

Monetary Instruments and Inflation in Nigeria: A Revisit of FAVAR

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- This paper revisits the potency of Factor Augment Vector Autoregression (FAVAR) model to trace the channel of monetary policy instruments in Nigeria.
- Bernanke et al. (2005) measured the effect of monetary policy using FAVAR.
- Although the results properly identified the monetary channel,
- but the price puzzle effect issues were not totally resolved.

The use of FAVAR in Nigeria has yielded mixed results;

- 1 Mordi et al. (2014) analyze the reaction of prices to Central Bank of Nigeria (CBN) announcements their results are mixed and “price puzzle“ effect is observed.
- 2 Obafemi and Ifere (2015) examined the transmission channel of monetary policy, the price and the liquidity puzzles are present in the early stage but disappear later.

Our study, therefore, appeals to the flexibility of FAVAR by introducing the communality and uniqueness of Factor Analysis to reconcile the mixed results in monetary policy management in Nigeria.

Study Objective

The study capstone and objective is to re-examine and revisit the FAVAR approach in establishing the effectiveness of monetary policy instruments¹ in Nigeria as discussed in Mordi et al. (2014).

¹Monetary Policy Rate (MPR), Treasury Bill Rate (TBR), and Cash Reserve Ratio (CRR)

It is a two-stage time series estimation.

- The extraction of the unobserved factors using principal component analysis (PCA),
- The identification and elimination of the factors with higher uniqueness errors,
- and estimation of VAR on the variables with higher cummunality.

Model: FAVAR

$$\text{Var}(X_i) = \sum_{j=1}^k \Lambda_{ij}^2 F_j + \Psi_{i,i} \quad (1)$$

$\text{Var}(X_i)$ comprises two components;

- the *communality* of variable X_i given by the variance shared with other variables via the factors $\sum_{j=1}^k \Lambda_{i,j}^2$
- *uniqueness*, $\Psi_{i,i}$, given by the variance not shared with other variables.

The informational time series, X_t , that are related with the unobserved factors, F_t , and observed factors, Y_t , is given by

$$X_t = \Lambda^f \mathbf{F}'_t + \Lambda^y \mathbf{Y}'_t + \epsilon'_t \quad (2)$$

$\text{Var}(X_i)$ comprises two components;

- Λ^f is an $N \times K$ matrix of factor loadings,
- Λ^y is $N \times M$ matrix.
- ϵ_t is $N \times 1$ vector of weakly correlated error terms.

- Quarterly data that spans from year 2000 to last quarter of year 2019.
- 121 macroeconomic variables,
- We excluded all CPI indices with weight less than 10 percent of headline CPI variables.
- All the variables are transformed to their stationary states.
- removed the macroeconomic variables with uniqueness higher than 60%

- The results revealed that about 67 percent of our variables has communality that is more than 40%
- In essence, we re-caliberate our model by eliminating the variables with communality lower than 40%
- retaining the variables with larger amount variance shared with other factors.
- The results show that about 53% of the variation in the 71 variables can be explained by six factors.

- The Forecast Error Variance Decomposition (FEVD) results show that 82.7 percent of the variation in inflation in the second quarter is due to changes in itself.
- In addition, the changes in the unobserved factor component of monetary aggregates in PC4 increasingly affects the variation in inflation.
- Changes in other unobserved factors of the macroeconomic variables trivially trigger variation in inflation.

	INFL	PC1	PC2	PC3	PC4	PC5	PC6	MPR
1	1	0	0	0	0	0	0	0
2	0.827	0.029	0.014	0.003	0.072	0.000	0.012	0.043
3	0.754	0.049	0.035	0.022	0.077	0.004	0.011	0.049
4	0.720	0.046	0.041	0.023	0.069	0.005	0.051	0.045
5	0.673	0.039	0.067	0.026	0.075	0.006	0.069	0.045
6	0.632	0.046	0.064	0.025	0.096	0.006	0.071	0.060
7	0.615	0.051	0.061	0.030	0.099	0.018	0.068	0.058
8	0.590	0.053	0.066	0.039	0.100	0.028	0.067	0.057
9	0.573	0.052	0.064	0.048	0.102	0.031	0.073	0.057
10	0.563	0.054	0.067	0.050	0.108	0.031	0.071	0.056
11	0.560	0.054	0.067	0.050	0.107	0.035	0.071	0.056
12	0.544	0.064	0.066	0.060	0.110	0.035	0.070	0.054

