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EXCHANGE RATE PASS-THROUGH AND CONSUMER PRICES: EMPIRICAL EVIDENCE FROM THE GAMBIA

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Abstract

In this work, we study the exchange rate pass through into consumer prices for The Gambia, using monthly data from 2001m12 to 2012m12. Applying Johansen cointegration and VECM, while controlling for supply shocks and monetary policy effects, we found that both the adjustment to equilibrium is slow and that exchange rate pass through into consumer prices is incomplete. Estimates of the pass through from the derived impulse responses show that a 1% depreciation in the exchange rate increases inflation by 0.12% in 24 months. Yet, the variance decomposition shows exchange rate contributing up to 35% of changes in inflation in The Gambia for the period under study.

Keywords: Exchange rate pass-through, Inflation, Co-integration, VECM, The Gambia

INTRODUCTION

Macroeconomic policy environment in The Gambia mirrors a liberal market economy since the successful Economic Recovery Programme (ERP), which was implemented in 1985-1989 to recover from the recession of the early 1980s. By the end of ERP, Program for Sustained Development (PSD) took off from 1990 to 1996 with the aim of sustaining the gains of the ERP. The political change in 1994 and the coming to being of the second republic show an ambitious Vision 2020 replace the PSD in 1996.

It is the broad objective of Vision 2020 to transform the country into a middle income nation by 2020, and seeks to achieve this through its Strategy for Poverty Alleviation (SPA) covering Poverty Reduction Strategy Paper (I and II) for 2001-2005 and 2007-2011 respectively. The main objectives of these programs were public sector resource management and macroeconomic stability; pro-poor growth and improved employment opportunities through private sector development; and provision of basic social services. As the PRSP expires in 2011, the Programme for Accelerated Growth and Employment for 2012-2015 (The Gambia Trade Policy, 2011) replaced it.

Recently, The Gambia has maintained a stable single digit inflation environment since 2000, except in 2002/3, due to drought. The average inflation between 2003 and 2009 was 6.5%. The Gambia runs a managed float system of exchange rate, where the CBG intervenes only to maintain the required reserve and contain the volatility of the exchange rate. Despite the CBG interventions, the flings in the exchange rate can be significant due to significant external shocks that are transmitted into the country. For example, the dalasi appreciated in 2007 by 24.4% from increased FDI and remittance inflows, and in 2008 the rate depreciated by 15.1% following the unset of the global financial crisis.

In the realms of a liberal trade regime and a floating exchange rate system for a small open economy like The Gambia, the central bank's effort in controlling domestic prices can be highly dependent on exogenous changes in the exchange rate. The degree to which changes in the exchange rate are transmitted into domestic prices is called the exchange rate pass through (herein called ERPT). The effectiveness of the central bank's effort in controlling domestic inflation is directly related to the degree of ERPT, especially when external shocks are common. Therefore, a precise knowledge of the degree of ERPT helps in devising and implementing appropriate monetary policy responses to exchange rate movements. The debate on ERPT has broad implication for monetary policy. For example, a low ERPT to domestic prices would reduce the expenditure switching effect of domestic monetary policy (Manuel and Goldberg, 2004) and countries with low exchange rate variability are likely to have lower ERPT to domestic prices. The increasing dependence on export and the rising fluctuation in the exchange rate in developing countries create an even greater need for understanding the determinants of the transmission of the exchange rate changes into domestic prices.

This paper seeks to estimate the ERPT to consumer prices for the Gambia for the period 2001M12 to 2012M12 using econometric techniques of cointegration, impulses responses and variance decomposition. This is paper contributes to the literature by adding the Gambia case for the period 2001M12 to 2012M12. We are not aware of any studies on the Gambia for the period under review.

Section 2 and 3 discuss the theoretical background and empirical literature respectively. Data and model estimation is covered in section 4, while section 5 accounts for the empirical result before finally concluding in section 6.

THEORETICAL BACKGROUND

According to Goldberg and Knetter (1997) "exchange rate pass-through is the percentage change in import prices in local currency resulting from a one percent change in the exchange rate between the exporting and importing countries''. However, along the supply chain, increased import prices translate into increased producer and consumer prices. Therefore, a broader definition by Jaffri (2009) is " the percentage change in domestic prices resulting from one percent change in exchange rate".

