as more Congolese Francs are needed to buy the same quantity of goods and services imported.

Three sub-periods can characterize the evolution of the exchange rate and inflation between 2002 and 2016:

• From 2002 to 2009: Exchange rate fluctuations have significantly increased, also implying a high volatility of inflation. For illustration purposes, the exchange rate increased from CDF 382 per US dollar to CDF 903 between 2002 and 2009, representing a depreciation of 57.6%, corresponding to inflation of 15.03% and 57.79% respectively.

• From 2010 to 2015: period of relative stability of the macroeconomic framework marked by a significant reduction in exchange rate fluctuations and disinflation. The exchange rate increased from CDF 915 per dollar to CDF 928 between 2010 and 2015, representing a depreciation of 1.37%, corresponding to an average inflation of 5.8%.

• Since 2016: return of instability and strong exchange rate variation implying a high level of inflation. Between 2015 and 2016 the exchange rate went from 928 to 1216, a depreciation of 23.6%, and the inflation rate in 2016 was 25.04%.

Vol. 2, No. 02; 2018

ISSN: 2456-7760

4| Data and Methodology

4|1 Data

The statistics used have a monthly frequency, covering the period from January 2002 to March 2017, published by the Central Bank of Congo. The variables selected are: the consumer price index (whose variation gives inflation) and the nominal exchange rate (average interbank price).

4|2 Methodology

The empirical literature review and the research question reveal that the behavior of the inflation rate π_t is a function of exchange rate fluctuations e_t. In the log-linear form, it is then formulated as follows:

$$\pi_t = \psi_o + \psi_1 e_t + u_t \quad (4.1)$$

Where the coefficient ψ_1 (> 0) is an elasticity measuring the effect of a unit variation of e_t on π_t, ψ_o is the ordinate at the origin and u_t is the term of the error.

The coefficient ψ_1, when it is statistically significant, is an indication of the existence of a long-term relationship between the two variables and that they have a common stochastic tendency, the fundamental characteristic of which is that the resulting residue is stationary. In other words, the relation (4.1) is supposed to be a cointegrating relation.

4|2|1 Cointegration test: Engle-Granger approach

To test the existence of cointegration between the two series, we use Engle-Granger's Augmented Dickey-Fuller cointegration test, or EG-DFA test (Stock and Watson, 2012).

$$\Delta\hat{u}_t = \xi\Delta\hat{u}_{t-1} + \Sigma k\ \beta_j\ \Delta\hat{u}_{t-1} + \omega_t \quad (4.2)$$

Where $\hat{u}_t$ is the residual after estimation of the long term relation and k is the shift chosen according to Akaike and Schwartz criteria. The existence of a long-term relationship opens the way for the estimation of the error correction model (ECM).

4|2|2 Error Correction Model

In order to analyze the short- and long-term effects of changes in the exchange rate on the behavior of inflation (pass-through), an ECM can be used.

If all of the above conditions are true and the inflation rates and the exchange rate share a common stochastic trend, that is, they are cointegrated, the ECM describing the relationship between the two series writes:

$$\Delta\pi_t = a + \gamma\Delta e_t - \delta\pi_{t-1} + \beta e_{t-1} + \mu_t \quad (4.3) \text{ with: } a > 0;\ \gamma > 0;\ \delta < 0;\ \beta > 0$$

Vol. 2, No. 02; 2018

ISSN: 2456-7760

This specification is a formulation in Banerjee and Hendry (1992). The parameter γ represents the dynamics of the short-term pass-through (this represents the short-run elasticity. That is, the short-term impact of changes in the exchange rate on inflation) and the parameter β characterizes the long-term pass-through equilibrium. The parameter δ is the error correction coefficient. This parameter δ indicates the speed of adjustment of π_t towards its equilibrium level, ie the way in which inflation adjusts when there is an imbalance in the exchange market. In addition | 1/δ | represents the length of time that macroeconomic volatility is fully absorbed after adjusting the imbalance in the foreign exchange market. The parameter a is the constant.

5| Results

This section discusses the results found on the pass-through analysis in DRC. The first point presents the Engel-Granger cointegration test, then point 2 discusses the dynamics of the pass-through effect.

5|1 Cointegration test

The long-term relationship between the inflation rate and the exchange rate in DRC is defined as follows because of the non-stationarity of the exchange rate and the rate of inflation, on the one hand, and the stationarity of the residual (Table 5.1), on the other hand.

$$\pi_t = 3.24 + 1.66\ e_t$$

$$(0.13)\ (0.02)$$

Where the (...) are the robust standard errors.

