

The Introduction of Higher Banknotes and the Price Level in Nigeria: An Empirical Investigation

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Abstract

The planned restructuring of the Nigerian currency to include a N5, 000 note has generated a lot of controversy. Much of the furor is centered around the supposed inflationary effects of introducing higher denomination notes, which provides the motivation for this paper. Using five different measures of inflation, from 1973 to 2011, we examine the effects of the introduction of new notes since the launch of the Naira in 1973. Our empirical results show that none of the currency restructuring episodes has had any effect on inflation. There, however, seems to be a short-lived positive effect on food inflation every time a new note is introduced. We attribute this not to the introduction of the note itself but to the change in inflation expectations following the introduction. However, the change in inflation expectations more than completely dissipates by the second month after which there is no subsequent effect.

Keywords: inflation, banknote, money illusion

JEL Classification: E310 E420 E410

1. Introduction

One of the core mandates of the Central Bank of Nigeria – hereafter on referred to as CBN - like most monetary authorities in the world, is the issuance and management of the legal tender currency. This implies that the CBN is responsible for the entire process of currency management, which includes the design, production, storage, distribution and the disposal of banknotes. An important component of this responsibility is to ensure an optimal currency structure in terms of efficiency, cost effectiveness and balanced mix of various denominations. This requires that the Bank be responsive to the changing needs of the economy and keep pace with the evolving trends in an ever-changing world.

According to international best practices, monetary authorities are required to review their currency regimes at intervals of between five (5) and ten (10) years. This is with a view to addressing the inevitable weaknesses and challenges noted in the management of notes and coins in circulation. Reviews are also necessitated by innovations in technology, aesthetics as well as security considerations.

In Nigeria, the controversy generated by the planned restructuring of the nation's currency resonated and has been sustained by some economic experts, political actors and business owners who have vehemently been opposed to the policy. The CBN announced a holistic restructuring of the nation's currencies and the introduction of N5, 000 banknote as well as N5, N10 and N20 coins from first quarter of 2013. The policy also proposes to redesign some of the other older notes. According to the CBN, the introduction of the higher denomination banknote will complement the bank's cashless policy by reducing the volume of currency in circulation in the long term. The conversion into coins and the redesigning of other notes will also enhance the security features of the currency as well as introduce other transactional features. The restructuring exercise code-named 'Project Cure', seeks to ultimately change the naira currency structure to 12, comprised of six coins and six banknote denominations.

Although the CBN began a sensitization campaign in all the geopolitical zones of the country to drum up support, opposition to the policy does not seem to have waned. The proposal was greeted with spontaneous reactions from members of the business community, political class and other businesses interests who have expressed

divergent views on the new currency policy.

A number of critics of the policy articulated the fear that the introduction of the N5, 000 note at a time when the nation is recording double digit inflation will not be in the interest of the economy. Although other alleged negative consequences have been mentioned, the main concern seems to be the effect on inflation. The critics argue that the introduction of a higher denomination banknote, such as the N5000 note, will accentuate inflationary trends and be counter-productive to the CBN's drive to reduce inflation.

In this paper we hope to dispel the myth of an effect of introducing new banknotes on inflation in Nigeria. The objective of this paper is to empirically investigate and examine the assertion that the introduction of higher denomination notes is inflationary in the Nigerian economy. Nigeria has introduced higher denomination notes six times before. One way to examine the possible effects of the introduction is to examine the effects on inflation during previous introductions of higher denominated currency. We examine five different inflation time series spanning the period 1973 to 2011 for possible effects. We do this using intervention analysis or an event study. According to Box and Tiao (1975) this is an appropriate way to assess the impact of a special event, such as the introduction of higher denomination banknotes, on inflation time series. In this case the special event is the various years of the introduction of the higher denomination.

Following this introduction, the rest of this paper is structured in 4 sections. Section 2 is a review of theoretical and empirical literature, section 3 describes the statistical methods and data used, section 4 discusses the empirical results and section 5 concludes the paper.

2. A Review of the Theoretical and Empirical Literature

In literature, the theoretical foundation for this study was captured by Chen (1975), who sought to show that an improvement in the size mixture of money would be contractionary on the price level. He argued that the achievement of an appropriate mixture of money would typically have three types of effects on the real demand for money. First, it would cause a reduction in the real demand for money because fewer real units of the more efficient money would be required to handle a given transaction on a real flow of monetary expenditure. This he termed the 'efficiency effect'. Second, it would cause an increase in the demand for real cash balances since the more optimal size mixture implies that money is more attractive. This leads to the substitution of money for barter exchange and of money holdings for other asset holding including commodities. This implies an increase in the real balance to income ratio. He called this the 'substitution effect'. The third effect, he argued, is that the real flow of income would increase. Thus, the increased use and efficiency of money would imply a savings of labour and other real resources, thus engendering a positive 'income effect' on the demand for money.