It is of relevance to policy in that the effectiveness of monetary and exchange rate policies depend on how exchange rate changes affect domestic prices. Precisely, if exchange rate changes become inflationary, then policy makers need to factor the exchange rate in their efforts to put inflation under control. Therefore, a low ERPT will give a greater freedom for monetary authorities to follow independent monetary authority and inflation targeting.

The two extreme case of the impact of exchange rate on prices is the classical 'Law of One Price', where pass through is zero, and 'the Keynesian-fix-price idea incorporated in the open economy IS-LM model of the Meade-Mundell type' (Ziet, 1993).The classical Law of One Price works under perfect competition, homogeneous good, and goods arbitrage where the real exchange rate is equal to one (absolute PPP) or equal to a constant (relative PPP). So changes in exchange does not affect prices. Under conditions of imperfect goods substitutability, goods are priced as a markup added up to unit cost. Changes in exchange rate, given a constant unit cost and markup, will be completely reflected in the prices, hence pass through is complete (Goldberg and Knetter, 1997). However, models of imperfect competition, where domestic and foreign firms interact strategically to set prices and quantity are reminiscent with incomplete pass through (Dornbusch 1987).

There are direct and indirect channels through which exchange rate changes affect domestic inflation. A fall in exchange rate directly increases the prices of imported finished and intermediate goods in local currency. When the exporting firm absorbs some of the changes in exchange rate into her markup-a practice called Pricing to Market (PTM) in Krugman (1987) - ERPT will be incomplete.

The indirect channel works through making domestic products cheaper for foreign buyers, which increases demand for domestic products and finally raises aggregate demand. Finally, the increased aggregate demand raises domestic prices. In the short run when nominal wages

are constant, real wages will move down as prices rise. However, as workers demand higher pay to level their real wages, cost of production will raise and domestic prices will raise further.

EMPIRICAL LITERATURE

Anil Khosla and JuroTeranishi (1989) shows that the incomplete ERPT is explained by lags responses. That because the elasticity depends on the nature of the product, pass through in countries with high content of raw materials in their export should decline overtime and should increase in countries that have higher proportion of final goods in their export. That is international difference in ERPT is mainly determined by the trade composition of the countries and not their income statues. Countries with high content of final goods in their exports show higher ERPT, and they also have higher ERPT in the long run than countries with higher content of raw materials in their exports. In addition, changes in cost affects the degree of pass through.

Campa and Goldberg (2005) investigated the extend of exchange rate pass through in a cross section of 23 OECD countries and found that in the short run the pass through is incomplete, and in the long run counties with higher exchange rate volatility have higher pass through elasticities. In the sample, average short run elasticity is 0.46% and 0.60% over the long run. The US has 0.23% ERPT in the short run and 0.42% in the long run.

Gaulier et al (2008) investigated ERPT at product level and shows that 25% of the sectors considered show complete ERPT and the remaining exhibiting incomplete pass through or PTM. Average estimates of long run pass through are around 80%, but when heterogeneity is controlled for this average vary across sectors. The study shows that ERPT tend to be greater in macroeconomic environment of higher volatility, in LDC, and in weakly integrated markets.

Jaffri (2010) for Pakistan showed that ERPT effects are low, with the short run being higher than the long run ERPT. The different specifications show differing results of significance. When exchange rate misalignment is introduced in the specification, it is found significant in the overall sample.

In addition, Hakan Kara and Fethi Ogunc (2008) investigated the ERPT for Turkey employing a monthly VAR model based on McCarthy (1999) and found that exchange rate pass through has been reduced post IT in Turkey by any measure of inflation, but public manufacturing inflation show no slowdown in pass-through measures, a case explained by the monopoly nature of this industry and the fact that Turkey is a price taker in market for the goods in the public manufacturing sector. The apparent reduction in the ERPT post IT is explained by the shift to managed floating exchange rate regime, which allowed agents abandon indexation based on the exchange rate, and adoption of the inflation target in forming expectations encouraged by policy credulity of the CBT.

Hamid Faruqee (2006), Exchange Rate Pass Through in the Euro Area employing a VAR approach and found that short run pass throughs are low in euro area on factor and trade prices, and near zero for retail and wholesale prices. Long run ERPT are higher, with that of import prices higher than the consumer prices, indicating the role of the retail sector and distribution cost. Asymmetries are observed in terms of a higher degree of local currency pricing (LCP) in import pricing and a higher degree of producer currency pricing (PCP) in export prices. Finally, despite the PTM and LCP prevalence, depreciation can improve the trade balance, albeit with small short run trade elasticities.