Table 5.1. Application of EG-DFA test on residual $\hat{u}_t$

Statistical :	*-9,44*		
Residual $\hat{u}_t$	*Threshold of significance*		
	1%	*5%*	*10%*
	-4,01	*-3,44*	*-3,14*

Source : Authors

5|2 Dynamics of the pass-through effect

Based on the results found above, the error-correction model is used to analyze the pass-through effect. The dynamic relationship whose results, along with robust standard errors (..) are presented below:

Vol. 2, No. 02; 2018

ISSN: 2456-7760

$\Delta\pi_t = 0.23 + 0.38\ \Delta e_t - 0.08\ \pi_{t-1} + 0.13\ e_{t-1}$

(0.04) (0.03) (0.01) (0.02)

The degree of pass-through is 0.38 in the short term, implying that an increase in the exchange rate, ie a depreciation of 1% (the analysis is done by the quotation with the uncertain one which implies that an increase of the exchange rate is a depreciation of the exchange rate and a decrease is an appreciation), is accompanied by an increase in the inflation rate of 0.38%. The degree of short-term repercussions is medium and sensitive. This is good information for the conduct of monetary policy in its forecasts of inflation. However, it should be noted that in the short term there are other variables that influence the upward behavior of the inflation rate (the constant (0.23) gives a reliable result).

The degree of long-term pass-through is 1.66 implying that a 1% depreciation will increase the level of inflation to 1.66% over the long term. This shows that in the long term the rate of inflation responds more than proportionally to changes in the exchange rate. This strong long-run elasticity between inflation and the exchange rate suggests that the analytical framework for monetary policy in Congo needs to pay special attention to the prediction and targeting of the exchange rate because the degree of pass-through is very high.

The error correction coefficient or the restoring force is - 0.08 implies that, if during the previous period the level of inflation was 1% higher than that predicted by the long-term equilibrium ratio. In the long term, there will be an adjustment to reduce the level of inflation by 0.08% during this period to restore the long-run equilibrium relationship between inflation and the exchange rate.

As a result, the macroeconomic instability could be fully absorbed after (| 1/ -0.08 |) 12 months and 2 weeks after adjusting the imbalance in the foreign exchange market unless no other shock comes to lengthen this duration. Indeed, this shows the big problem facing the Congolese economy. This reversal of price instability is not only long, but depends on the speed at which macroeconomic policies will adjust the imbalance in the foreign exchange market.

So, in DRC the degree of pass-through is important, its magnitude is a basic reflection for the conduct of monetary policy. This should attract the attention of the central bank in an environment of strong dollarization, with a high degree of pass-through and especially calling for the strengthening of fiscal discipline. Indeed, in a dollarized environment, the risk of a mixture of transformation of exchange rate instability into monetary crisis and, ultimately, banking crisis is significant.

6| Conclusion

This paper aims to analyze the relationship between the exchange rate and inflation in DRC, in particular to measure the degree of pass-through of the exchange rate to inflation over the period from January 2002 to March 2017. The aim is to identify the implications for the conduct of monetary policy in a context of recovery macroeconomic instability since 2016.

Vol. 2, No. 02; 2018

ISSN: 2456-7760

The results suggested that the degree of pass-through is quite high at short (0.38%) and long term (1.66%) and the adjustment to equilibrium will take time (12 months and 2 weeks). This situation of a "more than complete" pass-through, given that the excessive exchange rate fluctuations will be more than proportionally transmitted to the general price level in the long term, highlights the vulnerability of the Congolese economy to exogenous shocks and negatively affects the credibility of monetary policy to maintain, over time, a low inflation regime.

This analysis leads to a rethinking of the monetary policy regimes (targets), adopting a hybrid targeting (quantitative monetary objective and targeting the exchange rate while remaining in the floating exchange rate regime) .This implies an implicit and flexible targeting of the exchange rate.) given a high degree of pass-through. This adoption would strongly influence the forecast of inflation and the conduct of monetary policy.

Four recommendations emerge from this analysis: (i) enrich the analytical framework of monetary policy by adopting a framework for in-depth analysis of exchange rate developments (consider also the return to implicit and flexible anchoring in exchange rate) to guide the inflation forecast and the future on the tactics of monetary policy; (ii) to ensure compliance with the rules on the independence of the Central Bank and the prohibition of the monetary financing of government deficits (including the development of a domestic securities market, starting with treasure) and strengthen banking supervision, etc. given the importance of the "Money → Change → Price → Banking System" mechanism in the Congolese economy; (iii) continue to pursue policies aimed at improving the domestic productive base (structural reforms accelerating the diversification of the economy) with a view to reducing the high level of imports, which policies contribute to reducing the high degree of pass-through; (iv) pursue the dedollarisation measures of the economy with the aim of restoring the effectiveness of monetary policy constrained by a high level of dollarization that maintains exchange rate volatility.