With the current trend towards fractional reserve banking system, there is an additional contractionary force at work, because better denomination mix of currency will lead to a shift out of deposits into currency, that is, a rise in the currency to deposits ratio, which, in turn, will reduce the money multiplier. Thus, with an unchanged nominal quantity of high-powered money, the nominal stock of money will decline, rendering an additional contractionary force on the price level. This can be called the "tight money effect." Therefore, for an improvement in the currency denomination mix to be inflationary, the direct efficiency effect has to be so strong that it out-weighs the combined forces of the substitution effect, the income effect, and the tight money effect. Historical evidence, however, seems to suggest that the efficiency effect is not even strong enough to offset the substitution effect. Although the "efficiency" of money has almost surely increased over the past decades, the income velocity of money has declined secularly in most of the countries. This seems to suggest that the substitution effect of an increased efficiency of money has outweighed the direct efficiency effect. These assumptions were within the analytical framework of general equilibrium (Tobin 1969, 1970) and a supplementary explanation of Milton Friedman's well-known thesis that money is a luxury good.

Empirically, the relationship between changes in currency structure and inflation has also been examined across countries. Franses (2006) examines the causality between bigger banknotes and inflation. He analyzed 40 years of data on inflation and denominations for 59 countries. His results showed one-way causality from inflation to banknotes but not from banknotes to inflation, thus clearly debunking the fear by monetary authorities that the introduction of higher denomination banknotes would reflect an expectation of impending inflation. The study used a vector auto-regression (VAR) model for inflation and banknotes denomination.

The introduction of the Euro also presents an experiment for the effects of a change in currency structure on inflation. Although not as straightforward as the introduction of a higher denomination note, the introduction of the Euro represents an extreme example of a change in currency structure. Pollan (2002) and Angelini and Lippi (2005) examines the effects of this change in structure on inflation in Germany, Switzerland and Italy. Both papers find no evidence of the change in currency structure on inflation even in this extreme case.

Studies on the implications of the higher denomination banknotes on inflation in Nigeria have not been carried out. This provided more impetus for this study. We aim to show, empirically, the implications of the introduction of higher denomination banknotes on inflation in Nigeria. The introduction of higher denomination banknotes always seems controversial with attendant speculative effects.

3. Statistical Methods and Data

An appropriate method to evaluate the impact of the introduction of higher denomination banknotes on inflation is "Intervention Analysis". This provides a means of assessing the impact of a discrete change in inflation resulting from an event, such as the introduction. For our analysis we select a model of the form

$$I_t = \alpha_0 + \sum_1^T (\alpha_1 I_{t-1}) + \beta_0 Z_t + \mu_t \quad (1)$$

where I_t represents inflation at time t and μ_t represents the usual error term. Z_t is the intervention variable which takes on a value of zero prior to the introduction of the new banknote and unity from the date of the introduction of the new banknote. In this model β_0 is our variable of interest. A statistically significant β_0 implies an initial or impact effect of a new note on the inflation series. We examine six possible intervention points individually, corresponding to the introduction of each new note since 1973. As an alternative strategy we test the joint effect of the introduction of a new note. We do this by defining Z_t as unity for all time periods in which a new note was introduced and zero for all other periods. In this case β_0 would measure the impact of the introduction of new notes in general. A statistically significant β_0 also implies an effect on inflation.

For our empirical analysis, six intervention points were examined. The N20 note was introduced in February of 1977, the N50 in October of 1991, the N100 note in December of 1999, the N200 note in November of 2000, the N500 in April of 2001 and the N1000 note in October of 2005. We use five different data sets to test the impact of a new note on inflation. We use annual inflation data computed from the Consumer Price Index and the GDP deflator separately. This series is available from the World Bank1. We use data from 1961, following the independence of Nigeria, to 2011. Second we use monthly inflation data provided by the Central Bank of Nigeria. The CBN data reports monthly headline, core and food inflation from January 1995 to July 2012. To deal with seasonality in the monthly inflation series we include dummy variables for the 1st 11 months in all regressions.