Frimpong and Adam (2010) studied pass through for Ghana, using data on exchange rate, domestic inflation, interest rate (T-bill), and foreign price (US-inflation) in a VAR framework. They show incomplete pass through of 0.025 associated with a one percent depreciation of the exchange rate after a quarter, and 0.09 after eight quarters.

A handful of studies have been done on African countries and we observed that they are supportive of incomplete pass through effects. Boamah (2012) uses a VAR approach for a selection of West African countries and found that ERPT is incomplete, highest in Ghana and lowest in Nigeria. Being the closest to our study, we differ from Boamah (2012) in two significant ways. In our accounting for the ERPT we have controlled for both supply shocks and monetary policy stand of the country. Secondly, we prefer using the nominal effective exchange rate to the bilateral dollar rate motivate by the fact that The Gambia's main trading partner is European Union (EU).

RESEARCH METHODOLOGY

We estimate the exchange rate pass through using monthly data from 2001M12 to 2012M12, collected from the IM IFS website and World Bank Global Economic Monitor databases online. We use the consumer price index, as oppose to import or producer prices they are not available for the Gambia. The UK Brent oil price is used as an indicator of supply shocks, M2 money supply is used an indicator of monetary policy stand, and finally we used the nominal effective exchange rate as a measure of exchange rate. Oil price control for the effect of international shocks on inflation and money supply controls for the effect of monetary policy effect on prices. All variables are seasonally adjusted and taking in their natural logarithmic form.

The structural VAR uses econometric theory to get the structural innovations from residuals of a reduced form VAR, which is unlike the Cholesky decomposition. Consider a SVAR in two variables, y and z.

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix} \qquad (1)$$

In matrix notation form, (1) can be rewritten as:

$$\mathrm{B}X_t = \Gamma_0 + \Gamma_1 X_{t-1} + \varepsilon_t \qquad (2)$$

The reduced form of (2) is:

$X_t = \mathrm{A}_0 + A_1 X_{t-1} + e_t \quad (3)$,

Where, $A_1 = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$, $A_0 = \begin{bmatrix} a_{10} \\ a_{20} \end{bmatrix}$, $e_t = \begin{bmatrix} e_{yt} \\ e_{zt} \end{bmatrix}$; and $A_0 = B^{-1}\Gamma_0$, $A_1 = B^{-1}\Gamma_1$, $e_t = B^{-1}\varepsilon_t$

The e_t vector is the composite of the structural shocks ε_t, and the two are related via the following equation.

$$\begin{bmatrix} e_{yt} \\ e_{zt} \end{bmatrix} = \left[\frac{1}{1 - b_{12}b_{21}}\right] \begin{bmatrix} 1 & -b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix} \qquad (4)$$

The e_t are the forecast errors in X_t without any structural interpretation, and ε_t are the autonomous change in X_t in equation (2). Hence to derive the short impulse responses and the variance decomposition, we use the ε_t instead.