Figure: Monetary Policy Rate vs Inflation

	INFL	PC1	PC2	PC3	PC4	PC5	PC6	TBR
1	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.771	0.098	0.024	0.007	0.048	0.002	0.026	0.023
3	0.663	0.115	0.067	0.025	0.044	0.025	0.028	0.033
4	0.617	0.120	0.064	0.040	0.043	0.026	0.043	0.048
5	0.606	0.096	0.086	0.035	0.053	0.033	0.053	0.038
6	0.564	0.136	0.083	0.033	0.063	0.035	0.051	0.035
7	0.551	0.135	0.091	0.037	0.064	0.037	0.050	0.036
8	0.508	0.148	0.091	0.036	0.065	0.047	0.071	0.034
9	0.487	0.142	0.088	0.038	0.066	0.046	0.100	0.033
10	0.477	0.142	0.091	0.041	0.067	0.045	0.102	0.035
11	0.471	0.144	0.090	0.041	0.066	0.051	0.102	0.035
12	0.457	0.153	0.087	0.049	0.064	0.052	0.103	0.034

Figure: Treasury Bill Rate vs Inflation

	INFL	PC1	PC2	PC3	PC4	PC5	PC6	CRR
1	1.000	0	0.000	0.000	0.000	0.000	0.000	0.000
2	0.762	0.058	0.047	0.003	0.060	0.005	0.063	0.004
3	0.653	0.053	0.072	0.044	0.070	0.026	0.058	0.023
4	0.633	0.053	0.072	0.040	0.066	0.031	0.058	0.047
5	0.654	0.042	0.094	0.032	0.052	0.034	0.055	0.037
6	0.638	0.052	0.093	0.033	0.058	0.033	0.056	0.036
7	0.617	0.050	0.090	0.034	0.070	0.045	0.054	0.041
8	0.583	0.053	0.092	0.039	0.069	0.068	0.057	0.040
9	0.569	0.052	0.090	0.049	0.067	0.070	0.062	0.040
10	0.563	0.052	0.097	0.048	0.069	0.070	0.061	0.040
11	0.560	0.053	0.096	0.048	0.069	0.073	0.061	0.040
12	0.543	0.058	0.096	0.060	0.067	0.073	0.062	0.042

Figure: Cash Reserve Ratio vs Inflation

- The MPR impact is low but not trivial, especially when factors have higher communality loading.
- While MPR has the highest impact on inflation in the sixth horizon,
- CRR and TBR have highest impact in the fourth horizon thus,
- impact of CRR and TBR on inflation is earlier than impact of MPR.

- Shocks to all the monetary instruments led to a more than 10 percent decrease in inflation.
- However, there exists a level of inflation persistence in response to a monetary shock to CRR after initial decrease than other two monetary instruments.
- we are able to show that a decrease in inflation follows an increase in monetary instruments if variables with higher uniqueness loading are excluded.
- Consequently, the "price puzzle" syndrome prevalent in VAR and FAVAR models are sterilized in our models.

Response of inflation to 1%

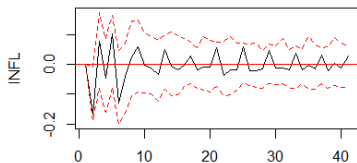


Figure: Impulse shock to MPR

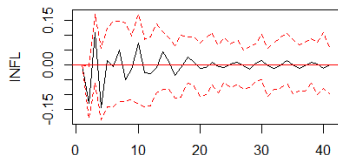


Figure: Impulse shock to TBR

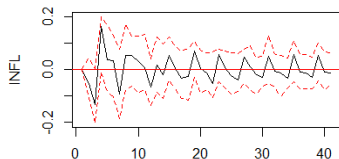


Figure: Impulse shock to CRR

- Our results indicate a high impact of all the monetary instruments on Inflation.
- The factor components of monetary and short-term interest rates as well as real outputs have a nontrivial impact on inflation.
- We thus, reveal that there exists some latent information extracted directly from operating and intermediate target that can be useful for price stabilization policy in Nigeria.

- The oscillating variations in inflation resulting from all the principal components suggest that inflation vulnerability is subject to uncertainty and volatility.
- The persistent increase in the unobserved information of short-term interest rates serves as an effective intermediate target in the monetary channel.

- extracting the communality of the macroeconomic variables to improve policy shock identification resolves price and liquidity puzzle effect.
- Our approach is useful for better measurement of Factor Analysis in VAR estimations.
- The operating targets reduces the short-term interest rates, increases credit to the private sector, and increases net domestic credit and industrial outputs.

- This channel is effective in encouraging real investment and real personal disposable income.
- The latent factors that are directly extracted from macroeconomic variables validate a strong intermediate target in the achievement of price stability in Nigeria.
- we show from our study that food CPI and food mostly drive the inflation.

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