4. Empirical Results

Following the standard assumption that inflation time-series contains a stochastic process, the first step is to model the series and select the most appropriate autoregressive integrated moving average representation. Figures 1 to 5 plot each of the five series used. Both annual inflation series suggest nonstationarity. From the graphs we note that the variance of both annual measures of inflation seem to change around the year 2000. We perform the augmented Dickey Fuller test on all the series. The test statistic suggests that all five series are stationary. We used the Hannan and Quinn information criterion and the Schwarz's Bayesian information criterion to select the appropriate number of lags. This results in no lag for monthly core inflation and one lag for all other series.

As indicated above, testing the effect of the introduction of a higher denomination banknote involves testing the significance of the coefficient on the intervention variable, β_0 . We use a maximum likelihood estimator to obtain the results. Table 1 reports the coefficients using all five inflation series and for all intervention points selected. Outer product of gradients (OPG) standard errors is reported in brackets. In all cases the impact of the introduction of higher denomination bills is not significant.

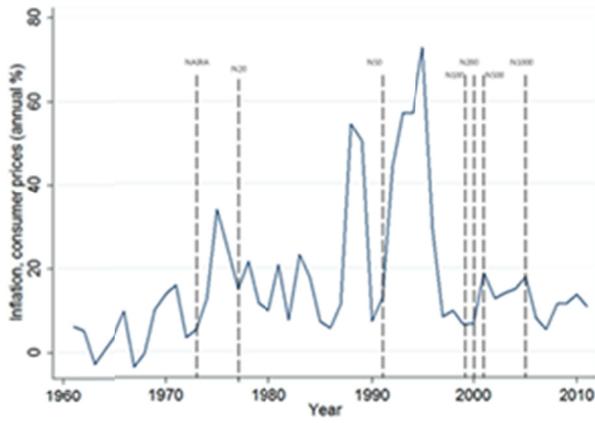


Figure 1.

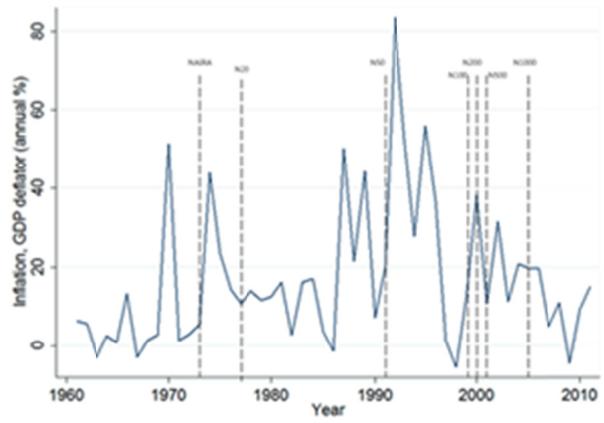


Figure 2.

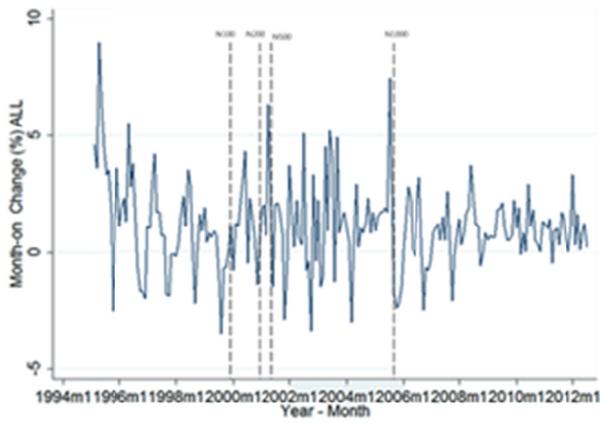


Figure 3.

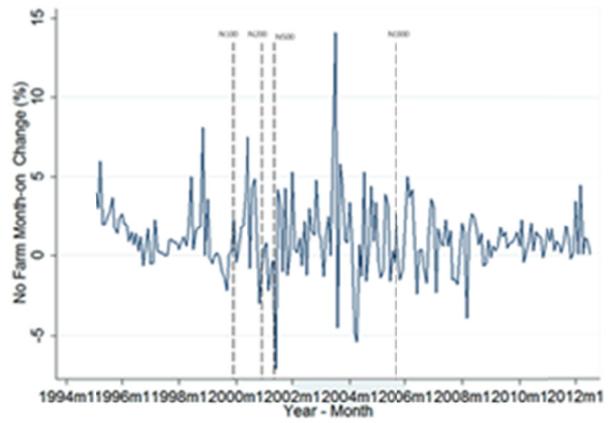


Figure 4.