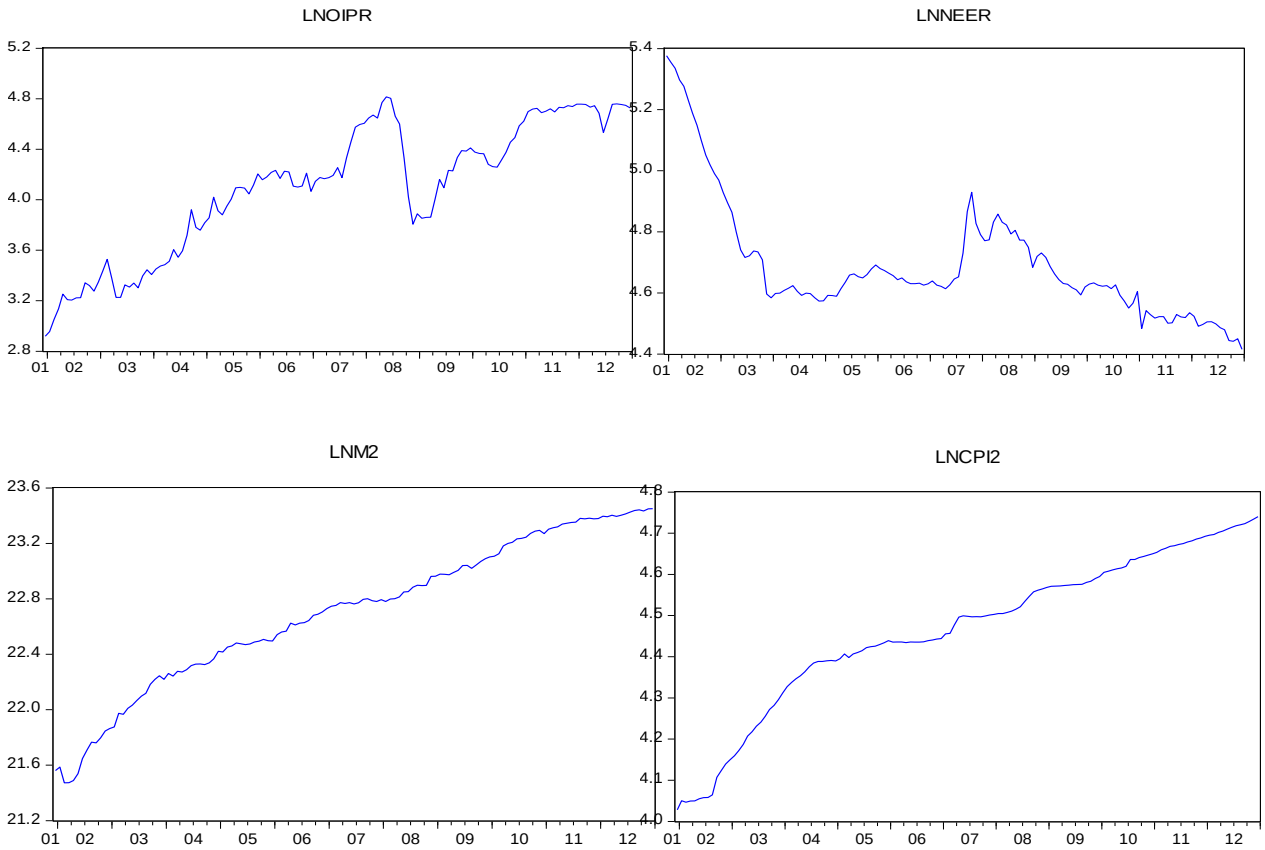
In our empirical model comprising exchange rate (NEER), CPI, and oil price (OILPR) and money supply (M), like Ogundipe and Samuel (2013) for Nigeria, we estimate the inflation forecast error from: $e_{pt} = \delta\varepsilon_{ot} + \tau\varepsilon_{mt} + \phi\varepsilon_{st} + \varepsilon_{pt}$ from a broader structural VAR that is identified by the strict exogeneity of oil price, and ordering the variables oil price, and exchange rate money supply, then finally inflation. This systems method allows restricted interaction among the endogenous variables.

EMPIRICAL RESULTS

While the methodology part describes a structural VAR methodology, we are constraint in using it due to the existing of cointegration among our unit root variables. Hence, in this section the ERPT is derived from impulse responses from a co-integrated VAR.

Data Description and Unit Roots

We use data on consumer price index (CPI), nominal effective exchange rate (NEER), money supply (M) and oil prices (OP). All variables are in their natural logarithms. The graphical inspection of the variables show that most variables have a trend stationarity. Whereas exchange rate and oil prices seem to show more volatility, consumer prices and money stock show more trend and stationarity. We formally test for the stationarity using ADF methods.



The ADF formality test result is shown as below.

Table 1: Stationarity Test (Probabilities in brackets)

Variable	Level		Difference	
	Constant	Cons. & Trend	Constant	Cons. & Trend
OIPR	-1.941 (0.31)	-2.769 (0.21)	-9.046* (0.00)	-9.068* (0.00)
NEER	-3.565* (0.00)	-3.351 (0.06)	-8.706* (0.00)	-8.866* (0.00)
M	-2.733 (0.07)	-1.937 (0.62)	-10.728* (0.00)	-11.176* (0.00)
CPI	-2.900* (0.04)	-2.919 (0.16)	-4.761* (0.00)	-5.276* (0.00)

Given the trend shown in the graphs and in conjunction with the formal ADF test, we conclude that all our variables are I (1). Our next step is to test the cointegration among the variables OIPR, NEER, M and CPI.