Attachments

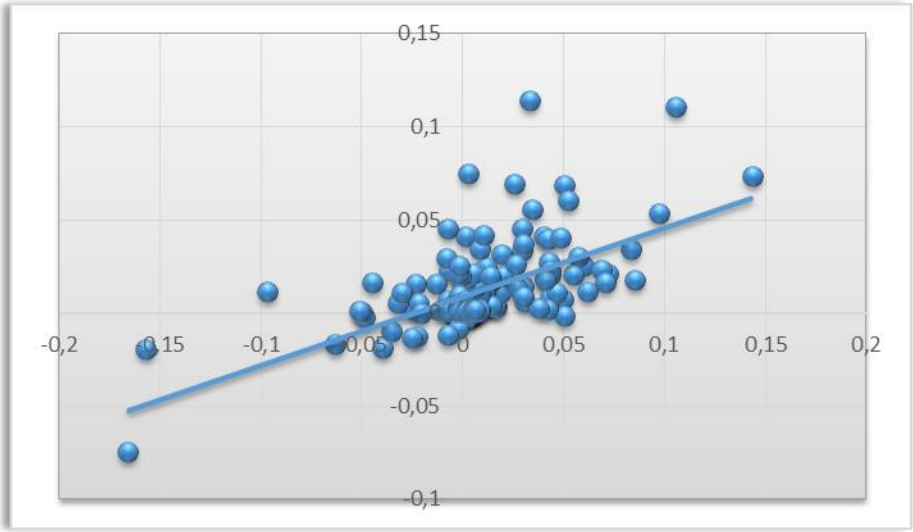
Close relationship between inflation rate and exchange rate

If we test the long-term relationship between the variables (see the cointegration test), cointegration indicates a positive relationship between the inflation rate and the exchange rate. Chart 7.1 illustrates the positive and intimate relationship between the inflation rate and the exchange rate.

Chart 7.1. Relationship between the inflation rate (in logarithm) and the exchange rate (in logarithm)

Vol. 2, No. 02; 2018

ISSN: 2456-7760



Stationarity

The inflation rate and the exchange rate are non-stationary in level but integrated of order 1.

Table 7.1. Augmented Dickey-Fuller Test (DS process, neither trend nor intercept)

	Statistique du test de Dickey-Fuller	
Variables	*en niveau*	*en différence première*
π	*-1,24 (-3,43)*	*-8,53 (-3,43)*
e	*-1,59 (-3,43)*	*-12,54 (-3,44)*

Les valeurs ( ) sont les valeurs critiques de Mackinnon au seuil de 5%

Ljung-Box test

The serial correlation of the residues calls into question the reliability of the time series, it is useful to check the behavior of the residues. It should be reassured that the residuals behave well, that is to say, distributed around a random average of zero (White noise process). The Ljung-Box test (1978) is one of the best known tests for diagnosing the absence of a serial correlation of residues.

The test statistic is written :

$$LB\ (K) = T\ (T+2) \sum_{k=1}^{K} \frac{\widehat{\rho_{k(\widehat{\mu_t})}}^{2}}{T-K}$$

Under the null hypothesis of absence of serial correlation of residues:

$$\hat{\rho}_{1(\widehat{\mu_t})} = \hat{\rho}_{2(\widehat{\mu_t})} = \cdots = \hat{\rho}_{k(\widehat{\mu_t})} = 0$$

The Ljung-Box test of absence of serial correlation of the residues is carried out for a maximum number of delays K equal to 17. The test shows graphically (Table 7.2) that the serial correlation of the estimated residues lies within the confidence interval, which suggests that the residues do not have a serial correlation and the probability attached to the Ljung-Box test statistic (6.033) is 0.993 higher than the statistical threshold of 0.05. As a result, the null hypothesis of no serial correlation is accepted.

Table 7.2. Ljung-Box test

Sample: 2002M01 2017M03

Included observations: 180

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.069	0.069	0.866	0.352
.|. |	.|. |	2	0.052	0.048	1.365	0.505
.|* |	.|* |	3	0.091	0.085	2.897	0.408
.|. |	.|. |	4	0.017	0.003	2.950	0.566
.|. |	.|. |	5	-0.002	-0.012	2.951	0.707
.|. |	.|. |	6	0.052	0.045	3.455	0.750
.|. |	.|. |	7	0.062	0.056	4.179	0.759
.|. |	.|. |	8	0.065	0.056	4.976	0.760
.|. |	.|. |	9	0.054	0.035	5.541	0.785
.|. |	.|. |	10	0.023	0.003	5.647	0.844
.|. |	.|. |	11	0.033	0.019	5.860	0.882
.|. |	.|. |	12	0.004	-0.009	5.864	0.923
.|. |	.|. |	13	-0.010	-0.018	5.882	0.950
.|. |	.|. |	14	-0.018	-0.028	5.942	0.968
.|. |	.|. |	15	-0.002	-0.008	5.943	0.981
.|. |	.|. |	16	0.009	0.005	5.958	0.989
.|. |	.|. |	17	0.019	0.015	6.033	0.993

Vol. 2, No. 02; 2018

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