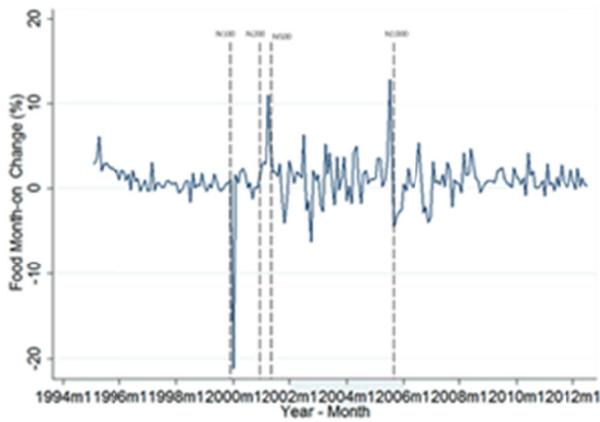


Figure 5.

Table 1. Individual effects of the introduction of a new banknote on inflation

		N20 (Feb. 1977)	N50 (Oct. 1991)	N100 (Dec. 1999)	N200 (Nov.2000)	N500 (Apr. 2001)	N1000 (Oct. 2005)	No. of Obs
ANNUAL	CPI	6.95	7.01	-5.38	-3.81	0.44	-2.67	51
ANNUAL	GDP	(11.35)	(9.35)	(27.56)	(28.59)	(17.53)	(25.64)	51
MONTHLY	Deflator	9.01	9.42	-1.16	-0.33	-5.49	-6.58	210
MONTHLY	CPI	(7.18)	(6.40)	(11.78)	(10.41)	(14.11)	(19.57)	210
MONTHLY	Headline			-0.27	-0.33	-0.25	-0.48	210
	CPI			(0.33)	(0.32)	(0.31)	(0.40)	
	Core			-0.26	-0.56	-0.34	-0.42	
	CPI			(0.43)	(0.37)	(0.37)	(0.44)	
	Food			-0.09	0.42	0.28	-0.24	
				(0.71)	(0.64)	(0.63)	(0.64)	

Notes: Outer product of gradient standard errors are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels.

Table 2. Joint effect of introduction of new banknote on inflation

		Joint Effect	No. of Obs
ANNUAL	CPI	-3.40	51
ANNUAL	GDP	(7.67)	51
MONTHLY	Deflator	-1.55	210
MONTHLY	CPI Headline	(14.19)	210
MONTHLY	CPI Core	0.67	210
	CPI Food	(0.59)	
		-1.52	
		(1.53)	
		2.69***	
		(0.83)	

Notes: Outer product of gradient standard errors are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels.

An alternative is to test for the joint effect of the introduction of higher denomination notes. In this case we are testing not for the effect from the introduction of a particular note, but for the effect of the introduction of any note. To examine the joint effect we include a dummy variable with a value of 1 for the period of introduction and zero for all other periods. As in our earlier regressions we use maximum likelihood estimator to obtain results. The results are reported in table 2 with OPG standard errors reported in brackets. The effect of the introduction of any note is not significant using four of the five different measures of inflation. The exception is monthly food inflation which shows a positive and significant effect on inflation. This suggests that there may be some effect of the introduction of new notes on food inflation in the month of introduction. We explore this further in the next section and make suggestions as to the cause of the effect.

• Effects on Food Inflation

The results from the previous section show no permanent effect of the introduction of any of the banknotes on food inflation individually. However there appears to be a joint effect of the introduction of any note on food inflation during the month of introduction. In this section we explore the persistence of the effect on food inflation. Extending the model to include lagged effects of the introduction of new banknotes suggest that the effect is short-lived. To evaluate this proposition we adjust our original model to include the effect of the introduction of any banknote on future values of inflation. The adjusted model takes the form

$$I_t = \alpha_0 + \sum_{i=1}^T (\alpha_i I_{t-i}) + \sum_{d=0}^D \beta_d Z_{t-d} + \mu_t \quad (2)$$

where Z_{t-d} represents the d^{th} lag of the introduction. Estimating the effect of the d^{th} lag of the intervention, Z_{t-d} on I_t is effectively the same as estimating the effect of Z_t on future inflation, I_{t+d} . We estimated the model for up to four lagged periods using the same estimators as the standard model. The results are reported in table 3.

Including a one period lag, Z_{t-1} , results in a coefficient that is negative, significant and more than double the magnitude of Z_t . This suggests that the positive effects of the introduction in the first month are more than reversed by the second month following the introduction. Including further lags up to the fourth month show no significant effect on inflation. This implies that the effects die out relatively quickly. Testing the effect of the intervention on future inflation using our four other measures of inflation show no significant effect.