Cointegration Test and The VECM

A set of non-stationary variables are said to be cointegrated when there exit one or more linear combinations (of the non-stationary variables) that is stationary. Johansen maximum likelihood

technique is suitable for testing cointegration among a set of non-stationary variables. In this section, we present Johansen test results.

Table 2: Cointegration Test Result

Test	Trace Test (Case 3)	Max. Eigen Value Test (Case 3)
None	75.80* (0.00)	43.12* (0.00)
At most 1	32.68* (0.02)	18.89 (0.10)
At most 2	13.78 (0.08)	7.87 (0.39)
At most 3	5.91 (0.01)	5.91 (0.01)

The trace test shows a two cointegration relationship while the Eigen value shows one cointegration result. We feed in one CE- in accordance with Max Eigen value result- in the program and run a VECM to derive the impulse responses and variance decompositions. The ordering of the variance we follow the OIPR -> NEER -> M -> CPI.

The estimated VECM indicated a speed of adjustment of 10 %, which is very slow and the coefficients of the pass through are moderate. From the impulse responses we estimate the ERPT as: $ERPT_{t,t+s} = {DP_{t,t+s}}/{EP_{t.t+s}}$

Where, $DP_{t,t+s}$ is the cumulative response of CPI to an exchange rate shock, and $EP_{t.t+s}$ is the cumulative response of exchange rate to exchange rate shock, and $ERPT_{t,t+s}$ is the pass through coefficient in time t over s horizon.To maintain a positive sign, we use the absolute value of $DP_{t,t+s}$, given that NEER is defined such that appreciation corresponds to an increase.

Estimates of the exchange rate pass through show that6 months pass through is 4.8% and in the longer term of 2 years it is 12.2%. The signs show that a depreciation of the exchange rate corresponds to an increase in inflation as expected.

Table 3: Estimated ERPT Coefficient from IRF

Time	6-month	12 months	18 months	24 months
Coefficient	0.048	0.083	0.106	0.122

The variance decompositions show that NEER is responsible for 35% of the changes in inflation after two years and just 13% after 6 months. Money is a greater contributor to inflation and foreign prices the least. The high contribution of the exchange rate in the decomposition of

consumer price changes also points to the fact that policy should not be greatly concern with the destabilizing effect of exchange rate movements on domestic inflation in The Gambia

Table 4: Variance Decomposition of CPI

Variables	NEER	OIPR	M	CPI
6-month	13.46	15.10	14.34	60.93
12-month	29.16	18.74	29.58	22.46
18-month	34.31	17.57	37.71	10.39
24-month	35.82	16.30	40.48	6.97

CONCLUSION

We have investigated the exchange rate pass through for The Gambia, after controlling for monetary policy and supply side shocks, and our results, in line with previous works, show that the pass through effect is not very high even in the long run, and the speed of adjustment to equilibrium is also slow. What does this mean for stabilization policy? The Central Bank of The Gambia (CBG) does not have to worrier about the volatility of the exchange rate in frustrating its ability to control domestic prices. In contrast to Baomah (2012), our results show a higher pass through and speed of adjustment indicating the need to control for monetary policy in the system. Moreover, using NEER and oil price as oppose to simple bilateral GMD dollar rate and US prices respectively is expected to improve our estimates as 1. US is not a major trading partner of The Gambia as oppose to the EU, and 2. Oil prices indicate a better representation of foreign prices for The Gambia.

SCOPE FOR FURTHER RESEARCH

While this paper estimates the exchange rate pass-through coefficient across different horizons for The Gambia, further efforts to unveil the evolutionary path of the pass-through coefficient will clearly show the effect of shifts in monetary policy or trade policy regimes on pass-through. In line with the pioneering works of McCarthy (1999) and as applied to Turkey by Dedeoglu and Kaya (2014), rolling VARs are suited for investigating the effect of monetary policy regime change on the pass-through coefficient in a non-structural way. Moreover, in a different strand of literature, in highly opened economies like The Gambia where the volume of oil imports is significant, empirical researchers are interested in estimating the oil pass-through coefficient on domestic prices. Such empirical estimates will help the central bank in properly responding to oil shocks in an effort to control inflation.

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