Table 3. Adjusted model for delayed intervention effects

		Z_t	Z_{t-1}	Z_{t-2}	Z_{t-3}	Z_{t-4}	No. of Obs
MONTH	CPI Food	2.69***					210
MONTH	CPI Food	(0.83)	-5.06***	0.01	0.68	-0.32	210
MONTH	CPI Food	1.69**	(0.62)	(1.06)	(2.77)	(2.42)	209
MONTH	CPI Food	(0.81)	-5.05***	0.15	0.61		208
MONTH	CPI Food	1.69**	(0.65)	(1.07)	(2.81)		207
		(0.82)	-5.02***	0.13			
		1.68**	(0.65)	(0.1.06)			
		(0.81)	-5.03***				
		1.73**	(0.65)				
		(0.88)					

Notes: Outer product of gradient standard errors are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10% levels.

The short lived effect of the introduction of a new note on food inflation is consistent with Shafir, Diamond and Tversky (1997) on the effects of money illusion. They argue that the presence of nominal accounting issues could sometimes affect decisions. The introduction of a new note perhaps represents such as case. Even though there is no real effect on inflation, introducing new denominations could lead to the expectation of higher inflation. The expectation of higher inflation is an important driver of actual inflation (Lucas and Rapping, 1969). The effect on inflation is however short-lived. Our results suggest a subsequent drop in inflation by a magnitude higher than the initial rise; perhaps because of the realization of no real effects on inflation. It is also not surprising that the temporary effect is only on food inflation. Food inflation is traditionally more sensitive to shocks than other measures of inflation.

5. Conclusion

The empirical results in this paper lead to the conclusion that the introduction of higher denomination banknotes does not lead to higher inflation in Nigeria. Hence the prediction of higher inflation triggered by the introduction of the N5, 000 by most Nigerians is not founded by empirical investigation. Using both annual and monthly inflation data, we examine the effect of past introduction of higher denomination banknotes in Nigeria. Employing intervention analysis of time series inflation data, there is no evidence from the results of unwanted consequences of issuing higher banknotes. Our results are consistent with other studies by Pollan (2002), Angelini and Lippi (2005) and Franses (2006) who find no effect of a change in the denomination of banknotes on inflation.

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References

- Angelini, Paulo, & Lippi, Francesco. (2005). Did Inflation Really Soar after the Euro Cash Changeover? Indirect Evidence from ATM Withdrawals. *Tem di discussione (Economic working papers)*, Bank of Italy, Economic Research and International Relations Area. No 581
- Box, G. E. P., & G. C. Tiao. (1975). Intervention analysis with applications to economic and environmental problems. *American Statistical Association*, 70, 70-79. <http://dx.doi.org/10.1080/01621459.1975.10480264>
- Chen, Chau-nan. (1972). Bimetallism: Theory and Controversy in Perspective. *History of Political Economy*, 4(1), 89-112.

- Chen, Chau-nan. (1975). Flexible Bimetallic Exchange Rates in China, 1650-1850: A Historical Example of Optimum Currency Areas. *Journal of Money, Credit and Banking*, 7(3), 357-76.
- Fisher, I. (1926). *The Purchasing Power of Money*. New York: The Macmillan Co.
- Franses, Philip Hans. (2006). Empirical causality between bigger banknotes and inflation. *Journal of Applied Economic Letters*, 13(12), 751-752. <http://dx.doi.org/10.1080/13504850500424926>
- Lucas, Robert E., Jr., & Rapping, Leonard A. (1969). Price Expectations and the Phillips Curve. *The American Economic Review*, 59(3), 342-350.
- Pollan, Wolfgang. (2002). Price Development upon the Introduction of Euro Banknotes and Coins. *Austrian Economic Quarterly*, 7(4), 167-175
- Shafir, Eldar, Peter Diamond, & Amos Tversky. (1997). Money Illusion. *Quarterly Journal of Economics*, 112(2), 341-374. <http://dx.doi.org/10.1162/003355397555208>
- Tobin, James. (1969). A General Equilibrium Approach to Monetary Theory. *Journal of Money, Credit and Banking*, 1(1), 15-29. <http://dx.doi.org/10.2307/1991374>
- Tobin, James. (1970). Deposits Interest Ceilings as a Monetary Control. *Journal of Money, Credit and Banking*, 2(1), 4-14. <http://dx.doi.org/10.2307/1991309>

Note

Note 1. Accessed from <http://databank.worldbank.org> on the 3rd of September, 2012